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Conference Proceedings
From Strength to Strength
The Cerebral Palsy Foundation

Founded in 2005, the Cerebral Palsy Foundation has gone from strength to strength.

Achievements so far:

- Partners with the National Health & Medical Research Council to co-fund selected research projects
- Supported the establishment of the Australian CP Register
- Supported the landmark study that has identified global priorities for cerebral palsy research
- Partners with the University of Notre Dame, creating a cerebral palsy research hub within the St Vincent’s research precinct
- Established the Macquarie Group Foundation Chair of Cerebral Palsy
- Awarded over $1 million for national and international research projects through the CP Institute
- Building national research capacity through infrastructure grants
- Proudly sponsoring the International Cerebral Palsy Conference 2009

To make a donation or for more information contact www.cpfoundation.com.au or phone 1300 55 11 37

No money raised by the Cerebral Palsy Foundation is used to cover administrative costs.
Welcome

The CP Institute is delighted to welcome our keynote speakers, presenters and delegates to the 3rd International Cerebral Palsy Conference in Sydney. Over 1300 people are attending this conference which makes it the largest cerebral palsy conference ever held in the world. 300 delegates are attending from outside Australia from 45 countries making this a truly international conference.

The 3rd International Cerebral Palsy conference in Sydney, Australia follows the second conference in Oulu, Finland in 2006 organised by Professor Leonard Von Wendt and the first conference in Quebec City, Canada in 2003 convened by Professor Carol Richards.

16 key note speakers from across the world, and 6 concurrent streams of papers, posters, seminars and workshops will provide delegates with sessions that are relevant to their particular field, whether coming from a basic science, aetiology, medical, allied health, service provider, policy or governmental background. There is also great anticipation of the inaugural World Congress of Cerebral Palsy Registers and Surveillance Systems, with all existing registers in the world contributing to the program. It is a direct result of the dedication of researchers and clinicians across the world that we are able to bring you this exciting, high quality program.

The abstracts of keynotes and the top 100 papers have been published in a supplement to Developmental Medicine and Child Neurology, and all remaining accepted papers and posters are published in this book.

We are thrilled that people with cerebral palsy, their families and carers have shown a great deal of interest in the program. A generous grant received from the Commonwealth Department of Families, Housing, Community Services and Indigenous Affairs (FaHCSIA) has provided 115 day registrations for people with CP and their families.

The CP Institute would like to thank other key supporters and partners, in particular Allergan Australia for their generosity as Premier Sponsor and the New South Wales Department of Ageing, Disability and Home Care for Silver Sponsorship. The New South Wales Department of Ageing Disability and Home Care has also made it possible for 200 allied health staff to attend from throughout NSW. Financial Management Solutions/AMP Foundation are the Bronze Sponsor; other sponsors are the CP Foundation and Medtronic. The Perinatal Society of Australia and New Zealand (PSANZ) is jointly supporting key note Professor Donna Ferriero. The University of Notre Dame Australia generously provided the location for the pre- and post-conference workshops.

The Australasian Academy of Cerebral Palsy and Developmental Medicine (AusACPDM) has kindly donated the prize for best paper at the conference. The Cerebral Palsy Foundation is also donating a prize to a promising cerebral palsy prevention researcher.

Many thanks to the Conference Coordinators, Scientific Committee, Organising Committee and Ambassadors who have committed valuable time, energy and expertise to developing the scientific program and social events to make this conference one to remember!

Thank you for supporting researchers and clinicians by attending this conference. It is anticipated that by participating in the 3rd International Cerebral Palsy Conference you will gain new knowledge, create valuable collaborations and it is hoped that this new knowledge will be translated into best practice services for people with cerebral palsy throughout the world. In the mean time it is a requirement of this conference that you also experience some of the delights of a Sydney summer. Welcome and lets have fun!

Sarah McIntyre and Iona Novak
Chairs – Organising Committee

Roslyn Boyd
Chair – Scientific
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Cerebral Palsy Foundation

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The University of Notre Dame Australia

Best Scientific Paper Award Sponsor

Australian Academy of Cerebral Palsy and Developmental Medicine

Bondi BBQ Sponsor

Medtronic

Key Note Speaker Sponsors

Professor Fiona Stanley

Dr Roslyn Boyd
Cerebral Palsy Foundation

Vision: To prevent and cure cerebral palsy
The Cerebral Palsy Foundation was established in 2005 to take on the global challenge of preventing and curing cerebral palsy. The Foundation aims to fundraise $50,000,000 of which only the interest will be used to support research. This innovative concept will ensure work continues until the answers are found. This will be achieved by:-

- funding research through an expanding Grant Program
- bringing together the best minds and research from around the world
- building partnerships for an international research program

The conference Organising Committee is happy to announce that any funds raised as a result from the International CP Conference will go directly to the CP Foundation and the Grant Program. By attending this conference your investment will accelerate cerebral palsy research.

www.cpfoundation.com.au

Conference Ambassadors

- Dr Adrienne Harvey McMaster University, Ontario Canada
- Dr Anna Mackey University of Auckland, Auckland New Zealand
- Alicia Frost The Spastic Centre NSW, Sydney Australia
- Alison Wu The Spastic Centre NSW, Sydney Australia
- Cameron Tang Consumer, Sydney Australia
- Dr Christine Imms LA Trobe University, Melbourne Australia
- Dawn Solars Consumer, Sydney Australia
- Dr Elise Davis VicHealth Public Health McCaughey Centre, Melbourne Australia
- Nola Gibson Princess Margaret Hospital, Perth Australia
- Françoise Wilson The Spastic Centre NSW, Sydney Australia
- Joanna Lockwood The Spastic Centre NSW, Sydney Australia
- Jo Clunes The Spastic Centre NSW, Sydney Australia
- Karen Durell The Spastic Centre NSW, Sydney Australia
- Nicole Ison University of Western Sydney Equity and Diversity Unit, Penrith, Sydney Australia
- Dr Pammi Raghavendra Novita Children’s Services of SA Inc, Adelaide Australia
- Sarah Love Princess Margaret Hospital, Perth Australia
- Dr Catherine Gibson University of Adelaide, Adelaide Australia
- Carmen Ewens Darwin Hospital, Darwin Australia
- Cathy Morgan The Spastic Centre, Sydney Australia
- Natalie Morton The Spastic Centre, Sydney Australia
- Sally Craik The Spastic Centre, Sydney Australia
- Petra Karlsson The University of Western Sydney, Sydney Australia
- Megan Kentish Queensland Cerebral Palsy Health Service, Brisbane Australia

Scientific Committee (cont)

- Associate Professor Roslyn Boyd University of Queensland, Brisbane Australia - Chair
- Dr Peter Anderson University of Melbourne, Melbourne Australia
- Associate Professor Nadia Badawi Children’s Hospital at Westmead, Sydney Australia

www.cp2009.com.au

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Conference Aims for Green Event

CP 2009 is taking responsibility for the climate impact associated with hosting a conference. The following activities have been implemented to reduce the negative impacts on the environment.

- Printing on recycled paper
- Electronic marketing
- Promoting electronic registration
- Working with the Sydney Convention Centre on a range of measures including composting food, recycling bins, signage and menu selection
- Use of biodegradable lanyards and satchels
- Selection of accommodation properties which have environmental policies in place

CP 2009 has recognised that the largest impact of any large gathering is the transport related emissions and over half of the delegates will use air transport to attend the conference. A carbon offset program has been introduced for delegates if they choose to participate. See staff at the registration desk to ask how you can offset your carbon flight emissions - You can make a difference!

Sydney: The Host City

The visual excitement and variety of the Harbour City is matched by the diversity and energy of its four million people. High-rise buildings of the central business district look across the water at green headlands of national parks and comfortable garden suburbs. To the west, the World Heritage Blue Mountains stand as a spectacular barrier to the inland, while the ever-changing moods of the Pacific Ocean dominate the beaches, which stretch for miles north and south from the forbidding cliffs of Sydney Heads. Sydney’s cultural scene is vibrant. The Opera House with its graceful sails is home to the Sydney Symphony Orchestra and Australian Chamber Orchestra, as well as the Australian Ballet and the Sydney Theatre Company.

Dining out is a favourite relaxation in Sydney with the abundance of ingredients, the influences of many cultures and local wines make for great choices in style and cost.

Sydney Convention and Exhibition Centre

The Sydney Convention and Exhibition Centre is the largest and most technically advanced convention centre in Australia. Both exhibition and convention centre spaces can be configured to suit any type of usage in this fully integrated facility, and it’s all under the one roof. Ideally located within the convention area of Darling Harbour, the SCEC is only 5 minutes to the city centre, overlooking the stunning Sydney Harbour and nearby parklands. Food, hotels, and entertainment are only walking distance away.
Keynote Speakers

Associate Professor Eve Blair (Australia)
Causal Pathways to CP

Associate Professor Roslyn Boyd (Australia)
Looking Forward for Children with Cerebral Palsy

Dr Christine Cans (France)
SCPE Network’s Contribution to the Epidemiology of Cerebral Palsy

Professor Giovanni Cioni (Italy)
Clinical and Neurophysiological Evidence for Early Intervention in High Risk Infants: Animal and Human Studies

Professor Ann-Christin Eliasson (Sweden)
Aspects of Hand Function, Usefulness, Development and Intervention

Associate Professor Darcy Fehlings (Canada)
Botulinum Toxin: Development of an International Consensus Statement

Professor H Kerr Graham (Australia)
Long Term Outcomes of Orthopaedic Surgery in CP

Professor Ingeborg Krägeloh-Mann (Germany)
Motor Function and the Young Brain’s Plasticity

Associate Professor Lena Krumlinde Sundholm (Sweden)
On the Other Hand: About Successful Use of Two Hands Together

Professor Alastair MacLennan (Australia)
Cerebral Palsy – Genomic Susceptibility and Environmental Triggers

Professor Karin Nelson (USA)
Prevention of CP: Best Chances for Breakthroughs

Professor Robert J Palisano (USA)
Gross Motor Function Through the Lifespan of Individuals with Cerebral Palsy

Professor Peter Rosenbaum (Canada)
What Parents And Clinicians Want To Know – and What We Should be Telling Them – in 2009

Professor Matthew Sanders (Australia)
Triple P–Positive Parenting Program

Professor Fiona Stanley (Australia)
Children’s Health – Is it Improving? Influencing Government to Make Child Health a Priority

Associate Professor David Walker (Australia)
Animal Models of Cerebral Palsy
Inaugural World CP Register and Surveillance Congress

The World CP Register and Surveillance Congress will form an integral part of the International Cerebral Palsy Conference. It will form one stream on Thursday, February 19th and will provide an opportunity for individuals to consider together the long term vision for the use and development of registers and surveillance data. Chaired by Christine Cans (Surveillance of Cerebral Palsy Europe, SCPE), Eve Blair (Western Australian Cerebral Palsy Register, ACPR) and Sarah McIntyre (New South Wales Cerebral Palsy Register, ACPR) this congress will provide a forum for those around the world interested in surveillance and registers to:

- Consider how to best maximise the quality and use of register and surveillance data
- Share knowledge, expertise and brainstorm challenges
- Consider whether shared research goals exist and which would benefit from forming new partnerships
- Consider how to best develop greater CP research capacity

Scientific Program Information

Prizes

Australasian Academy of Cerebral Palsy and Developmental Medicine (AusACPDM) Award for the Best Scientific Paper

This award will be presented to the best scientific paper from the 3rd International Cerebral Palsy Conference, Sydney 2009. The top 50 scientific paper presenters at the International CP Conference will be eligible for the prize, including international presenters.

The recipient of “AusACPDM Best Paper Award” will be offered:

- Free registration to the 2010 AusACPDM conference in Christchurch, New Zealand. This includes general registration costs, the costs of up to two pre-conference/ conference workshops and attendance at the conference dinner
- Remuneration up to the value of AUD$1,500 to reimburse, or part-reimburse, an economy class direct airfare from the recipient’s home town or nearest capital city to the 2010 AusACPDM meeting in Christchurch. The proposed airfare route and costs must be pre-approved in writing by the Secretary of the AusACPDM at least eight weeks in advance of the meeting and reimbursement will be contingent on:
  - Participation in the meeting;
  - The recipient will be expected to present their award-winning paper at the 2010 meeting in an extended 20 minute form.
  - In the event that the successful recipient cannot take up the prize, the prize is non-transferable.

Cerebral Palsy Foundation Promising Researcher Award

This award, sponsored by the CP Foundation, awards AUD$2000 to a promising cerebral palsy prevention researcher who is within five years of completion of doctorate training and commencement of a current research career. Authors of scientific papers or posters considered for the prize must present original new research relating to the aetiology, prevention and cure of cerebral palsy.

Program Changes

The program is correct at the time of printing. Please check the program changes board for amendments to the Program. The program changes board will be located in the Parkside Foyer on Level 1 near the registration desk.

Please be aware that if a presenter is unable to present for any reason, the session will continue. There will be no gaps in the program.

Program Enquiries

If you have any queries regarding the program or your presentation, please visit the registration desk in the Parkside Foyer on Level 1.

The desk will operate during the following times:

- Wednesday 18 February: 07:00 – 18:00
- Thursday 19 February: 06:30 – 18:00
- Friday 20 February: 06:30 – 18:00
- Saturday 21 February: 06:30 – 16:00

Poster Sessions

All poster sessions will take place in the Parkside Foyer on Level 1 of the Sydney Convention and Exhibition Centre. Presenters: Please be aware that it is your responsibility to place and remove your poster. The conference managers will not be responsible for posters left behind at the end of the conference.

- Wednesday 18 February
  - Set up available: 07:00 – 08:00
  - Poster viewing session: 11:55 – 13:15
- Thursday 19 February
  - Set up available: 07:00 – 08:00
- Friday 20 February
  - Set up available: 07:00 – 08:00
  - Poster viewing session: 12:50 – 14:30
- Saturday 21 February
  - Set up available: 12:50 – 08:00
  - Dismantle: 15:30 – 17:00
Exhibitor Listing

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<td>ETS Mobility</td>
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Exhibition Opening Times

- **Wednesday 18th February**: 7.00am - 4.10pm
- **Thursday 19th February**: 10.00am - 3.10pm
- **Friday 20th February**: 9.00am - 4.00pm
- **Saturday 21st February**: 9.00am - 3.30pm
Social information

Included Social Functions

Welcome Reception – Harbour Cruise

Celebrate the opening of the 3rd International Cerebral Palsy Conference at the Official Welcome Reception – Harbour Cruise.

You will be treated to a stunning cruise around the world famous Sydney Harbour. Pass iconic Sydney landmarks such as the Harbour Bridge and Opera House, while enjoying drinks canapés.

Date: Wednesday 18 February
Departure/Arrival Point: King Street Wharf berths 8 and 9 (10 minute walk from Venue)
Time: 18:00 – 19:30. Please arrive at least 15 minutes prior to departure time.
Directional Guide: A directional guide will be available from the convention centre leaving at 17.40pm from the main entrance of the Parkside Convention Centre. By foot, delegates will be lead to the wharf. Please refer to venue map on page 7 for the meeting point. Guides will be holding a sign to easily identify the group meeting location. Please note that the departure time will be 17.40pm sharp.

Full wheelchair facilities are provided on the vessel. For wheelchair access the path to the wharf is flat and we don’t anticipate any restrictions. If you do require assistance in getting to the wharf please see the registration desk.

Additional tickets can be purchased for AUD$90 each.

Bondi Beach Barbeque

Proudly sponsored by Medtronic

The Bondi Surf Life Saving Club will be the venue of the Friday night Beach Barbeque (BBQ). The venue is perfectly located a stones throw away from the water with breathtaking views of Australia’s most famous beach, Bondi Beach! There is no better place for you to experience a relaxing summer evening with great food, drinks and new friends. The evening includes transport to and from the Convention Centre to the Bondi, with a photo stop at Dover Heights, where views of Sydney Harbour are splendid and unique. This will truly be an evening to cherish and remember.

Date: Friday 20 February
Venue location: Bondi Surf Life Saving Club
Commences: 18:30
Transfers: Transport has been arranged to and from Bondi for all delegates attending the dinner.

The bus will depart from the main entrance of the Bayside Convention Centre between 18.00-18.30pm. Please refer to venue map on page 7.

The bus will depart from Bondi from 21.30pm onwards until 11.30pm and will drop delegates back to the convention centre.

Additional tickets can be purchased for AUD$87 each.

Optional Social Function

The optional social function is not included in registration fees. To book tours please see staff at the registration desk.

Opera House Performance “The Magic Flute”

Wolfgang Amadeus Mozart

Date: Thursday 19 February
Time: 19:30–22:20
Venue: The Sydney Opera House
Cost: Premium Reserved Seating AUD$250
A-Reserve Seating AUD$198
B-Reserve Seating AUD$140

Please collect your tickets from the Registration Desk.

Prince Tamino and the lovely Pamina are lost in a mysterious land of fantastical creatures and strange characters. Will they be steadfast, will they discover the truth, and will they find each other? Welcome to the enchanting world of The Magic Flute.

David Freeman’s daring production of Mozart’s final work for the theatre combines a talented array of singers with the aerial wizardry of physical theatre company Legs on the Wall. Expect exotic beasts, dancing animals and death-defying stunts. Above all, be amazed by Mozart’s music, which reaches out to young and old. Performed in German with English dialogue and surtitles.

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Accredited by AMP Financial Planning
Tours

All tours are not included in registration fees. To book tours please see staff at the registration desk.

Optional Tours – Half Day Tours

Introducing Sydney

**Date:** Wednesday 18 February 2009  
**Time:** 13:30 – 16:30pm (3 hours)  
**Cost:** AUD$65.00 per person

Explore the vibrancy and style of cosmopolitan Sydney, one of the world’s most beautiful harbour cities. Discover colonial buildings and cobbled lanes in The Rocks, Sydney’s oldest historical precinct. Enjoy views of the Harbour Bridge and Opera House. From Mrs Macquarie’s Chair, a waterfront seat carved into the rock for the wife of visionary colonial governor, Lachlan Macquarie. Travel through Sydney’s fashionable eastern suburbs, renowned for their elegant homes and harbour vistas, on the way to world-famous Bondi Beach – a haven for surfers and sun lovers.

Includes knowledgeable local guide and private coach charter. Based on a minimum of 12 guests.

Sydney Opera House Guided Tour

**Date:** Thursday 19 February 2009  
**Time:** Various departure times starting from 10:00. Tour runs for approximately 1 hour and 15 minutes  
**Cost:** AUD$35.00 per person

A knowledgeable Opera House guide will bring to life the stories and secrets behind this international landmark, its original design and building period as well as today’s uses. See inside the major theatres and halls, where some 2500 events and performances are staged each year and learn what’s on during your stay.

Includes knowledgeable guided tour (non exclusive). There are approximately 200 steps on this tour. Transport not included, guests are required to make their own way to the Sydney Opera House. No minimum number required.

Aboriginal Insights & Gardens Tour

**Date:** Friday 20 February 2009  
**Time:** 14:30 – 17:00 (2.5 hours)  
**Cost:** AUD$75.00 per person

Experience the world’s oldest living culture on a guided walking tour of the Royal Botanic Gardens, where the original inhabitants of Sydney gathered plants, seeds and roots for food and medicine. See how Aborigines produced a honey drink from the Banksia, roasted seeds from the Moreton Bay Chestnut and made fishing line from the bark of the Bolwarra tree. Listen to the beautiful rhythm of the Didgeridoo.

Includes knowledgeable Aboriginal guide for 1.5 hour private tour. Return transport to and from the conference venue is included. Based on a minimum of 12 guests.

BridgeClimb

**Date:** Various  
**Time:** Various departure times. Climb duration is 3.5 hours including safety briefing.  
**Cost:** AUD$189.00 per person (day or night climb)  
**Cost:** AUD$199.00 per person (Sat or Sun)

Climbing the Sydney Harbour Bridge is an exhilarating experience. Rendezvous at the BridgeClimb office for a safety briefing and prepare for your three-hour adventure! Accompanied by an experienced leader your small team will cross the catwalk to the pylon and walk up to the summit of the Bridge’s upper arch - 130 metres above sea level. Harnessed to a static line for the duration of the climb, be treated to spectacular 360-degree views across one of the greatest harbours in the world.

Includes knowledgeable guided tour (non exclusive). Transport not included, guests are required to make their own way to the BridgeClimb office in the Rocks. No minimum number required.

Optional Tours – Full Day Tours

Blue Mountains 4WD Adventure

**Date:** Sunday 22 February 2009  
**Time:** 08:00 – 17:30pm (approx 9.5 hours)  
**Cost:** AUD$249.00 per person

Travel off the beaten track on an intimate adventure tour of the Blue Mountains. On route to the Blue Mountains, get up close and personal with some of Australia’s unique animals during a stop at a wildlife park. Later, experience the magical beauty of the Australian bush, ancient landscapes and native flora and fauna – less than two hours from Sydney. Enjoy lunch in a leafy setting and breathe in the essence of the Australian eucalyptus whilst enjoying panoramic views of the famous Three Sisters.

Includes knowledgeable guided tour including morning tea and lunch (non exclusive). No minimum number required.

Hunter Valley Wine Tour

**Date:** Sunday 22 February 2009  
**Time:** 08:00 – 17:30 (approx 9.5 hours)  
**Cost:** AUD$249.00 per person

A trip to Sydney is not complete without a visit to the world class wineries of the Hunter Valley. Work your way through the leafy Northern Suburbs, then escape through the brilliant sandstone outcrops of Ku-ring-gai National Park before reaching the Hawkesbury River. From Mt View you will descend into the Hunter Valley and begin your wine tasting experience at a few of the very special boutique wineries in the area. Here you will have the opportunity to chat to the owners, admire the cottage locations and let them introduce you to the best of their vintages. At the foothills of the Broken Back Range, you will enjoy a sumptuous lunch and then spend the afternoon visiting some of the larger vineyards for more superb wine tasting. As the afternoon approaches you will return to Sydney via the scenic freeway to conclude this relaxing and enjoyable day.

Includes knowledgeable guided tour including morning tea and lunch (non exclusive). No minimum number required.
Locals Guide to Sydney

Pre or post conference, or outside conference hours, there is an incredible array of activities and entertainment for delegates and partners. Why not try one of the local Organising Committee’s recommendations?

**Manly by ferry**

Still the locals’ preferred way of seeing Sydney’s beautiful harbour. Manly is the first of a long string of surfing and swimming beaches stretching all the way to the tip of the Peninsula at Palm Beach.

To visit Manly, travel to Circular Quay by rail (approximately AUD$3.20) or on foot. Catch the Manly Ferry departing every 20–30 minutes, with the stunning trip taking approximately 30 minutes. An adult one-way ticket will cost AUD$6.40. From here, you can walk to shops, restaurants, and the beach.

**Live sporting game**

Watch a live game from cricket to tennis to horseracing – it’s a national obsession.

For further information regarding bookings, contact Ticketek on 132 849, www.ticketek.com.au, or visit a Ticketek agency at:

**CBD:** Theatre Royal Sydney, MLC Centre, 108 King Street

**Hyde Park:** Ticketek @ Park, 50 Park Street (corner Castlereagh Street)

**Wynyard:** Colours of Life – Kodak Express, Shop T3 Met Centre, 273 George Street

**Bondi surfing experience**

Why not visit one of Australia’s favourite beaches and amongst one of the most well known in the world. Learn to surf with the help of an expert.

Let’s Go Surfing (www.letsgosurfing.com.au) is a surf school based at Bondi. They offer a variety of surfing lessons for example “The Bondi Surf Experience – Taste Test”, a 2 hour beginner group course, which includes the lesson, surfboard and wetsuit rental. The course runs every day of the year, and costs approximately AUD$89. Children’s lessons are also available. Contact Let’s Go Surfing on 9365 1800. They are located at 128 Ramsgate Avenue, North Bondi. To visit, catch a taxi, take bus 380 or 381 from city, alighting at North Bondi Surf Club, or catch train to Bondi Junction, then bus 380 or 381.

**Sail Sydney harbour**

Imagine sailing in front of the Opera House or under the Harbour Bridge. Sydney is one of the world’s greatest and friendliest places to sail. Taking the opportunity of learning to sail this beautiful waterway and the enjoyment you will get from it can only be labelled as priceless.

Pacific Sailing School (www.pacificsailingschool.com.au) is a sailing school based at the Cruising Yacht Club of Australia (home of many Sydney to Hobart Yachts), at Rushcutters Bay, in Sydney’s Eastern Suburbs. They offer a **“Try Sailing”** 3 hour lesson every day, at 9am, 12.30pm, or 4pm, for $95 per person, with a maximum of 4 per yacht.

Contact them on 9326 2399 for further information. To visit, catch a taxi, a bus (324, 325, 326) from Circular Quay to Rushcutters Bay Park on New South Head Road, or a train from Town Hall or Central Station to Edgecliff Station then a short walk.

Alternately sail with Sydney by Sail, depart from Darling Harbour (from $150 for 3 hours per adult) individual, group or corporate sailing, Ph: 9280 1110.

For a shorter and faster trip on the Harbour, try a Jet Boat Adventure, for 30-60 minutes departing from the convention centre jetty, at Darling harbour (www.harbourjet.com, Ph: 1300 88 73 73), (from $40–85 for adults).

Or combine the jet boat adventure with an aerial view of Sydney by Seaplane (from Rose Bay to Pittwater near Palm beach, (approx $275 per adult), you can always return by bus (see Palm Beach adventure).

**Open Air Cinema**

Take in the beautiful surroundings of Sydney Harbour and the Botanical Gardens and enjoy a summer evening at Sydney’s Open Air Cinema.

The Open Air Cinema (www.stgeorgeopenair.com.au) is located at Fleet Steps, Mrs Macquarie’s Point, Sydney, adjacent to the Royal Botanical Gardens. Visit by taxi, train (nearest stations Martin Place or St James), or bus (nearest stop corner Market and Elizabeth streets), or on foot. Pre-sale tickets sell out quickly, however a limited number of tickets are available for sale at the door each night. Phone 1300 366 649 after midday on any given day to hear information regarding the tickets for that evening’s screening. General admission ticket $28.

**Watson’s Bay**

Catch a ferry to Watson’s Bay on the eastern shores of Sydney Harbour and while away the afternoon with a long lunch in the restaurant or a cold beer in the beer garden at the famous Doyle’s.

Catch a bus from Circular Quay (324 or 325). Ferries also run from Circular Quay to Watson’s Bay every 30–45 minutes however please check times to ensure you catch the last ferry home (late afternoon). The trip takes approximately 30 minutes, and a ferry ticket will cost $5.20. Doyle’s on the Wharf is open 7 days from 11am – 5pm, with later opening hours over Summer.

**Opera Bar**

Why not watch the sun go down over a cocktail on the shores of beautiful Sydney harbour at the Opera Bar, one of Sydney’s premier locations in the iconic Sydney Opera House.

The Opera Bar is located at the Lower Concourse Level of the Sydney Opera House. It is a 3 minute walk from Circular Quay train station and ferry terminal. Buses and taxis can be accessed from nearby Macquarie Street. Opera Bar is open from 11:30 daily, offering drinks, lunch and dinner.

**Locals Guide to Sydney (cont)**

**Shopping at the QVB**

The Queen Victoria Building (QVB) is Sydney's premier shopping destination, which is synonymous with sophistication and style. A magnificent heritage building, with its dominant feature being a mighty centre dome. The QVB is located on the corner of George and Market streets in city, next to Town Hall station, and within walking distance of Darling Harbour and the conference venue. Trading hours are from 09:00 to 18:00 Monday to Saturday, with extended hours until 21:00 on Thursday. On Sunday, trading hours run from 11:00 to 17:00. Some stores may open slightly later (10:00) and some restaurants remain open for longer hours.

**Palm Beach**

Take a scenic bus trip to the famous Palm Beach, holiday spot of the rich and famous. Palm Beach, the jewel of the Northern Beaches, is the northernmost suburb of Sydney. Take the L90 bus from bus stops in the city (near Central or Wynyard train stations), and travel to Palm Beach, a trip taking approximately 1 hour 40 minutes, and costing approximately $5.00. Please be aware that there are no rail services on the Northern Beaches.

**Snorkel at Shelly Beach**

Enjoy the amazing submarine culture of Cabbage Tree Bay at Shelly Beach near Manly. This Aquatic Reserve has some great samples of sub-tidal reef, seagrass beds and offshore kelp communities that are home to weedy sea dragons, elegant wrasse and black rock cod. The bay also provides a home for the Blue Groper.

To visit Shelly Beach, travel to Manly (see recommendation #1 for travel details), walk along the Manly Corso to the ocean beach, then turn right and walk along the promenade behind the beach, around to Fairy Bower and Shelly Beach.

**Balmain**

Visit one of Sydney’s oldest working class suburbs, Balmain where most of Sydney’s ferries were built. Balmain which is only a 10 minute ferry ride from Circular Quay is now a colourful and artistic suburb, home to some of Australia’s best-known writers, actors, film directors, musicians and artists.

Stylish cafés, bistros, pubs and restaurants burst with creative energy. Its pulsating nightlife is a magnet for a cosmopolitan crowd.

Ferries leave Circular Quay approximately hourly, tickets cost approximately $5.20, then take the bus up the hill, or walk?

**Sydney Fish Markets**

Stroll around Sydney Fish Markets and sample some of the world’s best seafood or visit the Seafood School for some handy tips in one of their cooking classes.

Sydney Fish Market is located at Bank Street, Pyrmont, and are open daily from 07:00. To visit, take the Light Rail from Central Station, Haymarket, or Darling Harbour to the Fish Market stop. Light rail operates every 12 minutes, 24 hours a day, and will cost approximately $5.00 return. Bus 501 from Central Station and 443 from Town Hall Station also service the area – disembark on the corner of Harris and Pyrmont Bridge Road and walk 5 minutes to the Fish Markets. Alternatively, simply walk from Darling Harbour to the Fish Markets (10 minutes) via Pyrmont Bridge Road.

**Fashion Tour**

Walking fashion tour of Sydney’s famous Oxford Street. Explore Sydney’s famous Oxford Street with the help of a local guide. A shopping experience not to be missed.

Meet at Circular Quay (Customer Service Desk, Australian Travel Specialists). Shop W1, corner Alfred and Wharf 6, opposite Jetty 6, Circular Quay to begin your 1½ hour walking tour, which commences daily at 13:00. The price of $30.00 per person (children welcome) includes return bus trip Circular Quay to Oxford Street, Paddington, and area map and shopping guide, and a tour photo (digital). Visit www.viator.com and follow the links to book.

**Breakfast with views**

Enjoy some of Sydney’s best water views whilst enjoying breakfast. The Bower Restaurant at Manly is located halfway between Manly and Shelly beaches, the views of the ocean are stunning (see recommendation #1 for location details). Or, why not take a stroll through the Rocks to the beautiful Sydney Park Hyatt hotel and breakfast in the stunning Harbour Kitchen Restaurant whilst taking in the breathtaking views of Sydney. To visit, walk from the Circular Quay train and ferry terminal, turn right onto George Street off Circular Quay Drive, following through The Rocks, and turn right to find the Park Hyatt at 7 Hickson Road.

**High Tea**

Slip out for high tea and relax your afternoon away in luxurious surroundings. Try The Victoria Room in Darlinghurst, where high tea is served on Saturdays from 12:00 - 17:00 or Sundays from 13:00 to 17:00. Bookings are highly recommended - phone 02 9357 4488. Standard high tea costs $35.00 per person (10% surcharge on Sundays).

Alternatively try The Tea Room in the historic Queen Victoria Building, where morning tea is served weekdays 11:00 – 12:00 and weekends 10:00 – 12:00, or afternoon tea is served from 11:00 weekdays and from 10:00 on weekends. Visit the QVB (see recommendation #8) and find The Tea Room located on Level 3, North End; phone 9283 7279.
Coastal walk

Experience Australia's beautiful and unique coastline by taking one of the many coastal walks available around Sydney. Two of the local favourites include Bondi to Bronte and Manly to the Spit. Why not stop for a swim along the way.

Bondi to Bronte (2.5km walk): travel to Bondi beach via taxi, or catch train to Bondi Junction then bus 333 to Bondi Beach. Walk south along the path to Tamarama Beach and onto Bronte Beach for a swim and brunch.

Manly to the Spit (9.5km walk): travel to Manly (see recommendation #1), then walk north to the Spit.

Writers Walk

Walk the cobble-stone streets of The Rocks and along the promenade of Circular Quay and learn about famous Australian writers and literary visitors and contributions include art critic and historian Robert Hughes; feminist, academic and author Germaine Greer; and writers Thea Astley, Peter Carey, Dorothy Hewitt and James A Michener. Travel to The Rocks (see recommendation #14), then walk the streets!

Paddington Markets

Visit one of Sydney's oldest community markets at Paddington. Paddington is known for: its exciting and quirky atmosphere; its eccentric and colourful traders; its eclectic products and contemporary design; the high quality of its art, craft, design, and fashion; and for innovation in both products and market operation. Open Saturday 10am - 4pm.

Walk to Paddington from Central, Town Hall, or St James train stations, or take a bus from the city (eg. bus 373, 378, 396, L94).

Not to be confused with Paddy's Market, in Chinatown, dating back to 1834, it is an archetypal cheap and cheerful market to find those bargain souvenirs, including Australian Sheepskin products, as well as fresh fruit, vegetables and flowers.

Stanley Street Dining

Take a short taxi ride to Stanley Street and sample some great food. Stanley Street is a small street in the East Sydney district of Sydney. It is primarily residential, but was the centre of Sydney's original Italian community in the 1950s and 1960s, and was subsequently part of Sydney's first “Little Italy”. Many Italian restaurants and cafes still line the street, and the street is home to the annual Primo Italia no festival.

Tropfest – Perfect Timing if you are still in Sydney on Sunday!

Experience the atmosphere at the world's largest short film festival, Tropfest, held outdoors in the leafy Domain in Sydney. This annual event includes a fantastic afternoon and evening of musical entertainment followed by screening of the finalists of the short films, followed by judging and finally the awards ceremony.

Tropfest is held on Sunday 22nd February in The Domain, Mrs Macquaries Road, Sydney. Gates open and entertainment (DJ’s, MCs, live bands etc) at 15:00. Screening of Part 1 of finalist films begins at 19:45, interval at 08:50, then screening of part 2 of finalist films at 21:20. Judging follows, with the awards ceremony at 22:30. To visit The Domain, walk from the CBD, catch a train to St James or Circular Quay, or bus 324 and 325 from Circular Quay.

Cocktails with a view of Sydney Harbour

Take in a sophisticated evening cocktail overlooking Sydney's famous harbour. The Blue Horizon bar in the Shangri La hotel at the Rocks has an exclusive cocktail bar with a panoramic view overlooking the Harbour Bridge and the world-famous Sydney Opera House. The bar won Best Hotel Bar of the Year in 2007. Open weekdays 5pm-late; Friday 3pm-late; Saturday Noon-late.

Cultural Highlights – Museums

Powerhouse Museum – a modern Design, science and technology museum within walking distance from Darling Harbour (2 blocks). Currently showing is the Star Wars: Science meets Imagination and Living in a Sensory world: stories from people with blindness and low vision, plus for children the Magic Garden. Street Address: 500 Harris st, Ultimo (behind Darling harbour), opening hours 10 am – 5pm daily.

Australian Museum – experience the real Australia, 6 College st., Sydney (the heart of Sydney) including Indigenous stories, art, dinosaurs and the Surviving Australia exhibition (safely get up close to some of Australia's deadliest creatures. Open 9-30 am till 5pm (tours at 11am and 2pm).

National Maritime Museum – in Darling Harbour; traditional islander boats, warships, and the America's Cup exhibit is a must (we won it back for the Americans in 1997). www.anmm.gov.au.

The Art Gallery of NSW – Sydney’s modern contemporary and Aboriginal Art gallery overlooking Circular Quay (10 minutes from Darling harbour). www.artgallery.nsw.gov.au. Recent exhibitions included Monet and the Impressionists. This is New South Wales main art collection and always worth a visit. Stroll there through the domain gardens and follow your visit with lunch in the Gallery Cafe.

Museum of Contemporary Art – Sydney's modern contemporary and Aboriginal Art gallery overlooking Circular Quay (10 minutes from Darling harbour). 140 George st., The Rocks, open 10 am – 5pm. www.mca.com

The National Opal Collection – 60 Pitt st., in the heart of the city, open daily, free entry. The Opal is one of only seven official icons of Australia. Find out about the connection between opals and dinosaurs.
Locals Guide to Sydney (cont)

Cultural Highlights - Theatre

**Sydney Theatre Company** – The Wharf, Pier 4/5 Hickson rd., Walsh Bay. See Cate Blanchett in the War of the Roses (if you can get a ticket) a play by a famous Australian Director David Williamson.

**The Opera House** – a visit for the view is a must, take a tour; visit the Opera (the Magic Flute) or at the Drama Theatre Juliette Bionche and Akram Khan.

Sydney’s Gay and lesbian Mardi Gras festival – 14th February till 7th March. Centres around Paddington and Darlinghurst.

Get up close and personal with some Australian animals!

**Sydney Aquarium** – over 12,000 Australian aquatic animals, including the Great Barrier Reef display including sharks, stingrays and recently Dugongs! Open 9 am till 10pm in Darling harbour (Aquarium Pier).

**Sydney Wildlife World** – in Darling Harbour. Walk amongst Wallabies, birds and butterflies in interactive habitats. Cuddle a koala. Open 9 am till 10 pm. Aquarium Pier Darling Harbour.

The main **Taronga Park Zoo**, is situated across the harbour (a 12 minute ferry ride, from Wharf 2 Circular Key) in Mosman, with spectacular views of the Harbour. You can have breakfast with the animals. Take at least half a day to explore the zoo and see Australia’s fascinating and novel animals. There are five new Asian Elephants. www.zoo.nsw.gov.au; Open daily 9am–5pm.

Sporting facilities:

**Swimming Pools** – casual admission is available at:
- The Ian Thorpe Pool (Olympic size indoor pool, 2 blocks from the Convention Centre) on Harris St, opens at 6 am.
- The Boy Charlton pool - an outdoor saltwater pool in Woolloomooloo on the edge of the Royal Botanical Gardens, a Sydney Icon.
- North Sydney Municipal Pool – outdoors, adjacent to the harbour on the northside under the harbour bridge – the pool with the view.

**Jogging tracks** – you can jog around the rocks and to the Domain and Botanical Gardens and return via Hyde park. Alternately try Centennial Park in the Eastern Suburbs.

**Surfing Beaches** – The safest and best surfing is at Bondi and Coogee in the Eastern Suburbs, and for the more adventurous try Manly, North Curl Curl or Avalon on the Northern Beaches. For people watching go to Tamarama (“glamorama”) or Bronte, but both are known for their changing “rips” so take care and stay between the flags.

Sydney has many tennis centres and golf courses open to the public within a ten minute radius of Darling Harbour. Talk to your hotel about these options or ask a local.

The 3rd International Cerebral Palsy Conference

is proudly supported by the NSW Department of Ageing, Disability and Home Care

Working in partnership with disability services to:
- strengthen families
- promote community participation
- support inclusion of people with a disability.

www.dadhc.nsw.gov.au
Dining Out in Sydney

While in Sydney, experience some of the culinary delights that the city has to offer. Greatly influenced by our multicultural population, Sydney’s cafes and restaurants provide cuisine from around the world, often with an Australian twist, as well as “Modern Australian” fare. The Organising Committee has plenty of dining out experience – here are some of their favourite dining precincts:

Woolloomooloo Bay Wharf
An historic wharf conversion, located on the east side of the Botanic Gardens. For a fine dining experience al fresco, this area cannot be beaten. “China Doll” is a favourite with the locals.

Stanley St East Sydney, Victoria St Darlinghurst & Oxford St Paddington
As mentioned in the Locals Guide, Stanley Street in East Sydney offers a “Little Italy” experience with a range of Italian cafes and restaurants. Nearby Oxford and Victoria Streets run through Darlinghurst & Paddington, where you can savour everything from cheap and cheerful cafes, funky Australian Pub food, fine-dining Australian and international food from France, Asia, Italy, Greece, India, Turkey, Mexico.

Kirribilli
A five minute ferry trip from Circular Quay takes you across the harbour to Kirribilli. Sydney home of the Prime Minister and Governor General of Australia, but also a cool, relaxed village with intimate restaurants and cafes. Spectacular views of the city, harbour bridge and Opera House.

East Circular Quay
The Opera House and Harbour Bridge are the backdrop to your meal, as you enjoy some of the best restaurants Sydney has to offer. Seafood, Modern Australian, and a variety of other styles are scattered across this stunning area, as well as the perfectly-situated “Opera Bar”. “Café Sydney” boasts jazz on Sundays and the “Young Alfred” in Custom House serves great food adjoining the international and national newspaper library.

Surry Hills
Surry Hills, located a short taxi ride from the conference venue, offers an eclectic mix of traditional ethnic fare and Australian fine dining in renowned restaurants such as Bills 2 and Billy Kwong.

Glebe/Newtown/Leichhardt
Each suburb is located several kilometres west of the city centre; all urban centres with a variety of cafes, restaurants and pubs providing food for the local university and inner-city crowd.

Chinatown
Located a short walk from the venue, around Dixon, Sussex and Goulburn Streets, Chinatown hosts more than 60 restaurants and stalls. These offer food from China and its regions, as well as Vietnamese, Thai, Korean, Japanese, Taiwanese and Malaysian styles. Try a traditional yum-cha, where small plates of different meals can be selected from the waitstaff roving the restaurant with trolleys.

Darling Harbour
Enjoy the stunning water views, proximity to the conference venue, and variety of cafes and restaurants around the Darling Harbour areas of Harbourside, Cockle Bay, and King Street Wharf. From cafes to seafood to international fare, and even a Brewery!

The Rocks
This historic part of Sydney, at the northern tip of the city centre, offers pub meals, cafes, and fine-dining restaurants, as well as international beer cafes and the famous “Pancakes on the Rocks”. Enjoy dinner and then strolling the cobble-stoned streets, and picking up a few Australian souvenirs along the way.

Spanish Quarter
The Spanish Quarter is situated around Liverpool and Kent Streets in the city. Enjoy traditional Spanish fare including tapas, paella, and of course sangria!

For specific names and details (price range and addresses) visit the conference information desk where the Sydney Morning Herald Good Food Guide 2009 will be available.
Transport Information

While vast distances separate the major cities in Australia, travelling between the different states and territories is also possible via rail, road or air. Transport in and around Sydney is relatively easy, with a variety of modes available:

Walking
Many areas of the CBD of Sydney can be easily accessed on foot – enjoy the sights of the city and the summer weather! Be aware of walking alone, particularly at night, and walk in well-lit areas.

Car (taxi)
Taxis (cabs) are common and accessible at a taxi rank, by hailing on the street, or by ordering by phone. An illuminated “TAXI” sign on the top of the car indicates that they are available for service. Costs can be expensive if travelling a long distance, and passengers are responsible for paying fares and tolls from the journey. Taxis will generally accept payment by cash or card. Taxis have a meter to calculate the fare which is visible in the middle of the front dashboard, you will be expected to pay the fare indicated and any additional tolls.

<table>
<thead>
<tr>
<th>Taxi Service</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taxi Combined Services</td>
<td>133 300</td>
</tr>
<tr>
<td>Silver Service Fleet</td>
<td>133 100</td>
</tr>
<tr>
<td>Lime Taxis</td>
<td>135 463</td>
</tr>
</tbody>
</table>

Note: (offers priority pick-up for accessible fares)

Train
CityRail trains service Sydney and its surrounding suburbs with frequent trains on several different transport lines. The major train stations in the city include Circular Quay (next to the Opera House and Harbour Bridge), Wynyard, Town Hall and Central (from north to south), with additional stations at Martin Place, Museum and St James on a city circle line. The Town Hall Station is walking distance to Darling Harbour (10 minutes) or you can take the overground monorail to Darling Harbour. Train fares are reasonable and can be purchased as a single ticket, or return ticket. Tickets are electronic and must be passed through a gate when entering and exiting from the train station. Train timetables can be accessed online (www.131500.com.au), by phone 13 15 00, or at any train station. When travelling at night, travel in the carriage marked with a blue light, which is closest to the Guard’s compartment, for safety. A day ticket is valid for return use until 04:00 the following morning.

Bus
Many bus services are available in Sydney, both public and private. Sydney Buses are most frequently used in the CBD. Tickets may be purchased when getting onto a bus – please ensure you have small change as drivers do not carry much change. Some buses will require you to have the correct fare. To disembark from the bus, press the red "stop" button, available at each seat, and the driver will stop at the next bus stop. Bus timetables can be accessed online (www.131500.com.au) or by phone 13 15 00.

The well-known red Sydney Explorer bus is an air-conditioned tourist bus which allows you to visit 27 Sydney attractions. Commentary is provided onboard regarding the attractions near each bus stop, and you can hop on and off the buses at your leisure. Buses run 7 days a week, starting at Circular Quay at 08:40 and running every 20 minutes until the last service returns to Circular Quay at 19:20. Tickets can be purchased on board or from Transit Shops. A one-day adult pass costs $39, child $19, family $97. Two day passes are also available.

Similarly, a Bondi Explorer bus runs through the Eastern Suburbs, accessing 19 destinations along the 30km route. Buses also run from Circular Quay, and tickets are the same price as for the Sydney Explorer bus.

Ferry
Ferries service the beautiful harbour and waterways of Sydney. Ferries dock in the city at Circular Quay train and ferry terminal, located next to the Harbour Bridge and Opera House. Various ferry routes are available, including travel north to Manly, east to Watsons Bay, west to Balmain and Parramatta, and north to Taronga Zoo. Ferry timetables can be accessed online (www.131500.com.au) or by phone 13 15 00.

Combined
NSW Government services (CityRail trains, Sydney Buses, and Sydney Ferries) offer some combined tickets which may be useful when accessing more than one type of transport in a day. Tickets can be purchased at most train stations, transit shops, or on board buses and ferries. These include:

- **Day Tipper** – a ticket which includes unlimited transport on trains, buses, and most ferries for a day. The ticket will also provide a discount on admission to various Sydney attractions including Luna Park, National Maritime Museum, OceanWorld Manly, Powerhouse Museum, Sydney Aquarium and Taronga Zoo. Tickets cost $17.00 for adults, and $8.60 for children.
- **Family Fare Deal** – when at least one paying adult accompanies their children, the adult pays for their ticket and the first child’s ticket (at child fare), and any remaining children travel for free. The family fare deal is available with Day Tipper tickets.
- **Children’s tickets** – Young children under 4 years of age travel for free on public transport. Children aged 4 – 15 receive a child’s fare.
- **Sydney Pass** - Allows unlimited travel for 3, 5 or 7 days, within an 8 day period. This includes Sydney Explorer buses, Bondi Explorer buses, Sydney Buses, Sydney Ferries, and selected CityRail trains. You will also receive a bonus return transfer on the Airport Link trains, and discounts to Sydney attractions. Tickets cost from $110 for adults (3 days), $55 for children (3 days), or $275 for families (3 days) (2 adults and all children from the same immediate family).

Please enquire for more offers available and details of these tickets.
**Light Rail**

The Light Rail runs through the CBD, from Lilyfield, past the Fish Markets, Star City Casino, the Sydney Convention and Exhibition Centre, and into Central Station in the centre of the city. Stations are dotted along the route, and the light rail runs 24 hours a day, 365 days a year, every 10-15 minutes from 6am to midnight, and every 30 minutes from midnight to 6am. Purchase tickets onboard from a conductor.

**Monorail**

The Monorail travels high above the streets on a circuit around Sydney City, from Darling Harbour, to Paddy's Markets, City Centre and returning to Darling Harbour. The monorail runs 364 days a year (closed Christmas), Monday to Thursday from 07:00 to 22:00, Friday and Saturday 07:00 to midnight, and Sunday 08:00 to 22:00. It travels past stations every 3-5 minutes. Purchase tickets from monorail stations. Transport Information

While vast distances separate the major cities in Australia, travelling between the different states and territories is also possible via rail, road or air. Transport in and around Sydney is relatively easy, with a variety of modes available:
General Information

Accommodation Accounts
All accommodation accounts must be settled upon check out. The Organising Committee and the Conference Managers will not be responsible in any way for accommodation accounts.

Airport Transfers
Sydney’s Domestic and International Airports (adjacent to each other) are located approximately 8 km from central Sydney, and can be accessed with various transport methods. There is a transfer bus between the International and Domestic Terminals.
Taxi: A taxi ride from Sydney Airport to the Sydney Convention Centre will cost approximately AUD$25.00 - $30.00. The trip will take approximately 10 minutes out of peak hour, up to 30 minutes in peak hour.
Bus: The airport shuttle bus, Sydney Airporter provides a rapid transit link between the airport and the CBD, and will pick up/drop off at hotels in the city. Fares are AUD$12.00 per adult.
Train: The railway link will take you from the airport (both domestic and international have stations) to Central or Town Hall stations. The single adult fare from Sydney International Airport to Sydney Central station is AUD$13.80. The trip to Central takes 10-15 minutes.

Alcohol
In Australia, the legal age for drinking alcohol is 18 years. If you appear to be under 25 years of age, you will be asked to provide photo ID at venues where alcohol is served. Various alcohol-free zones are in place in outdoor areas—these are indicated by signs along the streets.

Banking Facilities
Banks in Australia are generally open 09:30 – 16:00 Monday to Thursday, and until 17:00 on Friday. The nearest banking facilities to the conference venue are:

St George
699 George Street
Haymarket NSW 2000
Phone: +61 13 33 30

Westpac
44 Market Street (Corner Clarence Street)
Sydney NSW 2000
Phone: + 61 2 9226 3311 or 13 20 32

ANZ
365 George Street (Corner King Street)
Sydney NSW 2000
Phone: +61 13 13 14
665-669 George Street
Haymarket NSW 2000
Phone: +61 13 13 14

Commonwealth Bank
691-693 George Street
Haymarket NSW 2000
Phone: + 61 2 9211 2133 or +61 13 22 21
There is an ATM (cash machine) located in the Hall 3 Foyer opposite Exhibitor Services. Additional ATMs are located within the Harbourside Shopping Centre, and throughout Sydney and Australia. ATMs can be used 24 hours a day.

Beaches
Australia is well known for its stunning beaches however please be aware of safety, as the Australian surf can be deceptively powerful for even strong swimmers. Only swim at beaches that are patrolled by professional and volunteers Surf Lifesavers (visible wearing red and yellow shirts and hats). Remember their “FLAGS” to stay safe:

F - Find the flags and swim between them – the red and yellow flags mark the safest place to swim at the beach
L - Look at the safety signs – they help you identify potential dangers and daily conditions at the beach
A - Ask a surf lifesaver for some good advice – surf conditions can change quickly so talk to a surf lifesaver or lifeguard before entering the water
G - Get a friend to swim with you – so you can look out for each other’s safety and get help if needed. Children should always be supervised by an adult
S - Stick up your hand for help – if you get into trouble in the water, stay calm, raise your arm to signal for help. Float with a current or rip – don’t try and swim against it.

And remember – NEVER:

Never swim at unpatrolled beaches
Never swim at night
Never swim under the influence of alcohol
Never run and dive into the water
Never swim directly after a meal

Business Hours
Banks generally open from 09:30-16:00 hours, Monday to Friday.
General office hours are 09:00-17:00, Monday to Friday.
Post Offices operate to general office hours; however stamps are often available from hotels.
Late night retail shopping is available on Thursday evenings.

Catering Breaks/Dietary Needs
All catering breaks including lunch, morning and afternoon teas will be served in the Parkside Foyer of the Sydney Convention Centre. If you have indicated a special dietary need, please speak to a venue staff member to collect your meal. All fresh food left over is donated to OzHarvest and shared with people in need.

Please note from the program that meals included in registration cost are:

Wednesday 18th February:
Morning tea, Lunch, Afternoon tea, Harbour Cruise (canapés and drinks)

Thursday 19th February:
Morning tea, Afternoon tea

Friday 20th February:
Morning tea, Bondi Beach BBQ (dinner)

Saturday 21st February:
Morning tea

A light breakfast will also be served to those delegates that attend the 7am workshops. All other meals are to be purchased at the delegates own expense. A variety of eateries and cafes are conveniently located within a 5 minute walk of the Sydney Convention & Exhibition Centre:

- Harbourside Centre, adjacent to the venue, offers:
  - A food court with take-away, quick meals and snacks, offering choices such as salads, kebabs, grills, pies, sandwiches, coffees, Thai, Italian, Japanese, fast food, and ice cream and gelato.
A variety of restaurants and cafes, including Indian, pizza, Japanese, Italian, pancakes, Chinese seafood, Middle Eastern, Thai, noodle bars and sushi.

And several bars and the Pumphouse Brewery.

The broader Darling Harbour precinct offers more take-away outlets, cafes and restaurants to choose from, including:
- Juices, smoothies and coffees (Imax cinema complex).
- Small supermarket is available on the top floor of the Darling harbour centre, larger supermarkets are situated in Broadway and Newtown (Coles, Woolworths).
- Many cafés and restaurants along the eastern side of Cockle Bay, including the Lindt Chocolate Cafe! These offer Modern Australian, seafood, steaks.
- King Street Wharf, located at the northern end of the Cockle Bay strip, Italian, Thai, Japanese, Chinese, Malaysian. Locals recommend Georges for tapas to share and Bungalow 8 for alfresco drinks.
- Authentic Chinese food is not far away, with Chinatown located south-east of the conference venue, around Dixon, Sussex and Goulburn Streets. Here more than 60 restaurants and food court stalls offer Chinese specialties, along with Vietnamese, Thai, Korean, Japanese, Taiwanese and Malaysian offerings. The Golden Century is famous for its fresh seafood (in live tanks!)

Conference Managers

GPO Box 128, Sydney NSW 2001 Australia
Phone: 1300 799 691 (within Australia) +61 2 9265 0890 (outside Australia)
Fax: +61 2 9265 0880
Email: cp2009@meetingplanners.com.au
Website: www.cp2009.com.au

Conference Registration Entitlements

The full registration fee entitles all delegates to the following:
- Program/Abstract Book
- Developmental Medicine & Child Neurology Supplement (Volume 51, Supplement 2)
- Welcome Reception - Harbour Cruise (Wednesday 18th February)
- Bondi Beach BBQ (Friday 20th February)

The paid $400 day registration fee entitles all delegates to the following:
- Program/Abstract Book
- Developmental Medicine & Child Neurology Supplement (Volume 51, Supplement 2)
- Satchel
- Catering (catering see previous page)

Complimentary day registrations do not include social events.

Certificate of Attendance

A certificate of attendance is available on a request basis. Please visit the registration desk.

Conversions

Australia operates using the metric system. For conversions:

Celsius to Fahrenheit - multiply by 1.8 and add 32
Litres to Imperial Gallons - multiply by .22
Litres to US Gallons - multiply by .26
Kilograms to Pounds - multiply by 2.2
Kilometres to Miles - multiply by .62

Currency

Decimal currency is used in Australia with the dollar as the basic unit. 100 cents (c) = one dollar ($) Notes come in $100, $50, $20, $10 and $5 denominations. Coins come in 5c, 10c, 20c, 50c, $1 and $2 denominations. Note that the $2 coin is smaller than the $1 coin.

Australia no longer has 1c or 2c coins in operation, however shops commonly charge odd amounts for products (eg. $1.99). The bill will be rounded to the nearest 5c.

Currency exchange facilities are available in most banks, hotels and airports and operate normal business hours. See “Banking Facilities” for the nearest banks. Foreign currency exchange services are located in the Harbourside Shopping Centre, adjacent to the conference venue:

UAE Exchange; Shop 436a, Darling Harbour
UAE Exchange; Shop 175, Harbourside Shops, Darling Harbour

As at 6 January 2009, the current currency exchange rates are:

<table>
<thead>
<tr>
<th>Country</th>
<th>AUD to Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>1.00 AUD = 0.86 CAD</td>
</tr>
<tr>
<td>USA</td>
<td>1.00 AUD = 0.72 USD</td>
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<tr>
<td>Euro</td>
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<tr>
<td>UK</td>
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<tr>
<td>Japan</td>
<td>1.00 AUD = 67.76 JPY</td>
</tr>
<tr>
<td>NZ</td>
<td>1.00 AUD = 1.21 NZD</td>
</tr>
</tbody>
</table>

Source: www.xe.com

Credit cards are accepted at most restaurants and shops. the most widely used being MasterCard, Visa, American Express and Diners Club. Shops may prefer that you use cash to pay for small purchases, and some may have a minimum purchase limit (eg. $10) for the use of credit cards or debit cards (EFTPOS).

Department Stores

Sydney's largest Department stores are David Jones (2 stores on Hyde Park) and Myer in the City centre.

Disabled Facilities

The convention centre has been designed to incorporate facilities for the disabled, including nominated spaces in the car park and direct access from the car park to convention centre via lifts in section 1 and 5 of the car park.

Toilets for the disabled are located in the Parkside and Bayside centres.

Dress

Smart casual attire is appropriate for all conference sessions.

Driving

Overseas visitors must carry their National driving licence or an International Driving Permit when driving in Australia; if your licence is not printed in English, you require a translation. Australian cars are right-hand drive, and drive on the left side of the road. When crossing the road, check for traffic by looking to your RIGHT first.

Seat belts must be worn by all people in the car and children must travel in an approved child seat. It is illegal to drive when using a hand-held mobile phone, or when affected by alcohol (for experienced drivers, the level is 0.05) - random breath testing is very common. Observe speed regulations - speed cameras are commonly used to detect speeding drivers. Ensure that your car is parked according to the street signs in the area - illegally parked cars can be fined or towed away to a depot, and retrieval of the car is very expensive. Road regulations vary between states so please obtain further information as appropriate - in NSW visit www.rta.nsw.gov.au or phone 13 22 13.

Electricity

In Australia, the voltage for domestic use is 220-240 volts, AC 50Hz, with 3-pin power outlets. With the use of an adapter, UK appliances will work; US 110V appliances also need a transformer.

Emergency Procedures
The Sydney Convention & Exhibition Centre emergency contact number is extension 5555 if dialing from an internal phone or (02) 9282 9788 if dialing externally.
In Australia, the Emergency telephone number for Ambulance, Fire or Police is 000.

Goods & Services Tax (GST)/Tourist Refund Scheme (TRS)
Since 1 July 2000, Australia’s taxation system has incorporated the Goods & Services Tax (GST). All prices quoted in this brochure are inclusive of GST unless otherwise specified.
As part of this taxation system, the Australian Government introduced the Tourist Refund Scheme (TRS). The scheme is administered by the Australian Customs Department. The TRS enables travellers departing Australia to claim a refund of the Goods and Services Tax (GST) and Wine Equalisation Tax (WET) paid on goods bought in Australia.
To claim the refund, you must:
- Spend $300 (GST inclusive) or more in one store and get a single tax invoice receipt
- Buy goods no more than 30 days before leaving Australia
- Wear/carry the goods when leaving Australia, presenting them with your tax invoice, passport and international boarding pass to a Customs Officer at a TRS facility (at the international airport, located past Customs and Immigration outwards processing)
- Claims are available up to 30 minutes prior to the scheduled departure of your flight
This does not apply to services or goods consumed or partly consumed in Australia (eg. wine, chocolate, perfume). Most goods can be used prior to leaving Australia (eg. clothing, camera). Your refund will be processed as a cheque, credit to an Australian bank account, or payment to a credit card.
Australian aviation security measures limit the amount of liquids, aerosols and gels that can be taken as hand luggage on flights. Goods that are therefore not allowed to be taken on as hand luggage may still be claimed under the TRS. If however the goods are oversize (eg. a case of wine), these must be sighted by a reciprocal agreement. Contact the Medicare Information Service on 13 20 11 for further information.
In Australia, the Emergency telephone number for Ambulance, Fire or Police is 000.

The nearest hospitals with emergency departments are:
- Royal Prince Alfred Hospital, Missenden Road, Camperdown. Phone: 02 9515 6111
- St Vincent’s Hospital, 390 Victoria Street, Darlinghurst. Phone: 02 8382 1111
- Dental Emergency - 9369 7050.
- Emergency prescription - 9325 0333.

Some Medical Centres (General Practitioners) located near the conference venue are:
- Castlereagh Healthcare, 260 Castlereagh Street, Sydney. Phone: 02 9283 1234
- Healthpac Medical Centre, Lower Ground, 59 Goulburn Street, Sydney. Phone: 02 9282 9725.

Enquire with your hotel concierge for the closest doctor to your accommodation.

Mobile Phones and Pagers
Please respect the presenter and other members of the audience by ensuring your mobile phone and/or pager is switched off or on silent while you are in sessions.

Mobility Needs
Should you require specific assistance, please see the conference staff at the registration and information desk.

Emergency Prescription

A message board will be placed in the Parkside Foyer, Level 1. Messages for delegates are to be pinned to the board. Please check the boards regularly.
- * Indicates top 100 scored abstract and is published in the accompanying Developmental Medicine and Child Neurology Journal.

Mobile Phones and Pagers
Please respect the presenter and other members of the audience by ensuring your mobile phone and/or pager is switched off or on silent while you are in sessions.

Mobility Needs
Should you require specific assistance, please see the conference staff at the registration and information desk.

Name Badges
Each conference delegate will receive a name badge on registration. This badge will be your official pass and must be worn to gain entry to all sessions, the exhibition area, morning and afternoon tea, lunch and the social functions included with your registration.
The name badges have been given a distinct colour code, so as to identify all groups as follows:
- Delegate – Blue
- Ambassador – Green
- Committee – Yellow
- Invited Speaker – Red

Newspapers
In Sydney, the most popular daily newspaper is the “Sydney Morning Herald”, while the most popular national newspaper is “The Australian”. Newspapers are available at newsagents and some supermarkets; international newspapers are available at specialist newsagents. National and international newspapers can be read for free in the newspaper library at Customs House at Circular Quay (Weekdays 10am-7pm; weekends 11am-4pm).
Opera Tickets
Delegates attending “The Magic Flute” Opera on Thursday 19 February at 19:30 are required to collect their tickets from the registration desk.

Parking
The Sydney Convention & Exhibition Centre car park is conveniently located off Darling Drive, underneath the Centre’s five exhibition halls. The car park has direct access to the venue and the many attractions and facilities available in Darling Harbour.

Car park opening hours:
Monday to Thursday - 6am to 1am the next day
Friday - open from 6am (24 hours)
Saturday - open 24 hours
Sunday - closes at 1am Monday morning

Rates (AUD$)
Day Rates for all vehicles are:
0-1 hours = $8.00 1-2 hours = $15.00
2-4 hours = $21.00 4-5 hours = $25.00
5+ hours = $27.00

Evening Rates for all vehicles are:
0-1 hours = $7.00 1-2 hours = $13.00
2+ hours = $18.00

Evening Rates apply for entry after 5pm and exit before 9am the following day.

Automatic pay stations are located throughout the car park, with a central pay station in the area under Hall 5. Payment is made at these stations prior to exiting the car park. Prepayment is also available.

Please note that the ceiling height of the car park is 1.8 metres.

For any enquiries please telephone +61 2 9282 5000.

Personal Insurance
Delegates are strongly advised to secure appropriate travel and health insurance. Delegate registration fees do not provide any such insurance coverage. The Organising Committee and the Conference Managers accept no responsibility for loss in this regard.

Pharmacy
There is a pharmacy located in Harbourside Shopping Centre: Harbourside Pharmacy, 111 Harbourside Shopping Centre, Darling Harbour. Phone: 9281 4077.

Your hotel concierge can provide details of the closest pharmacy to your accommodation.

Post Office
Post Offices generally open from 09:00 to 17:00 Monday to Friday. The nearest post offices are located at:
183 Harris Street, Pymont
44 Market Street, Sydney
Shop 10, 48 World Square Shopping Centre, 644 George Street, Sydney

Public Telephones
Coin and card operated public telephones are available in the Foyers of Halls 1 and 5 of the Exhibition Centre. Public telephones are also available in Foyer Ground Level, Convention Centre Bayside and beside the Parkside Office on Level 1 of Convention Centre Parkside.

Privacy
Australia introduced the Privacy Amendment (Private Sector) Act 2000 in 2001. The Conference Managers comply with such legislation which is designed to protect the right of the individual to privacy of their information. Information collected in respect of proposed participation in any aspect of the Conference will be only used for the purposes of planning and conduct of the Conference and may also be provided to the organising body or to organisers of future events. It is also usual to produce a ‘Delegate List’ of attendees at the Conference and to include the individual’s details in such a list. Consent for publication of the individual’s information may be withheld when completing the Registration Form for the Conference. Individuals are also entitled to access the information held by written application to the Conference Managers.

Registration Desk Open Times
The registration desk is located in the Parkside Foyer Level 1 and will operate during the following times:

Wednesday 18 February 07:15 – 18:00
Thursday 19 February 06:30 – 18:00
Friday 20 February 06:30 – 18:00
Saturday 21 August 06:30 – 16:00

Smoking
Smoking is banned in most public places in Australia, including at the 3rd International Cerebral Palsy Conference and the Sydney Convention & Exhibition Centre. All restaurants, cafes, licensed premises, shopping centres and public transport are smoke-free. Smoking is also prohibited in all covered areas of train platforms, tram and bus shelters. For those that smoke please do so outside the Sydney Convention & Exhibition Centre.

Shopping
In general, shops open from 09:00 to 17:30 during the week with late night shopping on Thursday until 21:00. On Saturday, most shops open from 09:00 to at least 17:00, and major department stores in the city are open on Sundays from 10:00 to 18:00.

Harbourside shopping centre is conveniently located at Darling Harbour, adjacent to the conference venue. Its specialty stores are open from 10:00 to 21:00 7 days, and some of their cafes, bars and restaurants are additionally open earlier and later hours. This is an ideal venue for all those souvenirs to take back home with you. This centre has many uniquely Australian stores to choose from.

A short walk into east into town (approximately 10 minutes) leads to the iconic Queen Victoria Building (QVB) next to Town Hall railway station, with shops over several levels in this beautiful historic building. The centre is open from 09:00 to 18:00 Monday to Saturday, with extended hours until 21:00 on Thursdays. Sunday trading is from 11:00 to 17:00. A short stroll over to Pitt Street Mall and its surrounding arcades offers more shops including the Strand Arcade and Westfield Centrepoint.

Style and boutiques abound in Paddington, accessible by car, bus or walking from the city. Oxford Street, Paddington, is known as the city’s “style mile”, and markets are also held each Saturday off Oxford Street. The historic Rocks area, located next to the Harbour Bridge and a 5 minute walk from Circular Quay, also hosts markets on both Saturday and Sunday, with plenty of Australian souvenirs and a new section for young designers.
General Information (cont)

Speakers' Preparation Room
The Speakers' preparation room will be located in Parkside G05. The operation hours are as follows:

- Wednesday 18 February: 07:00 – 18:00
- Thursday 19 February: 06:30 – 18:00
- Friday 20 February: 06:30 – 18:00
- Saturday 21 August: 06:30 – 16:00

Telephones
Mobile phones can be used if international roaming has been activated.

International calling cards can be purchased to call from a landline to an overseas number. These are available from newsagents, petrol stations, and tobacconists, and can provide a very economical method of calling internationally. To make an outgoing international call, dial 0011, the country code of the country you are calling, then the number. People making an international phone call incoming to Australia must dial 0061 in front of the phone number (and delete the ‘0’ from the area code). For directory assistance, phone 1123.

Telephone Directory
Emergency Services
(outside the Convention Centre) 000

Registration & Tours Desk (Parkside Level 1)
Telephone +61 2 9282 5457
Tours +61 2 9282 5458

Emergency Centre
Royal Prince Alfred Hospital
Missenden Road, Camperdown
+61 2 9515 6111

Directory Assistance
1223

Taxi Services
Taxi Combined Services 133 300
Silver Service Fleet 133 100
Lime Taxis 135 463
(offers priority pick-up for accessible fares)

Airlines
Qantas 131 131
Virgin Blue 136 789
Jetstar 131 538
Sydney Airport 9677 9111

Accommodation contacts
Four Points by Sheraton Darling Harbour +61 2 9290 4000
Novotel Sydney on Darling Harbour +61 2 9934 0000
Grand Mercure Apartments One Darling Harbour +61 2 9563 6666
Oaks Goldsbrough Apartments +61 2 9518 5166
Travelodge Sydney +61 2 8267 1700
Hotel Ibis Darling Harbour +61 2 9563 0888

Time
Sydney is 11 hours ahead of Greenwich Mean Time in February (Eastern Summer time – daylight saving). In February the sun dawns around 5.30 am and sets at around 7.30 pm.

Tipping
Tipping is not as widespread or regulated in Australia as it is in other parts of the world. Tipping is your choice as a reward for good service. It is customary to tip hotel porters (eg. $2.00) and a gratuity of about 10 per cent is usual in restaurants if good service is received. Tips for taxis are regarded as optional, however you may choose to round up to the nearest dollar or two if desired.

Tours
If you have any queries regarding the tours, please visit the registration desk in the Parkside Foyer on Level 1.

Visitors Information Centres
Information centres can provide an abundance of advice and written information. A large centre is located at the corner of Argyle and Playfair Streets, The Rocks, and is well worth visiting. The centre is open from 09:30 to 17:30 daily. Various other information centres can be found throughout the city.

Volunteers
Volunteers will be available during the conference to assist with conference queries.

Weather
February in Australia is the end of our summer season. In Sydney, the mean February temperatures are a minimum of 18.7 degrees Celsius (65.7 degrees Fahrenheit), and maximum of 25.7 degrees Celsius (78.3 degrees Fahrenheit). It is not uncommon however to have individual days a lot hotter (and a lot cooler!). February has an average of 9 days of rain. Wearing cotton clothing and carrying a light cardigan should be sufficient. The Australian sun is very strong and can easily bum. It is recommended that various methods of skin protection are used: wearing broad-spectrum sunscreen, a hat, sunglasses, sun-protective clothing, seeking shade, and taking extra care between 10:00 and 15:00 when UV levels are at their highest. Be sure to drink sufficient water to stay hydrated in the heat.

Disclaimer
The organisers have made every attempt to ensure that all information in this publication is correct. The organisers take no responsibility for changes to the program or any loss that may occur as a result of changes to the program. Some of the information contained in this publication has been provided by external sources. Although every effort has been made to ensure the accuracy, currency and reliability of the content, the organisers accept no responsibility in that regard.
Be a Part of Finding the Answers to Cerebral Palsy Piece by Piece

The Cerebral Palsy Foundation funds the Cerebral Palsy Institute to coordinate research. Our endeavours will continue until the answers to the prevention and cure for cerebral palsy are found.

We will find the answers by:

• Funding research and expanding a grants program
• Building partnerships
• Encouraging researchers to adopt cerebral palsy as their area of study
• Bringing together the best research minds and sharing information

We know where to look!
Our world-first Delphi study, involving leading international experts, has determined our research priorities. Prioritised study areas include:

• Genetics - Factors that predispose babies to injury and blood clotting
• Infection and inflammation - Infections that cause cerebral palsy
• Blood diseases - Blood clotting and stroke risk factors
• Injury timing and outcome - Causes in premature and full-term babies

The Cerebral Palsy Institute, funded by the Cerebral Palsy Foundation, provides research grants annually.
Research grants program - 2009
Innovative Research Grants between $25,000 - $100,000 for up to 3 years
or
National Health and Medical Research Council (NHMRC) / CP Foundation Co Funded Program
(These funds are matched by the NHMRC)

For 2009, there are four options:

• 1 x NHMRC Career Development Award
  $100,000 each year for 4 years
  Open: 19 January 2009
  Close: 31 March 2009

• 1 x NHMRC Training Fellowship
  $68,500 each year for 2 years
  Open: March 2009
  Close: May 2009

• 2 x NHMRC Doctoral Scholarship
  $27,560 for up to 3 years
  Open: May 2009
  Close: July 2009

Application forms are available on
www.cpinstityute.com.au
or email cpinstityute@tscnsw.org.au
## Conference Program

### Wednesday 18 February 2009

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<td>Registration Desk Open</td>
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<td>0750</td>
<td>Arrival Coffee and Tea</td>
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<td>0830</td>
<td>Official Welcome: Marelle Thornton AO</td>
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<td>Welcome to Country</td>
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<td>Welcome from Scientific Chair</td>
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<td>Keynote Session 1:</td>
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<td>Helen Dalley MC</td>
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<td>0845</td>
<td>Children's health - is it improving? Influencing government to make child health a priority*</td>
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<td>Proudly sponsored by</td>
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<td>Prof. Fiona Stanley (Australia)</td>
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<td>0915</td>
<td>What parents and clinicians want to know - and what we should be telling them – in 2009*</td>
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<td>Prof. Peter Rosenbaum (Canada)</td>
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<td>1000</td>
<td>AUSACPDm - Launch of Hip Surveillance Guidelines</td>
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<td>Assoc. Prof. Sue Slott (New Zealand)</td>
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<td>President of the AUSACPDm</td>
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<tr>
<td>0935</td>
<td>Morning Tea (provided)</td>
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*Published in Developmental Medicine & Child Neurology*
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<td><strong>Epilepsy in hemiplegic cerebral palsy resulting from perinatal arterial ischemic stroke</strong></td>
<td><strong>Apolipoprotein E genotype is not associated with cerebral palsy</strong>*</td>
<td><strong>Effect of prenatal asphyxia on pregnancy outcome, brain and behavior in newborn sheep</strong>*</td>
</tr>
<tr>
<td>Sue Reid</td>
<td>Gai McMichael</td>
<td>Ana Baburamani</td>
</tr>
<tr>
<td><strong>The additional effect of botulinum toxin-A on Fitts tasks in children with cerebral palsy, who received a standardised intensive task oriented therapy programme</strong></td>
<td><strong>Assisted conception leads to more children with cerebral palsy</strong>*</td>
<td><strong>Asphyxia at birth, prenatal ischemia and sensorimotor disuse in rats to better understand cerebral palsy</strong></td>
</tr>
<tr>
<td>Eugene Rameckers</td>
<td>Dorthe Hvidtjørn</td>
<td>J-Olivier Coq</td>
</tr>
<tr>
<td><strong>Combining botulinum toxin type A injection and modified constraint-induced movement therapy in patients with cerebral palsy</strong></td>
<td><strong>Cerebral palsy after placental laser ablation surgery for severe twin-twin transfusion syndrome</strong>*</td>
<td><strong>Electrographic seizures are associated with the same degree of brain injury as clinical seizures in the hypoxic-ischemic newborn piglet</strong>*</td>
</tr>
<tr>
<td>Yu Ching Lin</td>
<td>Peter Gray</td>
<td>Tracey Bjorkman</td>
</tr>
<tr>
<td><strong>Systematic review of upper limb casting</strong>*</td>
<td><strong>Anti-coagulant related SNPS associated with spastic cerebral palsy</strong>*</td>
<td><strong>Influence of (Ccttt)N Inos-A promoter expansion and -C511&gt;T8-13; haplotype on cerebral palsy and neuropsychological disorders development at school age associated with perinatal hypoxia-ischemia</strong>*</td>
</tr>
<tr>
<td>Natasha Lannin</td>
<td>Jakob Grove</td>
<td>Sofia Tore</td>
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## Conference Program

### Wednesday 18 February 2009

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<tr>
<td>1139 – 1155</td>
<td>Questions</td>
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<tr>
<td>1155 – 1315</td>
<td>Lunch (provided)/Poster Viewing Session</td>
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</table>
| 1315 – 1415 | CONCURRENT ORAL SESSION 7  
OWE07 Bayside 204A | CONCURRENT ORAL SESSION 8  
OWE08 Parkside 110B | CONCURRENT ORAL SESSION 9  
OWE09 Parkside G04 |
| Participation and Quality of Life: Young Adults | Prevention of Impairments: Hips and ITB | Effective Interventions: Bone Density and Communication |
| Chairs: Prof Peter Rosenbaum, Dr Elise Davis | Chairs: A/Prof Sue Stott, Dr James Rice | Chairs: A/Prof Darcy Fehlings, Rachel McDonald |
| Chairs: Robert Palisano | Meredith Wynter | Janet Hough |
| 1323 | Factors influencing participation of children with cerebral palsy in Australia* | The cerebral palsy hip classification* | Pamidronate improves pain, wellbeing, fracture rate and bone density in 14 children and adolescents with chronic neurological conditions |
| Chairs: Christine Imms | H. Kerr Graham | Jane Valentine |
| 1331 | Investigating the quality of life of adolescents with cerebral palsy as they transition into secondary school: What does the literature suggest?* | Early hip development in the young child with cerebral palsy – risk status and relationship to motor development in an early natural history study | Intensive speech therapy for children with dysarthria |
| Chairs: Rona Jones | Roslyn Boyd | Lindsay Pennington |
| 1339 | Quality of life for adolescents with cerebral palsy: Perspectives of adolescents and parents | Survivorship analysis of adductor surgery to prevent hip displacement in children with cerebral palsy* | Treatment of drooling in children with cerebral palsy using ultrasound guided intraglandular injection |
| Chairs: Melanie Davern | Xavier Yu | Lai Choo Ong |
| 1347 | Life satisfaction and psychological well-being in youth with cerebral palsy: Exploratory study | Intrathecal baclofen for treatment of spasticity in cerebral palsy: A systematic review* | Predicting the speech and communication development of young children with cerebral palsy: Findings from a pilot study |
| Chairs: Diana Brandao | Monika Hassenat | Lindsay Pennington |
| 1355 | How Do Children With Cerebral Palsy And Complex Communication Needs Use Their Time? Relationship Between Time Use And Activity Participation | Efficacy of intrathecal baclofen therapy in children with intractable spastic cerebral palsy: A randomised controlled trial |
| Chairs: Parmi Raghavendra | Johan Vles |
| 1355–1405 | Questions | Questions | Questions |
| 1405–1415 | Room change | Questions | Questions |
| 1415–1535 | SEMINAR SESSION 1  
SWE01 Parkside 110A | SEMINAR SESSION 2  
SWE02 Parkside 204A | SEMINAR SESSION 3  
SWE03 Parkside 110B |
| Long Term Outcomes | Physical Potential | Service Models |
| Chairs: Dr Alicia Spittle | Chairs: Dr Anna Mackey | Chairs: A/Prof Dinah ReddiHough |
| Long-term outcomes for children born very preterm | Fit for life - encouraging children of all abilities | Cerebral palsy: Care throughout the lifespan |
| Chairs: Peter Anderson | Cindy Miles | Hank Chambers |
| 1535–1605 | Afternoon Tea (provided) | Questions | Questions |
| 1610–1730 | KEYNOTE SESSION 2  
KWE02 Parkside Ballroom | Questions | Questions |
<p>| Motor function and the young brain’s plasticity* | Prof Ingeborg Kagerloh-Mann (Germany) | Prof. H Kerr Graham (Australia) |
| Chairs: Prof Giovanni Cioni, Dr Hank Chambers |
| 1710–1725 | Question Time of Panel of Keynotes | Questions | Questions |
| 1800–1930 | WELCOME DRINKS – Harbour Cruise | Questions | Questions |</p>
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<tr>
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<tr>
<td><strong>CONCURRENT ORAL SESSION 10</strong>&lt;br&gt;Oウェ10 Parkside Ballroom</td>
<td><strong>CONCURRENT ORAL SESSION 11</strong>&lt;br&gt;Oウェ11 Bayside 204B</td>
<td><strong>CONCURRENT ORAL SESSION 12</strong>&lt;br&gt;Oウェ12 Parkside 110A</td>
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<tr>
<td>Chairs: Dr Lena Krumlinde Sundholm, Brain Hoare</td>
<td>Chairs: Prof Rona Stanley, Prof Paul De Cock</td>
<td>Chairs: Dr Dianne Russell, Angela Tillmans</td>
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<tr>
<td>The revised pediatric motor activity log to measure upper limb outcome in children with hemiplegic cerebral palsy*</td>
<td>Racial disparity in the prevalence of cerebral palsy explained by perinatal risk factors but not by maternal education: Results from a U.S. birth cohort study*</td>
<td>Perspectives from administrators: Do knowledge brokers make a difference?</td>
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<tr>
<td>Margaret Wallen</td>
<td>Matt Maenner</td>
<td>Dianne Cameron</td>
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<tr>
<td>Internal consistency, inter-rater and intra-rater reliability the quality of upper extremity skills test for children with cerebral palsy*</td>
<td>Case-control study of cerebral palsy in term and preterm infants in Western Australia, 1980–1995: The outcomes of NICU graduates</td>
<td>Equipment for children with cerebral palsy can be predicted and economically forecasted: A cohort study*</td>
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<tr>
<td>Natasha Lannin</td>
<td>Jan De Groot</td>
<td>Hayley Smithers-Sheedy</td>
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<tr>
<td>The clinical utility of quality of upper extremity skills test for children with cerebral palsy</td>
<td>Cerebral palsy in term infants: A population-based case-control study of antenatal and intra partal risk factors</td>
<td>Family-centred services for children with cerebral palsy: How are we doing?*</td>
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<tr>
<td>Natasha Lannin</td>
<td>Kristina Ahlin</td>
<td>Joyce Magill-Evans</td>
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<tr>
<td>Retest and alternate forms reliability of the assisting hand assessment*</td>
<td>The characteristics of CP in term infants not admitted to NICU*</td>
<td>Is it time to facilitate parent-to-parent support as part of family-centred pediatric rehabilitation?</td>
</tr>
<tr>
<td>Marie Holmefur</td>
<td>Sarah McIntyre</td>
<td>Lesley Marriott</td>
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<tr>
<td>Parents' and therapists' perceptions about the content and construct of the Manual Ability Classification System, MACS</td>
<td>Brain metrics at term equivalent age predicts early cognitive and motor development in very preterm children*</td>
<td>Perceived Level Of Disability For Clients With Cerebral Palsy: Factors Influencing Therapists’ Judgment</td>
</tr>
<tr>
<td>Ann-Marie Öhrnwall</td>
<td>Peter Anderson</td>
<td>Mehdi Rassafani</td>
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<tr>
<td>Evaluating of bimanual skills in young children with hemiplegic cerebral palsy: A systematic review*</td>
<td>Is breech presentation a risk factor for cerebral palsy?*</td>
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<tr>
<td>Susan Greaves</td>
<td>Guro Andersen</td>
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<td>Questions</td>
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<tr>
<td><strong>SEMINAR SESSION 4</strong>&lt;br&gt;Sウェ04 Parkside Ballroom</td>
<td><strong>SEMINAR SESSION 5</strong>&lt;br&gt;Sウェ05 Parkside 204B</td>
<td><strong>SEMINAR SESSION 6</strong>&lt;br&gt;Sウェ06 Parkside G04</td>
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<tr>
<td>Service Intensity</td>
<td>Quality of Movement Measurement</td>
<td>Quality of Life: Mealtimes</td>
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<tr>
<td>Chairs: Dr Adam Scheinberg</td>
<td>Chairs: Cathy Morgan</td>
<td>Chairs: Dr Lindsay Pennington</td>
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<tr>
<td>Early intense therapy for children with cerebral palsy – time to reflect on the service delivery model</td>
<td>Quality of movement of ambulatory children and youth with cerebral palsy: Introducing the quality FM</td>
<td>Mealtimes changes in older adults with cerebral palsy and dysphagia</td>
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<tr>
<td>Johanna Darrah</td>
<td>Virginia Weight</td>
<td>Bronwyn Hemsley</td>
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### Conference Program

**Thursday 19 February 2009**

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<th>Chairs</th>
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<tbody>
<tr>
<td>0630 – 1730</td>
<td><strong>REGISTRATION DESK OPEN</strong></td>
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<tr>
<td>0700 – 0900</td>
<td><strong>ADVANCED PRACTITIONER WORKSHOP 1</strong>&lt;br&gt;APW01 Bayside G04&lt;br&gt;Measuring: Upper Limb Assessment</td>
<td>Parkside Ballroom</td>
<td>Alicia Frost</td>
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<tr>
<td>0700 – 0900</td>
<td><strong>ADVANCED PRACTITIONER WORKSHOP 2</strong>&lt;br&gt;APW02 Parkside Ballroom&lt;br&gt;Measuring: Gross Motor Assessment</td>
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<tr>
<td>0700 – 0900</td>
<td><strong>ADVANCED PRACTITIONER WORKSHOP 3</strong>&lt;br&gt;APW03 Bayside 204A&lt;br&gt;Promoting Coping and Self-Esteem</td>
<td></td>
<td>Nicole Ison</td>
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<tr>
<td>0900 – 0905</td>
<td><strong>ROOM CHANGE</strong></td>
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<tr>
<td>0905 – 1015</td>
<td><strong>KEYNOTE SESSION 3</strong>&lt;br&gt;KTH03 Parkside Ballroom&lt;br&gt;Prevention of CP: Best chances for breakthroughs* Prof. Karin Nelson (USA)</td>
<td></td>
<td>A/Prof Nadia Badawi, Prof Kerr Graham</td>
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<tr>
<td>1005</td>
<td><strong>Keynote Question Time</strong></td>
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<tr>
<td>1015 – 1045</td>
<td><strong>Morning Tea (provided)</strong></td>
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<td>Proudly sponsored by <strong>ALLERGAN</strong></td>
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<tr>
<td>1045 – 1155</td>
<td><strong>KEYNOTE SESSION 4</strong>&lt;br&gt;KTH04 Parkside Ballroom&lt;br&gt;Botulinum Toxin: Development of an International Consensus Statement* Dr. Darcy Fehlings</td>
<td></td>
<td>Prof Florian Heinzen, A/Prof Roslyn Boyd</td>
</tr>
<tr>
<td>1115</td>
<td><em><em>On the Other Hand: About Successful Use of Two Hands Together</em> Dr. Lena Krumlinde Sundholm (Sweden)</em>*</td>
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<tr>
<td>1145</td>
<td><strong>Keynote Question Time</strong></td>
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<tr>
<td>1155 – 1300</td>
<td><strong>Lunch (not provided)</strong></td>
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<tr>
<td>1300 – 1350</td>
<td><strong>CONCURRENT ORAL SESSION 13</strong>&lt;br&gt;OTH13 Parkside G04&lt;br&gt;Quality of Life and Participation: Adults</td>
<td></td>
<td>Nicole Ison, Dr Melanie Davern</td>
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<tr>
<td>1300 – 1350</td>
<td><strong>CONCURRENT ORAL SESSION 14</strong>&lt;br&gt;OTH14 Parkside Ballroom&lt;br&gt;Measurement: Gait</td>
<td></td>
<td>Dr. Kevin Lowe, Zoe Atkinson</td>
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<td>1300 – 1350</td>
<td><strong>CONCURRENT ORAL SESSION 15</strong>&lt;br&gt;OTH15 Bayside 204A&lt;br&gt;Measurement: Communication</td>
<td></td>
<td>Dr. Jan William Gortz, Katherine Svinbun</td>
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<tr>
<td>1300</td>
<td>The ICF environmental factors as facilitators or barriers used in describing personal and social networks. A pilot study of adults with cerebral palsy</td>
<td></td>
<td>Gerd Jönsson</td>
</tr>
<tr>
<td>1308</td>
<td>Living with a lifelong disability – experiences from adults with CP</td>
<td></td>
<td>Fiona Dobson</td>
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<tr>
<td>1316</td>
<td>Quality of life in young adults with cerebral palsy</td>
<td></td>
<td>Mary Jo Cooley Hidercker</td>
</tr>
<tr>
<td>1324</td>
<td>‘I don’t think I would move him’, family attitudes to moving younger people with cerebral palsy out of nursing homes*</td>
<td></td>
<td>Katie Price</td>
</tr>
<tr>
<td>1332</td>
<td>The importance of ‘linked lives’ in the life course of adults with cerebral palsy and their non-disabled siblings*</td>
<td></td>
<td>Angela Dew</td>
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</tbody>
</table>

*Published in Developmental Medicine & Child Neurology
**World Cerebral Palsy Register and Surveillance Congress**

**WCP01  Parkside 110A&B**

**1045** The Who, What and How of the World Register and Surveillance Congress  
Sarah McIntyre

**1100 – 1250** Part 1: Outputs from Different Types of registers and Surveillance Programs  
**1100 – 1150** Registers Aimed at Monitoring Rates and Prevention  
Chair: Karin Nelson

**1100** Trends In The Panorama Of Cerebral Palsy In Western Sweden*  
Kate Himmelmann

**1108** Prevalence Of Cerebral Palsy In Three Areas Of The United States In 2004: An Update From The Autism And Developmental Disabilities Monitoring Network*  
Nancy Doernberg

**1116** The Changing Picture Of Cerebral Palsy For Those Born At Term: 16 Years Of Population Data*  
Sarah McIntyre

**1124** Changes In Subtypes And Severity Of Cerebral Palsy Among Icelandic Children Born 1990–2003.*  
Torstein Vik

**1132** Characteristics Of Cerebral Palsy And Co-Occurring Developmental Disabilities Among Children 8-Years-Old-Metropolitan Atlanta Developmental Disabilities Surveillance Program, 2004 Surveillance Year*  
Kim Van Naarden Braun

**1140** Questions  
**1150 –1155** Break  
**1155 – 1235** Registers Methodologies Aimed at optimising Outcomes for People with Cerebral Palsy  
Chair: Dinah Reddihough

**1155** Lessons from Survey Methodologies in Describing Functioning, Participation and Well-being Across Developmental Ages In Children and Youth with Cerebral Palsy  
Michael Msiell

**1200** Using the Victorian Cerebral Palsy Register as a Sampling Frame for Research  
Sue Reid

**1205** Surveillance Of Gross Motor Level Of Function Among Children With Cerebral Palsy: Feasibility And Reliability In A United States Cohort  
Ruth E. Benedict

**1213** Introduction to CPUP  
Eva Nordmark or Lena Westbom

**1218** Development Of Lower Limb Range Of Motion From Early Childhood To Adolescence In Cerebral Palsy - A Population Based Study.*  
Eva Nordmark

**1226** CPOP - The Cerebral Palsy Follow-Up Program In Norway*  
Reidun Jahnsen

**1234** Questions for speakers and discussion  
Comment: Fiona Stanley

**1250 – 1350** Lunch

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**ADVANCED PRACTITIONER WORKSHOP 4** Bayside 204B

Measurement Classification  
Chairs: Dr William Oppenheim

Prevention of Deformity: Effective Orthoses  
Chairs: Dr Peter Flett

Effective Interventions: Participation  
Chairs: Ruth Evans

Towards a better description of spastic cerebral palsy: Use of the Australian spasticity assessment scale and the reliable description of cerebral palsy form  
Noula Gibson  Jules Becher  Andrea Lamont

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**ADVANCED PRACTITIONER WORKSHOP 5** Parkside 110A&B

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**ADVANCED PRACTITIONER WORKSHOP 6** Parkside 203

---

**COMCURRENT ORAL SESSION 16** Bayside 204B

**OTH16**

Physical Potential: Maximising Mobility  
Chairs: Dr Adrienne Harvey, Sue Gibson

Mobility experiences of youth with cerebral palsy  
Robert Palisano

Impact of musculoskeletal co-morbidities on the health related quality of life of children with severe non-ambulatory cerebral palsy*  
Unni Narayanan

The relationship between gross motor capacity and performance of daily life mobility in children with cerebral palsy at primary school age  
Dirk-Vouter Smits

Visual spatial attention and balance in children with cerebral palsy  
Leanne Johnston  Jon Skanes

Probability of walking and wheeled mobility for children and youth with cerebral palsy based on age and environmental setting  
Robert Palisano

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**COMCURRENT ORAL SESSION 17** Bayside 203

**OTH17**

Aetiology and Prevention  
Chairs: A/Prof David Walker, Prof Claudine Amiel-Tison

Erythropoietin is neuroprotective in a preterm ovine model of endotoxin-induced central nervous system injury*  
Sandra Rees

Sulfasalazine use in an ovine model of in utero infection: A prospect for neuroprotection?*  
Burcu Saglam

Cerebral palsy and neuromaging in children with congenital cytomegalovirus infection*  
Vlatka Mejaški-Bošnjak

Abnormal brain connectivity in Very Low Birth Weight (VLBW) CP adolescents at 14 and 19 years of age*  
Robert Palisano
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<td>1400 – 1500</td>
<td><strong>CONCURRENT ORAL SESSION 18</strong> OTH18 Bayside 204A</td>
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<tr>
<td></td>
<td>Effective Interventions: Botulinum Toxin A</td>
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<td></td>
<td>Chairs: Dr Jane Valentine</td>
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<tr>
<td>1400</td>
<td>Do botulinum toxin injections (BTX) alter the passive mechanical properties of the calf muscles in children with cerebral palsy (CP)?*</td>
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<tr>
<td></td>
<td>Chairs: Dr Jane Valentine</td>
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<tr>
<td>1408</td>
<td>No effect of botulinum toxin a on ankle biomechanics during velocity-matched gait in children with hemiplegic cerebral palsy</td>
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<tr>
<td></td>
<td>Chairs: Richard Baker</td>
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<tr>
<td>1416</td>
<td>Systemic adverse events following injections of botulinum toxin A (Bont-A) in children with cerebral palsy*</td>
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<tr>
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<td>Chairs: Luigi Piccinni</td>
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<tr>
<td>1424</td>
<td>The Safety Of Bont-A Treatment In Children With Gmfc Level Iv And V Cerebral Palsy</td>
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<td>Chairs: Leanne Johnston</td>
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<td>1432</td>
<td>Dutch Version Of The Functional Mobility Scale: A Valid And Reliable Tool For Measuring Functional Mobility In Children With Cerebral Palsy?</td>
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<td>Chairs: Carel Maathuis</td>
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<tr>
<td>1440</td>
<td>Predictors Of 6 Minutes Walking Test In Adults With Cerebral Palsy</td>
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<td>Chairs: Grethe Maanum</td>
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<tr>
<td>1500 – 1530</td>
<td>Afternoon Tea (provided)</td>
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<tr>
<td>1530 – 1650</td>
<td><strong>SEMINAR SESSION 7</strong> STH07 Parkside Ballroom</td>
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<td>Hip Displacement Interventions</td>
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<td>Chairs: Dr Unni Narayanan</td>
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<td>1530</td>
<td>The management of hip displacement in cerebral palsy: Moving from surveillance to management</td>
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<td>Chairs: Dr Unni Narayanan</td>
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<td>1700 – 1830</td>
<td><strong>ETS MOBILITY SPONSORED WORKSHOP</strong> ETS01 Parkside Ballroom</td>
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<td></td>
<td>Managing complex posture and movement problems in CP with TheraTogs Systems</td>
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<td></td>
<td>Chairs: Beverly Cusick (USA)</td>
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<td>1900</td>
<td>OPTIONAL SOCIAL PROGRAM</td>
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**World Cerebral Palsy Register and Surveillance Congress (continued)**

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<th>Location</th>
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<tr>
<td>1350 – 1730</td>
<td>Part 2: Challenging Aspects of CP Registers and Surveillance Programs</td>
<td>Parkside 110A&amp;B</td>
<td>Angela Dew, Carol L. Richards, Dr Andrea Guzzetta</td>
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<tr>
<td>1350</td>
<td>Overview for Papers and Workshop A</td>
<td>Bayside 203</td>
<td>Manshalyan Yeangin-Alsopp</td>
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<td>1405</td>
<td>Mild Cerebral Palsy And Inclusion Criteria In Cerebral Palsy Register</td>
<td>Bayside 203</td>
<td>Rosa Zaminkalam</td>
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<td>1413</td>
<td>Inaccuracy Rate Of The Diagnosis Of Cerebral Palsy In South Australian</td>
<td>Bayside 203</td>
<td>Dr Andrea Guzzetta</td>
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<td>1421</td>
<td>Questions for paper presenters</td>
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<td>1425</td>
<td>Overview for Papers and Workshop B</td>
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<td>1440</td>
<td>Clinical Examinations At Five Years Of Age Provide A ‘Gold Standard’ For</td>
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<td>Cerebral Palsy (CP) Registers</td>
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<td>Peter Flett, Michael Msall</td>
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<td>1458</td>
<td>Overview for Workshop C</td>
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<td>Christine Cans</td>
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<td>1453</td>
<td>Questions for paper presenters</td>
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<td>1513</td>
<td>D) Comparisons of Rates and Trends: Ensuring Validity</td>
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<td>1535 – 1600</td>
<td>Afternoon Tea (provided)</td>
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<td>1600 – 1730</td>
<td>Concurrent Working Groups</td>
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<td>1740 – 1900</td>
<td>Part 3: Where to From Here</td>
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<td>1820</td>
<td>Research questions needing CP Registers to work together</td>
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<td>1830</td>
<td>General Discussion</td>
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<td>1840</td>
<td>General Discussion and Remaining Questions</td>
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<tr>
<td>1900</td>
<td>OPTIONAL SOCIAL PROGRAM</td>
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### Conference Program

**Friday 20 February 2009**

#### 0630 - 1800

- Registration Desk Open

#### 0700 - 0900

<table>
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<tr>
<th>Workshop</th>
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<tbody>
<tr>
<td>APW07</td>
<td>Physical Potential: Fitness</td>
<td>Parkside Balroom</td>
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<tr>
<td>APW08</td>
<td>Effective Interventions: Upper Limb</td>
<td>Parkside 110B</td>
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<tr>
<td>APW09</td>
<td>Effective Interventions: Goal-Directed Training</td>
<td>Bayside 204B</td>
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**Chairs:**
- Dr Adrienne Harvey
- Dr Lena Sundholm Krumlinde
- Sue Greaves

**Content:**
- Fitness tests and exercise training in children and adolescents with cerebral palsy
- One hand or two? Optimizing outcomes in upper limb rehabilitation for children with hemiplegia
- Evidence-based goal-directed training: An intervention approach for people with cerebral palsy

#### 0900 - 0910

**Room change**

#### 0910 - 1110

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<tr>
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<tr>
<td>APW13</td>
<td>Effective Interventions: Osteopenia</td>
<td>Bayside 204B</td>
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<td>APW14</td>
<td>Measurement: Upper Limb</td>
<td>Parkside G04</td>
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<tr>
<td>APW15</td>
<td>Effective Interventions: Home Programs</td>
<td>Parkside Ballroom</td>
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</table>

**Chairs:**
- Dr Kate Himmelmann
- Dr Joyce Magill-Evans
- Prof Robert Palisano

**Content:**
- Evidence-based guidelines for management of osteopenia in children/adults with physical disabilities
- Using the assisting hand assessment for treatment planning
- Designing and implementing effective home program intervention for children with cerebral palsy

#### 1110 - 1140

**Morning Tea**

**Proudly sponsored by** ALLERGAN

#### 1140 - 1240

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<td>OFR24</td>
<td>Measurement: Upper Limb Assessment</td>
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<td>OFR25</td>
<td>Effective Interventions: Multi Level Surgery</td>
<td>Parkside Ballroom</td>
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**Chairs:**
- Sarah Love, Megan Kentish
- Melinda Randall, Siobhan Reid
- Dr Stephen O’Flaherty, Dr Gerhard Kiefer

**Content:**
- Does self-report measure performance? A study of the construct validity of the functional mobility scale*
- A novel method of assessment of upper limb useful workspace using a virtual representation of the subject on screen
- Evaluation of multilevel surgery and rehabilitation in children and youth with cerebral palsy - a two year follow-up*

#### 1148

**Titles:**
- Measuring higher level functional mobility skills in children with cerebral palsy (CP) in GMFCS Level I: preliminary work on a proposed challenge module for the gross motor function measure*
- Tactile Assessment In Children With Congenital Hemiplegia: Which Tool To Use?*
- Evaluation of multilevel surgery and rehabilitation in children and youth with cerebral palsy - a two year follow-up*
- Strength outcome and progression over time following multilevel orthopaedic surgery in children with cerebral palsy*

**Chairs:**
- Adrieenne Harvey
- Tim Scott
- Anita Akerstedt
- Virginia Wright
- Megan Auld
- Hilde Reys
- William Oppenheim
- Megan Auld
- Deepak Sharan

**Content:**
- Interrater reliability of the selective control assessment of the lower extremity (scale) for patients with spastic cerebral palsy
- Seeing The Gaps: A Review Of Visual Assessments For Congenital Hemiplegia •
- Complications during postoperative rehabilitation following single event multilevel surgery in cerebral palsy
- Coordination of the arms during unilateral and bilateral movements in children with hemiplegic cerebral palsy
- Correction of severe crouch gait: Long term follow-up

#### 1204

**Titles:**
- Capacity, capability and performance: different constructs or three of a kind?*
- Associated Reactions: What Are Their Characteristics In People With Hemiplegic Cerebral Palsy
- Trajectory of change following single event multilevel surgery in children with spastic cerebral palsy in the context of a RCT™

**Chairs:**
- Majolijn Ketelaar
- Hsu-Ching Chiu
- Jillian Rodda
- Kelly Clanchy
- Hsu-Ching Chiu
- Pam Thomason
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<tr>
<td>APW10</td>
<td>Effective Interventions: Rehabilitation</td>
<td>Dr Sue Stott</td>
<td>Research based guidelines for rehabilitation of children with cerebral palsy.</td>
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<tr>
<td>APW11</td>
<td>Effective Interventions: Sialoreah</td>
<td>Dr Anna Gubbay</td>
<td>Management of drooling: Ultrasound-guided botulinum toxin a injection to salivary glands.</td>
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<tr>
<td>APW12</td>
<td>Effective Interventions: Long Term Outcomes: Adults</td>
<td>Dr William Oppenheim</td>
<td>Use of the international classification of function to facilitate management of the person with cerebral palsy.</td>
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<td>APW16</td>
<td>Measurement: Physical Activity</td>
<td>Susan Reid</td>
<td>Ambulatory and physical activity assessment: clinical and research issues.</td>
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<td>APW17</td>
<td>Effective Research: Partnerships</td>
<td>Dr Christine Imms</td>
<td>Cerebral palsy partnerships: creating global awareness and promoting research.</td>
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<td>APW18</td>
<td>Effective Interventions: Sleep</td>
<td>Dr Katherine Langdon</td>
<td>Sleep, behaviour and learning in children.</td>
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<td>OFR26</td>
<td>Quality of life: Relationships and Coping</td>
<td>Dr Michael Msall, Dr Peter Anderson</td>
<td>Assessing the wellbeing of children with severe cerebral palsy: A comparison of the CP child with other quality of life measures.</td>
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<tr>
<td>OFR28</td>
<td>Participation in play and recreation: Measuring the extent of assistance provided by mothers of children with disabilities*</td>
<td>Rachel McDonald</td>
<td>Use of locally made mobility and seating systems for children with severe cerebral palsy in district and rural areas of Malaysia.</td>
</tr>
<tr>
<td>OFR29</td>
<td>Friendships Of Children Who Have Cerebral Palsy And Complex Communication Needs.*</td>
<td>Helen Bourke-Taylor</td>
<td>Use of upper limb orthoses, adaptive equipment and therapy in a community based sample of children with hemiplegic cerebral palsy.</td>
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<tr>
<td>OFR30</td>
<td>“Just Like You”, A Disability Awareness Programme For Children: Pilot Study Findings.*</td>
<td>Kate Anderson</td>
<td>Robotic rehabilitation of upper limb in hemiplegic children.</td>
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<tr>
<td>OFR31</td>
<td>Attention/Executive, Learning And Memory Functions In Young Adults With Cerebral Palsy (Cp) Born Premature With Very Low Birth Weight.*</td>
<td>Nicole Ison</td>
<td>Effects of power wheelchairs on the development of children aged 14 to 30 months with severe motor impairments*.</td>
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<tr>
<td>OFR32</td>
<td></td>
<td>Remo Russo</td>
<td>Use of locally made mobility and seating systems for children with severe cerebral palsy in district and rural areas of Malaysia.</td>
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<td>OFR33</td>
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<td>Enrico Castelli</td>
<td>Use of upper limb orthoses, adaptive equipment and therapy in a community based sample of children with hemiplegic cerebral palsy.</td>
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<td>Measurement: Lower Limb Assessment</td>
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<td>Chairs: Sarah Love, Megan Kentish</td>
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<td>1200</td>
<td>The validity of the Alberta Infant Motor Scale (AIMS) and Neuro Sensory Motor</td>
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<td>Development Assessment (NSMDA) in predicting motor performance at 2 years of</td>
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<td>age in very preterm infants*</td>
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<td></td>
<td>Alicia Spittle</td>
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<td>1220</td>
<td>Physical Fitness in Children With Cerebral Palsy: Reliability Of Testing And</td>
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<td>Comparison With Typically Developing Children</td>
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<td></td>
<td>Annet Dallmeijer</td>
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<td>1228</td>
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<td>1250-1430</td>
<td><strong>SEMINAR SESSION 12</strong>&lt;br&gt;SFR12 Parkside G04</td>
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<td></td>
<td>Effective Interventions: Sialorreah</td>
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<td>Chairs: Alison Wu</td>
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<td></td>
<td>Managing drooling in children with cerebral palsy - a multi disciplinary team</td>
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<td>Dinah Reddihough</td>
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<td>1250-1430</td>
<td><strong>SEMINAR SESSION 13</strong>&lt;br&gt;SFR13 Bayside 204A</td>
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<td></td>
<td>Service Models: Knowledge Brokering</td>
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<td>Chairs: Dr Ray Russo</td>
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<td></td>
<td>Knowledge brokers: What are they and how can they help move cerebral palsy</td>
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<td>research into clinical practice?</td>
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<td></td>
<td>Dianne Russell</td>
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<td>1550-1600</td>
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<td>1600-1745</td>
<td><strong>KEYNOTE SESSION 5</strong>&lt;br&gt;KFR05 Parkside Ballroom</td>
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<tr>
<td></td>
<td>Cerebral palsy – genomic susceptibility and environmental triggers* Prof.</td>
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<td></td>
<td>Alastair MacLennnan (Australia)</td>
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<td>1600</td>
<td>Clinical and neurophysiological evidence for early intervention in high risk</td>
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<td></td>
<td>infants: Animal and human studies*</td>
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<td>1730-1745</td>
<td><strong>Festival of Keynotes</strong></td>
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<td>BONDI BEACH BARBEQUE</td>
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<td>Concurrent Oral Session 26</td>
<td>Concurrent Oral Session 27</td>
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<td><strong>OFR26</strong> Parkside 110B (cont)</td>
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<tr>
<td>Quality of Life: Relationships and Coping</td>
<td>Effective Interventions: Adaptive Equipment</td>
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<td>Chairs: Dr Michael Msall, Dr Peter Anderson</td>
<td>Chairs: Eugene Rameckers, Petra Karlsson</td>
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<tr>
<td>How children with cerebral palsy feel about on-screen keyboards</td>
<td>Denise Reid</td>
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Questions

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<td>Physical Potential and Measurement</td>
<td>Effective Interventions: Task Orientated Therapy</td>
<td>Measurement: Neuroimaging</td>
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<tr>
<td>Chairs: Ann Lancaster</td>
<td>Chairs: Val Lehmann-Monck</td>
<td>Chairs: Dr Marijke Eysen</td>
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<tr>
<td>GMFCS as a template for the musculoskeletal management of children with cerebral palsy</td>
<td>Intensive task oriented upper limb therapy</td>
<td>Current knowledge on brain structure and function</td>
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<td>Adrienne Harvey</td>
<td>Eugene Rameckers</td>
<td>Ingeborg Krageloh-Mann</td>
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Prof. Giovanni Cioni (Italy)
### Saturday 21 February 2009

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<td><strong>REGISTRATION DESK OPEN</strong></td>
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<td>0700 – 0800</td>
<td><strong>ADVANCED PRACTITIONER WORKSHOP 19 APW19</strong></td>
<td>Parkside Ballroom</td>
<td>Chairs: Megan Auld</td>
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<td><strong>Measurement: Vision</strong></td>
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<td>0700 – 0800</td>
<td><strong>ADVANCED PRACTITIONER WORKSHOP 20 APW20</strong></td>
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<td><strong>Effective Interventions: Dysphagia</strong></td>
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<td>0700 – 0800</td>
<td><strong>ADVANCED PRACTITIONER WORKSHOP 21 APW21</strong></td>
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<td>Chairs: Dr Pammi Raghavendra</td>
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<td><strong>Measurement: Adults</strong></td>
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<td>0700</td>
<td>The visual system, cerebral palsy, and why visual acuity measures just isn’t enough</td>
<td>Parkside 110A</td>
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<td>0735</td>
<td>John Ravenscroft and Cathryn Crowle</td>
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<td>0730 – 0805</td>
<td><strong>The role of multidisciplinary assessment and management of dysphagia/undernutrition and respiratory and bone health in cerebral palsy</strong></td>
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<td>0810 – 0840</td>
<td><strong>Are we making a difference? New ways to measure outcomes for people with a disability and the communities with whom they engage</strong></td>
<td>Parkside 110A</td>
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<td>0840 – 0915</td>
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<td>Parkside Ballroom</td>
<td>Chairs: Prof Paul Colditz, A/Prof Roslyn Boyd</td>
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<td>0915 – 0920</td>
<td><strong>Animal models of cerebral palsy</strong></td>
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<td>0920 – 1020</td>
<td><strong>Triple P – Positive Parenting Program</strong></td>
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<td>1040 – 1140</td>
<td><strong>CONCURRENT ORAL SESSION 29 OS/29</strong></td>
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<td><strong>Service Models: Best Practice Rehabilitation</strong></td>
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<td>Chairs: Professor Peter Rosenbaum, Dr Robert Armstrong</td>
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<td>1040</td>
<td>Moving cerebral palsy research into practice: Do “knowledge brokers” make a difference?*</td>
<td>Parkside 110A</td>
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<td>1048</td>
<td>Developing research based guidelines for rehabilitation of children with cerebral palsy*</td>
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<td>0915 – 0920</td>
<td><strong>Break</strong></td>
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<td>0920 – 1020</td>
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<td>0950</td>
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<td>1040 – 1140</td>
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<td><strong>Neuroscience of Upper Limb Function</strong></td>
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<td>Chairs: Prof Giovanni Cioni, Dr Francine Malouin</td>
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<td>1040</td>
<td>Early development of hand motor function in infants with neonatal cerebral infarction*</td>
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<tr>
<td>1048</td>
<td>Developing research based guidelines for rehabilitation of children with cerebral palsy*</td>
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*Published in Developmental Medicine & Child Neurology
Effective Interventions: Botulinum Toxin

Chairs: Florian Heinen

Single event multi-level chemoneurolysis with botulinum toxin a and phenol for children with spastic cerebral palsy

Kylie Aroyan

Video workshop on upper limb assessment and treatment for clinical practice

Living a life with cerebral palsy pride; the theoretical, sociological frame work and its significance impacting on disability community

Toru Furui

Critical issues in the use of ultrasound of muscles in children with cerebral palsy (begins at 0800)

Heakyung Kim

Early clinical markers of brain damage: contribution of the Amiel-Tison neurological assessment

Heakyung Kim

Learning for life

Claudine Amiel-Tison

Claire Cotter

New opportunities in postural alignment: Carbon composite AFO and new theories for a VAHO

Jopi Siirtola

Reflection: Encouraging and enabling people with cerebral palsy to narrate their stories

Jopi Siirtola

Angela Dew

Advanced therapeutic orthotic management techniques for the child with spastic cerebral palsy

Steffen Berweck

Promoting fitness and lifelong physical activity in adults with cerebral palsy: Project act now

Steffen Berweck

Mark Deharde

Debbie Thorpe
### Conference Program

**Saturday 21 February 2009** continued

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<td>Parkside 110B</td>
<td>Professor Peter Rosenbaum, Dr Robert Armstrong&lt;br&gt;Prof Giovanni Cioni, Dr Francine Malouin</td>
<td><strong>Service Models: Best Practice Rehabilitation</strong>&lt;br&gt;<strong>Neuroscience of Upper Limb Function</strong>&lt;br&gt;Rehabilitation services for children with cerebral palsy in Alberta, Canada&lt;br&gt;Hand function in relation to underlying brain lesion and cortical organization in children with unilateral spastic cerebral palsy</td>
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<td>1056</td>
<td><strong>Johanna Damah</strong></td>
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<td>Community-based rehabilitation in Fiji: Evaluation of the competency, assessment, and local solutions (CAL) programme*&lt;br&gt;Potential of neurophysiological measures to better understand hand function in young people with hemiplegia cerebral palsy</td>
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<tr>
<td>1104</td>
<td><strong>Sarah McIntyre</strong></td>
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<td>Rehabilitative everyday life to support the child&lt;br&gt;Disassociated hand-foot reorganization in congenital malformation of cortical development: Different brain reorganization pattern for different homolateral somatotopical area’s</td>
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<td>1120</td>
<td><strong>Salla Sipari</strong></td>
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<td>Effects of long-term intensive rehabilitation in children with cerebral palsy: Our view on the neuronal group selection theory&lt;br&gt;Unique transcriptional profiles in wrist muscles from cerebral palsy patients*</td>
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<td>1128</td>
<td><strong>Svetislav Polovina</strong></td>
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<td>Questions</td>
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<td><strong>KEYNOTE SESSION 7</strong>&lt;br&gt;KSA07 Parkside Ballroom</td>
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<td>Prof Kerr Graham, Dr Eve Blair</td>
<td><strong>AWARDS PRESENTATIONS</strong></td>
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The botulinum toxin indicated for Upper Limb Spasticity in Cerebral Palsy

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**BOTOX®** (botulinum toxin type A) purified neurotoxin complex is a prescription medicine containing 100 units (U) of botulinum toxin type A for injection.

**Indications:** Strabismus; blepharospasm associated with dystonia, including benign blepharospasm & VIIth nerve disorders (hemifacial spasm) in patients 12 years & over; cervical dystonia (spasmodic torticollis); *focal spasticity of the upper & lower limbs, including dynamic equinus foot deformity due to spasticity in juvenile cerebral palsy patients 2 years & older; severe primary hyperhidrosis of the axillae; focal spasticity in adults; spasmodic dysphonia; upper facial rhytides (glabellar lines, crow’s feet and forehead lines) in adults. **Contraindications:** Hypersensitivity to ingredients; myasthenia gravis or Eaton Lambert Syndrome; infection at injection site(s). **Precautions:** Use with aminoglycosides or drugs that interfere with neuromuscular transmission; peripheral motor neuropathic diseases or neuromuscular junctional disorders; inflammation at injection sites; excessive weakness in target muscle; pregnancy & lactation. Generalised weakness & myalgia may be related to systemic absorption. Different botulinum preparations are not therapeutically equivalent. Exercise extreme caution should substitution with another botulinum preparation be necessary. Blepharospasm: Reduced blinking following injection of the orbicularis muscle can lead to corneal pathology. Caution with patients at risk of angle closure glaucoma, including anatomically narrow angles. Strabismus: Inducing paralysis in extrinsic muscles may produce spatial disorientation, double vision or past pointing. Use in chronic paralytic strabismus only in conjunction with surgical repair to reduce antagonist contracture. Spasticity: Not likely to be effective at a joint affected by a known fixed contracture. Cervical Dystonia (spasmodic torticollis): Possibility of dysphagia or dysphonia. May be decreased by limiting dose injected into the sternocleidomastoid muscle to <100U. Primary Hyperhidrosis of the Axillae: Consider causes of secondary hyperhidrosis to avoid symptomatic treatment. Spasmodic Dysphonia: Laryngoscopy in diagnostic evaluation is mandatory. Avoid treatment in patients due to have elective surgery requiring general anaesthesia. Paediatric Use: Safety & effectiveness below 2 years not established for focal spasticity. Caution should be exercised when treating patients with significant disability & co-morbidities. **Adverse Reactions:** Usually transient & occur within first week of injection. ≥1% Localised pain, tenderness, bruising, infection, local & general weakness, erythema, oedema, ptyosis, iritation/tearing, vertical deviation, diplopia, sub-conjunctival & conjunctival haemorrhages, reversible increase in intra-ocular pressure, *trigger finger, *clumsiness, *falling, *hypokinesia, *increased frequency of micturition, *joint dislocation, *muscle spasms, *convulsions, *nasopharyngitis, *pneumonia, *vomiting, *confusion, *kg pain/cramps, *fever, *knee pain, *ankle pain, *fetidary, arm pain, hypertonia, fever flu syndrome, accidental injury, incoordination, paresthesia, asthenia, headache, hyperkinesia, neck pain, dysphagia, perceived increase in non-axillary sweating, vasodilatation, paralytic dysphonia (breathy dysphonia), aspiration, stridor, technical failure, blepharoptosis, face pain, ecchymosis, skin tightness, nausea, temporary lateral lower eyelid droop, eyebrow ptosis, eyelid swelling, aching/itching forehead, feeling of tension, seizures. Dose/Administration: Use one vial for one patient. Store reconstituted BOTOX® in refrigerator; use within 24 hours of reconstitution. Blepharospasm: Initially 1.25U to 2.5U injected into upper lid medial & lateral pre-tarsal orbicularis oculi & into lower lid lateral pre-tarsal orbicularis oculi. Cumulative dose over 2 months should not exceed 200U. Strabismus, Initial doses 1.25 – 2.5U to 2.5 – 5.0U per muscle. Maximum single injection for any one muscle is 25U. VIIth Nerve Disorders (hemifacial spasm): Dosing as for unilateral blepharospasm. Inject other facial muscles as needed. *Focal Spasticity in Children 2 Years & Older: 0.5-2.0U/kg body weight for upper limb & 2.0-4.0U/kg body weight for lower limb. 4U/kg or 200U (the lesser amount) for equinus foot deformity. Other muscles range 3.0-8.0U/kg body weight & do not exceed 300U divided among muscles at any treatment session. Focal Spasticity in Adults: Individualise dosing. Cervical Dystonia (spasmodic torticollis): Individualise dosing. Maximum dose 360U every 2 months. Primary Hyperhidrosis of the Axillae: 50U intradermally to each axilla in 10-15 sites 1-2 cm apart. Spasmodic Dysphonia: Bilateral injections. Individualise dosing. Glabellar Lines: 2x4U in each corrugator muscle & 4U in the procerus muscle for 20U total dose. Crow’s Feet: 2.6U/injection site, 3 sites bilaterally in lateral orbicularis oculi. Forehead Lines: 2-6U/injection site, 4 sites in frontal muscle.

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Conference Abstracts

The Conference Abstracts are published in the Conference Proceedings and the accompanying Developmental Medicine and Child Neurology (DMCN). Abstracts that are denoted by an ( * ) in the program are published in the accompanying DMCN and also indicate that the abstract is also a top 100 scored abstract.

DMCN Journal Changes

Due to program changes certain abstracts published in the DMCN do not correspond to the final program. These are listed below:

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The Quebec Adult Cerebral Palsy Study: 3. Public or Community Service Utilization and User Satisfaction

PhD Carol Richards, PhD Normand Boucher, MSc Francine Dumas, PhD Desiree Maltais
Centre for Interdisciplinary Research in Rehabilitation and Social Integration and Laval University

Background: Overall, there is a lack of information regarding the social participation of adults with cerebral palsy (CP) in particular related to their level of utilization of mainstream community and public services. Children with CP who become adults are often forgotten in terms of specialized services.

Objectives: The purpose of this study was to obtain information on the use of public health and social services by adults with CP and their level of satisfaction.

Design: Questionnaire-based survey

Methods: Adults who had been patients as children from 1984–2004 at the Children’s Rehabilitation Centre in Quebec City were contacted and invited to participate. 145 accepted. They were requested to answer an in-house socio-demographic, health profile and service utilization questionnaire mainly by telephone.

Participants: The mean age of the participants was 28 yrs, range 18–41; 49% were women, 83% were single, and 52% lived with parents. The anatomic distribution of the motor disorder was: diplegic (27%), quadriplegic (41%), hemiplegic (25%) and other (7%). The motor severity according to the GMFCS classification was: GMFCS I (30%), II (19%), III (15%), IV (22%) and V (13%).

Results: In the last 12 months prior to answering the questionnaire, 84% of participants used health specialized services provided by hospital and medical clinics and 63% used local health community services. Adapted public transportation was used by 54% and rehabilitation centre services by 50% of participants. Recreational and leisure services were used by 50% while educational and employment services were used by 35% and 27% of participants, respectively. Respite support services were used by 63% of respondent families (n=54). User satisfaction was usually high with a rating of 85% or better in most cases. A higher dissatisfaction level, 16%, 18% and 20% of participants, respectively. Respite support services were expressed for the employment services, respite support services and public adapted transportation services.

Conclusions/Clinical Implications: According to these findings, the community services most used by the participants are related to health and mobility issues. Utilization of educational and employment services within their community is very low amongst participants. The highest level of satisfaction was with educational, recreational and leisure services while the highest dissatisfaction level was mainly related to adapted public transportation and respite support services for participants.

Acknowledgements: This work was supported by grants from the Laval University Research Chair in Cerebral Palsy and the Centre for Interdisciplinary Research in Rehabilitation and Social Integration.

The Experiences of Adults with Cerebral Palsy and Other Lifelong Disabilities Who Act as Volunteers

Mr David Trembath1, Professor Susan Balandin1-2, Dr Leanne Togher1, Professor Roger Stancliffe1
1The University of Sydney, 2Høgskolen i Molde Norway

Background: Volunteering is a common activity amongst adults without disability which can result in benefits for the individuals, the organisations in which they volunteer, and society at large through the development of social capital. Recent studies indicate that many adults with lifelong disability want to volunteer. However, they are underrepresented in the volunteering workforce. It has been suggested that communication difficulties might act as a key barrier to successful volunteering. However, to date, no studies have been conducted into the experiences of adults with lifelong disability who have complex communication needs who engage in volunteering.

Objectives: The aim of this study was to explore the experiences of adults with cerebral palsy and other lifelong disabilities who engage in volunteering in order to identify (a) their motivations for volunteering, (b) the benefits they receive, (c) the barriers they face, and (d) strategies that individuals and organisations can use to promote and support successful volunteering.

Design: The study was conducted according to the qualitative methodology of grounded theory.

Participants/Setting: The researchers conducted in-depth interviews with 26 adults with cerebral palsy and other lifelong physical disabilities across three states in Australia who had complex communication needs and who had engaged in volunteering. All participants used augmentative and alternative communication modes (e.g., spelling boards, speech generating devices). The interviews were transcribed and then analysed using grounded theory.

Results: Communication emerged as one of several key themes in understanding the experiences of the participants. Both the nature of the participants’ communication difficulties and the extent to which they had access to appropriate augmentative and alternative communication systems impacted on their interactions with colleagues, their ability to perform in their roles as volunteers successfully, and their ongoing motivation to engage in volunteering. Strategies for promoting and supporting successful volunteering were identified.

Conclusions/Clinical Implications: The results of this study, including the practical suggestions proposed by the participants, will help to promote and support volunteering amongst adults with cerebral palsy and other lifelong disabilities who have complex communication needs and who want to volunteer.

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Mr David Trembath1, Professor Susan Balandin1-2, Dr Leanne Togher1, Professor Roger Stancliffe1
1The University of Sydney, 2Høgskolen i Molde Norway

Background: Volunteering is a common activity amongst adults without disability which can result in benefits for the individuals, the organisations in which they volunteer, and society at large through the development of social capital. Recent studies indicate that many adults with lifelong disability want to volunteer. However, they are underrepresented in the volunteering workforce. It has been suggested that communication difficulties might act as a key barrier to successful volunteering. However, to date, no studies have been conducted into the experiences of adults with lifelong disability who have complex communication needs who engage in volunteering.

Objectives: The aim of this study was to explore the experiences of adults with cerebral palsy and other lifelong disabilities who engage in volunteering in order to identify (a) their motivations for volunteering, (b) the benefits they receive, (c) the barriers they face, and (d) strategies that individuals and organisations can use to promote and support successful volunteering.

Design: The study was conducted according to the qualitative methodology of grounded theory.

Participants/Setting: The researchers conducted in-depth interviews with 26 adults with cerebral palsy and other lifelong physical disabilities across three states in Australia who had complex communication needs and who had engaged in volunteering. All participants used augmentative and alternative communication modes (e.g., spelling boards, speech generating devices). The interviews were transcribed and then analysed using grounded theory.

Results: Communication emerged as one of several key themes in understanding the experiences of the participants. Both the nature of the participants’ communication difficulties and the extent to which they had access to appropriate augmentative and alternative communication systems impacted on their interactions with colleagues, their ability to perform in their roles as volunteers successfully, and their ongoing motivation to engage in volunteering. Strategies for promoting and supporting successful volunteering were identified.

Conclusions/Clinical Implications: The results of this study, including the practical suggestions proposed by the participants, will help to promote and support volunteering amongst adults with cerebral palsy and other lifelong disabilities who have complex communication needs and who want to volunteer.
**New Learners: A Mentoring Program Tapping the Experience of Adults Who Use Speech Generating Devices**

Ms Liora Ballin\(^1\), A/Prof Susan Balandin\(^1\), Dr Leanne Togher\(^1\), A/Prof Roger Stancliffe\(^1\)

1Faculty of Health Sciences, The University of Sydney, 2Avdeling for helse- og sosialtleg, Høgskolen i Molde

**Background:** Augmentative and alternative communication (AAC), including speech generating devices (SGDs), offer people with cerebral palsy who have complex communication needs the potential for improved communication and participation in society (McNaughton et al., 2008). However, learning to use AAC competently, and in particular an SGD, requires both instruction and practice. Those new to SGDs must learn to make use of sophisticated communication technology and at the same time successfully participate in communicative interactions with others (Rackensperger, Krezman, McNaughton, Williams, & D’Silva, 2005). People experienced in using SGDs may be well placed to mentor people who are learning a new device, as they have previously undergone the process and challenges of learning to use these technologies. A mentoring program may provide enhanced learning experiences for both the learner and family members.

**Objective:** The aim of this study was to explore how adults experienced in using SGDs may be involved in mentoring people who are learning a new device.

**Design:** Study design was based upon traditional focus group research methods (Morgan & Krueger, 1998).

**Participants/Setting:** Three focus groups comprised adults with cerebral palsy experienced in using SGDs. An additional three focus groups comprised speech pathologists who work with people who use AAC. Participants were recruited through organisations that provide services to people with disability and through the researchers’ own networks. Purposeful sampling ensured information rich cases were available for study (Patton, 2002).

**Method:** We conducted six focus groups, analysed the contents of the group discussions, and verified the analysis with participants (Morgan & Krueger, 1998).

**Results:** Participants explored a) learning to use a communication device and how those experienced in using SGDs can be involved as mentors in an SGD mentoring program, b) the benefits of learning from other individuals who communicate using SGDs, c) ideas for the development of an SGD Training Package which will prepare adults experienced in using SGDs to act as mentors to people new to using a device, and d) how those who use SGDs and speech pathologists can work together to help people new to SGDs.

**Conclusions/Clinical Implications:** Clinical implications will be discussed in relation to the challenges of learning to use an SGD and the benefits of learning from people experienced in using a device. This presentation will provide information to both clinicians and service providers regarding the importance of including adults experienced in using SGDs in the delivery of communication therapy interventions.

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**The Effect of Restricted Gastrocnemius Length on Plantar Pressure Patterns During Gait in Children with Cerebral Palsy**

Dr Jesper Bencke\(^1\), Mr Thomas Bandholm\(^2\), Ms Ida Krag\(^3\), Dr Ben Stansfeld\(^2\), Mr Derek Curtis\(^4\)

1Hvidovre Hospital Gait Laboratory, 2Dept. of Bioengineering, University of Strathclyde

**Background:** Changes in plantar pressure patterns are typical in children with cerebral palsy (CP) but there are few studies that relate pattern changes in this population to a specific clinical pathology.

**Objectives:** To investigate the differences in plantar pressure patterns between children with CP and gastrocnemius contracture and children without pathology.

**Design:** Cross-sectional study.

**Participants/Setting:** Eight children with CP participated. The study took place at a University Hospital gait laboratory.

**Materials/Methods:** Plantar pressure measurements were made of feet (n=14) from eight children (4 girls, 4 boys, mean ± 1SD, 12 ± 2 yrs, range 8–15yrs) with CP and gastrocnemius contracture and an age-matched reference group (RG) of children without pathology. Plantar pressure data, from gait at a self-selected speed was recorded using a 27 by 47cm EMED-NT pressure platform (Novel, Munich, Germany). The foot was divided into ten anatomical regions: medial (1) and lateral (2) heel, medial (3) and lateral (4) mid-foot, first metatarsal head (5), second metatarsal head (6), lateral forefoot (7), hallux (8), second toe (9) and third to fifth toes (10). The CP values of pressures and forces over the regions of the foot were then compared with the RG data using independent-samples T-tests (Table 1).

**Results:** Mean normalised force, maximum normalised force and maximum plantar pressure were significantly reduced (p < 0.05) under the medial and lateral heel regions for CP compared to RG. The lateral midfoot and lateral forefoot regions for children with CP showed significant differences with an increased contact area, a higher maximum and mean normalised force and an earlier start contact (normalised to stance phase) compared to RG. Earlier start contact was also evident for the second metatarsal head, halluc and second toe. The CP group third to fifth toes showed a significantly higher mean pressure and earlier start contact than for RG. Contact times for the CP group were significantly higher for the second to fifth toes, lateral forefoot and second metatarsal head than for RG.

<table>
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<th>Parameter</th>
<th>Foot region</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<td>8.7*</td>
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<td>7.0*</td>
<td>11.5</td>
<td>12.2</td>
<td>26.2*</td>
<td>7.3</td>
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<tr>
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<td>RG</td>
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<td>12.1</td>
<td>0.4</td>
<td>1.9</td>
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<td>53*</td>
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<td>2.4</td>
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<td>5.0*</td>
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<td>4.8*</td>
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<td>Cont. time (ms)</td>
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<td>86.2</td>
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* = statistically significant difference at p<0.05.

**Conclusions/Clinical Implications:** Gastrocnemius contracture was associated with increases in normalised force, pressure and contact area under the lateral midfoot and forefoot with an increased start contact and increased contact time, together with a reduced normalised force and pressure under the heel. This link between a specific clinical pathology and the associated modification in timing and pattern of plantar pressure will be helpful in the interpretation of clinical plantar pressure measurements in this population.
A Prospective Dynamic Pedobarographic Study of Indirect Kinematic Changes in the Roll-Over Process of Valgus Foot Deformities Pre/Post Surgery in CP

Dr. Jan Robert Matussek

Introduction: 3-D dynamic kinematic data acquisition in the child's feet is difficult as marker positioning is challenging and the process of a full gait analysis time consuming and costly. Especially the evaluation of dynamic foot kinematics when in ankle-foot-orthotics is hardly possible. Readily available pedobarographic insoles to measure rapid pressure changes during gait possibly give sufficient indirect kinematic data to characterize relative pressure changes during the foot's roll-over process. This enables the clinician to prospectively compare a baseline of dynamic pedobarographic and indirect kinematic data of pre- and postoperative gait in valgus feet with data acquired from healthy subjects.

Material and Methods: 19 children and adolescents (GMFCS I-III) between 9 and 12 yrs. (f: 8/m:11) with severe flexible valgus foot deformities due to CP (Tetraplegic n: 2; Diplegic n: 14; Hemiplegic n:3) who underwent bony subtalar fusion and calf tendon lengthening procedures were studied pre and postoperatively with and without orthotics. Of the tetraplegic/diplegic group n: 8 needed bilateral subtalar fusion treatment. 9 children had previous bony and/or other SEML surgery before addressing the foot problem, 10 children qualified for SEML surgery with the subtalar fusion procedure. Outcome measurements were done between 12 and 18 months postsurgery. These children underwent video and pedobarographic gait analysis with a wireless 64-pressure-sensor 60-Hz system (capacitive pressure measurement system Medilogic®). All had standardized foot x-ray. A control group of 20 clinically healthy feet rendered so-called normal pressure distribution data. Gait parameters included speed, stride length, effective foot length, CoP line (centre of pressure), width of gait line as well as hind-, mid- and fore-foot pronation indexes as a measure of indirect foot kinematics (inversion/eversion).

Results: CoP line, effective foot length and foot pronation indexes significantly improved in n:14 (n: 3 hemiplegic, n: 11 diplegic patients) already without bracing, whereas an additional AFO adjusted measurements close to those of the control group. In n:5 children, AFO bracing was compulsory to stabilize gait, but was done more comfortably postsurgically than before. Data from the control group surprised with a high degree of variation and although clinically normal, foot pressure patterns from highly inverted to plano-valgus were observed. Moreover, from the tetraplegic and diplegic group n: 8 needed bilateral subtalar fusion treatment. 9 children had previous bony and/or other SEML surgery before addressing the foot problem, 10 children qualified for SEML surgery with the subtalar fusion procedure. Outcome measurements were done between 12 and 18 months postsurgery.

Discussion: Insights into the indirect kinematics of valgus foot deformities are easily available with dynamic pedobarography; functional evaluation with and without AFO bracing is possible giving valuable information into whether longterm postsurgical bracing is necessary.

LengThening of the Triceps Surae in Cerebral Palsy: A Biomechanical Study in Human Cadavers

Prof Kerr Graham, Mr Michael McMullan, Dr Altay Altuntas, Dr Terence Chin, Dr Paulo Selber

The Royal Children's Hospital, Melbourne

Background/Objectives: Controversy exists about the optimum method of lengthening at the triceps surae for the management of equinus deformity. To date there have been no randomised clinical trials and the topic remains controversial with highly polarised views in the literature. Given the lack of equipoise in terms of designing clinical trials, we performed a series of randomised trials in the formalin preserved intact human cadaver.

Materials/Methods: The principal methods for lengthening of the gastrocsoleus were determined from the literature and standardised in the intact gastrocsoleus muscle tendon unit in the formalin preserved human cadaver. Such cadavers adopt an equinus posture at the ankle post mortem which becomes fixed during the formalin preservation process producing a highly reproducible model for equinus deformity in children with cerebral palsy. Randomised trials were performed to compare eponymous procedures for equinus surgery in each of the zones of the gastrocsoleus including (from proximal to distal) Baumann versus Strayer, Baker versus Vulpius, White slide versus Hoke triple hemisection. Both lower limbs from nine cadavers, were used for each of the three randomised trials. Following the performance of standardised surgical procedures, a 40 kg force was applied to the metatarsal heads using torque dynamometer and the resulting lengthening effect on the trips surae recorded using Vernier calipers.

Results: The results are summarized as box and whisker plots in Figure 1 by anatomical zone in the triceps surae.

The amount of lengthening achieved was determined by the zone of lengthening rather than the eponymous procedure performed. However there was a statistically significant difference between procedures performed at each zone with the procedures in zone one (Baumann and Strayer) being more stable and offering less overall lengthening than procedures in zone two (Baker and Vulpius) or zone three (White and Hoke).

Conclusions/Significance/Clinical Implications: The methods tested offer a range of options from stable/conservative lengthenings (Baumann and Strayer) which may be suitable for children with spastic diplegia undergoing multilevel surgery and who require a minor degree of selective lengthening of the gastrocnemius. At the other end of the spectrum, children with hemiplegia who have a severe contracture affecting the gastrocnemius and soleus can be offered a lengthening of the tendo Achilles with the potential for much greater deformity correction. The data from this study provides essential information for choosing the correct “dose” of surgery in the management of fixed equinus deformity in children with cerebral palsy.
Residual Pelvic Rotation After Single Event Multilevel Surgery in Spastic Hemiplegia

**Professor Moon Seok Park**, **Professor Chin Youb Chung**, **Fellow Sang Hyeong Lee**, **Professor In Ho Choi**, **Professor Tae-Joon Cho**, **Professor Won Joon Yoo**

1Seoul National University Bundang Hospital, 2Seoul National University Children’s Hospital

**Background/Objectives:** The aim of the study was to determine the amount of residual pelvic rotation and the factors affecting it after single event multilevel surgery.

**Study Design:** Studies of Prognosis (Retrospective study)

**Participants & Setting:** A total of fifty two children were evaluated. The inclusion criteria were as follows: spastic hemiplegia, GMFCS level I-II, single event multilevel surgery, a follow-up period of more than 1 year, and a pre- and postoperative gait analysis. The exclusion criteria were previous gait correcting surgery, selective dorsal rhizotomy, and joint or muscle disease other than cerebral palsy. Patients who underwent confounding surgical procedures such as tibialis posterior split transfer, Dwyer osteotomy, calcaneal lengthening and tibial derotation osteotomy that can act on pre- and post-operative kinematic analysis of the transverse plane, were excluded.

**Materials/Methods:** The patients were divided into two groups for comparison; femoral derotation osteotomy (FDO) and No FDO groups. Preoperative gait analysis was performed a few days before surgery. Postoperative gait analysis was performed after more than 1 year. Multiple regression was used to delineate the explanatory variables, which affect the residual pelvic rotation.

**Results:** Average age of patients were 8.1y (SD 2.9y). Mean follow up was 1.8y (SD 1.2). There were 34 and 18 patients in the FDO and No FDO group, respectively. Hip rotation and foot progression improved in both group significantly, while pelvic rotation improve in FDO group (p<0.01). Prognostic factors are femoral derotatono osteotomy, preoperative pelvic rotation, and postoperative hip internal rotation.

**Conclusion:** The amount of external pelvic rotation decreased after single event multilevel surgery with femoral derotation osteotomy in spastic hemiplegia. The residual pelvic rotation can be predicted when patients have severe pelvic rotation before surgery. Therefore, the patients, parents, and caregivers should be informed before performing single event multilevel surgery.

Effect of a Dega Osteotomy on Transverse Plane of Acetabulum – Reliability and Validity of Transaxial CT Indices

**Professor Moon Seok Park**, **Professor Chin Youb Chung**, **Fellow Sang Hyeong Lee**, **Professor In Ho Choi**, **Professor Tae-Joon Cho**, **Professor Won Joon Yoo**

1Seoul National University Bundang Hospital, 2Seoul National University Children’s Hospital

**Background/Objectives:** This study examined the effect of a Dega osteotomy on the transverse plans of the acetabulum, and assessed the reliability and validity of the transaxial indices in examining a pelvic reshaping osteotomy.

**Participants & Setting:** Twenty-two acetabuli from 16 cerebral palsy patients with hip instability were examined.

**Materials and Methods:** We carried out a three dimensional CT analysis of the acetabulum before and after a Dega osteotomy. The validity and reliability test of the transaxial CT indices was performed. To analyze the effect of a Dega osteotomy on the transverse plane of acetabulum, the postoperative variables were compared with the preoperative variables.

**Results:** The transaxial CT indices revealed substantial intra- and interobserver reliability. The concurrent validity of the anterior acetabular and posterior acetabular indices before the osteotomy was significant while the concurrent validity after the osteotomy was not. The anterior acetabular index increased significantly but the amount of the increase was not clinically signifi cant when compared with the control, and same with the decrease of acetabular anteversion. The axial acetabular index and posterior acetabular index showed no signifi cant changes (p=0.11, 0.51).

**Conclusion:** The transaxial CT indices are reliable and valid for assessing the acetabular coverage, but not valid for assessing morphologic changes after a Dega osteotomy. Furthermore, a Dega osteotomy has little effect on transverse plane of acetabulum. Care should be taken when using these indices as an outcome assessment of a pelvic reshaping osteotomy, the hinge of which is over the triradiate cartilage, because the indices only show the morphology of the acetabulum under the vertex of the triradiate cartilage.
Outcome of Single Event Multilevel Lever Arm Restoration and Anti Spasticity Surgery for Cerebral Palsy

Dr. Deepak Sharan, Mr. Biju Nirmal Jacob, Mr. Ajeesh PS
RECOUP Neuromusculoskeletal Rehabilitation Centre, Bangalore, India

Background: In Cerebral Palsy, lever arm dysfunction and spasticity of non-antigravity or the body propelling muscles are the major factors which restrict gait and functions.


Design: Prospective outcome study.

Participants and Setting: The present study evaluated the outcome of SEMLARASS in 600 consecutive patients with different type of cerebral palsies like Spastic diplegia (70%), Spastic Quadriplegia (12%), Spastic Hemiplegia (10%) and Spastic Athetoid Quadriplegia (8%) during a period of 8 years (2000–2008). The mean age at the time of surgery was 7 years (range 3–32). Over 10,000 surgeries were performed by a single Orthopaedic Surgeon.

Materials and Method: The surgical procedures included myofascial releases (Orthopaedic Selective Spasticity Control Surgery) and restoration of lever arm dysfunctions (hip joint, femur, tibia and calcaneum), usually under a single anesthesia. The femoral rotational osteotomies or varus derotational osteotomies were stabilised by external fixators. The post surgical plaster immobilisation period was between 5–10 weeks and was followed by physical therapy for at least 6 months. The follow up ranged from 1 year to 8 years (mean 3 years). The post surgical rehabilitation included manual therapy, suspended treadmill training, hippotherapy, aquatic therapy and yoga therapy. The outcomes were measured after rehabilitation using GMFMCS, Modified Ashworth Scale, joint range of motion, Observational Gait Analysis and Instrumented Gait Analysis (IDEEA) and compared to pre-surgical values.

Results: All the outcome measures showed significant improvement after 6 months of post surgical rehabilitation.

Conclusion/Clinical Implication: In SEMLARASS both the lever arm dysfunction and the muscle spasticity in non-antigravity muscles are corrected simultaneously. A well-planned and executed SEMLARASS, in the context of a multi-disciplinary team, provides the patient with CP a dramatic, predictable and lasting functional improvement. This is especially true of patients with severe spastic and/or athetoid Quadriplegia.

Ms Jane Butler1, Professor Louise Ada2

1The University of Sydney Associate, 2The University of Sydney

Background: The importance of clinical decision making based on the best evidence available is emphasised in all areas of physiotherapy. Of particular interest to clinicians is determining what evidence is available in a specific area of physiotherapy and how that evidence supports their clinical practice.

Objectives: The aim of this study was to assess the evidence for physiotherapy intervention in children with cerebral palsy. Therefore, we asked: In children with cerebral palsy, is physiotherapy intervention effective in:

1) reducing impairment?
2) improving activity?
3) improving participation?

Design: A summary of systematic reviews was undertaken. We examined any physiotherapy intervention, alone or combined with another intervention, compared to a placebo or no intervention and/or any other intervention. Outcome measures were identified at the level of impairment (weakness, spasticity, contracture or motor in-coordination), activity limitation (gait, upper limb), or participation restriction (home, school or community activities, or quality of life).

Participants/setting: Children under the age of 18 years with any classification of cerebral palsy.

Materials/Methods: A search for systematic reviews of physiotherapy intervention for cerebral palsy that were based on randomised controlled trials, quasi randomised controlled trials or controlled trials published from 2000 to March 2008 was carried out.

Results: The search yielded 1178 papers. Of these, 34 full-text papers were retrieved and assessed for inclusion by two independent assessors. 7 reviews were subsequently included and were assessed for quality by the same two independent assessors. The included reviews were high quality. These reviews showed beneficial short-term effects of casting and electrical stimulation at the impairment level, casting and constraint-induced movement at the activity level. However, no reviews measured participation.

Conclusions/Clinical Implications: There is a paucity of high-level evidence to support physiotherapy intervention for children with cerebral palsy. Given the large number of randomised controlled trials published, more rigorous systematic reviews are necessary to collate the evidence for physiotherapy intervention.

Exploring Movement Planning in Children with Mild Spastic Hemiplegia

Dr Jacqueline Williams1 Associate Professor Dinah Reddihough1, Professor Victoria Anderson2, Ms Sue Reid4

1Australian Centre for Child Neuropsychology Studies, Murdoch Childrens Research Institute, 2Department of Developmental Medicine, Royal Children’s Hospital, 3Australian Centre for Child Neuropsychology Studies, Murdoch Childrens Research Institute, 4Department of Developmental Medicine, Royal Children’s Hospital

Children with CP have known deficits in motor execution, but recent studies suggest they might also have difficulty with motor planning. While the motor execution difficulties of children with moderate to severe CP may be too great to benefit from any intervention focusing on motor planning ability, children with mild CP, who still face challenges in their daily functioning, may benefit significantly from improvements to their planning abilities.

Motor imagery tasks, which require the imagination of a particular movement without actual movement, have been used to explore motor planning deficits in adolescents with CP – atypical patterns of response were found in this group, indicating a deficit in motor planning ability.

This study aimed to explore this issue more thoroughly, using a broader range of motor imagery tasks in a sample of children with CP. It also aimed to explore the relationship between imagery ability and adaptive behaviour through a parent questionnaire.

Two groups of children, both aged 8–12 years, were recruited – children with mild spastic hemiplegia and typically developing children without any physical or neurological disability. Recruitment is ongoing, with an aim of 42 children per group. Children were assessed at the Royal Children’s Hospital in Melbourne, or at their schools if this was more convenient.

Participants completed the McCarron Assessment of Neuromuscular Development (MAND) to provide an objective measure of their motor development, while their parent/guardian completed the Vineland Adaptive Behavior Scale. In addition, the participants completed six motor imagery tasks – three were computer based mental rotation tasks, which require an imagined movement of their own body to respond to a stimulus on the screen. The remaining three tasks involved a comparison of imagined and overt movements – a visually-guided pointing task, imagined walking and imagined sit-to-stand.

We will present results from this study, including a comparison of the pattern of performance of the two groups across the imagery tasks to determine if a deficit is evident in the CP group. We will also look at the relationship of their performance to parent ratings of functional abilities and the objective measures of motor development, to determine whether any deficit observed can be linked to deficits in functional performance.

We expect these results to have a positive impact on the approach to intervention for children with mild CP.
Epilepsy in Hemiplegic Cerebral Palsy Resulting from Perinatal Arterial Ischaemic Stroke

Ms Sue Reid1, Dr Jithangi Wanigasinghe1, Dr Jithangi Wanigasinghe2, Dr Jeremy Freeman3, Dr Mark Mackay4, A/Prof Dinah Reddihough5, Dr Simon Harvey6

1Murdoch Childrens Research Institute, 2Department of Neurology, Royal Childrens Hospital, Melbourne, 3Department of Neurology, Royal Children's Hospital, Melbourne, 4Department of Neurology, Royal Children's Hospital, Melbourne, 5Developmental Medicine, Royal Children's Hospital, Melbourne, 6Department of Neurology, Royal Children's Hospital, Melbourne.

Background: Epilepsy is a major problem in children with cerebral palsy, potentially affecting cognitive development, mobility and the ability to live independently. Estimates of the frequency have depended on the type and severity of motor impairment. Little is known about risk factors and long term outcomes.

Objectives: To describe the risk factors, frequency, types and evolution of epilepsy in children with hemiplegic cerebral palsy resulting from perinatal arterial ischaemic stroke and to assess the impact of epilepsy on quality of life.

Design: Descriptive/case-control study

Participants/Setting: The study was undertaken at a tertiary children's hospital and included children from a population-based cerebral palsy register who were aged 4 to 18 years and had brain imaging studies confirming a diagnosis of perinatal arterial territory ischaemic stroke.

Material/Method: A telephone interview was conducted and information collected on antenatal and perinatal risk factors, neonatal seizures, family history and motor function. Quality of life was assessed using the parent proxy module of PedsQLTM. Epilepsy history was recorded using a validated epilepsy module of PedsQLTM. Seizures were classified according to seizure phenomenology, types and epilepsy syndromes. Quality of life scores and the frequency of risk factors were compared statistically for children with and without a history of epilepsy.

Results: Sixty three children were included in the study. Fourteen (18%) developed seizures during the first year of life, 26 (38%) by five years and 34 (54%) in total. Term delivery and more severe motor impairment, but not neonatal seizures or a family history of epilepsy, increased the likelihood of epilepsy. The initial seizures types were either spasms (n=7), focal (n=24), both (n=2) or myoclonic (n=1). Although no children continued to have spasms beyond their second birthday, 5 of 9 later developed focal seizures. By age 18, 65% children had a history of epilepsy, but ten years after seizure onset only 15% continued to have active epilepsy. Psychosocial aspects of quality of life were rated as lower in children with epilepsy.

Conclusions/Clinical Implications: Despite a relatively high incidence of epilepsy in children with hemiplegic cerebral palsy secondary to arterial ischaemic stroke, the prognosis for seizure remission is good. Rare children with uncontrolled focal or generalized seizures may be amenable to curative epilepsy surgery.

The Additional Effect of Botulinum Toxin-A on Fitts Tasks in Children with Cerebral Palsy, who Received a Standardised Intensive Task Oriented Therapy Programme

Dr Eugene Rameckers1, MD Lucianne Speth2, Prof J aak Duyssens3, Prof Hans Vlies4, Prof Bouwien Smits Engelsman5

1Rehabilitation Centre Franciscusoord, 2Rehabilitation Centre Franciscusoord, Netherlands, 3Motor Control Lab. Faculty of Kinesiology and Rehabilitation Sciences Leuven, 4Academic Hospital maastricht, Netherlands, 5Motor Control Lab. Faculty of Kinesiology and Rehabilitation Sciences Leuven

Objectives: To investigate the additional effect of Botulinum Toxin-A (BTX) in an intensive standardised task oriented therapy programme on 3 Kinematic Aiming Tasks (KAT) in children with congenital spastic hemiplegia.

Design: A single blindedRCT.

Participants and Setting: Twenty children, aged 4-16 years (mean 9.5) completed a rehabilitation based task oriented therapy programme was performed 3 x per week for 6 six months.1 Matching was performed according to age and Zancolli level. After randomisation, 10 children received multi level BTX in the upper limb (BTX+ group) and 10 children stand alone physical and occupational therapy (PT/OT group).

Methods: Three KAT tasks were used.2 Two tasks in which discreet movement towards targets were made either by shifting over the surface or through the air and a third task in which continuous movement over the surface had to be made toward the same targets. Outcome measures of the KAT tasks were Movement Time (MT), percentage successful movements (PSM) and Index of performance effective (IP-E).

Results: In both discrete KAT tasks MT decreased slightly for both groups. In a fast continuous moving KAT task the BTX+ group showed a significant reduction of MT compared to the PT/OT group.

Conclusions: This research demonstrates that in both study groups a decrease of MT and an increase of the task performance (IP-E) in the fast continuous task, in which the BTX+ group showed the largest benefit. The benefit of BTX seems to be obvious in fast ongoing movement tasks; however in discrete tasks no additional benefit has been shown compared to task oriented PT/OT.
Combining Botulinum Toxin Type a Injection and Modified Constraint-Induced Movement Therapy in Patients with Cerebral Palsy

Dr Yu Ching Lin1, OT Yi Chen Tseng2, OT Jui Yun Su3
1I-Shou University, 2E-DA Hospital, 3E-DA Hospital

Background: Hypermobility interferes with selective motor control and performance of activities in children with spastic cerebral palsy. Present, most therapists use traditional therapeutic techniques such as neurodevelopmental treatment or other approaches to handle the problems posed by cerebral palsy but the results are not very good. Many studies have shown that botulinum toxin type A (BTX-A) injection can control abnormal muscle tone effectively without major side effects. Constraint-induced movement therapy (CIMT) includes constraint of the sound side upper limb and intensive therapy of the affected limb. In order to reduce spasticity and enhance the use of the affected limb simultaneously, we combined these two therapies and investigated treatment feasibility.

Objectives: To study the effect of combining botulinum toxin type A injection and constraint-induced movement therapy in upper extremity function of patients with cerebral palsy.

Design: A case series.

Participants/Setting: Four children with spastic type cerebral palsy. Study was done at a tertiary referral hospital.

Materials/Methods: Subjects were divided into two groups according to parents’ willingness. The experimental group had BTX-A injection and CIMT for two months in the more affected upper limb. The control group received BTX-A injection only. The outcome measures were assessed before injection, one month, two months, and four months after the injection by the same investigator. The evaluation tools included Modified Ashworth scale (MAS), Pediatric Evaluation of Disability Inventory self care domain (PEDI, functional skills and caregiver assistance), Peabody Developmental Motor Scale II fine motor quotient (PDMSII, grasping and visual-motor integration), and Upper limb Physicins Rating scale modified version (ULPRS).

Results: After BTX-A injection, MAS scores decreased in all subjects but increased again at four months. In the control group, all other scores increased at one month and two months, but decreased at four months. Compared with the baseline, the experimental group made progress at one month, two months and four months. The experimental and control groups had similar progress at one month and two months, but decreased at four months. The experimental group had more improvement than control group at two months after injection, as shown by the slope of progress (slope of PEDIfun, PEDIcar, PDMSIIvis, ULPRS in experimental group and in control group= 1.10/1.07, 1.08/1.03, 1.21/1.13, 1.48/1.33).

Conclusion/Clinical Implications: Combining BTX-A injection and CIMT achieve a better performance of upper extremity in patients with cerebral palsy, indicating that BTX-A and CIMT may have a synergistic therapeutic effect.

The Role of Congenital Malformations and Risk of Cerebral Palsy in Children Born Small for Gestational Age

Mr Claus Svaerke1, Mr Poul Thorsen1, Mr Jacob Grove1, Mrs Dorte Hvidtjørn1, Mrs Diana Schendel2, Mr Bo Jacobsson3
1NANE, Department of Epidemiology, Institute of Public Health, University of Aarhus, 2National Center on Birth Defects and Developmental Disabilities, Centers for Disease Control and Prevention, 3Perinatal Center, Department of Obstetric and Gynecology, Göteborg University

Background: Studies find an increased risk of cerebral palsy (CP) in children born small for gestational age (SGA) in singleton births. However, SGA is often observed in children with congenital malformations and it is not known if the increased risk of CP is due to malformations or SGA. In the Danish registries we have a unique opportunity to investigate this because of access to both obstetric data, information on malformations and CP diagnosis.

Objectives: To assess the risk of CP from SGA in children born without congenital malformation.

Design: Population based follow-up study.

Participants/Setting: Danish singleton births from January 1, 1997 to December 31, 2000. Altogether 257,358 children were identified in the Danish Medical Birth Register from which information was obtained on gestational age, gender, birth weight, smoking, and congenital malformations. Children with CP (N=477) were identified in The National Register of Cerebral Palsy (NRCP). To be included in the NRCP the child’s CP diagnosis has to be confirmed by a neuro-pediatrician.

Materials/Methods: SGA was defined based on a model by Marsål et al using birth weight, gestational age (GA) and gender. Data was analyzed in three strata according to GA, term (>36 weeks of gestation), moderate preterm (32–36 weeks of gestation) and very preterm (<32 weeks of gestation). A generalized linear model with log link was used to analyze data reporting risk ratio and 95% confidence interval (CI). Smoking was considered a confounder and included in the analysis.

Results: Congenital malformation was present in 112 (23.48%) and 9.669 (3.76%) children with and without a CP diagnosis respectively. Data was complete on 225,041, children; 312 with CP. The excess risk of CP in SGA children was present in this study excluding children with congenital malformations although it depended on GA strata: RR of CP in children born SGA in the three strata was: 4.78 (95% CI 3.03–7.53) in term, 2.53 (95% CI 1.17–5.46) in moderate preterm and 1.19 (95% CI 0.60–2.37) in very preterm.

Conclusions/Clinical Implications: The increased risk of CP in SGA children can not be explained by confounding from congenital malformations. However, the severity and level of disproportional growth in term children seem to affect the risk for CP to a greater degree than in earlier gestational age strata. This information might impact on decision-making of when to deliver the fetus when diagnosed with intra-uterine growth restriction.
Asphyxia at Birth, Prenatal Ischemia and Sensorimotor Disuse in Rats to Better Understand Cerebral Palsy

Dr J - Olivier Cog, Maxime Delcour, Dr Michael Russier
Laboratoire de Neurobiologie Integrative & Adaptative/CNRS – Aix-Marseille Universite

Background: Cerebral palsy (CP) is usually related to white matter injury (WMI), i.e. periventricular leukomalacia, which is induced by infections, asphyxia or ischemia before, at or after birth. Related to this early brain damage, infants who develop CP exhibit abnormal patterns of spontaneous movements that lack complexity, variation and fluency with age. Later, these children display impairments in motor skills and locomotion, crude self-somatosensory representation, tactile discrimination deterioration, and so on.

Objectives: Our aim is to reproduce in rats the main deficits observed in patients to better understand the mechanisms of CP.

Design: We investigate gait, posture and the neurophysiological correlates in the primary somatosensory (S1) and motor (M1) cortex of rats. These rats experienced neonatal asphyxia (PA), prenatal ischemia (PI) and/or developmental sensorimotor disuse.

Materials/Methods: For asphyxia, rat pups were exposed to atmospheric nitrogen for 12 min at the day of birth and the day after. Ischemia was obtained by unilateral ligation of intra-uterine artery at E17 and was followed by reperfusion at birth. Disuse consisted in hind limb immobilization with a cast for 16 hrs/day for 28 days from birth. For gait and posture the 3D-kinematics of the right hind limb were analyzed during treadmill locomotion at different speeds and postnatal stages. Multiunit activity in layer IV of S1 was recorded for 16 hrs/day for 28 days from birth. For gait and posture the 3D-kinematics of the right hind limb were analyzed during treadmill locomotion at different speeds and postnatal stages. Multiunit activity in layer IV of S1 was recorded for 16 hrs/day for 28 days from birth. For gait and posture the 3D-kinematics of the right hind limb were analyzed during treadmill locomotion at different speeds and postnatal stages. Multiunit activity in layer IV of S1 was recorded for 16 hrs/day for 28 days from birth. For gait and posture the 3D-kinematics of the right hind limb were analyzed during treadmill locomotion at different speeds and postnatal stages. Multiunit activity in layer IV of S1 was recorded for 16 hrs/day for 28 days from birth. For gait and posture the 3D-kinematics of the right hind limb were analyzed during treadmill locomotion at different speeds and postnatal stages. Multiunit activity in layer IV of S1 was recorded for 16 hrs/day for 28 days from birth. For gait and posture the 3D-kinematics of the right hind limb were analyzed during treadmill locomotion at different speeds and postnatal stages. Multiunit activity in layer IV of S1 was recorded for 16 hrs/day for 28 days from birth. For gait and posture the 3D-kinematics of the right hind limb were analyzed during treadmill locomotion at different speeds and postnatal stages. Multiunit activity in layer IV of S1 was recorded for 16 hrs/day for 28 days from birth. For gait and posture the 3D-kinematics of the right hind limb were analyzed during treadmill locomotion at different speeds and postnatal stages. Multiunit activity in layer IV of S1 was recorded for 16 hrs/day for 28 days from birth. For gait and posture the 3D-kinematics of the right hind limb were analyzed during treadmill locomotion at different speeds and postnatal stages. Multiunit activity in layer IV of S1 was recorded for 16 hrs/day for 28 days from birth. For gait and posture the 3D-kinematics of the right hind limb were analyzed during treadmill locomotion at different speeds and postnatal stages. Multiunit activity in layer IV of S1 was recorded for 16 hrs/day for 28 days from birth.

Results: Neither spasticity nor locomotor deficits were observed in PA and PI rats. However, the organization of the S1 and M1 hind limb maps was degraded in adult rats after PI, but not following PA. Interestingly, sensorimotor disuse during development induced locomotor impairments and a drastic degradation of the S1 and M1 map organization. The deficits in locomotion and cortical degradation were the most pronounced when PI and disuse were combined.

Conclusions/Clinical Implications: Our data show that PI, and PA in a lesser extent, can generate the substrate for brain damage, which is worsened by abnormal sensorimotor experience during maturation. Our results could explain the progressive, disabling movement disorders observed in children with CP. To better understand the mechanisms of CP may help to develop new strategies for prevention and remediation.

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Incidence of Neonatal Seizures After Perinatal Asphyxia

Ms Steph Miller1, Dr Tracey Bjorkman2, Prof Paul Colditz2
1University of Queensland, 2Perinatal Research, University of Qld Centre for Clinical Research

Detecting perinatal asphyxia presents an ongoing challenge for obstetricians and midwives alike. Often the diagnosis of asphyxia is made after the asphyxia event; and treatment is limited to rectifying the physiological and metabolic homeostasis. The brain is particularly vulnerable to hypoxia (decreased oxygen) during perinatal asphyxia due to the high oxygen requirements. When the brain is exposed to acute severe hypoxia, neuronal cell injury and cell death ensue. Perinatal asphyxia is a leading cause of morbidity and mortality in term neonates. Treatment strategies to prevent long term morbidities from brain injury include early identification of high-risk infants. One of the major symptoms of underlying brain injury is seizures, however in the neonate seizures may present subclinically.

Objective: To assess the incidence of seizures in hypoxic term neonates and report the level of agreement between seizure detection on 2-channel amplitude-integrated EEG, standard multi-channel EEG and visually identified clinical seizures.

Subjects: Term or near-term neonates admitted to the Royal Brisbane and Women's Hospital intensive care nursery for treatment of perinatal asphyxia (cord or early pH<7.15 or arterial base deficit>12 or 5min Apgar score <6) were recruited with informed parental consent. Neonates with congenital or chromosomal abnormalities were excluded.

Methods: 40 neonates were monitored continuously for 24-48h using 2-channel amplitude-integrated EEG (aEEG). Standard multi-channel EEG (approx. 1hr monitoring) was performed between day 1 and 5 of life. Infants were assigned into Good or Poor outcome (based on Ages and Stages Questionnaire at 6months or BSID II at 18months).

Results: There were significantly more emergency caesarean sections performed in the Poor outcome group compared with the Good outcome but no significant difference in the cord pH or 5min Apgar score between groups. Eleven neonates had seizures detected by both aEEG and EEG. Eleven had no seizures detected on either aEEG or EEG. Ten neonates had seizure detected on aEEG monitoring but not detected on multi-channel EEG. Of the neonates with aEEG seizure 15/24 had poor outcome vs. 4/14 in neonates the no seizures (p<0.001). A further six neonates were diagnosed clinically with seizures and showed no electrographic seizure activity.

Conclusion: Long-term EEG monitoring is necessary to identify all seizure activity in neonates, and prevent clinical over diagnosis of seizure.
Quality of Life for Adolescents with Cerebral Palsy: Perspectives of Adolescents and Parents

Dr Melanie Davern1, Dr Elise Davis1, Ms Amy Shelly2, Prof Elizabeth Waters2, Prof Andrew Mackinnon2, Assoc Prof Dinah Reddihough3, Assoc Prof Roslyn Boyd4

1University of Melbourne, 2Deakin University, 3Royal Children’s Hospital, 4University of Queensland

Background: Although quality of life (QOL) has emerged as an outcome for measuring the effectiveness of health improvement interventions, a valid and reliable measure of QOL that accommodates the developmental transitions, experiences and views of adolescents with CP is not available.[5]. This study aimed to identify domains of QOL for adolescents with CP to a) gain insight into issues identified as core dimensions of their QOL and b) guide the development of a condition-specific QOL instrument.

Design: Qualitative semi-structured interviews.

Method: A qualitative study was conducted utilising grounded theory. Adolescents (N=17) aged 13–18 years with varying levels of impairment and their parents (N=23) participated in semi-structured interviews. Questions included ‘what do you think is important to your (child’s) QOL?’, and ‘how does CP impact on your (child’s) life?’

Results: Fifteen themes were identified including domains related to health issues in adolescence, participation, education, specific CP-related issues (pain and discomfort, communication), family issues, practical issues (financial resources) and changes associated with adolescence (sexuality, independence).

Conclusion: The composition of these QOL domains reflects the developmental concerns of adolescents with CP and strongly supports adolescent participation in the development of self reported wellbeing and QOL measures. Many of the domains are consistent with child reports of QOL and thus it appears feasible and valid to develop a measure which will transition across childhood and adolescence.

Life Satisfaction and Psychological Well-Being in Youth with Cerebral Palsy: Exploratory Study

Dr Diana Brandao, Prof. José Luís Pais Ribeiro

Faculty of Psychology and Educational Sciences, Oporto University, Portugal

Background: Cerebral Palsy (CP) describes a group of chronic conditions characterized by motor dysfunction, whose main cause is a non progressive brain damage, occurred during fetal development (UCP, 2001). It extends over the individual’s whole life, causing disability in various degrees, imposing an adjustment and adaptation, to promote their psychological well-being.

The Psychological Well-Being (PWB) is a multidimensional concept that includes (Novo, 2003): Self-acceptance (positive evaluation that each individual makes of himself and his life); Personal growth (sense of continuous development as a person); Purpose in life (belief that life’s significant); Positive relations with others (involvement in positive interpersonal relationships); Environmental mastery (ability to successfully manage life, to address and respond effectively to external demands); Autonomy (sense of self-determination and independence in face of external pressure).

Objectives: This study aims to assess the PWB and General Life Satisfaction in youth with CP.

Design: This is a transversal descriptive study, using the correlational method.

Participants: The sample was constituted by 52 subjects, aged between 16 and 36 years (M = 23), 57.7% male and 42.3% female.

Materials: There were used self-response questionnaires, anonymous: socio-demographic questionnaire, the Frenchay Activities Index (Holbrock & Skillbeck, 1983, adapted by Martins, Pais Ribeiro & Garret, 2003), the Barthel Index (Wade & Collin, 1988, adapted by Araújo, Pais Ribeiro, Oliveira, & Pinto, 2007), the Scale of General Life Satisfaction (Andrews & Withey, 1976) and the Scales of Psychological Well-Being (experimental version adapted from Ryff (1989) by Novo, Silva e Peralta, 2004).

Results: For General Life Satisfaction it was found an average value of 6,81. For the PWB we found an average value of 49,84. Regarding its six dimensions, the results show average values of 6,87 for Purpose in life; 9,67 for Personal growth; 8,65 for Self-acceptance; 7,13 for Positive Relations with others; 7,35 for Environmental mastery and 8,50 for Autonomy. Concerning the different Clinical Types of CP the results showed that youth with Diplegia have less Life Satisfaction, than youth with Diskinesia; and that youth with Ataxia have greater PWB than youth with Diplegia and youth with Diskinesia. The results showed that General Life Satisfaction was negatively correlated with Environmental mastery and Purpose in life; and Environmental mastery was positively correlated with age.

Conclusions: The youth with CP have low General Life Satisfaction and a PWB reasonably high. General Life Satisfaction and PWB vary depending on the severity of the Clinical Types of CP.
How do Children with Cerebral Palsy and Complex Communication Needs Use Their Time? Relationship Between Time Use and Activity Participation

Dr. Pammi Raghavendra¹, Dr. Alison Lane², Ms. Rachel Virgo², Dr. Timothy Olds³

¹Novita Children’s Services, ²Assistant Professor, School of Allied Medical Professions, College of Medicine, The Ohio State University, ³Research Officer, Division of Research & Innovation, Novita Children’s Services, ⁴Professor, Centre for Applied Anthropometry, University of South Australia

Abstract: Individuals with complex communication needs (CCN) who use augmentative and alternative communication (AAC) have restricted linguistic forms and limited opportunities to interact with others (Blackstone & Hunt Berg, 2003). These individuals could be at a significant risk of reduced health and well-being due to compromised involvement in life situations. Currently, there is no research that has specifically examined how children with cerebral palsy (CP) and CCN use their time and their activity participation patterns.

Objectives: This paper reports on a preliminary study that describes the types of activities participated in and time spent in those activities by children with CP and CCN. In particular, the diversity, intensity, location, social context and expressed enjoyment of activities will be reported and compared with children without disabilities.

Design: Cross-sectional descriptive survey study.

Participants/Setting: Twelve children with CP and CCN, aged between 10 and 15 years at GMFCS levels 4 or 5 were recruited from a community based pediatric disability service. Comparison data from children without disabilities has been drawn from existing normative datasets and the purposive recruitment of 12 children matched for age, sex and socio-economic status

Materials/Methods: All participants were administered the Children’s Assessment of Participation and Enjoyment (CAPE, King et al. 2004) and the Multimedia Activity Recall for Children and Adolescents (MARCA; Ridley, Olds & Hill, 2006).

Results: Children with CP and CCN experience restrictions in the diversity, intensity, location and social context of activities. Specifically, CAPE data shows that children with CP and CCN are participating in an average of 25 different activities, the majority being social and recreational. The intensity of involvement is also low and social contexts and locations tend to be limited to close family and neighborhoods. Time diary data from the MARCA indicate that children with CP and CCN engage in a restricted range of daily activities when compared with their non-disabled peers, however, both groups spend equivalent time in watching TV and/or playing on the computer (~5 hours/day). Children with CP and CCN on average participated in 15–20% less physical activity than similarly aged non-disabled peers.

Conclusion/ Clinical Implications: This study confirms the risk of children with CP and CCN for restrictions in activities and participation in life situations. In particular, restrictions in physical activity are noted when compared to non-disabled peers. Further research is needed to quantify the contribution of participation restrictions to the poorer health outcomes of this group.

Process for the Development of Australian Guidelines for Hip Surveillance in Children with Cerebral Palsy: How did we Reach Consensus?

M Wynter¹, N Gibson¹, M Kentish¹, S Love¹, N Snape¹, P Thomason¹, H Kerr Graham¹

¹Royal Children’s Hospital, Queensland, ²Princess Margaret Hospital for Children, Western Australia and University of Western Australia, ³Princess Margaret Hospital for Children, Western Australia and Curtin University of Technology, ⁴Royal Children’s Hospital, Victoria

Background: Hip surveillance for children with cerebral palsy (CP) is conducted in all states of Australia yet there is variation in age of commencement, frequency of review and criteria for discharge. A National Working Group was established to develop draft guidelines for hip surveillance. The guidelines were developed using expert opinion and national working group experience where published evidence was not available. Gross Motor Function Classification System (GMFCS) underpins risk and surveillance frequency.

Objective: To gain feedback on draft guidelines to further inform the consensus process for development of Australian Hip Surveillance Guidelines.

Design: Three part survey to obtain individual expert opinion and consensus

Participants: Orthopaedic surgeons, paediatricians, rehabilitation physicians, therapists, and a small number of other relevant medical & allied health professionals working with children with CP.

Methods: The process followed the NHMRC Guidelines for establishing Guidelines. Consultation was sought in three separate formats:

• Direct mailout to corresponding working party.
• Survey at Australasian Conference
• Survey to selected professions identified as missing from the previous survey respondents

The survey results were scanned to digital format utilising Telephone technology (v10.2). Survey feedback was grouped according to level of experience and profession, and results collated. Where disagreement with draft guidelines was expressed, respondents from the most experienced group were contacted individually and expert opinions were synthesised into minor modifications to create the Guidelines document.

Results: One hundred and twenty-four medical and allied health participants responded to the survey. There was 100% agreement on the need for standardised guidelines and 96% agreement for use of GMFCS levels being the best way to classify children for hip surveillance. Consensus agreement with guidelines was defined as greater than 80% agreement on each guideline statement.

Table: Percentage agreement with Guidelines (Two Most Experienced Groups)

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<th>GMFCS I</th>
<th>GMFCS II</th>
<th>GMFCS III</th>
<th>GMFCS IV</th>
<th>GMFCS V</th>
<th>WCH</th>
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<tr>
<td>Commencement of surveillance</td>
<td>90.6%*</td>
<td>93%*</td>
<td>95%*</td>
<td>87.5%*</td>
<td>87.5%*</td>
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<td>Frequency of Surveillance</td>
<td>78%</td>
<td>95%*</td>
<td>86%*</td>
<td>89%*</td>
<td>82.8%*</td>
<td>82.8%*</td>
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<tr>
<td>Age at Discharge</td>
<td>79.6%</td>
<td>84.3%*</td>
<td>90.6%*</td>
<td>86%*</td>
<td>84.3%*</td>
<td>89%*</td>
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* Consensus

Conclusion: Consensus was reached across all areas, with the exception of GMFCS I, supporting the Australian Guidelines for Hip Surveillance. These Guidelines have now been endorsed by the Australasian Academy of Cerebral Palsy and Developmental Medicine and are available for dissemination, implementation and ongoing evaluation with a revision process established.
Early Hip Development in the Young Child with Cerebral Palsy – Risk Status and Relationship to Motor Development in an Early Natural History Study

Miss Roslyn Boyd1, Ms Carly Hanson2, Mrs Anne Moodie1, Mrs Belinda Luther1, Dr Michael Fahey1, Dr Barry Rawicki2, A/Prof Roslyn Boyd2

1Queensland Cerebral Palsy Rehabilitation and Research Centre, Royal Children's Hospital, 2Queensland Cerebral Palsy and Rehabilitation Research Centre, University of Queensland, 3Munroch Children's Research Institute, Melbourne. *Monash Medical Centre, Melbourne.

Background: Hip displacement in cerebral palsy has been described as a silent problem in that many children with rapid and marked hip displacement are often referred too late for effective and timely interventions.

Objective: To evaluate the relationship between the early natural history of hip displacement, motor type and gross motor functional classification level (GMFCS).

Design: Population based natural history study

Participants: 56 children (39 males), primary motor type (spasticity=31 of whom 3 unilateral; 18 dystonia, 4 hypotonia) with GMFCS levels (I=22; II=9; III=7, IV=10; V=8). Children were assessed at 6 monthly intervals from 18 months to 3 years corrected age.

Main Outcome Measures: Outcomes measures were:- GMFCS level (status and change), Migration Percentage (MP) and Acetabular dysplasia (AI > 27°) of each hip, Hip asymmetry (≥ 10% difference in MP), hip status of worst hip (no risk MP ≤ 10%, Moderate risk 11–30%, High risk MP > 30%), and progression to orthopaedic treatment. Hip radiographs were measured by 2 independent raters.

Results:

i) Change in GMFCS: 65% (33) did not change from 18–36 months ca. 33% (17) improved (II to I (n=6), III to II (n=6), VI to III (n=1) and V to IV (n=5)) and one subject deteriorated (from II to III).

ii) Status of worst hip (by MP): 5 subjects subjects had normal MP (110%) and these were GMFCS levels I=3, II & III=0, IV=1, V=2. 38 subjects (68%) had moderate displacement (MP 11–30%) and were GMFCS I=11, II=9, III=7, IV=6, V=5. 13 subjects (23%) had hips at high risk (MP >30%) were GMFCS I=2, II=1, III=4, IV=2, V=4.

iii) Acetabular development (AI >27°): 14 subjects (27%) had AI >27°. Of these 8 remained abnormal; 8 improved; and 3 deteriorated.

iv) Hip asymmetry: 34 subjects (61%) had a 10% difference in MP between hips.

v) Orthopaedic Rx: 5 subjects (GMFCS II=1; III=1; IV=1; V=2) underwent surgical intervention (STR adductors ± psoas, 1 BTX-A). Six subjects are under close review (GMFCS I=1, III=1, IV=2; V=2).

Conclusion: In young children with CP there is some change in gross motor levels (GMFCS) (mostly improvement), and this can occur across all levels. Marked hip displacement and asymmetry is quite common and can occur across the GMFCS levels. Acetabular index may start high and sometimes improves with age. Standardized serial measures of MP and AI and GMFCS levels are recommended for early surveillance of cerebral palsy to examine amount of displacement as well as asymmetry between sides.

Efficacy of IntraThecal Baclofen Therapy in Children with Intractable Spastic Cerebral Palsy: A Randomised Controlled Trial

Prof Johan Vles1, Dr Marjanka Hoving2, Dr Lisette Raak van3, Dr Geert Spincemaille4, Prof Jules Becher5, Prof Johan Vles6

1University Hospital Maastricht, 2Department Of Child Neurology, University Hospital Maastricht, The Netherlands, 3Department of Neurology, University Hospital Maastricht, The Netherlands, 4Department of Neurosurgery, University Hospital Maastricht, The Netherlands, 5Department of Rehabilitation, University Amsterdam, The Netherlands, 6Department Of Child Neurology, University Hospital Of Maastricht, The Netherlands

Background: Intractable spasticity can be treated effectively with continuous infusion of intrathecal baclofen. Because evidence for its use in the treatment of children with spastic cerebral palsy is lacking, we conducted a randomised controlled trial.

Objectives: To test whether continuous infusion of intrathecal baclofen is effective in comparison with standard treatment only.

Design: A randomised controlled trial.

Participants and Setting: Seventeen children, aged 13.2 +/- 2.8 years, with intractable spastic cerebral palsy were randomised to receive a Synchronmed pump for continuous infusion of intrathecal baclofen after either one month (CITB group) or six months (Control group).

Methods: Primary outcomes were the 6-month-change scores on the 0–10 visual analogue scale for individual formulated problems and the Caregiver Assistance scale of the Pediatric Evaluation of Disability Inventory self-care domain. One of the secondary outcome measures was health related quality of life as measured with the Child Health Questionnaire-PF50.

Results: Nine children were randomly assigned to the CITB group and eight to the Control group. The visual analogue scale for individual problems improved with 4.0 +/- 1.7 in the CITB group and changed with -0.2 +/- 1.3 in the Control group (p=0.001). Pediatric Evaluation of Disability Inventory scores did not improve significantly. The Child Health Questionnaire-PF50 6 month-change score significantly differed in favour of the CITB group for the domains of bodily pain/discomfort (p=0.014), mental health (p=0.045), psychosocial status (p=0.027) and parents'personal time limitation (p=0.043).

Conclusion: The results of this randomised controlled trial establish continuous infusion of intrathecal baclofen to be effective in carefully selected children with problems caused by intractable spastic cerebral palsy.
Pamidronate Improves Pain, Wellbeing, Fracture Rate and Bone Density in 14 Children and Adolescents with Chronic Neurological Conditions

Dr Jane Valentine1, Dr Warwick Howe2, Ms Gillian Charlwood2, Dr Elizabeth Davis2

1Princess Margaret Hospital, 2Endocrinology/Princess Margaret Hospital

Intravenous pamidronate has been shown to improve bone density in children with chronic neurological conditions but their role in treatment of symptomatic osteopenia is unclear. At Princess Margaret Hospital, Perth, the sole tertiary referral paediatric hospital for Western Australia a cohort of patients with chronic neurological conditions and low bone density, in whom fractures and bone pain were impacting on their daily care were being referred for treatment. To address this fourteen participants (M:F = 7:7, average baseline age 12.37 years) were enrolled in a prospective uncontrolled study of pamidronate over a 2 year period. Pamidronate was infused every 6-8 weeks at a dose of 1mg/kg though due to patient illnesses &/or hospital admissions the average dose received over the 2 year period was 6.25 ± 0.72mg/kg/year. Outcome measures include: bone mineral density (BMD) z score, fracture rate, the effect of pamidronate on patient pain and wellbeing as assessed by carer’s completing a visual analogue scale. Bone mineral density z score improved at all sites measured over the two years: whole body -4.84 to -3.14 (p = 0.01), lumbar spine -2.92 to -1.1 (p = 0.02) and femoral neck -4.6 to -3.58 (p = 0.04). Eight out of 14 patients reported significant pain at baseline and pain improved in seven out of these 8 patients. Of the 11 patients who answered the general wellbeing part of the questionnaire, eight patients reported an improvement in general wellbeing and 3 reported no change. Average annualised fracture rate decreased from 0.42+/0.49 to 0.14+/0.36 fractures per year, p=0.09. In a patient group with chronic neurological conditions and fractures or bone pain pamidronate has a positive effect.

Intensive Speech Therapy for Children with Dysarthria

Dr Lindsay Pennington, Dr Nick Steen, Dr Nick Miller, Ms Eftychia Eftychiou, Ms Sheila Robson

Newcastle University

Background: Children with with cerebral palsy often have dysarthria. Speech and language therapy focusing on helping children maximise their motor control for louder, slower speech has been advocated but not evaluated. We conducted a pilot study to investigate the potential impacts of a therapy that focused on controlling breath supply and maintaining a steady rate of speech across phrases.

Objectives: To investigate if, following therapy, children’s speech was: More intelligible in single words and connected speech to familiar and unfamiliar adults, Louder across words and phrases, Rated as less impaired by expert therapists.

Design: Interrupted time series with 4 measurements taken before therapy and 4 after.

Participants/Setting: Children: 16 children with dysarthria (9 girls), aged 11-18 years (mean age 14 yrs, SD 2). Exclusion criteria: severe sensory impairments, profound cognitive impairments, inability to follow grammatically simple sentences.

Unfamiliar listeners: 128 adults with no experience of disordered speech or cerebral palsy.

Familiar listeners: 3 adults who worked with each child at school.

Raters of speech impairment: 16 unfamiliar speech and language therapists.

Materials/Methods:
1) Mean percentage intelligibility of single words: Children’s Speech Intelligibility Measure. Different lists were used for each child at each data collection point.
2) Mean percentage intelligibility in connected speech: Children’s described picture sequences.
3) Acoustic measures: Sound pressure level, pitch and loudness perturbation/steadiness and harmonics to noise ratio of words from Measures 1 and 2 above.
4) Impairment: Composite score on Grade, Roughness, Breathiness, Aesthenia, Strain (GRBAS) scale using recordings for Measures 1 and 2. Children received three sessions of individual therapy per week for six weeks at school. Speech recordings for Measures 1 and 2 were taken at four time points: six weeks before therapy, one week before therapy, one week after therapy, six weeks after therapy.

Results: Children’s intelligibility increased after therapy to familiar and unfamiliar listeners. Mean increase in single word test scores was 14.7 (95% CI: 9.8, 19.5) and 15.0 (95% CI: 11.7, 18.2) for familiar and unfamiliar listeners respectively. Mean increase in connected speech test scores was 12.1 (95% CI: 4.3, 20.0) and 15.9 (95% CI: 11.8, 20.0) for familiar and unfamiliar listeners respectively. Data from acoustic and perceptual measures are currently being analysed. Findings will be presented at the conference.

Conclusions/Clinical Implications: The clinical effectiveness of the intervention should be tested in a pragmatic trial.
Percutaneous intrasalivary injections of botulinum toxin A (BTX-A) into the parotid and submandibular salivary glands of 14 children (6 had repeat injections) aged 4 to 18 years with cerebral palsy and sialorrhoea, under ultrasound guidance.

Methods: Response was assessed at 2, 8 and 16 weeks postinjection. At baseline and each visit, drooling rating score, drool quotient (based on a 15 minute video recording of the number of 15-second epochs the child drooled), number of bib changes per day and a visual analogue score (on a scale of 0 to 10, with higher scores indicating more severity) was recorded. A quality of life questionnaire (QOL) was administered at baseline and week 8. A caregiver satisfaction score was obtained at week 2, 8 and 16 (a scale from 2-13, with higher scores indicating more satisfaction). Adverse events related to the procedure or BTX-A were recorded at each visit. ANOVA was used to determine differences in drooling parameters at each visit.

Results: Mean age was 9.2 (sd 2.5) yrs. Mean dose of BTX-A was 3.5 U/kg body weight (sd 0.9). One third had spastic quadriplegia and half of them had a GMFCS score of IV or V. Drool rating scores were significantly reduced from baseline to weeks 2, 8 and 16 (mean scores 7.6, 5.5, 5.1, 5.5 respectively; p<0.001). Significant reductions were also seen for the visual analogue scale (mean scores of 6.2, 3.6, 3.0, 3.5; p<0.001), number of bibs changed daily (mean numbers 5, 1.61, 1.3, 1.4; p<0.001) and drooling quotient (mean scores 23.9, 8.1, 7.3, 9.7; p<0.001). QOL scores dropped from a mean of 36 (sd 5.7) at baseline to 11 (sd 1.2) at week 8; p<0.001. Caregiver satisfaction was high at weeks 2, 8 and 16 (mean scores 10.5, 11.5 and 11.2 respectively). Transient adverse events were encountered in 10 (41.7%) patients in the first week post-injection - these included pain (8.3%) and swelling (16.7%), excessively thick saliva (12.5%), fever (8.3%) and dysphagia (8.3%). 83.3% of the parents wished for repeat injections in the future.

Conclusion: Percutaneous intrasalivary injection of BTX-A significantly reduces drooling in children with cerebral palsy and severe sialorrhoea, with a concomitant improvement in their quality of life and caregiver satisfaction. Significant response was still noted 16 weeks postinjection. Almost half of the patients reported transient adverse events, but most caregivers still requested for a repeat injection.

Predicting the Speech and Communication Development of Young Children with Cerebral Palsy: Findings from a Pilot Study
Dr Lindsay Pennington1, Prof Helen McConachie1, Dr Mark Pearce1, Prof Allan Colver1, Dr Mary Gibson1
1Newcastle University, 2Newcastle upon Tyne Hospitals NHS Foundation Trust

Background: Parents of young children with cerebral palsy often ask speech and language therapists and paediatricians “Will my child talk?” At present there is little research evidence to inform prediction of the risk of severe speech and communication impairment in cerebral palsy.

Objectives: Pilot the design and methods of a longitudinal prospective cohort study of children’s speech and communication development from 2-5 years of age. Test the feasibility of conducting a longitudinal study.

Design: Prospective cohort

Participants/Setting: All children with CP residing in North of England Collaborative Cerebral Palsy Survey (NECCPS) area born between 1.7.2005 and 31.3.2006, whose communication is giving cause for parental and/or clinician concern at age 2 to 2.6 years.

Materials/Methods: Independent measures. Corrected age in months; Birth weight; Site, type and extent of neurological lesions on MRI; Surveillance of Cerebral Palsy in Europe classification; GMFCS; MACS; Vision and hearing acuity; Pre-School Language Scales UK (Boucher & Lewis, 1997); Mullen Scales of Early Learning, (visual reception scale) (Mullen, 1995) or Leiter-R Scales (Roid & Miller, 1997); Oral Speech Motor Control Protocol; Diagnostic Evaluation of Articulation and Phonology (Dodd et al., 2002); MacArthur Communicative Development Inventory UK (Klee et al., 1999).

Dependent measures.
1) NECCPS Communication rating. 4 point severity rating scale.
2) Communication Function Classification Scale (CFCS, Hidecker et al 2008), 5 point scale.

Results: 34 children were identified for the pilot study and 27 children recruited (80%).

NECCPS Communication rating median = 2.5, IQR 2, 4; CFCS median = 4, IQR 3, 5.

Independent measures of speech and language correlated highly with dependent measures of communication (p = <0.001 for all). No significant association was observed between GMFCS score and NECCPS communication score or GMFCS and CFCS.

Conclusions/Clinical Implications: Results suggest that a prospective cohort study is feasible and that methods are appropriate for children as young as 24 months of age. With a sample of 100 children we will have the power to detect 0.8 SD change in standardised measures of speech production. The full study will commence September 2008.

This study will predict which children with speech or communication difficulties at two years of age have persisting difficulties at five years, and the severity of such difficulties.

Data on children aged 2 to 2.6 years seen before 30.1.2009 will be presented at the conference.
The Clinical Utility of Quality of Upper Extremity Skills Test for Children with Cerebral Palsy

Dr Natasha A Lamin1, Ms Megan Thorley2, Prof Anne Cusick3, Ms Iona Novak4, A/Prof Ros Boyd5

1University of Sydney, 2Queensland Cerebral Palsy Health Service; University of Sydney, 3University of Western Sydney, 4CP Institute, 5Queensland Cerebral Palsy and Rehabilitation Research Centre

Background: Rehabilitation clinicians and researchers use assessments for three main purposes: to identify and describe key issues to be addressed in rehabilitation, to evaluate outcomes and predict future function. Appraisal of appropriate assessments for use in clinical practice is an important part of meeting these purposes and demonstrating the evidence base of our practice. Even when an assessment has solid psychometric properties, if it is not feasible to use in a clinical setting or does not provide useful clinical information, then it is of little value to a clinician.

Objectives: To determine the clinical utility of the Quality of Upper Extremity Skills Test (QUEST) for children with cerebral palsy.

Design: Masked email survey distributed via snowball method to therapists and physicians across Australia.

Participants/Setting: 25 clinicians responded: occupational therapists (n = 22) physiotherapists (n = 2), physicians (n = 1).

Methods: Respondents rated the clinical utility of the QUEST using a questionnaire that was developed based on the definition of clinical utility by Law and Letts (1989). Questions on (1) time to administer and score; (2) cost; (3) acceptability to clients; (4) clarity of format; (5) ability to provide unique information; (6) contribution to clinician decisions and (7) responsiveness were included. Data on the perceived utility were compared to other upper limb functional assessments including the Assisting Hand Assessment and The Melbourne Assessment of Unilateral Upper Limb Function (MUUL).

Results: All respondents reported knowledge of the QUEST and 70% reported using the assessment with their clients. In the survey group the average number of QUESTS performed per month was 1.6 (SD 1.4). On average, clinicians agreed that the QUEST is clinically useful, particularly in terms of time to administer, cost effectiveness and accessibility. Mean perceived utility scores for the QUEST were comparable to those achieved by MUUL, with the exception of time where the QUEST was shorter to administer and score.

Conclusion: The sample indicated the QUEST was widely known and used. It received equivalent ratings on cost, format, and responsiveness to the MUUL but was faster to administer and score. While comparable construct validity is yet to be explored, the clinical utility findings of this study provide an empirical base for practitioners to consider the relative merits of each instrument.

Parents’ and Therapists’ Perceptions About the Content and Construct of the Manual Ability Classification System, MACS

PhD OT Ann-Christin Eliasson

Karolinska Institutet, Department of Woman and Child Health

Background: The Manual Ability Classification System (MACS) is a five-level classification that describes how children with cerebral palsy (CP) use their hands when handling objects in daily life. The MACS level is determined by asking parents, therapists or someone else who knows the child well, how they think the child uses their hands i.e. not by assessing the child. If the classification is going to serve as a useful tool in the description of a child’s hand function it needs to be meaningful and easy to understand for both parents and therapists.

Objectives: The aim of this study was to investigate parents and therapists descriptions of the children’s ability to use their hands in daily manual tasks and to relate that information to their choice of MACS level and the comprehension of the MACS concept.

Design: A semi-structured interview was used together with the MACS classification.

Participants/Setting: 25 children, ages 8–12, 13 boys and 12 girls, with CP were represented in this study by a parent and a therapist, the latter being the treating occupational therapist or physiotherapist.

Materials/Methods: Data was collected from parents and therapists on separate occasions. After a short presentation of MACS, the respondents rated the child’s MACS level. Subsequently, in a short interview, they described their thoughts about the child’s ability, the classification and the scoring process. Data analysis was influenced by content analyses.

Results: Parents and therapists found that MACS gives a good description of how children with CP use their hands in activities and that the five levels were meaningful and generally easy to choose between. The parents emphasised that the MACS focuses on the actual performance of the child rather than on limitations. A unique description of the children’s ability at each level confirmed the validity. This provided evidence which strengthened the content and construct validity of MACS. The results also indicated that additional information complimenting the existing leaflet could further facilitate the scoring process.

Clinical Implications: Parents and therapists thought MACS could be used as a tool for communication between parents and medical staff, policy makers and the social services. It could also be used as a guide in discussion about goal setting and intervention. In research MACS can be used as a tool to describe groups and to compare results between studies to further deepen the knowledge of children with CP and the possibilities they have of using their hands.
Case-Control Study of Cerebral Palsy in Term and Preterm Infants in Western Australia, 1980–1995: The Outcomes of NIC graduates

Ms Jan de Groot, Associate Professor Eve Blair, Ms Linda Watson, Professor Fiona Stanley

Telethon Institute for Child Health Research

Background: Cerebral Palsy (CP) in Western Australia (WA) occurs in approximately 2.5 per 1000 live births. CP is associated with significant lifelong morbidity and high service needs. Rates have not declined in the last 50 years and the aetiological pathways are often unknown or poorly understood. Neonatal intensive care (NIC) is an important factor in facilitating the survival of preterm infants. This study explores patterns of outcomes (intact survival, CP or death) of NIC graduates born 1980–95.

Objectives: To report the frequency and severity of CP in NIC graduates stratified by Gestational Age (GA) and year of birth

Design: A controlled population based study comparing CP cases with individually matched neonatally surviving controls and a representative sample of intrapartum and neonatal deaths approximating the number of cases.

Participants/Setting: Subjects comprised (1) 94.6% of all cases of CP born in WA 1980–95 (N=741), (2) each matched to a surviving control for year of birth, GA and plurality (3) a representative sample of intrapartum and neonatal deaths (N=605) and (4) the co-multiple(s) of any selected subject (183).

Material/Method: Data was extracted from all medical records relating to the pregnancy, delivery and neonatal period by data collectors blind to case control status. Data was collected on infants till discharge from the hospital or to death and for mothers from presentation of the pregnancy to delivery.

Results: For all cases of CP almost half went to NIC (359/741: 48%) of whom 60.2% (216/359) received mechanical ventilation, that is, 47% for singletons and 60% for multiples. The severity of impairment in NIC infants born <32 weeks tended to be high and increasing, whereas the severity of term born CP not attending NIC is static.

Conclusion/Clinical Implications: Approximately half of the children with CP are NIC graduates and many of these would not have survived without receiving NIC. CP may represent the balance between death and intact survival in which case we cannot expect a decline in the rate of CP in the face of increasing survival of NIC graduates. Of greater concern is the increasing severity of CP resulting from NIC.

Cerebral Palsy in Term Infants: A Population-Based Case-Control Study of Antenatal and Intrapartal Risk Factors

MD Kristina Ahlin1, MD PhD Kate Himmelmann2, MD PhD, Associate p Bo Jacobsson3, MD Professor Gudrun Hagberg1, MD PhD Poul Thorsén4, MD Professor Henrik Hagberg1, MD PhD Ulla-Britt Wennehoffm5

1Departm. of Obstetrics and Gynecology, 2Department of Pediatrics, Institute of Clinical Sciences, Sahlgrenska University Hospital, Gothenburg, Sweden, 3Department of Obstetrics and Gynecology, Sahlgrenska University Hospital, Gothenburg, Sweden, Guest Professor Division of Faculty, Rikshospitalet, Department of Obst. and Gyn. Oslo, Norway and N. Atlantic Neuro Epid. Dep. of Epid. Univ. of Aarhus, Denmark, 4Department of Pediatrics, Institute of Clinical Sciences, Sahlgrenska University Hospital, Gothenburg, Sweden, 5North Atlantic Neuro Epidemiology Inst. of public Health Dep. of Epidemiology University of Aarhus, Denmark, 1Department of Obstetrics and Gynecology, Sahlgrenska University Hospital, Gothenburg, Sweden, 2Department of Obstetrics and Gynecology Sahlgrenska University Hospital, Gothenburg, Sweden

Objective: The aim of this study was to analyze infection-related risk factors during pregnancy and delivery for spastic CP in infants born at term in a large case-control study.

Design: A population-based series of infants with spastic CP born at term (n=334) between 1983–94, were included and matched with a control group (n=668). Maternal, antenatal and intrapartal variables were retrieved from obstetric records. The focus was infectious factors defined in advance. Both univariate and multivariate analyzes were performed.

Results: In general, few episodes of fever were observed in the records and only one case of clinical chorioamnionitis. Univariate analyzes showed a borderline significant association between fever (>38 degrees) before onset of the delivery (OR 2.62 (0.97–7.11)) and CP. Fever (>38 degrees two times with at least 4 h apart) within 48 h after delivery was associated with CP, (14/329 cases, 10/660 controls (OR 2.89 (1.27–6.59))). Use of antibiotics during pregnancy (65/334 cases, 75/668 controls (OR 1.91 (1.33–2.74))), 2 times during pregnancy (14/329 cases, 10/660 controls (OR 2.33 (1.15–4.73))), 3 times during pregnancy (14/329 cases, 10/660 controls (OR 2.89 (1.27–6.59))), and use of antibiotics before onset of delivery correlated with CP (12/334 cases, 3/668 controls (OR 8.28 (2.31–29.6)). There was an association between any infectious disease during pregnancy and CP (125/334 cases, 173/668 controls (OR 1.71 (1.29–2.27))).

Our multivariate analyzes showed an increased risk of CP among women having used antibiotics during delivery (OR 6.51 (1.77–24), antibiotics postpartum (OR 2.87 (1.61–5.12)) and also among those who had had E. coli in urine during pregnancy (OR 3.28 (1.06–10.1)). The presence of information on infectious episode during pregnancy (OR 1.38 (1.01–1.87)), suspected IUGR (OR 4.94 (1.97–12.4)) and umbilical cord complication (OR 5.10 (1.29–20.2)) constituted independent risk factors of higher risk of CP.

Conclusion: Multivariate analyzes concluded that infection related variables such as antibiotics used during delivery, antibiotics used postpartum, presence E. coli in urine during pregnancy and infectious episode during pregnancy was associated with CP in term born infants.
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Perspectives from Administrators: Do Knowledge Brokers Make a Difference?

Dr. Dianne Russell1, Lisa Rivard2, Dr. Johanna Damah3, Dr. Robert Palisano4
1CanChild Centre for Childhood Disability Research, 2University of Alberta

Background: Administrators need to balance the demands of delivering therapy services with the need to provide staff educational opportunities which promote evidence-based practice. The effectiveness of using a Knowledge Broker (KB) to help physical therapists increase their knowledge and use of evidence based measures of motor function for children with cerebral palsy (including the GMFM, GMFCS and the Motor Growth Curves) was evaluated in 28 pediatric treatment facilities in three provinces of Canada.

Objectives: The objective of this study was to determine what administrators perceived to be the utility, supports and barriers to the use of a KB in their facility following a six month intervention.

Design: Qualitative study design using a phenomenological approach.

Participants/Setting: Administrators from 27 of 28 participating pediatric facilities completed a telephone interview.

Method: Semi-structured interviews were conducted by an interviewer independent from the study team following six months of active brokering. These interviews were recorded and transcribed. Four members of the study team independently read the transcripts to identify important issues and reach consensus on themes. A member checking process with participating administrators was used to ensure credibility of the results.

Results: Administrators were generally very positive about the benefits of having a KB at their facility. They acknowledged the efficiency and effectiveness of this type of educational experience, and had praise for the committed and respected knowledge brokers. Many administrators commented on the stimulating peer-to-peer learning environment that the KB process encouraged, and reported both on the cross-disciplinary educational opportunities that arose from this KB project as well as the possibility that the KB concept could be expanded to other practice areas. Administrators often referred to their organizational beliefs and values when discussing their need to make priorities for limited human resources and finances, and this impacted on their decision about whether they would ensure the continuation of a KB role at their facility, (either formally or informally), after the study was completed.

Conclusion: Administrators reported many positive benefits of having a KB in their facility/region. Although the benefits were significant, administrators had varied responses about whether they could maintain a formal or informal KB role in their facility once the study was over. Funding restraints and the lack of necessary resources were the two major barriers identified by the administrators.

Is it Time to Facilitate Parent-To-Parent Support as Part of Family-Centred Pediatric Rehabilitation?

Ms. Lesley Wiart3, Dr. Johanna Damah1, Dr. Lynne Ray3, Dr. Joyce Magill-Evans3, Dr. John Andersen4
1Faculty of Rehabilitation Medicine, University of Alberta, 2Dept. of Physical Therapy, University of Alberta, Edmonton, AB, Canada, 3Dept. of Nursing, University of Alberta, Edmonton, AB, Canada, 4Dept. of Occupational Therapy, University of Alberta, Edmonton, AB, Canada, 5Dept. of Pediatrics, Faculty of Medicine and Dentistry, University of Alberta, Edmonton, AB, Canada

Background: Family-centred services has been widely advocated as a best practice approach in many health care fields, including paediatric rehabilitation. A family-centred approach is characterized by a focus on family strengths, family/professional collaboration, ensuring families have access to information about services and resources, and respect for the diversity of families. Facilitating parent-to-parent support was identified as a key element of family-centred service in early literature.

Objective: To determine how families’ experiences with pediatric occupational therapy (OT) and physical therapy (PT) services compare with therapists’ perceptions of services and with key components of family-centred service discussed in the literature.

Design: Mixed methods, descriptive study.

Participants/Setting: Pediatric rehabilitation programs from rural and urban sites providing services for children in three age groups (0–3 years, 3–6 years, and 6–18 years) were identified throughout Alberta, Canada. Thirty-nine parents of children with cerebral palsy (aged 2–17 years) and therapists (22 OTs and 32 PTs) from 54 programs providing services to children with cerebral palsy participated.

Materials/Methods: Parents participated in one of 11 focus groups or 2 individual interviews. Focus group questions were designed to explore their experiences and expectations for OT and PT services for their children. Therapists completed the Measure of Processes of Care for Service Providers (MPOC-SP), a standardized self-assessment measure of family-centred care. The MPOC-SP has 4 subscales: 1) showing interpersonal sensitivity, 2) providing general information, 3) communicating specific information about the child, and 4) treating people respectfully. Items within each sub-scale are rated on a 7-point scale, ranging from 1 (not at all) to 7 (to a very great extent).

Results: Parents reported a lack of opportunities to meet other parents of children with disabilities. They viewed other parents as an invaluable source of emotional support, practical advice, and information about community resources and services. Therapists rated themselves lowest on the ‘providing general information’ subscale (mean= 3.65, SD=1.38) that included items on facilitating parent-to-parent contact and providing information about community services and supports. Therapists in two other published studies also rated themselves lowest on this subscale.

Conclusions/ Clinical Implications: Therapists and programs need to actively facilitate parent-to-parent linkages. Many children with cerebral palsy attend inclusive schools and community programs, further limiting opportunities for parents of children with physical disabilities to connect. Consequently, enabling parent-to-parent support may be even more important now than when family-centred service was initially conceptualized.
Perceived Level of Disability for Clients with Cerebral Palsy: Factors Influencing Therapists’ Judgment

Dr Mehdi Rassafiani
The University of Social Welfare and Rehabilitation Sciences Tehran

In many service delivery models, severity of cerebral palsy is used to determine the extent of support offered to individual clients and their families. There is little consensus, however, in the literature about the factors used to classify level of disability. This study aimed to understand the factors that influence therapists’ perceived level of disability regarding clients with cerebral palsy and its association with their decisions about intervention options.

One hundred and ten hypothetical case vignettes on the basis of methodology of Social Judgment Theory were developed and therapists were asked to identify the level of disability and the intervention option for each case. Eighteen experienced occupational therapists with an average of 10 years clinical experience participated in this study.

Results indicated that therapists mostly used two factors to identify the level of disability namely severity of spasticity and limitation in gross motor function. The factors driving intervention options were again severity of spasticity but this was coupled with wrist and finger posture instead of gross motor function. Finally, there was no association between the therapists’ perception of client disability and their decision about intervention options. This finding suggests that therapists utilize different decision making processes when determining level of disability and identifying intervention options for clients with cerebral palsy.

Key Areas: Level of disability, clinical reasoning, cerebral palsy, social judgment theory

Long-Term Outcomes for Children Born Very Preterm

Dr Peter Anderson¹, Ms Carly Molloy², Dr Alicia Spittle², Dr Jacques Williams²
¹The University of Melbourne, ²The University of Melbourne/Murdoch Childrens Research Institute

Background: Approximately 2% of live births are very preterm (<32 weeks’ gestation), and with advances in medical care the majority of these infants now survive (> 85%). In contrast, morbidity rates have not improved with more than 50% of very preterm survivors experiencing later neurobehavioural impairments, and the societal economic burden associated with preterm birth is enormous and was recently estimated to be in excess of US$26 billion in the USA alone.

Seminar Outline: This seminar will be presented by an interdisciplinary team including psychology, physiotherapy and human movement. It will involve a series of integrated presentations describing the nature and severity of neuropsychological and motor outcomes in very preterm children.

The first section of the seminar will describe neuropsychological impairments exhibited by very preterm children, and outline factors associated with these difficulties. Dr Peter Anderson will provide a general description of the attentional, memory, executive, educational and emotional-behavioural problems reported in this population, and briefly summarise neuro-imaging studies examining brain-behaviour relationships. Ms Carly Molloy will then focus on visuo-spatial deficits in very preterm children, as this has been proposed to be a primary deficit. The nature of visual-spatial deficits in this population, the neural mechanisms associated with these impairments, and the academic and social implications associated with visual-spatial deficits will be discussed.

The second section will focus on motor problems in very preterm children, with a particular focus on the assessment of these problems. Dr Alicia Spittle will report on findings from a recent study examining the predictive validity of three infant motor assessment tools namely Prechtl’s General Movements Assessment, the Alberta Infant Motor Scale and the Neuro-Sensory Developmental Motor Assessment in a sample of 98 very preterm children. Finally, Dr Jacques Williams will review what is currently known regarding prevalence and risk factors of minor motor impairment (MMI) in very preterm children, with a specific focus on an important area yet to be adequately explored – the underlying mechanism of MMI.

Seminar Objective: At the completion of this symposium attendees should have a sound understanding of the nature and severity of impairments exhibited by very preterm children, and be in a position to apply this information for the development of surveillance and intervention programs. The seminar will discuss the appropriateness of various assessment approaches which should be of great interest to those attendees who are involved in the follow-up and management of these children.
Fit for Life – Encouraging Children of all Abilities

Mrs Cindy Miles, Cindy Miles & Associates

**Theory:** Three critical components associated with health-related fitness which should lead to improved physiological well-being and greater functional health, thus promoting greater participation in daily life and the ability to meet everyday challenges include:

1) Aerobic Functioning
   a. Endurance
2) Body Composition
   a. Degree of Leanness
3) Musculoskeletal Functioning
   a. Muscular Strength
   b. Muscular Endurance
   c. Flexibility/ROM

Cerebral palsy is a non-progressive disorder that affects the individuals’ movement abilities. According to the American College of Sports Medicine (ACSM), children with cerebral palsy have lifelong difficulties with function and mobility. Many individuals diagnosed with cerebral palsy demonstrate deterioration of their level of independent function and mobility as they enter adolescence and adulthood. The ACSM recommends that health-related physical fitness should be integrated into rehabilitation programs to avoid or decrease a loss of functional mobility. An exercise program for persons with cerebral palsy should include: cardiorespiratory and muscular endurance, muscular strength, balance/agility, body composition and flexibility.

In 2007, Barclay and Murata found that an exercise training program improved physical fitness, participation level, and quality of life for children with cerebral palsy.

**Interactive Discussions/Activity/Clinical Implications:** It is the responsibility of pediatric therapists to enhance each child’s maximum potential. Collaborating with the family to insure each individual achieves their maximum ability, allowing the individual “to be the best they can be!”

This Seminar is designed to provide therapists with research and recommendations pertaining to fitness and sports participation throughout various pediatric age groups. Guidelines for strength, flexibility, cardiovascular training, and measures of body composition will be provided to enhance both the clinicians and researchers’ approach to a Lifespan Fitness Approach for All Children.

This Seminar will motivate pediatric therapists to recognize that therapists in any pediatric setting are able to provide “training & fitness” for their challenged clients. The session will provide pediatric therapists with resources and ideas on how to both encourage and implement fitness and sports within any setting, allowing each child the opportunity to maximize their fitness potential. Clinical examples of children participating in fitness and sports activities and the pediatric therapist’s role and responsibility will be provided. Factors that act as facilitators or barriers to participation in fitness programs for children will be reviewed. Ideas to combat the barriers will include innovative volunteer and student programs. The extensive use of pictures and videos will provide participants with a fun relaxed medium for learning that Exercise is for Everyone!

Cerebral Palsy: Care Throughout the Lifespan

**Dr. Hank Chambers**
American Academy for Cerebral Palsy and Developmental Medicine

**Theory:** Adults with cerebral palsy present with different problems and concerns than the same patients did when they were young. Their concerns with ambulation and attending school has been replaced with concerns of worsening walking and sitting ability, increased pain, loss of function and loss of support systems.

The Adult Cerebral Palsy Clinic at Rady Children’s Hospital has been in existence for the last fifteen years. During that time we have seen over 3000 adults with cerebral palsy of all levels of involvement. Most of these patients were patients from our orthopedic group which has been in existence for over 35 years. Although initially devised as a musculoskeletal followup clinic, it quickly evolved to a multidisciplinary clinic with referrals to adult specialists such as gastrointestinal physicians, neurologists, gynecologists, etc. The understanding of the deterioration in walking and sitting ability, painful dislocated joints, progression and worsening of dystonia, increased seizure activity, progression of weakness, onset of manic/depression disorders and early onset of neurological symptoms at a young age normally associated with a more aged population (i.e. Parkinson like symptoms) in this population is important to understand.

Experience with taking care of children with cerebral palsy is important, especially when determining which decisions, when made in young children and teenagers, can have life long implications in these patients’ lives.

The purpose of this seminar is to highlight these conditions, discuss possible preventative measures in all of these areas, discuss diagnostic criteria, and treatment options for adults with cerebral palsy. Plans of transition from childhood to adult care will be discussed as well as a model for operating an adult clinic with close collaboration with adult facilities. A training program for adults providers will also be presented.
Early Intense Therapy for Children with Cerebral Palsy – Time to Reflect on the Service Delivery Model

Dr Johanna Darrah1, Dr. Joyce Magill-Evans2, Ms. Lesley Wiart3, Dr. John Andersen4, Dr. Lynne Ray4

1Department of Physical Therapy, University of Alberta, 2Dept. Occupational Therapy, Faculty of Rehabilitation Medicine, University of Alberta, 3Faculty of Rehabilitation Medicine, University of Alberta, 4Dept. Pediatrics, Faculty of Medicine, University of Alberta, 5Faculty of Nursing, University of Alberta

Theory: Intensive occupational and physical therapy interventions during preschool years is the predominant rehabilitation service delivery model for children with a diagnosis of cerebral palsy in North America. At school age, ‘regular’ therapy often decreases in frequency and may also change from direct therapy to a more consultative model of intervention. The assumption that early intense treatment is the best model arises from myriad theoretical underpinnings: 1) the theory of early critical periods of development, 2) the theory of neuroplasticity, 3) the extrapolation of the Head Start early intervention model developed for children from disadvantaged environments, and 4) the emphasis on educationally relevant intervention for children in school age years. The importance of early regular therapy intervention for young children with cerebral palsy is not in question. It represents the fastest period of growth and change in all developmental domains, and parents need early support and information. However, we now recognize that cerebral palsy cannot be ‘fixed’, and that persons with cerebral palsy and their families face lifelong challenges. Indeed the challenges for young adults with cerebral palsy change and may even increase in adolescence and young adulthood.

Interactive Discussions/Activity:
1) What does the pattern of therapy over the lifespan look like in your country?
   - Overview of international treatment models by presenters
2) Review of the theories that influenced the concept of intensive early treatment
3) What are the advantages/disadvantages of the current model of more intense treatment in the preschool years?
   - Discussion by participants moderated by presenters
4) What other service delivery models can be considered? What is the evidence to support these different models?
   - Participant discussion
   - Presenters will present examples of service delivery models (e.g. short term intense periods of therapy when child and/or parent has specific functional goals, community fitness, etc.). For each model the presenters will provide evidence to support and/or refute the model.
5) Thinking outside the box – envision a GREAT model!
   - Participant discussion

Clinical Implications: This seminar represents an opportunity to share international experiences regarding the types of service delivery models utilized with children that have cerebral palsy. It will act as a stimulus to reflect on the assumptions that have led us to the current delivery models and to consider alternative approaches. It will combine theory, present evidence and creative visioning!

Quality of Movement of Ambulatory Children and Youth with Cerebral Palsy: Introducing the Quality FM

Dr Virginia Wright1, Dr. Peter Rosenbaum2, Dr Ronit Mesterman2, Ms Ute Breuer1

1Bloorview Kids Rehab, 2CanChild, McMaster University, Hamilton, Canada, 3McMaster University, Hamilton, Canada, 4Dr von Hauners Children’s Hospital, Munich, Germany

Gross motor dysfunction is the defining problem for children with CP. Optimizing gross motor skills and quality of movement are the target of rehabilitation and surgical interventions. Quality of movement enhancement is particularly important for gait-related skills. If one considers Dynamic Systems Theory (DST) and the way that children learn and perfect motor skills, it has been proposed that “as subsystems of developing systems change, motor behaviours may either become more stable (more tightly constrained and more skilled), or they may destabilize. Periods of destabilization are referred to as transition states, and it is assumed that new forms of movement are most likely to appear during these periods of transition... Intervention guidelines emerging from DST suggest that transition periods are the optimal time to effect movement changes.” (Darrah & Bartlett, Infants and Young Children. 8:52–59, 1995; p. 53)

The absence of outcome measures of quality of movement of ambulatory children with CP means that a key focus of rehabilitation interventions cannot be evaluated, nor can the relationship between skill acquisition and improved performance be understood. The Quality FM, a new version of the Gross Motor Performance Measure (GMPM), has been developed by our research team to address this gap. The Quality FM focuses on evaluation of the GMPM’s five quality attributes (i.e., alignment, co-ordination, dissociated movement, stability and weight-shift). To improve on the GMPM’s reliability and responsiveness, the following adaptations were made with the Quality FM: expanded number of Stand and Walk items (from 8 to 38, creation of item-specific response wording, response option revision to score quality with and without performance cues, and use of a standardized video-scoring approach).

Interactive Discussion: This seminar for PTs, which will be of interest to physicians, and kinesiologists, will focus on detailed presentation of the Quality FM. GM FM Stand and Walk, Run, Jump videoclips, and scoring of these clips using the Quality FM will familiarize participants with key features of this new measure. Results of funded test-retest reliability testing with 20 children with CP will be shared.

Clinical Implications: This work builds on knowledge gained in the past decade, and closes the loop on this work by addressing the challenges identified with the GMPM when used to measure change in ambulatory children with CP. From an outcomes perspective, the Quality FM has strong potential for extensive clinical and research uptake in its position as a companion measure to the internationally-recognized GMFM.
Mealtimes Changes in Older Adults with Cerebral Palsy and Dysphagia

Dr. Bronwyn Hemsley1, Prof. Susan Balandin2, Prof. Justine Joan Sheppard3
1The University of Sydney, 2University College, Molde, Norway, 3Columbia University, New York.

**Theory:** Dysphagia and mealtime management in adults with cerebral palsy (CP) involves a complex amalgam of psychological and physiological conditions. In this seminar we will (a) present the findings of recent multi-site research into the experiences adults with CP aged over 30 years, and (b) lead participants in integrating the findings of this research into clinical practice and policy development in working with older adults with CP.

In a mixed-method study, we examined the mealtime experiences of 42 adults with CP and dysphagia aged over 30 years in Australia, the United States, and India. The Dysphagia Disorders Survey and the SWAL-QOL were used to scale the participants’ severity of dysphagia and measure their swallowing quality of life. In-depth interviews were conducted to determine their mealtime experience, the impact of changes in swallowing upon them, and their concerns for the future. Overall, there was a discrepancy between self-report of diet and mealtime management and results of the standardised assessments. Participants described psychosocial consequences associated with dysphagia including fear of choking, frustration, communication barriers and concerns, lack of involvement in decisions and the frustrations of family members. These issues had a direct impact on the self-reported quality of life of the participants by decreasing their enjoyment of meals, decreasing opportunities for self-determination and social interactions.

**Interactive Activities:** In this seminar participants will take part in small and large group discussions and learning activities relating to:

a) the process of gathering information about mealtimes from older adults with CP: develop a useful protocol for in-depth interviews about swallowing

b) combining qualitative interview data with standardised or clinical bedside examination of swallowing: interpreting two types of data to arrive at recommendations regarding mealtime management

c) improving access and participation for adults with CP and dysphagia in decisions about their own mealtime management.

**Clinical Implications:** This study has clinical implications for service providers working with adults with CP and dysphagia. These adults require regular reviews of their mealtimes to accommodate any ongoing changes they experience and support for dysphagia. As a consequence of the loss of function and independence during mealtimes, some adults require more assistance. Health professionals and policy developers need to provide staff, carers, and families with information, preparation and training to provide safe and enjoyable mealtimes to these adults.

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**Manual Ability Classification System (MACS) for Children with Cerebral Palsy**

Ass Prof Ann-Christin Eliasson, PhD Lena Krumlinde Sundholm, MSc, OT Ann-Marie Öhrvall
Karolinska Institutet, Stockholm, Sweden

**Theory:** The Manual Ability Classification System is a newly developed classification describing how children with cerebral palsy use their hands when handling objects in daily activities. The classification is designed to reflect the child’s typical manual performance, not the child’s maximal capacity. It is the collaborative use of both hands together that is classified. It does not intend to explain the underlying reasons for limitations of performance or to classify types of cerebral palsy. When defining the five levels of the MACS our primary criterion was that the distinctions in manual ability should be clinically meaningful.

The validation was based on the experience within an expert group, review of the literature and also on thoroughly analysis of children across a spectrum of function. Thereafter reliability was tested between 25 parents and 25 therapists and between pairs of therapists for 146 children between 4-18 years. The results demonstrated that MACS has a valid construct. The inter-rater reliability between parents and therapist was 0.96 calculated by Intra-Class Correlation Coefficient (ICC) (95% confidence interval 0.89–0.98) indicating excellent agreement. The reliability between therapists was 0.96 (0.96–0.98).

**Practice Intervention plan:** This workshop will introduce health professionals working with children with cerebral palsy to the concepts behind, and the content of the MACS. Information about the process of developing the MACS, as well as validity and reliability, will be presented, as well how MACS can be used for functional descriptive purposes, for communication between different professionals and parents, and for goal setting in clinical practice. In the workshop there will be time to learn the MACS and practice scoring children from video recordings. There will also be opportunities to further discuss the classification.

**Clinical Implication:** MACS has been demonstrated to be a useful tool in describing manual ability in children with cerebral palsy. Participants in this workshop will gain knowledge how to use MACS within their own clinical setting.
Assessing Gross Motor Development in the Young Cerebral Palsy Child – Practical Tips and Precautions

Miss Roslyn Boyd1, Ms Carly Harrison1, Mrs Belinda Luther2, Mrs Anne Moodie1, Prof Robert Palisano1, A/Prof Roslyn Boyd2
1Queensland Cerebral Palsy Rehabilitation and Research Centre, Royal Children’s Hospital, 2Munroch Childrens Research Institute, Melbourne, 3Professor of Rehabilitation, Drexel University, USA.

Purpose: Considerable experience in early motor assessment of young children with CP and we currently investigating the early longitudinal motor development of children with CP. In the current Australian NHMRC study VicCPchild and QldCPchild, Ontario study there was limited data on children with CP under the age of 4 years. In the natural history of motor development in children with CP, to benefit from intervention. The Gross Motor Function measure (88 and 66 versions) are valid and reliable tools used to measure gross motor abilities in children with Cerebral palsy and children with motor delay (such as Down’s Syndrome). These measures were used to develop the Gross Motor Development Curves in the Ontario Motor Study (Rosenbaum et al. 2002). The motor development curves have been used to measure of the natural history of motor development in children with CP, to screen for the need for intervention and to monitor the effect of interventions. In the Ontario study there was limited data on children with CP under the age of 4 years (209/657, 32%). In the current Australian NHMRC study VicCPchild and QldCPchild, we currently investigating the early longitudinal motor development of children with CP from 18 months corrected age through to 5 years. The research team has gained considerable experience in early motor assessment of young children with CP and will share their experiences in achieving optimal performance on the GMFM.

Purpose: This workshop will examine the current standards around early motor assessment of the child at risk of CP and will give practical tips on how to test young children with CP on the Gross Motor Function Measure (GMFM). The presenters will combine their research and clinical experience to highlight what is known on the early natural history of motor development of cerebral palsy from the Ontario Motor Study (Palisano) and from current studies in progress (Vic CP child/QldCP child, Boyd) and the Perinatal study (Janssen). The clinical research team will then give practical tips on how to achieve the most reliable and typical performance on the GMFM with young children with cerebral palsy aged 18 months to 5 years (Harrison, Moodie, Luther).

Target Audience: Health professionals involved in the clinical management and research of children with cerebral palsy.

Course Content: The presenters will highlight their research and clinical experiences to present what is known from previous and current research studies on early motor development in children with CP. The clinical research team will provide practical tips on performing the GMFM reliably and achieving optimal performance in the young child with CP from 18 months corrected age. The team will use video clips to highlight the practical tips, environmental factors and procedures for assessing children at all GMFM levels. The team will highlight how the GMFM has been used as part of a surveillance model to screen the early natural history of CP including what information is provided to families.

Course Format: The following topics will be addressed by the four speakers allowing time for discussion (total length = 2 hours):
1) Introduction and overview of the course
2) The GMFM - the Ontario Motor Study - the younger cohort < 5 years; Bob (30mins)
3) Practical tips in performing the GMFM supported by video tape clips to illustrate: Carly, Anne and Belinda
4) Use of the GMFM in an early natural history study of young children with CP - VicCP child/QldCP child; Ros, Jan-Willem (20 mins)
5) Panel Discussion: (10 mins)

Learning Objectives: At the end of the workshop, participants will have been able to:
1) To review the current information on validity, reliability of the gross motor assessments in young children with cerebral palsy.
2) To review the current information on the early natural history of motor development in children with cerebral palsy.
3) To identify and understand the key elements of various approaches for improved upper limb motor control in children with congenital hemiplegia.
4) To learn the practical tips, environmental modifications and cues to achieve the best performance on the gross motor function assessment in young children with CP.
5) To discuss how the gross motor function assessment is used in the context of early surveillance for children with CP across the spectrum of severity of GMFC levels.
Towards a Better Description of Spastic Cerebral Palsy: Use of the Australian Spasticity Assessment Scale and the Reliable Description of Cerebral Palsy Form

Ms Noula Gibson, Ms Sarah Love, Ms Sarah Love
Princess Margaret Hospital

Introduction: Cerebral Palsy (CP) is defined by motor impairments of early cerebral origin which vary in type, location and severity and may be accompanied by a wide range of other impairments. Attempts to classify the clinical manifestations of CP have resulted in categories which are interpreted very variably, hampering both communication between clinicians and generalisation of research results. The hypothesis behind the Reliable Descriptions of CP form (RDCP) is that clinicians can give reliable multidimensional descriptions of CP without using variably interpreted jargon. In contrast classification is inherently unreliable, perhaps because CP covers more than a few discrete syndromes. When developing the RDCP, problems were encountered in reliably describing degree of spasticity using existing clinical methods, necessitating development of the ASAS.

PART 1: Clinical assessment of spasticity using the ASAS

Theory: The theoretical background to the measurement of spasticity and development of the ASAS.

Comparative reliability: The reliability of ASAS scores will be compared with that of other spasticity scales in current clinical use.

Video Examples by Expert: Step by step instructions in how to rate spasticity with the ASAS.

Practice: Participants will be asked to apply the ASAS to a range of upper and lower limb muscles, presented on video. Participants’ answers will be discussed and compared with those of expert users.

PART 2: Achieving reliable descriptions of CP with the RDCP form

Theory: The rationale for the development of and logic in completing the RCDP description form, including demonstrating the reliability of existing methods of CP classification.

Video Example by Expert: Step by step instructions of how to complete the RDCP.

Practice: Participants will be asked to complete the RDCP form from videos of clinical examination of two cases of 5 year old children with spastic CP. Participants’ responses will be discussed and compared with those of expert users.

Clinical Implications: The ASAS is an unambiguous easy to use scale of spasticity. The ASAS with the RDCP enables clinicians to provide reliable, valid, concise descriptions in a standardised format without learning any radical new system. This will facilitate communication between clinical teams and allows researchers to define their research subjects according to any appropriate criterion or combination of criteria, enabling accurate generalization of research results.

Prescription of Ankle Foot Orthosis to Improve Mobility in Cerebral Palsy: Design in Relation to Gait Pattern

Prof Jules Becher1, MSc Merel Brehm2

1VU University Medical Center, 2Dept. of Rehabilitation Medicine Amsterdam

According to the ISPO Ankle Foot Orthoses (AFO) in Cerebral Palsy (CP) are indicated to prevent/correct muscle shortening and foot deformity, provide a base of support and improve efficiency of gait. Although AFOs are widely used to improve mobility, there is still conflicting evidence about the efficacy. In research about the effect of AFOs, mostly 2 kinds of research are performed: – pre-post comparison of walking with and without Orthosis ; - comparison of the effect on gait of two or more different AFO. The description of the gait is mostly limited (correction of equinus) or absent. However, the prescription of a specific type AFO and the biomechanical effect is dependent of the gait pattern of the whole kinematic chain. Unfortunately, there is no international consensus about description of gait pattern. Recently, video based sagittal gait patterns has been described, offering a framework for clinical practice for the prescription and design of an AFO on mobility.

With the aid of videos with simultaneous recording of EMG, ground reaction forces and vector representation, a classification of gait patterns will be presented. The main classification principal will be hyperextension moment or hyperflexion moment around the knee in stance in relation to M. Soleus and M. Gastrocnemius function. Based on this biomechanical analysis, a practice intervention schedule will be presented and illustrated.

Also, foot deformity in bare foot walking will be addressed, and biomechanical principles for correction presented.

In case study video’s with EMG, ground reaction force and vector representation the presented theory will be practised by making intervention plans, en evaluated with repeated recordings. Factors limiting the effect of AFO will be discussed.

Finally, the issue of evaluation of the efficacy will be addresses, and the value of measurement tools.

The clinical implication of the theory as presented will be, that prescription and evaluation of the effect of an AFO must be based at least on the gait pattern in the sagittal plane of hip, knee and ankle.
Engaging Children with Cerebral Palsy Using Augmented Reality and Music Therapy

Ms. Andrea Lamont1, Dr. Heidi Ahonen-Eerikainen2, Mr. David Hobbs1, Ms. Sonya Murchland1, Ms. Breanna Worthington-Eyre1, Ms. Prue Shiosaka3, Dr. Tom Chau4, Ms. Cynthia Tam5, Ms. Cynthia Tam4, Ms. Cynthia Tam7

1Bloorview Kids Rehab, 2The Laurier Centre for Music Therapy Research, Wilfrid Laurier University, 3Senior Rehabilitation Engineer, Division of Research & Innovation, Novita Children’s Services, 4Professional Leader, Occupational Therapy, Novita Children’s Services, 5Speech-Language Pathologist, Suneden Special School, 6Occupational Therapist, Physical Rehabilitation Team, Research Officer – VMI Project, Novita Children’s Services, 7Senior Scientst and Canada Research Chair in Paediatric Rehabilitation Engineering, Innovation & Development, Bloorview Kids Rehab, 8Clinician Investigator, Evaluation of Care, Bloorview Kids Rehab

Theory: Participation is essential to optimize health, wellness, and quality of life for children with Cerebral Palsy (CP), and to prevent related problems (Hough, 1999). Children with CP at GMFCS and/or MACS levels 4–5 are severely limited in their ability to participate and engage in activities within their environments.

The Virtual Musical Instrument is a video-capture software program developed at Bloorview Kids Rehab, Canada (Chau et al., 2003). The software allows a child to see him/herself on a video screen. The child or the adult then designates musical areas that are outlined on the screen by different coloured icons. A minimal movement by the child in the designated area produces the pre-defined musical sound.

Proven usable for children with severe CP (Chau et al., 2006), the VMI is consistent with a paradigm shift in the development of adaptive technologies which do not require refined motor abilities or endurance (Ellis, 1995). Removing the physical barriers that restrict musical participation, the VMI enables children to experience music making and associated psychosocial, emotional and therapeutic benefits (Schwellnus et al., 2002).

Reports made by parents of VMI users suggest that the technology has the potential to improve children’s body functions and enhance their participation in family activities (Tam et al., 2007). VMI emphasizes the restoration of self-image of the child with CP associated with the augmented reality of VMI and promotes participation in visual, auditory, kinesthetic, and self-awareness domains (Ahonen-Eerikainen, et al., in press). Using a single subject experimental design, an ongoing study is evaluating the effectiveness of VMI in facilitating play and communication behaviours in 20 children with severe CP (Raghavendra et al., 2008).

The advanced practitioner’s workshop will include:

1) demonstration of VMI to understand its potential
2) innovative video examples of VMI use to facilitate physical function, self-directed play, communication skills, language concepts
3) discussion of research outcomes
4) examples of intervention planning using VMI with a range of children with CP
5) experience using the VMI
6) discussion of the role of augmented reality in the VMI for children with CP and incorporation into educational and home settings
7) future directions for the VMI and children with CP

Clinical Implications: Explore the partnership potential of VMI with therapies commonly accessed by children with CP (eg physiotherapy, occupational therapy, speech-language pathology).

References:

Changes in Subtypes and Severity of Cerebral Palsy Among Icelandic Children Born 1990–2003

MD Torstein Vik1, MD Thordur Thorkeisson2, Miss Margret Halldorsdottir2, MD Olafur Thorarensen3

1State Diagnostic and Counseling Center; 2Children’s Hospital Iceland

Abstract: Premature infants are at higher risk of developing CP than full term infants. Overall prevalence of CP has remained relatively stable for the last two decades while critical prevalence at trends in prevalence and motor abilities among different gestational age subgroups are inconsistent. Monitoring changes in prevalence, severity and comorbidities of CP is important for service planning of affected children.


Design: A population-based study using systematically collected data on motor functioning and associated impairments of children with CP.

Participants, materials and Methods: Children with CP born 1990–2003 and assessed at the central developmental center in Iceland. They had motor assessment and were evaluated for associated impairments (epilepsy, intellectual impairment (IQ<70), visual and hearing impairments). Children with no or one associated condition were combined in one group while those with two or more associated conditions were combined in another group.

Results: 139 children were identified, corresponding to a prevalence of 2.3 cases per 1000 live births and did not differ between the two time periods. Children were assessed at mean age of 5.41 years (range 4.01 to 10.51 years). The proportion of preterm children increased with time from 35% to 63% (p=0.002) and the proportion of children with spastic diplegia increased from 21% to 41% with a concurrent decrease in the proportion with quadriplegia (p=0.047). Gross motor abilities improved with time as the proportion of children at levels I and II of the GMFCS increased from 56% to 76.5% while the proportion of children at levels IV and V decreased (p=0.033). The proportion of children with no or only one associated impairment increased from 61% to 79% while the proportion with two or more associated impairments decreased with time (p=0.016). Dab analyzed separately for children born at term and prematurely revealed that the improvements in time in gross motor abilities and the decrease with time in the proportion of children with two or more associated impairments were confined to children born at term (p=0.009 and p=0.030 respectively).

Conclusion: The proportion of children born preterm increased with time among our CP population while there was no change in the overall prevalence. Children born at term showed significant improvements with time as judged by improved motor function and less burden of associated impairments while there were no such changes among the preterm children.
The ICF Environmental Factors as Facilitators or Barriers Used in Describing Personal and Social Networks. A Pilot Study of Adults with Cerebral Palsy

OT Gerd Jönsson,
Department of Rehabilitation Medicine Stockholm, Danderyds University Hospital

Abstract

Background: The complex relationship between disability, participation and environment represent an area of specific importance for people in the rehabilitation professions. The revised version of the International Classification of Functioning, Disability and Health (ICF; World Health Organization, 2001) incorporates biological and social perspectives on disablement, as so to represent more fully the impact of health on a person’s life, including participation in the community. Environmental factors such as physical, social and attitudinal environment, and services system and policies, may influence the effect of a person’s impairment or activity limitations.

Objective: The aim of the study was, using the environmental factors of the ICF, to describe the social networks involved in the everyday lives of adults with cerebral palsy (CP). A further aim was to use the ICF generic scale 1–4 to describe how far these adults experienced the contacts within these networks as facilitators or barriers.

Method: The interviews were performed using a guide on the component 'insight perspective' of their experiences.

Results: The participants described (ICF codes e310–e360) 85 contacts within the factor 'support and relationships' experienced as substantial facilitators (md=3.5), and 45 considered as both moderate-to-substantial facilitators and barriers (md=2.5). Four contacts were considered as barriers.

The participant described (ICF codes e410–e455) 88 contacts where their attitudes were considered substantial facilitators (md=3) and 36 contacts where their attitudes were considered as both moderate barriers and facilitators (md=2). In a further four contacts, their attitudes were considered as moderate-to-severe barriers (md=2.5).

Within the factor 'Services, system and policies' (e535–e590) the participant described 123 facilitators, the majority considered as substantial, 37 considered as both moderate facilitators and barriers and one considered as complete barrier.

Conclusion: The result of this pilot study has given new information concerning the contact network of adults with cerebral palsy. It indicates new possibilities for using the ICF environmental factors and the 1–4 scale of facilitators and barriers in clinical work. The participants felt the majority of the contacts in the networks to be supportive, while some felt to be both facilitators and barriers.

Living with a Lifelong Disability – Experiences from Adults with CP

RPT MSc Karin Sandström, OT PhD Kersti Samuelsson,
RPT Professor Birgitta Öberg
Linköping University, Sweden

Background: CP is a lifelong disability and today we know there is a decrease in body functions and activities in adulthood, but still we do not know much about how adults with CP experience the changes and their thoughts and feelings about living with a lifelong disability. It is therefore of importance to give an ‘insight perspective’ of their experiences.

Objective: The aim was to get an understanding in how adults with CP experience living with a disability and how environmental factors and personal strategies influence daily life.

Method: Qualitative study with a phenomenological approach.

Participants: Twenty two persons from five counties in Sweden, with functional levels II-IV according to Gross Motor Classification System (GMFCS), participated. Mean age was 47 years (range 35–68).

Results: The 22 narratives resulted in themes including a) perceptions of the physical body, self-image and autonomy b) strategies in daily life (to fight one’s way, to get used to it, to plan, to hide, to give one’s all).

The experiences of living with a disability showed the same heterogeneity as for anyone else. There was however some problems related to the disability. Perceptions of a body that appeared in an unpleasant way had increased during the years. They often tried to ignore the problems, but they became evident when they interfered with daily activities and had caused manifest changes. The disability is often integrated in self-image of ‘normality’, but is influenced by other people’s attitudes and limitations in taking part in activities. The ability to select among choices and to make decisions over daily life plays an important role in providing sense of autonomy and is not always related to function. Changes according to life-cycle and disability, in combination with different strategies in striving for ‘normality’ and autonomy, can give both positive and negative consequences in managing daily life problems.

Clinical Implications: It is important for professionals to see people with CP as individual subjects and to have knowledge in how different personal strategies can influence body function, self-image and autonomy. This can enhance intervention strategies and be a support in giving appropriate information about cerebral palsy and ageing.
Quality of Life in Young Adults with Cerebral Palsy

Objectives: To describe QOL and its determinants in young adults with CP.

Methods: Participants were asked to complete a postal questionnaire by self report, or proxy report by parents or carers for those with intellectual or severe physical impairments. The Quality of Life Instrument for Young Adults was used to measure QOL. Functional ability was assessed with regard to mobility and independence in daily activities, by using the self reported version of the Gross Motor Function Classification System (GMFCS) and the Barthel Index. Information was collected regarding social participation. Multivariate linear regression techniques were performed to analyze the determinants.

Results: A total of 335 young adults with CP participated. Their mean age was 24.7 ± 2.8 years; 51% were males, half were GMFCS level I or II, and one third were independent in daily activities.

In comparison with their able-bodied peers, young adults with CP had lower scores in most QOL domains, including perception of physical health, psychological wellbeing, role functioning, and independence in daily activities. The type of CP was not associated with any of the QOL domains. Mobility and functional independence in daily activities were determinants of physical health and role functioning, but not psychosocial well-being. Associated disabilities were important predictors of QOL in social relationships but not psychological well-being.

Conclusions: QOL was variable, but lower in young adults with CP than their able-bodied peers, especially in physical and in some aspects of psychological well-being. Greater efforts are needed to improve quality of life in individuals with cerebral palsy, and more research is required to understand the determinants of psychological well-being in this population.

The New Kinematic Classification of Diplegic Forms: Therapeutic Implications

The kinematic classification of the spastic forms of the Infantile Cerebral Palsy (ICP) uses the organizational strategies of the antigravity function as observation and classification criteria for tetraplegias, the walking patterns for diplegias and the manipulation for hemiplegic forms. Concerning diplegias, with regard to gait organization, it is possible to distinguish four main forms.

In this classification, gait organization examines some parameters such as:

- Trunk position
- Head position
- Movements of the pelvis in antero-retroversion and on the frontal plane
- Knee position
- Sequence of the stance and the swing of the foot
- Mechanism of progression
- Pendular movements of the upper limbs
- The selections of the fulcrooms

With regard to these elements we can distinguish four clinical forms of diplegia:

1. First form (propulsive): ante pulsed trunk, costant support on canes, lower limbs in flexion, adduction and equino-valgus-pronation of feet.
2. Second form (tight skirt): the lower limbs maintain a pronounced knee flexion pattern.
3. Third form (tight rope walkers): walk without canes. Adopt the speed up strategy. Significant perceptual disorder.
4. Fourth form (reckless): walk is precociously acquired and preserved forever.
5. In each of these forms, the development of muscular and osteotendinous deformities follows a precise, logic linked to the organizational strategies of the central nervous system.

The age of the patient is going to have a surgical procedure, varies in relationship to the maturation of the walking function which is different in the four forms. Our Paediatric Surgical Department has performed the functional surgery on ICP patients since June 1997. Six hundred and fifty-three ICP patients underwent surgical procedures up to 2004. Among these, 220 were diplegic according to the traditional classification based on the topographic distribution of the malformation.

From 2005 to 2006, 87 diplegic patients, identified according to the kinematic classification of the ICP proposed by Ferrari e Cioni in 2005, underwent surgical procedures. The use of a classification which introduces the predictable elements of the development of the organizational strategies, the possible compensations, the most frequent deformities of ICP, represents an important tool within the rehabilitative project. The cooperation between the paediatric surgeon and the physiatrist is necessary in order to identify the possible choices and what is more suitable for that child, at that age, and with that "natural history".

Bertana Sandra
Reducing Variability in Gait Analysis for Children with Cerebral Palsy

Dr. Richard Baker1, Dr. Jenny McGinley2, Dr. Oren Tirosh2, Dr. Rory Wolfe3, Dr. Jill Rodda1, Dr. Anthony Schache2, Prof. H. Kerr Graham1

1Royal Children's Hospital, 2Murdoch Children's Research Institute, 3Monash University, 4University of Melbourne

Background: There has been considerable concern over recent years about the reliability of gait analysis techniques used to assess children with cerebral palsy. Both kinematic fitting and functional calibration have been used by several groups but none have brought the two together in a package suitable for widespread use.

Objectives: This study aims to establish the potential of such an approach to determine pelvis, hip and knee kinematics. Although the end users of this work will be children with cerebral palsy this proof of concept study is on children with no gait pathology.

Patients/Materials and Methods: The approach is based on a 5 segment model (pelvis, 2x femur, 2x tibiae) with 3 dof hip joints and 3 dof knee joints (2 dof during calibration). A new 18 marker set was devised using skin mounted markers placed on locations considered to be least susceptible to soft tissue artefact. Calibration exercises comprised a five star movement through about 30º at the hip and three repeated non-weight-bearing knee flexions from about 10º to 90º. One assessor performed three fully independent gait analyses; another assessor performed one independent gait analysis. Both had more than 10 years experience in the field. Additional markers were also applied to allow concurrent comparison with the conventional gait model (Plugin Gait, VICON).

Multi-level random effects linear regression was used to estimate variance components including those within and between assessors.

Results: The two figures below illustrate within and between assessor variance components (standard deviation, SD, indicated by height of coloured area) and total variability (SD indicated by height of coloured + clear area). For all measurements the total variability was similar to or better than that when using the conventional gait model.

Conclusion Clinical Implications: The new model performs very well particularly in relation to the within or between assessor variability which is around 2º less across all variables. This presents excellent performance when compared with earlier studies of repeatability using the conventional gait model at a range of different centres. Use of functional calibration techniques suggest that many of the variables will be less sensitive to assessor expertise than the conventional model suggesting that good results might also be achieved by less experienced assessors.

Cerebral Palsy Surveillance of Communication and Eating

Dr. Mary J. Cooley Hidecker1, Ms. Carly Hanna1, Dr. Peter Rosenbaum2, Dr. Raymond D. Kent3, Dr. Nigel Paneth4

1Epidemiology, Communicative Sciences and Disorders, Michigan State University, 2CanChild Centre for Childhood Disability Research, McMaster University, 3Communicative Disorders, University of Wisconsin-Madison, 4Epidemiology, Michigan State University

Background: International cerebral palsy (CP) surveillance provides important population-based data. However, confusing and conflicting prevalence rates exist for communication and eating difficulties in CP. One possible reason for the differences could be whether and how communication and eating difficulties are ascertained. Important variables may include data collection timing and registry definitions.

Objectives: To determine whether, when, and what communication and eating data have been collected by CP registers.

Design: Web-based or phone survey of known CP surveillance units throughout the world.

Participants/Setting: Initial survey participants were 15 contact persons representing 17 CP registries in addition to 3 umbrella registries - the Australian Cerebral Palsy Register (ACPR), Surveillance of Cerebral Palsy in Europe (SCPE), and United Kingdom Cerebral Palsy (UKCP). Each respondent was also asked to identify other CP registries.

Materials/Methods: Registry contact persons received email invitations to participate. A 21-question survey was created to determine the type, frequency of collection, and operational definitions of communication (including speech, language, and hearing) and/or eating data collected. Email messages and phone calls are being made to those who have not yet responded to increase the response rate.

Results: 15 of 30 CP registries, currently operating, responded to the survey: 5 in Australia, 1 in Canada, and 9 in Europe. Much variation exists in what, if any, aspects of communication and eating performance are collected by CP registries. Hearing data are most often collected (93%), although 11 definitions were reported. Speech data are collected by 87% of responding registries using 8 definitions. Language data are collected by 40% using 4 definitions. Eating and/or swallowing data are collected by 67% with 6 definitions. Most registries collect the data once. Reasons given for not collecting data included: 1) not part of the agreed minimum data set; 2) not available; or 3) inadequate definitions or measurement tools.

Conclusions/Clinical Implications: People with CP demonstrate a range of communication and eating performance. Many CP registries are constrained by 1) limited resources to expand data collection, 2) a biological perspective where the role of hearing in communication is minimized, and 3) the lack of a consensus, valid, reliable measure of communication and eating performances. Addressing these issues would likely improve estimates of the prevalence of communication and eating challenges in individuals with CP. Public health concerns in CP, including appropriate service delivery regarding communication and eating, would be better informed.
Developing Functional Outcome Measures for Children Using Alternative and Augmentative Communication Systems

Ms Katie Price1, Dr Jeremy Parr2, Mr Tom Griffiths3, Dr Rachael McDonald4, Ms Emma Ham5
1Wolfson Neurodisability Service, Great Ormond Street Hospital, 2Occupational Therapy (Monash University, Victoria, Australia), 3Wandsworth PCT

Background: For both clinicians and researchers, it is difficult to determine the effects of any changes on communicative competence for those people supporting their expressive skills with augmentative and alternative communication (AAC) systems. The development of robust outcome measures must take into account the understanding that individual’s underlying skills, listener support, attitudes and experience can influence outcome in equal measures. However, intervention outcome research would result in better understanding of the impact of AAC on the development, better targeting of staff and equipment resources, and perhaps improved understanding of certain communication profiles (people with autism, acquired brain injury).

This presentation will present outcome findings from the Communication Aids Project (CAP). CAP was a 4 year initiative (2002–2006) by the English Department for Education and Skills, aiming to provide AAC communication equipment for school-aged students. As part of the Project, communication goals were set for each child, and evaluated after 6 months of communication aid use.

Methods: The targets of 60 children, between the ages of 3 and 18 years were examined. Data from the reported outcomes were analysed using descriptive statistics, and the explanations were grouped into common themes using a keyword analysis.

Results: Target achievement were disappointing, with over 60% of targets set report as “not achieved” or “partially achieved”. Associations were examined to explain possible reasons for this, looking at type of target, age of child, school placement and adequacy of assessment.

Conclusions: The introduction to target-setting in the trial and use of AAC as a standard clinical tool has been useful, despite the difficulties, and it is intended to develop its use as part of our standard clinical protocol, to guide both specialist and community teams in the evaluation of the effects of AAC provision for different groups of children.

McDonald R, Hams E, Price K and Jolleff N (2007) Elation or frustration? Outcomes following the provision of equipment during the Communication Aids Project data from one CAP partner centre Child: care, health and development, 34, 2, 223–229
Parr J, Price K and Sargent J (Paul Polani Research Award, British Academy of Childhood Disability) Measuring the efficacy of AAC intervention for children with cerebral palsy

Development of the Functional Communication Classification System

Ms Elizabeth Barby1, Ms Katy Caynes2
1Manager Early Intervention, The Centre for Cerebral Palsy, Western Australia, 2Senior Speech Pathologist, Cerebral Palsy League of Queensland

Background: The Gross Motor Function Classification Scale (Palisano et al., 1997) and the Manual Ability Classification Scale (Eliasson et al., 2006) for the classification of motor abilities of children with Cerebral Palsy (CP) has significantly improved communication and understanding between doctors, therapists, and parents. The need for a similar tool to classify functional communication skills has been acknowledged (ADCP Workshop, 2006, Bax 2005).

Objectives: To develop a Functional Communication Classification Scale (FCCS) for children aged 5 years and investigate the inter-rater reliability, to contribute to the Australian Description of Cerebral Palsy.

Design: Classification scale development and reliability study

Participants/Setting: Parents, speech pathologists and other allied health clinicians supporting children with a diagnosis of CP, aged between 4 years 0 months and 6 years 0 months, were recruited from The Centre for Cerebral Palsy WA (TCP), and the Cerebral Palsy League of Queensland (CPLQ).

Materials/Methods: In 2006, a draft FCCS was developed following a systematic literature review and consultation with an expert panel of speech pathologists from TCCP and CPLQ. In 2007, the FCCS was piloted and amendments were made. In 2008, intra-rater reliability was assessed using triads of data from one parent, a speech pathologist and another allied health clinician for each child. Levels of agreement were determined using kappa statistics.

Results: Preliminary results indicate that there is broad agreement between raters. The need to clarify the distinctions between levels I and II, and IV and V, have been noted for the follow up phase.

Conclusion/Clinical Implications: The FCCS aims to provide a valid and reliable way to classify communication disorders, profile populations and to improve research design in order to provide greater specificity in clinical management recommendations for children with CP

References:
Mobility Experiences of Youth with Cerebral Palsy

Dr Robert Palisano1, Lotie Shimmell2, Debra Stewart3, Dr John Lawless4,
Dr Peter Rosenbaum5, Dr Dianne Russell6

1Drexel University, Philadelphia, PA, USA and CanChild Centre, McMaster
University, Hamilton, ON, Canada, 2School of Rehabilitation Sciences,
McMaster University, 3CanChild Centre, McMaster University, 4Empire College,
Utica, NY, USA

Background: Knowledge of how adolescents with cerebral palsy experience
mobility is important for identification of resources, supports, and services that
optimize their social participation and transition to adulthood.

Objectives: To describe how youth with cerebral palsy experience mobility in their
daily lives.

Design: Qualitative methods, phenomenological approach.

Participants and Setting: 10 youth with cerebral palsy, 17 to 20 years of age.
Youth were selected from a sample of 228 using purposeful sampling with
maximum variation strategies.

Materials/Methods: An occupational therapist interviewed each youth one or
two times. Six interviews took place in the family home and one in the college
residence of the participant. Seven interviews were conducted by telephone.
Interviews lasted approximately 80–90 minutes and varied from 60 to 135
minutes. Interviews were recorded and transcribed. Transcripts were analyzed
for key concepts, themes, and to refine themes. Credibility was established
through >75% agreement among three researchers in the coding of transcripts
and asking participants for feedback as to whether the themes are representative
of their experiences and perspectives.

Results: Six themes and two sub-themes emerged. Participants viewed
mobility as important for self-sufficiency. Youth who walked and also used
wheeled mobility spoke of making choices. Safety and efficiency are important
considerations when making choices. Some participants had mobility
preferences at home that may not be safe, practical, or socially appropriate at
school or in the community. Youth spoke of constantly adapting to situations that
often reflected a lack of control over the environment. Youth indicated the need
for constantly planning ahead to go places and do things. Most participants
were dependent on others for transportation and expressed dissatisfaction with
public transportation. Safe and efficient mobility to enable participation in daily
activities appears to be a primary concern of youth with cerebral palsy.

Conclusions/Clinical Implications: Youth with cerebral palsy should be
encouraged to be actively involved in making choices on mobility methods,
task accommodations, assistive technology, and environmental modifications.
Evaluating performance in everyday settings enables assessment of
environmental factors that facilitate or hinder mobility.

The Relationship Between Gross Motor Capacity and Performance of Daily Life Mobility in Children with Cerebral Palsy at Primary School Age

MSc Dirk-Wouter Smits1, MD PhD Jan Willem Gorst2, PhD Marjolijn
Ketelaar3, MSc Petra van Schie1, PhD Annet Dalmeijer4, MD PhD Eline
Lindeman5, PhD Marian Jongmans6

1Rehabilitation Center De Hoogstraat, University Medical Center, Rudolf
Magnus Institute of Neuroscience, Utrecht, The Netherlands, 2CanChild,
Centre for Childhood Disability Research, McMaster University, Hamilton,
Canada, 3VU University Medical Center, Amsterdam, The Netherlands, 4Utrecht
University, University Medical Center, Utrecht, The Netherlands

Background and Purpose: Walking, running, and jumping are well established
abilities by the age of 5 years in typically developing children. 1 The gross
motor capacity of most children with cerebral palsy (CP), however, remains
important for treatment at and above this age. Still, little is known how the
gross motor capacity of children with CP from the age of 5 years relates to
their performance of mobility in daily life, i.e. what children actually do in their
everyday environment. The present study examined this relationship, particularly
(i) whether the relationship differs between children with relatively good motor
abilities (GMFCS I-II) and children with less than 50% of the motor abilities of
typically developing peers (GMFCS III-IV-V), and (ii) whether the relationship
differs between children aged 5 years and children aged 7 years.

Design: This cross-sectional study was performed as part of a cohort study on
yearly data and determinants of daily functioning in children with CP at primary
school age (PERRIN CP 5–9).

Participants: A clinic-based sample included 118 children with CP (64% boys;
GMFCS level I-V; median age 6.7 yr and range 4.6–7.6 yr).

Methods: Gross motor capacity was assessed by the Gross Motor Function
Measure (GMFM-66). Performance of daily life mobility was assessed by the
mobility domain of the Caregiver Assistance Scale of the Pediatric Evaluation
of Disability Inventory (PEDI). To analyze the relationship, multiple linear
regressions were performed with the PEDI as the dependent variable, and the
GMFM-66, GMFCS level, the interaction term of GMFM-66 with GMFCS level (I-II
versus III-IV-V), age, and the interaction term of GMFM-66 with age (5-year-olds
versus 7-year-olds) as the independent variables.

Results: Analyses showed a significant relationship (p<0.001) between
gross motor capacity and performance of daily life mobility. Further, analyses
showed that only the interaction of GMFM-66 with GMFCS level was significant
(p<0.001). In children with GMFCS level I-II, the explained variance of gross
motor capacity was much smaller (r2=0.39) than in children with GMFCS level
III-IV (r2=0.86).

Conclusions: Performance of daily life mobility is to a large extent related to
gross motor capacity in children with CP at primary school age. However, in
children with relatively poor motor abilities, this relationship is much stronger
than in children with relatively good motor abilities. In these children – like in
typically developing children – not merely gross motor capacity but other factors
appear to account for the variation in performance of daily life mobility.

References
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BE. Prognosis for gross motor function in cerebral palsy: creation of motor development curves. JAMA.
2002;288:1357-1363
Visual Spatial Attention and Balance in Children with Cerebral Palsy

Dr Leanne Johnston1, Ms Casey Nimmo-Genders2, Dr Sandra Brauer2, Prof Marjorie Woollacott3, Ms Sandra Saveedra3

1Cerebral Palsy League of Queensland and University of Queensland, 2University of Queensland, 3University of Oregon

Background: Children with Cerebral Palsy (CP) are known to experience balance difficulties during sitting, standing and moving tasks and this affects their functional manipulative and mobility performance. Attention to spatial cues is one important factor in balance control. Recent studies suggest balance control is more difficult when children are required to perform simultaneous spatial cognitive tasks that load the capacity of cortical networks that are also important to balance control. Studies have also demonstrated that difficulties with sensory perception are a common result of the damage sustained to the immature brain in CP. As yet, however, no research has been conducted investigating whether deficient spatial attention networks accompany balance deficits in children with CP.


Design: Cross-sectional

Participants: Participants were children aged 5–13 years in two groups. Group A included 10 children with CP (GMFCS I-III) recruited from the Cerebral Palsy League of Queensland and Group B included 30 age matched peers with typical development recruited from a local primary school.

Method: Balance was assessed using: the balance subtests from the Bruininks-Oseretsky Test of Motor Proficiency (2nd edition) (BOT2) and Movement Assessment Battery for Children (MABC); Functional reach in the forward and lateral directions; and the Timed-up-and-Go (TUG) under normal (walking), motor-load (walking while carrying a cup of water) and spatial-cognitive-load (walking whilst forward and then backward counting) conditions. Attention and processing of spatial stimuli was assessed using the Attention Networks Test. ANOVAs were used to investigate differences between children with and without CP in balance and spatial attention. Relationships between balance and attention were investigated using Pearson’s correlations.

Results: Children with CP demonstrated lower balance scores than typically developing children on the BOT2, MABC, functional reach in forward and lateral directions and TUG under normal, motor-load and spatial-cognitive-load conditions. Children with CP also demonstrated poorer results on the Attention Networks Test. Scores in spatial attention were related to balance performance/deficits.

Conclusions/Clinical Implications: Spatial attention networks appear to play an important role in the control of balance in children with and without CP. Deficits are evident and related to balance difficulties in children with CP. Information from this study will assist in the development of optimal treatment interventions for children with CP to improve their function and independence.

Probability of Walking and Wheeled Mobility for Children and Youth with Cerebral Palsy Based on Age and Environmental Setting

Dr Robert Palisano1, Dr Steven Hanna2, Dr Pter Rosenbaum2, Dr Beth Tieman1

1Drexel University, Philadelphia, Pennsylvania, USA and CanChild Centre, McMaster University, ON, Canada, 2CanChild Centre, McMaster University, ON, Canada, 3Georgia State University, Atlanta, Georgia, USA

Background and Objectives: To estimate the probability that children and youth with cerebral palsy (CP) walk, use wheeled mobility, or require physical assistance for mobility at home, school, and outdoors based on age and Gross Motor Function Classification System (GMFCS) level.

Design: Analytic longitudinal

Participants/Setting: 656 children with CP who were <12 years of age in 1996 were selected from an accessible population of 2,226. 224 youth from the original cohort participated in a second study.

Materials/Methods: Physical therapists classified GMFCS level and parents completed a questionnaire on methods of mobility. Usual method of mobility at home, school, and outdoors was reported yearly a mean of 5.2 times (SD=2.2). Response options were collapsed into three categories: walks (with or without assistive device), wheeled mobility (manually propels or powered), and requires physical assistance. For each GMFCS level, a proportional odds model with a random intercept and a cubic polynomial was used to estimate the probability of each method of mobility as a function of age.

Results: For children in level I, the probability of walking approaches 100% by age 4 (age 6 outdoors) and is maintained to age 18. For children in level II, the probability of walking varies at age 4 from 35% (outdoors) to 75% (school). At age 9, the probability of walking varies from 75% (outdoors) to 95% (school) and does not decline by age 18. For children in level III, the probability of walking increases in all settings until 8–11 years (65% at school) and then declines. For children in level IV, the probability of wheeled mobility increases with age. At age 7 (school) and age 9 (outdoors) children have an equal probability of using wheeled mobility or being transported in a wheelchair. At age 11, the probability of wheeled mobility is 65%. For children and youth in level V, the probability of being carried or transported in a wheelchair approaches 100% at all ages; a small number of children and youth use powered mobility.

Conclusions/Clinical Implications: The probability estimates provide evidence for decisions regarding mobility including anticipation of age related changes and the effect of environmental setting. The results have implications for sharing evidence with individuals with CP and their families. Individual preference and the specific environmental features of home, school, and outdoors are also important to consider when making decisions regarding goals and interventions for mobility.
Surveillance of Gross Motor Level of Function Among Children with Cerebral Palsy: Feasibility and Reliability in a United States Cohort

Dr. Ruth E. Benedict1, Ms. Jean Patz2, Ms. Carrie Arneson1, Mr. Matt Maenner2, Dr. Marshalyen Yawgin-Alsopp2, Ms. Nancy Doernberg2, Ms. Kim Van Naarden Braun2, Dr. Russell Kirby3, Dr. Maureen Dunkin3

1Wisconsin Center, University of Wisconsin-Madison, Madison, WI, 2Developmental Disabilities Branch, National Center on Birth Defects and Developmental Disabilities, Centers for Disease Control and Prevention, Atlanta, GA, 3Maternal and Child Health, School of Public Health, University of Alabama at Birmingham, Birmingham, AL, 4Department of Population Health Sciences & Waisman Center, University of Wisconsin-Madison

Background: Given the wide range of functional consequences experienced by children with cerebral palsy (CP), surveillance of the prevalence of the condition is necessary but not sufficient to determine its public policy and programmatic implications.

Objectives: To study the feasibility and reliability of conducting surveillance of gross motor functional skills among U.S. children with cerebral palsy using two methods of classification.

Design: Active, population- and records-based surveillance system

Participants/Setting: Children living in southeast Wisconsin who were eight years old in 2002 or 2004 and were identified as having CP through the Autism and Developmental Disabilities Surveillance Network administered by the Centers for Disease Control. Participants were limited to in-born cases for which information on gross motor function was abstracted from medical records after age 4 (N = 90).

Materials/Methods: Records of children with cerebral palsy were independently reviewed by two qualified clinicians. Level of function was coded using a modified version of the Gross Motor Function Classification System (GMFCS) and a three category scale based on ambulatory skill. For the GMFCS, combination levels of I-II, II-III, III-IV or IV-V were used when a definitive classification was not possible due to limited or conflicting information. The ambulatory skill categories included independent ambulation without assistive mobility devices, independent ambulation with assistive mobility devices, and non-ambulatory. Reliability coefficients (kappa) were calculated as a measure of the agreement between reviewers for each classification method.

Results: Using the modified GMFCS, reviewers achieved complete agreement on 62.2% of the classifications (kappa = 0.55, 95% C.I. = 0.47–0.63) and were within one modified GMFCS level of each other for 98.9% of the classifications. Using the three category classification of ambulatory skill, complete agreement was reached for 93.3% of the children (kappa = 0.88, 95% C.I. = 0.72–1.61). Of the children classified, 57% were described as ambulating without assistive mobility devices and 33% were nearly or completely dependent for gross motor activities.

Conclusions/Clinical Implications: Developing reliable and valid methods for population-based surveillance of functional level among children with cerebral palsy will provide important information for monitoring the impacts of advances in intervention techniques, understanding changes in the composition of cases over time, and estimating the cost of care for programmatic and policy purposes.

Inaccuracy Rate of the Diagnosis of Cerebral Palsy in South Australian Cerebral Palsy Register

Dr. Rosa Zarrinkalam1, Dr. Ray(Remo) Russo2, Dr. Catherine Gibson2, Ms. Phillipa van Essen3, Ms. Ann Peek4, Prof Eric Haan5

1Women’s and Children’s Hospital, 2MBBS, FRACP, FAFRM(RACP)/Department of Paediatric Rehabilitation Medicine, Adelaide Women’s and Children’s Hospital, 3PhD/South Australian Cerebral Palsy Register, Adelaide Women’s and Children’s Hospital, 4MPH/South Australian Cerebral Palsy Register, Adelaide Women’s and Children’s Hospital, 5South Australian Cerebral Palsy Register, Adelaide Women’s and Children’s Hospital

Background: Cerebral palsy (CP) as the most common cause of motor disability in childhood often adversely influence all facets of the child’s daily functioning, survival rate as well as financial and emotional burden of their families. There are some conditions that may mimic the clinical manifestations of CP which have a specific treatment or genetic implications for the child and the family. Therefore, it is critical to be accurate with the diagnosis.

CP registers are population databases, usually with multiple sources of ascertainment that receive notifications of children with CP. The last thirty years have seen the establishment of CP registers in North America, Europe and Australia but the inaccuracy rate of the diagnosis of CP is still largely unknown.

Objectives: The purpose of this cohort study was to document the inaccuracy rate of the primary diagnoses of CP recorded on the South Australian Cerebral Palsy Register (SACPR), a population based register that collects information on children with CP born in South Australia.

Material/Method: Children born in SA from 1993 to 2002 and notified to the SACPR with a primary diagnosis of CP, but subsequently identified with a final non-CP diagnosis, were identified through the SACPR database. Evidence supporting final diagnoses was obtained from medical records.

Results: Among 402 patients born in 1993-2002 in SA notified to the SACPR with CP, 21 (5.2%) had the diagnosis changed to a non-CP condition at a later stage. Thirty-eight percent of these children had a final diagnosis of either a metabolic disorder or a genetic condition, and brain imaging results were reported as abnormal studies in all of these patients. The other 62% had one of the following final diagnoses: developmental delay, gross motor delay, perinatal myelitis, spinal subdural and subarachnoid arterio-venous malformation, and Erb’s palsy. For 67% of these children, the diagnosis was changed at five years of age or older.

Conclusions: CP is a heterogeneous disorder sometimes indistinguishable from other childhood neurological/neuromuscular disorders. A complete clinical assessment at the time of diagnosis can identify non-CP disorders and improve diagnostic accuracy. Regular follow-up and re-assessment can also enable the clinician to exclude children with alternative diagnoses. Studies based on population registers may need to take into account the possibility of misclassification, estimated to be at least 5% by this study.
Clinical Examinations at Five Years of Age Provide a ‘Gold Standard’ for Cerebral Palsy (CP) Registers

A/Prof Peter Flett, Ms Phillipa van Essen, Dr Catherine Gibson, Dr Remo Russo
1 Calvary Rehabilitation Service, 2 South Australia Cerebral Palsy Register, CYWHS, Adelaide, 3 Paediatric Rehabilitation Service, CYWHS, Adelaide

Introduction: In Australia, the South Australian Cerebral Palsy Register (SACPR) has been the only register which routinely undertakes clinical examinations at around five years of age. The main reasons were an intuitively good age for confirmation of the diagnosis and for deciding to include or exclude cases more accurately and to capture those diagnosed late; and also to describe sub-categories and co-morbid health issues.

Study Design: Data on children born in South Australia (SA) with a five year clinical assessment undertaken between 1993 and 1998 (six years) were included in the review.

The diagnosis of CP was confirmed by either a paediatric rehabilitation specialist or a paediatrician experienced in evaluating CP.

Results: 266 notifications of CP were received, and of these 205 (77.1%) underwent a clinical assessment around five years of age. The average number of notifications received each year was 44 (range 29–56). Of the 205 children assessed, spastic diplegia was the most common type of cerebral palsy (n=78, 38%), followed by hemiplegia (n=67, 32.7%) and spastic quadriplegia (n=30, 14.6%). The final number of children in analyses was 175.

The largest differential in gender was seen in hemiplegia, where 39% were female. The majority of children with CP were born at term (44%), while the next largest group were born <32 weeks gestation (40%). Children born <32 weeks were nearly four times more likely to have diplegia than hemiplegia or quadriplegia (OR 3.73, 95% CI 1.97–7.09, p<0.0001). Over 70% of diplegics were in the 500–2499gm birth weight group compared to 40% or less for the other groups (OR 4.21, 95% CI 1.97–7.09, p<0.0001). For quadriplegics and hemiplegia, the majority of birth weights were between 2500 and 3999 gm.

Overall, 67% of children were able to walk without assistive devices (GMFCS 1, 2). Comparisons were made between the three main sub-categories of CP with respect to gross motor/mobility, gait, hip problems; physical interventions used including orthotics, orthopaedic surgery and botulinum toxin; fine motor and self help; speech and language; intellectual ability; epilepsy; visual and hearing impairment.

Conclusions: State-wide population based CP registers are proving to be an invaluable resource for clinicians and researchers investigating CP. Clinical examinations at five years of age provide a ‘gold standard’ opportunity to validate the initial diagnosis and to collect details of associated morbidities, functional progress, and interventions.

No Effect of Botulinum Toxin A on Ankle Biomechanics During Velocity-Matched Gait in Children with Hemiplegic Cerebral Palsy

Dr. Jesper Bencke, Mr. Thomas Bandholm, Mr. Derek Curtis, Dr. Søren Anker Pedersen, Dr. Stig Sonne-Holm

Gait Analysis Laboratory, Hvidovre University Hospital

Background: The effects of botulinum toxin A injections on biomechanical gait parameters in children with hemiplegic cerebral palsy have so far been equivocal. In different studies, children with various levels of spasticity and different botulinum toxin doses have been investigated, and these differences may have influenced the different treatment outcomes.

Objectives: To investigate the kinematics and kinetics of the affected leg in children with mild hemiplegia before and after injection of botulinum toxin A in the calf muscles at standardised injection sites and doses.

Design: Longitudinal intervention study, with analyses pre-treatment, and 4 and 12 wks post-treatment.

Participants/Setting: Nine children with equinus gait (mean age (SD): 9.7 (2.6) yrs.) were included for investigation in a biomechanical gait laboratory.

Materials/Methods: Injections in the gastrocnemius (GAS) and soleus (SOL) muscles were given at standardised injection sites according to (1) with a standard dose of 4 (GAS) and 2 (SOL) u/kg BM. Spasticity was assessed at all test sessions by the same experienced physiotherapist using modified Ashworth score. Following treatment, the participants received standardised physiotherapy twice a week for 12 weeks. At the pre-test, the gait analysis was performed at a self-selected speed using an 8 camera Vicon 612 system with 2 AMTI force plates. At post-tests, the gait velocity was matched with the pre-test velocity. Peak dorsiflexion angles during stance and swing, dorsiflexion at heel-strike, mean amplitude of ankle moment during midstance, peak ankle moment during terminal stance, and temporospatial parameters were derived. In addition, mean normalised GAS length during swing and at heel-strike was calculated (2). Repeated-measures ANOVAs were used for statistical analyses.

Results: The median spasticity of GAS for the affected leg was 2 at pre-test, and was significantly reduced at post-tests. No differences in any of the selected kinematic, kinetic parameters, or GAS length were found between test sessions. Furthermore, there were no differences in walking speed, cadence, step length, or percent stance phase.

Conclusion/Clinical Implications: The standardised protocol used in the present study showed no effects on gait parameters despite reduction in spasticity. This could imply that gait is not sensitive enough to measure the improvements in function as result of botulinum injections and physiotherapy in children with mild equinus, but other – more dynamic – motor tasks may be used to investigate functional effects in these children.

References:
The Safety of Bont-A Treatment in Children with GMFCS Level IV and V Cerebral Palsy

Dr Katherine Langdon, Sue-Anne Davidson, Dr Anna Gubbay, Dr Fiona Kay, Dr Gavin Nutana, Dr Peter Chauvel, Dr Sarah Skeldon, Dr Jane Valentine

1Department of Paediatric Rehabilitation, Princess Margaret Hospital for Children WA

Background: Botulinum Toxin A (BoNT-A) is widely used for the treatment of focal spasticity in children with cerebral palsy (CP). Extensive literature has been published on the side effects of BoNT-A1–4 and its safety profile is well established, however recent case reports of serious adverse events following the administration of BoNT-A5, 6 have raised safety concerns and prompted media releases about its use in children with severe CP.

Objectives: The aims of this audit were: (1) to review goal setting, outcomes and adverse events following Botulinum Toxin A injection in the Western Australian population of children with cerebral palsy (GMFCS level IV and V) for the period 2006–2008 and (2) to provide a comprehensive summary of risk factors in this cohort, which may contribute to adverse events from either medical or surgical intervention.

Design: The data was obtained by audit of the Cerebral Palsy Mobility Service (CPMS) database and retrospective chart review.

Participants: The CPMS at Princess Margaret Hospital (PMH) is the sole provider of medical treatment for children with CP in Western Australia. It is estimated that WA has 1200 children (0–18 years) with CP. The CPMS database contains a comprehensive data set for ten years of the spasticity management service.

Methods: The CPMS database was used to: identify BoNT-A treatment dates, dose and muscle selection. Also obtained were medications administered at the time of BoNT-A injection and adverse events recorded.

Further data was collected from the PMH file to review: emergency presentations and hospital admissions, and any history of epilepsy, upper airways obstruction, gastro-oesophageal reflux and dysphagia.

Results: Seventy-one children with GMFCS level IV and V CP received 77 and 79 episodes of treatment with BoNT-A respectively. The maximal dose used was 16 units/kg to or 400 units. Twenty five children received BoNT-A on at least three occasions.

Sixty-six children received multilevel BoNT-A injections into the lower limbs to assist with seating, comfort and function.

Data will be presented on the surgical and medical risk factors present in this cohort. It is notable that no BoNT-A treatment episode resulted in weakness causing an exacerbation of upper gastrointestinal tract symptoms or respiratory compromise.

Conclusions: Children with GMFCS level IV and V CP represent a medically vulnerable group however treatment with BoNT-A (16units/kg) has not been associated with clinical deterioration in more than 150 treatment sessions at PMH.

References:

The Movement Analysis Profile (MAP) and the Gait Profile Score (GPS) for Quantifying Gait Pathology in Children with Cerebral Palsy

Dr Richard Baker1, Dr Oren Tirosh2, Dr J enny McGinley2, Prof H Kerr Graham1

1Royal Children's Hospital, 2Murdoch Childrens Research Institute

Background: Full 3-d kinematic data are complex. There have been several attempts to derive a single score to summarise the extent of gait pathology of which the Gillette Gait Index (GGI) is the most widely accepted. This has several shortcomings that have been recognised by the original developers who are now proposing the GDI as an alternative. One particular limitation of both is that they cannot be decomposed in any obvious way to give insight into where gait pathology is arising.

Objectives: This study proposes a new measure of overall gait pathology which gives insight into the nature of that pathology.

Participants: All 180 children with CP who had 3D gait analysis within our Service during 2005–2007.

Materials and Methods: The analysis focusses on the root mean square (RMS) difference between a kinematic variable for a particular subject and the average values of that variable from people without pathology calculated over the gait cycle. The MAP is defined as the composite of these values for all the clinically relevant kinematic variables (see Figure to left). The GPS is defined as the RMS average of the components of the MAP and represents the RMS difference from the average reference dataset calculated over all relevant kinematic variables and across the whole gait cycle.

Analyses performed included correlation with the square root of the GGI and plotting of frequency distributions for each level of the GMFCS.

Results: The MAP has proved a useful overview of a patient's gait pattern. The example above shows significant issues with foot progression bilaterally and hip rotation on the right. Smaller but still important problems are observed in pelvic tilt and hip flexion, knee flexion and, to a lesser extent, dorsiflexion. The strong correlation between GPS and the square root of GGI (r2=0.62) and the frequency distribution across GMFCS levels and FAQ both validate the GPS as a measure of gait pathology.

Discussion: The MAP is not intended to be used instead of the full kinematic data. It has been found to be most useful as a starting point in the interpretation of the full data to focus on the key issues for any particular individual. Comparing pre- and post-op MAPs can also give an overview of how effective surgery has been. Both the MAP and GPS are now being used routinely in a range of clinical and research applications.

References:
Research for a Correlation Between Femoral Anteversion and Kinematic Knee Deviations in Children with Cerebral Palsy

MD Luigi Piccinini, PhD Veronica Cimolin, MD Anna Carla Turconi, Prof. Marcello Crivellini, Prof. Manuela Galli

1IRCCS Eugenio Medea, Bosisio Parini, Lecco, Italy, 2Bioeng. Dept. Politecnico di Milano, Milano (ITALY)

Objective: The aim of this study was the quantitative comparison of gait strategy between CP patients with stiff knee gait due to rectus femoris spasticity and CP patients with stiff knee gait due to femoral anteversion, using GA data (kinematic and EMG data).

Methods: 23 diplegic independent ambulators children (range: 3–15 years; mean age: 10.4 years; 51 limbs) and 20 healthy children (CG: Control Group; range: 5–12 years; mean age: 9 years) were evaluated in this study. Selection criteria for pathological subjects were a physician diagnosis of spastic diplegia with stiff knee gait in swing phase, no history of cardiovascular disease and no previous surgery or other significant treatments for spasticity. Clinical evaluation of femoral anteversion and Duncan Ely test [1] was performed. GA was conducted using an optoelectronic system (ELITE2002, BTS, Milan, Italy), a 8-channels surface EMG system (TeleEMG, BTS, Milan, Italy) and a synchronic Video system (BTS, Milan, Italy). Statistical analysis was conducted using parametric and non-parametric tests (p<0.05).

Results: Clinical evaluation revealed that 63% of limbs (GROUP1) exhibited excessive femoral anteversion while 37% (GROUP2) did not present this feature. In particular both group were characterised by a blunt peak of knee flexion during swing phase (less than normal peak), representative of spasticity of rectus femoris muscle, but two different gait strategies were found in term of the timing of maximum knee flexion during swing phase: GROUP1 exhibited a reduced value of maximum knee flexion with its timing close to normative data and an excessive hip internal rotation, that is correlated to increased femoral anteversion; GROUP2 instead presented a reduced peak of knee flexion in swing and a significant delay of its timing with hip rotation closed to normative data. No significant differences were exhibited as concern the other lower limb joints.

Conclusions: The results demonstrated that the presence of just reduced peak of knee flexion in swing can be directly connected to excessive femoral anteversion; the coexistence of reduced peak of knee flexion and of its delayed timing reveals rectus femoris spasticity. The results are clinically crucial for treatment choice (Dorative femoral osteotomy vs rectus transfer).

References:

Analysis of the Gait Characteristics of Children with Cerebral Palsy Walking in the Hart Walker

Dr Leanne Johnston, Ms Kate McCaskill, Mrs Veronica Case, Mrs Megan Audri

1Cerebral Palsy League of Queensland and University of Queensland, 2University of Queensland, 3Cerebral Palsy League of Queensland, 4Cerebral Palsy League of Queensland and University of Queensland

Background: The David Hart Walker Orthosis (HW) is a walking aide designed to provide non-ambulatory children with Cerebral Palsy (CP) the ability to mobilise independently with hands free support. However, as there has been little research into the gait characteristics and benefits of the HW, prescription is based on clinical experience rather than on evidence.

Objectives: Determine (a) progression of gait characteristics of children with CP using the HW and (b) factors at initial assessment that predict acquisition of an efficient gait pattern.

Design: Retrospective clinical audit

Participants: Participants included a retrospectively recruited convenience sample of 20 children (11 male) aged 2–13yrs with CP who were clients of the Queensland Walkways Mobility Program for ≥2years between 1998–2008.

Method: Client records were audited for classification, musculoskeletal and videographed gait data. Observational gait analysis from video footage was performed using two gait scales. The Edinburgh Visual Gait Score for Cerebral Palsy (EVGS) is a quantitative observational scale specifically for children with CP and the QGait scale is a qualitative gait scale appropriate for children using walkers. Gait patterns were investigated by descriptive statistics. Relationships between initial musculoskeletal and gait assessments and gait progression data were investigated using Pearson’s correlations.

Results: All children were able to take steps independently in the HW within 8m of initial fitting. The majority of gait improvement was observed in the first 3m, with improvements still seen in some children after 2 years. EVGS scores indicated the mid-stance phase of gait is close to normal, with stance phase deviations at initial contact (children tend to strike with a flatfoot) and terminal stance (children tend to lack full/normal hip extension and dorsiflexion). Swing phase deviations included reduced foot clearance due to reduced knee flexion in swing. Component deviations were within one point of normal. Correlations were found between GMFCS level and total EVGS score (r=0.65), age at initial assessment and total EVGS (r=0.42) and hip extension range and total EVGS (r=0.44).

Conclusions/Clinical Implications: Results support the HW as an effective walking device for children with severe CP. In this clinical cohort, all children achieved walking without facilitation in the HW. Gait components were close to normal with minor deviations due to individual musculoskeletal constraints and HW support mechanisms required for antigravity stance. Clinically important factors to consider when prescribing a HW were that gait tends to be better for children with a lower GMFCS, lower age at commencement and better hip extension.
Dutch Version of the Functional Mobility Scale: A Valid and Reliable Tool for Measuring Functional Mobility in Children with Cerebral Palsy?

Dr Karel Maathuis1, BSc Afke Grob2
1Center for Rehabilitation, Motion Laboratory, University Medical Center Groningen, Groningen, The Netherlands, 2Institute for Human Movement Sciences, University of Groningen, Groningen, the Netherlands

Background: Children with Cerebral Palsy (CP) represent the largest group of children with physical impairments treated within the child paediatrics in The Netherlands (2 out of 1000 children). The motor disorders of these children are often accompanied by disturbances of sensation, perception, cognition, communication, and behaviour, and by secondary musculoskeletal problems.

One of the aims of orthopedic surgery is to improve the walking ability for better functioning in daily living. For stipulating the effectiveness of these interventions there is a need for tools who can measure the change in functional mobility. Because of the varying levels of disabilities and functional mobility in children with CP the Functional Mobility Scale (FMS) is considered as a potential tool.

Objectives: In this pilot study the Dutch (translated) version of the FMS is tested whether it is a valid and reliable tool for measuring the functional mobility in children with CP.

Design Cross Sectional

Participants/Setting: A group (n=17) of children with spastic CP referred to the outpatient clinic of the Center for Rehabilitation was scored with the Dutch FMS version by different raters.

Materials/Methods: Different raters: parents (n=33), doctors (n=17), physiotherapists (n=11), and the patients (n=9) scored the FMS. Statistical analysis was completed with SPSS (version 14). The outcome was correlated with the Gross Motor Function Classification System (GMFCS)-level. Concurrent validity was calculated with the Spearman rho Correlation Coefficient and Interrater reliability was calculated with the Intraclass Correlation Coefficient (ICC: consistency, 95% confidence interval [CI]).

Table 1. Data of the CP group

<table>
<thead>
<tr>
<th>Gender</th>
<th>GMFCS (level)</th>
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Results: Results show a significant ICC (ICC=0.45–0.73). There is a significant correlation between the FMS and the GMFCS-level (Spearman rho = -0.44, p=0.04 [FMS-S]; Spearman rho = -.50, p= 0.02 [FMS-S]; Spearman rho=.54, p=0.01 [FMS-S]).

Conclusions: It is concluded that this pilot study support the hypothesis that the Dutch version of the FMS is a reliable and valid tool for measuring the functional mobility in children with CP. Further research is necessary, because of the small number of patients with a low variability of the GMFCS-level.

Predictors of 6 Minutes Walking Test in Adults with Cerebral Palsy

MD Grethe Maanum1, PT PhD Reidun Jahnssen2, PT Kerstin L. Larsen2, MD PhD Anne Keller3
1Sunnaas Rehabilitation Hospital, Research Department, 2The National Hospital, Dept for Child Neurology, Oslo, 3Ullevål University Hospital, Oslo.

Background: Adults with cerebral palsy (CP) report decreased walking capacity compared to childhood. Secondary impairments in body structures developing over time are thought to contribute to these changes, such as muscle-shortening, excessive biomechanical forces during weight-bearing activities, early joint degeneration, overuse syndromes, immobility, fatigue, obesity and stress/depression. The six minutes walking test (6MWT) is a valid and reliable test, measuring how many meters the person are able to walk in 6 minutes.

Objectives: The aim of the study was to investigate which factors that predict the results of a 6 minutes walking test (6MWT).

Design: A cross sectional clinical study of all the responders to a randomized controlled trial on effects of botulinum toxin type A in adults with CP (RCT-BTX-A).

Participants/Settings: The persons were recruited through advertisement in national leading newspapers and examined at baseline in Sunnaas Rehabilitation Hospital. Totally 113 persons performed a 6MWT, whether included in RCT-BTX-A or not. The population consisted of 69 women and 44 men with gait disorders due to uni- or bilateral spastic CP. They had no cognitive impairment and age ranged 18–65.

Material/Method: In addition to 6MWT, the following variables were recorded: Age, gender, work, status, Timed Up and Go (TUG), a test for basic mobility skills/balance, Gross motor function (GMFCS), Pain score Health related quality of life (SF-36pain), Fatigue Severity Scale (FSS), VAS Stiffness/spasticity, foot deformity and Trendelenburg test. First a simple linear regression was performed with 6MWT as dependent variable and each of the other variables as independent. Variables which were significant in this analysis were included in a forward/backward stepwise linear multiple regression analysis.

Results: Gender, work, FFS, VAS-Stiffness/spasticity, foot deformity and Trendelenburg test were not significant in the simple linear regression model and were not included in the multiple regression model. TUG, type of CP and GMFCS were the most powerful predictors explaining 63 % of the variance, while age and SF-36pain accounted for only for 2 %. The final model explained 65% of the variance.

Conclusion/Clinical Implications: Our results emphasise the central role of balance, gross motor function, and type of CP for walking capacity in adults with CP and it appears relevant to focus on balance skill in their rehabilitation programmes. Though it is necessary to investigate the impact of balance on walking capability in further studies, measuring balance difficulties in a more specific way.
Impairments and Activity Limitations of the Upper Limb in Children with Hemiplegic Cerebral Palsy

MSc Katrijn Klingels¹, Prof Guy Molenaers², Prof Paul De Cock², Prof Kaat Desloovere³, Prof Hilde Feys⁴

¹PT/Faculty of Kinesiology and Rehabilitation Sciences, Katholieke Universiteit Leuven, ²MD/Faculty of Medicine, Katholieke Universiteit Leuven, ³Faculty of Kinesiology and Rehabilitation Sciences, Katholieke Universiteit Leuven, ⁴PT/Faculty of Kinesiology and Rehabilitation Sciences, Katholieke Universiteit Leuven

Background: To improve upper limb treatment in children with hemiplegic cerebral palsy (CP), there is a need for more insight in their impairments and activity limitations of the upper limb in children with hemiplegic CP and to determine how impairments relate to upper limb activity.

Objectives: To study motor and sensory impairments and activity limitations of the upper limb in children with hemiplegic CP and to determine how impairments relate to upper limb activity.

Design: Cross-sectional survey.

Participants/Setting: Eighty-nine children with hemiplegic CP between 5 and 15 years (50 boys, 39 girls; mean age 10 years) were recruited from the Clinical Motion Analysis Laboratory (University Hospital Pellenberg) and 4 special education schools.

Materials/Methods: Motor impairments included passive range of motion (goniometry), muscle tone (Modified Ashworth Scale), muscle strength (Manual Muscle Testing) and grip strength (J AMAR). Sensory impairments included exteroception (touch), proprioception (movement sense of index), two-point discrimination (TPD) and stereognosis (recognition of familiar objects). At the activity level, unimanual capacity was assessed with the Melbourne Assessment of Motor Balance (MELB). The effectiveness of the hemiplegic hand in bimanual performance was assessed with the Assisting Hand Assessment (AHA). Descriptive statistics, correlation analysis and multiple linear regression were used.

Results: Range of motion was most limited for elbow extension and supination, in 22% and 27% of the children respectively. Increased muscle tone was most prominent in forearm pronators, wrist and finger flexors. Muscle weakness was most present in distal muscle groups. The mean relative grip strength of the hemiplegic hand compared to the non-hemiplegic hand was 42% (SD 29%). Stereognosis and TPD were the most affected sensory modalities with impairments in 53% and 60% of the children. Correlation analysis revealed strong associations between the activity measurements and muscle tone (MELB 0.77, AHA 0.74), muscle strength (MELB 0.90, AHA 0.89) and grip strength (MELB 0.77, AHA 0.62). Correlation between MELB and AHA was 0.88. The best predictors for unimanual capacity were wrist strength, wrist tone and proprioception, predicting 80% of the variance on the MELB. Wrist strength and grip strength were the best predictors of bimanual performance, predicting 81% of the variance on the AHA.

Conclusions/Clinical Implications: Both strength and muscle tone, but also sensibility are underlying body functions that strongly relate to both unimanual capacity and bimanual performance in children with hemiplegic CP. Interestingly, bimanual performance is highly determined by distal muscle strength. These insights may be valuable for upper limb treatment interventions.

Validating and Disseminating Qualitative Research Results for Young Participants

Ms Kate Anderson¹, A/Prof Susan Balandin¹, Dr Sally Clendon¹, Dr Bronwyn Hemsley¹

¹University of Sydney, Australia, ²University College, Molde, Norway

Background: To date few researchers have discussed methods of validating and disseminating the results of qualitative research to young participants, despite the recognized importance of effective feedback. The feedback process provides researchers with further depth of understanding regarding the participants’ experiences, and invites participants to discuss issues raised by others. Additionally feedback brings ‘closure’ to the research experience for participants and acknowledges their contribution.

Objectives: To describe an innovative feedback method used with young children participating in a study on friendship.

Design: Qualitative study using narrative methodology and restorying.

Participants/Setting: Four children (7–9 yrs) participated in two indepth interviews and a short feedback session. Interviews and feedback sessions were conducted at the children’s schools.

Materials/Methods: Individualised, illustrated storybooks were generated for each child to be used in the validation of interpretations during the second interview. At the end of the project, results and clinical implications were recorded for a new book that depicted a hypothetical friendship between a typically developing child and one with CP.

Results: In each book, identified themes were presented through the participant’s own evaluations and narratives. The researcher read each participant their own story, asking validation questions throughout the reading. Pop-up flaps and cartoon characters were used to share other participants’ experiences with each child, and to further probe selected themes in an indirect, non-intimidating manner. Participants explored this book and discussed it during the final feedback session.

Conclusions/Clinical Implications: Validating qualitative interpretations and disseminating information about a study is a requirement of ethical research that presents challenges to researchers, particularly if they are working with young children. The method reported here is one way of ensuring that young children’s views are interpreted accurately and that the children are included and informed about every stage of the project.
Social Outcomes Among Adults with Cerebral Palsy with or Without Cervical Surgery for Secondary Complications

Pfr Tom Funui, Ms Masayo Funii, Mr Kiyoharu Shinaiishi, Dr Diane Collins

1Osaka Kawasaki Rehabilitation University, 2Japanese Cerebral Palsied Surgery for Secondary Complications
2Osaka Kawasaki Rehabilitation University, 3Japanese Cerebral Palsied Surgery for Secondary Complications

Objective: To describe the social outcomes among adults with CP with or without cervical surgery for secondary complications.

Method: A retrospective case control study was conducted.

Inclusion Criteria: Participants were individuals with CP over the age of 36 living in community.

Results: Seventy-five participants were recruited, with age at time of cervical surgery ranging between 19 and 29. Significant improvements were observed in Barthel index scores and Craig Handicap Assessment and Reporting Technique (CHART) scores among groups after surgical management.

Conclusions: Cervical surgery for secondary complications can lead to improved social outcomes among adults with CP. Further research is needed to determine the long-term impact of this intervention on quality of life and independence.

Acknowledgements: This study was supported by the Office IL Center for Independent Living and a fellowship grant through University of Pittsburgh.

References:

Cervical Spinal Cord Compression in Cerebral Palsy

Dr Helen Somervile, A/Prof Ernest Somerville, Dr Brian Owler, Dr John Cummine

1Children’s Hospital Westmead & Westmead Hospital, 2The Spastic Centre NSW, 3Westmead Hospital, 4Prince of Wales Hospital, 5Children’s Hospital Westmead & Westmead Hospital

Objective: To increase the awareness of cervical spondylotic myelopathy in patients with CP.

Method: Case series, with 2 exemplary patients described in detail.

Results: 13 patients were identified from clinics for people with developmental disability and from personal communication with a non-governmental service for people with CP. The interval between symptom onset and surgical management of spinal cord compression ranged between 6 months and 2 years. Significant functional loss occurred in all patients. The change in function in some instances led to complete dependency for all activities of daily living.

Conclusions: Awareness of the risk of spinal cord compression from cervical spondylotic myelopathy in people with CP needs to be elevated in people with CP and the medical and allied health communities. Because delayed diagnosis and treatment frequently result in irreversible and severe disability, with potential loss of functional independence, prompt evaluation and referral for appropriate investigations and management are essential.

Distribution of an information pamphlet and an awareness campaign amongst medical and allied health professionals and people with CP are proposed to increase awareness of early symptoms. The pamphlet will be made available in lay publications, electronically and at medical conferences (including CP 2009, Sydney). A reduction in morbidity and loss of function with the consequent impact on quality of life of people with CP is anticipated.
‘Nobody Just Wants to Exist’, the Experiences of Younger Women with Cerebral Palsy Living in Nursing Homes

Ms Natalie Berg, Associate Professor Susan Balandin, Dr Leanne Togher
Disability and Community Faculty Research Group, Faculty of Health Sciences, The University of Sydney

Background: An increasing number of younger people with lifelong disability, including those with cerebral palsy are prematurely entering Australian nursing homes. This occurs when the care needs of the younger person exceed the level of care provided by community based residential services or the capabilities of ageing parents. Although younger people with cerebral palsy may experience physical changes related to ageing, accommodation in a nursing home is inappropriate.

Objectives: To explore the perceptions and accommodation preferences of younger people with cerebral palsy who are living in nursing homes.

Design and Participants: As part of a larger qualitative study investigating alternative accommodation options for younger people in nursing homes, in-depth interviews were conducted with two younger women with cerebral palsy living in nursing homes in metropolitan Sydney.

Method: The data was analysed using grounded theory.

Results: For these women, living in the nursing home was a daily battle for independence, ‘they tend to want to do it all for you because it is quicker and easier often’. Participants described feelings of alienation, ‘everybody was just so old. They were mostly sick and I just didn’t fit in’. Despite a desire to develop meaningful friendships with staff and fellow residents, these women report the need to carefully choose who they befriend, ‘you get so close to them and something happens, that’s why I chose very carefully the ones I get connected with’. Both individuals attributed their ability to cope with their living situation by having an outside life, ‘I am lucky in that I go out a bit’.

Conclusions/Clinical Implications: These younger women with cerebral palsy want more out of life than a nursing home can provide. They emphasised the need for alternative accommodation settings that promote independence and opportunities for purposeful vocational and non-vocational activities within the community. The implications of these results for policy developers and service providers will be presented and discussed with the assistance of a younger woman with cerebral palsy who began accessing nursing home accommodation from the age of nine.

Adults with Spastic Cerebral Palsy are at Risk for an Inactive Lifestyle

Mrs Wilma van der Slot1, Msc Channah Nieuwenhuijsen2, PhD Marij Roebroeck1, RD PhD FRCP Henk Stam2, PhD Rita van den Berg-Emons2
1Erasmus University Medical Centre, Department of Rehabilitation Medicine and Rijndam Rehabilitation Centre, 2Erasmus Medical Centre, Department of Rehabilitation, Rotterdam, The Netherlands

Background: Physical activity is an important aspect of a healthy lifestyle. No data are available on this aspect in adults with bilateral spastic cerebral palsy (CP).

Objectives: To quantify the level of everyday physical activity (PA) in adults with bilateral spastic CP and to study its correlates.

Design: Cross-sectional study

Participants/setting: We recruited eligible participants from ten rehabilitation centres throughout the western and central regions of the Netherlands. Fifty-six adults with bilateral spastic CP (mean age 36.4 ± 5.8 years, 62% male) participated.

Materials/Methods: We measured level of everyday PA with an accelerometer-based Activity Monitor. Main outcomes were duration of dynamic activity in minutes/day (composite measure of walking, running, cycling, wheelchair-propulsion and non-cyclic movements), and intensity of activity (motility, in gravitational acceleration [g]). We compared outcomes in CP with able-bodied controls.

Results: About 75% had a high level of gross motor functioning (GMFCS level I or II). Duration of dynamic activity in adults with CP was 116 ± 53 min/day and intensity of activity was 0.020 ± 0.007g. Women with CP were less physically active than able-bodied controls (121 min/day for CP versus 175 min/day for controls, p=0.00); for men this difference was not significant (113 min/day versus 136 min/day, p=0.11). In both women and men, intensity of activity was lower than in controls (in women: 0.021g for CP versus 0.028g for controls, p=0.03; men: 0.019g versus 0.027g, p=0.00). Adults with a higher level of gross motor functioning had higher duration (p=0.00) and intensity (p=0.00) of dynamic activity than those with a lower level of gross motor functioning. We found no differences for other personal and CP-related characteristics (age, gender, level of education, limb distribution of paresis and spasticity).

Conclusions: Adults with bilateral spastic CP, and particularly those with a lower level of gross motor functioning, are at risk for an inactive lifestyle.
Assessment of Cognitive and Motor Function in Newborn Intrauterine Growth Restricted (IUGR) Lambs

Dr Suzanne Milleg, Prof Graham J enkin, Dr Veena Supramaniam, Dr Tamara Yawno, Assoc Prof David Walker, Prof Euan Wallace
Monash University

Background: Intrauterine fetal growth restriction (IUGR) is a serious complication of pregnancy, associated with brain injury and reduced cognitive function of school-age children. IUGR is associated with cerebral palsy in infants delivered at term. This study aims to examine the attainment of normal behavioural milestones in newborn lambs that are healthy or IUGR, forming the basis of relating neurodevelopmental outcomes to regional brain damage, and evaluating treatments that ameliorate the effects of IUGR.

Study Design and Methods: Ewes carrying a single fetus underwent surgery at 0.7 gestation. We performed single umbilical artery ligation (SUAL) to induce IUGR or sham in control animals. A three-wire electromyography (EMG) lead was sutured to the uterine wall. When EMG activity was increased and indicative of labour, the ewe was moved into a lambing pen. From birth, the behaviour of the lambs were monitored and scored according to a set of behavioural milestones adapted by us from protocols described by the Scottish Agricultural College. Post mortem was performed on the lambs 24 hours after birth.

Results: Control (n=5) and IUGR (n=4) lambs were born at term, 145.5 ± 0.8 days. IUGR lambs weighed less than controls at birth (3.4 ± 0.8 v. 4.8 ± 0.4 Kg). Weight gain in the first 24 hours after birth was similar between the two groups (control = 0.2 ± 0.03 Kg v. SUAL = 0.3 ± 0.10 Kg). Brain to body weight ratio was greater in the IUGR group, indicating brain sparing. IUGR lambs took longer to reach all of the developmental milestones: viz., first attempt to stand on 4 legs (control 6.1 ± 0.7 mins v. SUAL 10.0 ± 6.0 mins); time to attain standing position with head erect (control 16.6 ± 8.7 mins v. SUAL 23.7 ± 0.4 mins); first success at suckling for >5sec (control 23.0 ± 1.9 mins v. SUAL 105.3 ± 37.9 mins). Brain histology shows TUNEL-positive cells and astrogliosis (GFAP-positive cells) in periventricular white matter of IUGR lambs, which were not observed in controls. Histological staining in the cerebellum indicates altered morphology of Purkinje cells.

Conclusions: Assessment of developmental milestones in newborn lambs provides an index of motor and cognitive function. IUGR lambs are slower to attain normal developmental milestones after birth, associated with pathological changes in the SUAL-IUGR brain. These observations form the basis for understanding the mechanisms of brain injury and how neuroprotective strategies may be developed.

Intrauterine Growth Restriction Alters Gaba-A Receptor Subunits Expression Levels in Piglet Brain Across Perinatal Period

Dr Viskasari Kalanjati, Dr Stella Bjorkman, Ms Stephanie Miller, Prof Paul Colditz
1School of Medicine, The University of Queensland, 2The University of Queensland

Background: Intrauterine growth restriction (IUGR) is strongly correlated with increased perinatal mortality and neuromorbidity. Prenatal protein malnutrition is one of the major IUGR risk factors, and depleted protein intake alters mRNA expression levels of GABA-A receptor subunits a1, b2 and a3 in rat brain. GABA affects the excitatory and inhibitory neurotransmission during physiological brain development predominantly through the GABA-A receptors. Aberrant changes on GABA-A receptor subunits disrupts normal synaptogenesis and has been proposed to underpin epileptogenesis in rat models.

Objectives: To examine the effect of IUGR on GABA-A receptor subunits expression levels in cortex and hippocampus of piglet brain across perinatal period.

Materials/Methods: Normally grown (NG) and IUGR piglets were born spontaneously and euthanased at P0 (NG n=6, IUGR n=6) and P7 (NG n=6, IUGR n=6), P-14 (NG n=3, IUGR n=7) and P-10 (NG n=4, IUGR n=4) piglets were obtained through caesarean sections. GABA-A receptor a1, a3 and b2 subunit expression was examined using Western blot and immunohistochemistry.

Results: The Western blot analysis showed that GABA-A receptor b2 and a3 subunit protein levels in IUGR hippocampus was significantly lower compared with NG animals at P7. Although not significant, lower a1 protein expression was found in all IUGR animals compared with NG in both brain regions. The immunohistochemistry of IUGR piglet brain regions showed significantly lower densitometry of the a1 subunit in the hippocampus at P-14, in the cortex at P0 and in both brain regions at P7 compared with NG piglets. The a3 subunit densitometry in cortex and hippocampus at P0; and b2 subunit in cortex at P0 was also significantly lower in IUGR piglets compared with NG piglets.

Conclusions: Lower GABA-A receptor a1, b2, a3 subunit expression was observed in IUGR piglet brain. Such alteration may contribute to a greater vulnerability to brain growth disruption and neuromorbidity.
Impact of Cerebral Excitotoxic Lesions on Mice Brainstem Networks Involved in Breathing and Swallowing

Dr Christian Gestreau1, Dr Romain Fontaine1, Dr Pierre Gressens2, Dr Olivier Coq2
1University Paul Cézanne, CNRS, CNRS, Marseille, France, 2Hôpital Debré, INSERM, Paris, France, 3University of Provence, CNRS, Marseille, France

Background: Cerebral palsy consists in a set of sensorimotor deficits resulting from lesions of the immature brain due to hypoxic/ischemic episodes around birth. Among the various deficits observed, an abnormal posture and troubles in coordination of voluntary limbs movements are frequently associated with oromotor dysfunctions.

Objectives: In an effort to develop an animal model of cerebral palsy in mice, ibotenate injected within the brain immediately after birth has been shown to induce extensive excitotoxic lesions that are reversed by co-administration of thiorphan, a molecule belonging to the ampakines. However, whether excitotoxic lesions are associated with oromotor deficits is yet unknown. In addition, the potential protective effect of ampakines has not been investigated on vital functions such as breathing and swallowing.

Design/Participants: Three groups of mice were studied to compare breathing and swallowing parameters: 1/control group (saline-injected, n=10), 2/lesioned group (ibotenate-injected, n=8), and 3/lesioned and protected group (co-injection of ibotenate + thiorphan, n=4).

Materials/Methods: In spontaneously breathing adult mice anesthetized with ketamine-xylazine or isoflurane, repetitive swallowing movements were elicited by electrical stimulation of one superior laryngeal nerve (20 to 30 sec, 30Hz, 250µs, 1–8V). Respiratory and swallowing motor activities were analyzed using electromyographic (intercostals and digastric) and neurographic (hypoglossal nerve) recordings.

Results: Lesioned mice did not show abnormal coordination between breathing and swallowing. As opposed to data from control mice, repetitive swallows were characterized by a decreased or a lack of facilitation of digastric and hypoglossal activities. Preliminary data obtained from animals administered with both ibotenate and thiorphan indicated a tendency toward a restoration of swallowing facilitation.

Conclusions/Clinical Implications: Our results indicate that ibotenate-induced brain excitotoxic lesions have an impact on brainstem neurophysiology and may represent a good model of cerebral palsy. The lack of facilitation seen in lesioned-mice is likely due to alteration of functional plasticity of the swallowing network. This alteration may be due to impairments of cortico-bulbar or propriobulbar pathways controlling the synaptic gain of cranial motoneurons. In addition, administration of Thiorphan tended to restore the progressive increase in motor discharges associated with repetitive swallowing. Thus, treatment with ampakines could be a useful strategy to cope with functional deficits associated with cerebral palsy, in particular those related to oromotor behaviors.

The Management of Hip Displacement in Cerebral Palsy: Moving from Surveillance to Management

Ms Pamela Thomason1, Dr Abhay Khot2, Prof H. Kerr Graham2
1Hugh Williamson Gait Laboratory, Royal Children's Hospital, Melbourne, Australia, 2Department of Orthopaedics, Royal Children's Hospital, Melbourne, Australia

Theory: Australian researchers have contributed significantly to the understanding of the epidemiology of hip displacement in children with cerebral palsy (CP). In addition the outcomes of clinical trials and cohort studies into interventions for hip displacement are complementing the epidemiological studies. We propose that a synthesis of this evidence can be used to establish new management guidelines for hip displacement in children with CP. A new management algorithm based on the following established or putative findings will be presented: 1) Hip displacement is directly related to GMFCS level. 2) GMFCS level determines the shape of the proximal femur; increased femoral anteversion with coxa valga maybe the causative link in hip displacement. 3) The outcome of adductor release surgery is directly related to GMFCS level. The largest series of adductor release surgery with the longest followup, to date. 4) The treatment effect size of focal neurolysis with Botulinum toxin A (BoNT-A) combined with SWASH bracing is small. 5) At GMFCS levels II and III, the effect of adductor release surgery combined with multilevel spasticity management (including phenolisation of the obturator nerve) is promising. 6) At GMFCS levels IV and V the severe abnormality of proximal femoral shape dictates that the majority of children will require bony reconstructive surgery to maintain hip stability.

Interactive Discussions/Activity: This workshop will review the epidemiology of hip displacement in children with CP based on population based evidence. Information from intervention studies reporting the outcome of non operative management, long-term outcome of adductor release surgery, the outcome of adductor releases combined with phenolisation of the obturator nerve and the long-term outcome of sequential adductor releases followed by bony reconstructive surgery will be discussed. Integrating this information will demonstrate that a comprehensive picture is emerging as to the optimum management of hip displacement. A proposed management algorithm based on GMFCS level will be presented: A series of case presentations will demonstrate the clinical indications and uses for this new management algorithm.

Clinical Implications: This new management algorithm may influence the planning, timing and treatment interventions for hip displacement in children with CP and may help to improve outcomes for hip pathology as well as set the direction for future research in this area.
Managing Loss in Later Life: The Experiences of Adults with Cerebral Palsy and Complex Communication Needs

Mrs Leigha Dark¹, Associate Professor Susan Balandin², Associate Professor Lindy Clemson³

¹The University of Sydney/The Spastic Centre, ²Høgskolen i Molde, ³The University of Sydney

Theory: It is well accepted that loss and grief are part of the human experience. All people regardless of ability or disability experience loss at some point in their life. Losses may include actual losses such as the death of a loved one, decline in physical ability or independence and changes to social networks or living arrangements. However losses are not always associated with a finite event but can be intangible, lifelong and pervasive; influencing hopes, dreams and perceptions. Although grief is a universal emotion, the experience of loss and grief is individual and varied. There is little information available on the experiences of loss and grief of people with disabilities and what little there is focuses on adults with intellectual or acquired disabilities. There is a paucity of information available on the losses experienced by adults with cerebral palsy (CP), particularly those who are older.

Interactive Discussions/Activity: In this study the authors used a Grounded Theory approach to explore and better understand the experiences of grief and loss of adults with cerebral palsy and complex communication needs. Participants were involved in in-depth interviews in which a range of types of loss were discussed. While some experiences of loss were very similar to those of people without disabilities e.g. loss of ability due to ageing, loss of occupation as a result of retirement, loss of significant others through death or moving away, a number of losses were identified that are unique to the experience of living with a lifelong disability such as cerebral palsy. These included:

- Loss of control over life events
- Loss of independence
- Loss of communication abilities and opportunities
- Loss of status and influence
- Loss of opportunity eg. in employment, relationships, dreams and aspirations

In this seminar participants will have the opportunity to contribute thoughts, opinions and experiences to a theoretical discussion on disability, communication, grief and loss, facilitated by the primary author.

Clinical Implications: People with cerebral palsy and complex communication needs experience a range of losses as they get older, many of which are unique and have not been explored in depth. It is important to be aware of how these types of loss impact on successful aging and quality of life of older people with cerebral palsy and how they can be utilised to inform adults and service providers as they plan for the future.

Upper Limb Rehabilitation and Measurement of Outcomes for Children with Congenital Hemiplegia

Ass Prof Ann-Christin Eliasson¹, PhD Lena Krumlinde Sundholm², Ass Prof Roslyn Boyd²

¹Karolinska Institutet, Stockholm, Sweden, ²University of Queensland, Brisbane, Australia

Theory: This seminar will examine the efficacy, content of and the evidence for different models of upper limb training available to improve outcomes for children with congenital hemiplegia. The main objectives is to identify and discuss the key elements and efficacy of various approaches to interventions and assessments of upper limb function in children with congenital hemiplegia. Effects of training on neural mechanisms and brain plasticity will be described.

Activities: The presenters will combine their research and clinical experience to debate and critique current training paradigms and outcome measurements. Different approaches that will be reviewed include Constraint Induced Movement Therapy and Bimanual training with or without the use of adjunctive treatments such as intramuscular injections of Botulinum toxin A. The various models cover methodologies such as structured practice, activity-based and goal directed practice. The features of each training approach, examples of treatments and their advantages and limitations will be highlighted. Measurements of outcomes will be critically reviewed and discussed. A clinical as well as research perspective on upper limb training will be presented.

Clinical Application: The seminar will help clinicians in decision-making for type and timing of different types of intervention in clinical practice.
Future Forecasting: Life Without Limits

Stephen Bennett

As Life Without Limits continues to evolve, the future is happening now, through open source environments that develop as communities become socially connected. Current artifacts include examples like user-driven videos available in public places like YouTube. Join Stephen Bennett as we move the future forward and create a vision of Believable Hope.

Contact Details: Stephen Bennett
President and CEO
United Cerebral Palsy
1660 L Street, NW, Suite 700
Washington, DC, 20036–5602
USA
Ph: +1 (202) 776 0406
Fax: +1 (202) 872 0304
Email: sbennett@ucp.org

Across the Lifespan – The Canadian Experience of Developing a Lifespan Model of Care

Ms. Joanne Maxwell1, Dr. Mark Bayley2, Helen Healy3, Joanne Zee2, Felicity Sloman2

1Toronto Rehabilitation Institute and Bloorview Kids Rehab, 2Toronto Rehabilitation Institute, 3Bloorview Kids Rehab

Theory: As children with cerebral palsy (CP) grow up, their disability does not disappear, but most of their specialized health services do vanish once they reach the age of 19. Advancements in medicine have dramatically increased life expectancy, but the adult health care system has lagged behind in developing expertise and services to manage the disabilities beyond childhood. The Living Independently Fully Engaged (LIFEspan) Service represents an innovative model of care, closing the gap from pediatric to adult services by better preparing young people with CP for the transition to adult health care services and developing specialized adult services to meet their ongoing rehabilitation needs as adults. The LIFEspan model was developed jointly by a children's rehab centre and an adult rehab centre in Toronto, Canada. The objectives of this seminar are to share key principles and components of the LIFEspan model (including Growing Up Ready, transfer services, and adult services), outline the results of preliminary evaluation of this interdisciplinary service involving 40 clients and identify key challenges and critical success factors in the development and implementation of a partnership LIFEspan model.

Interactive Discussions/Activity: The seminar will include opportunities for discussion including small group activities focused on the development of partnerships (e.g., to engage adult provider organizations), implementation of a lifespan model, and the development of expertise in the management of adults with CP. The seminar will also include an interactive panel discussion around the needs of individuals with CP across the lifespan including the typical issues of adults with CP and the potential for prevention of these issues. The panel will challenge the participants to identify key issues that pediatric providers need to know about CP in adulthood and explore how this knowledge might influence pediatric practice in the future.

Clinical Implications: Research shows that individuals with CP often have ongoing health needs throughout adulthood, yet there is limited access to services or expertise outside of the pediatric system. The LIFEspan model provides a sustainable solution to address this gap in services and is expected to lead to decreased overall health care costs through prevention of secondary conditions and promotion of healthy behaviours. Future recommendations include expansion of services to include older adults with CP and other conditions (e.g., spina bifida, spinal cord injury, neuromuscular conditions, musculoskeletal disabilities), continued collaboration and capacity building, and evaluation of the impact of the model on health status, participation and health services utilization.
Managing Complex Posture & Movement Problems in CP with TheraTogs® Systems

Beverly Cusick

This program offers a brief overview of the following principles as they pertain to the use of TheraTogs® orthotic undergarment and strapping systems in the management of children with cerebral palsy:

1) skeletal modeling processes occurring in early childhood, and the influence of movement on bone and joint design;
2) kinesiologic and biomechanical requirements for optimum muscle recruitment and joint longevity;
3) muscle balance theory as proposed by Shirley Sahrmann, PhD, PT;
4) cortical plasticity, and the role of abundant practice in skills acquisition; and
5) emerging awareness of the role of the sensory system in postural control and movement education.

These principles are applied in a TheraTogs donning and strapping demonstration, and are discussed with presented videotaped cases.

Fitness Tests and Exercise Training in Children and Adolescents with Cerebral Palsy

Dr. Olaf Verschuren1, Dr. Marjolijn Ketelaar2, Prof. Dr. Johanna Darrah3, Dr. Jan Willem Gorter4

1Rehabilitation Centre De Hoogstraat, Utrecht, The Netherlands, 2Rehabilitation Centre De Hoogstraat, The Netherlands, 3University of Alberta, Edmonton, Canada, 4McMaster University, Hamilton, Canada

Theory: Children and adolescents with cerebral palsy (CP) have distinctly subnormal aerobic and anaerobic capacity in comparison with typically developing peers. Low levels on these fitness components may contribute to the difficulties in motor activities most children with CP encounter in daily life.

To assess different aspects of physical fitness in children and adolescents with CP (GMFCS-level I or II) in a functional way different running-based exercise tests to measure aerobic and anaerobic capacity (10-m shuttle run test and Muscle Power Sprint Test) were developed.

Activities of daily childhood life consist of well balanced aerobic, anaerobic and muscle strength components. The principle of specificity of learning states that learning is optimized by practice that approximates the target skill. Therefore, a functionally based standardized exercise program that was easy to implement in clinical practice was developed for children and adolescents with CP (GMFCS-level I/II). This standardized exercise program (8 months) focused on improving the aerobic and anaerobic capacity. The results of this standardized exercise program show that a standardized exercise program improves physical fitness (aerobic, anaerobic capacity and muscle strength), the participation level and quality of life in children with CP when added to standard care.

Video Example (expert in practice): Videos of the exercise tests and the standardized exercise program will be shown during the workshop.

Case Study Video (for participants): Not applicable.

Practice Intervention Plan: The workshop will briefly review the relevant literature and evidence regarding exercise physiology in children. The course will then focus on more practical aspects including: 1) how to measure aerobic capacity and anaerobic capacity; 2) presentation of video examples; 3) practice different standardized exercise tests; 4) provide a framework for developing a standardized exercise program.

Comparison with Expert Plan: Not applicable.

Clinical Implications: Therapists will learn how to use running-based exercise tests and how to construct an effective functionally based fitness training program for children and adolescents with CP, who are classified at GMFCS-level I/II.
One Hand or Two? Optimizing Outcomes in Upper Limb Rehabilitation for Children with Hemiplegia

A/Prof Ros Boyd1, Ms Megan Thorley2, Ms Leanne Sakzewski3, Ms Kerry Provan4

1Queensland Cerebral Palsy and Rehabilitation Research Centre; University of Queensland, 2Queensland Cerebral Palsy Health Service, 3University of Queensland, 4Queensland Cerebral Palsy and Rehabilitation Research Centre

For children with congenital hemiplegia, impaired use of one upper limb compromises independence in activities of daily living and educational/vocational outcomes. Therefore, examination of the effectiveness of various models of upper limb training is of prime importance.

Purpose: examine the efficacy and content of constraint induced movement therapy (CIMT) and bimanual training (BIM) in the framework of a randomized trial. Workshop participants will be randomised to either CIMT or BIM and will participate in a novel training workshop which will mimic the experiences of children who participated in the INCITE trial. In doing so, participants will appreciate the context, content and expected qualitative and quantitative outcomes of each training model. Presenters will combine their research and clinical experience and use audience participation to debate and critique these training paradigms.

Target Audience: Health professionals involved in the research/management of congenital hemiplegia.

Course Content: Participation in novel training tasks will be used to highlight the context and content of CIMT and BIM. Participants will be able to compare their experiences and function/participation outcomes with those of children with hemiplegia who completed a randomised clinical trial.

Course Format:
- Introduction and overview
- Entry criteria, stratification, randomisation (Randomisation of workshop participants)
- Overview of current evidence for upper limb training for children with congenital hemiplegia (Results of systematic review/measurement issues)
- Developing goals and baseline measures
- Novel training: Participants in both treatment groups (CIMT and BIM) will participate in occupational tasks, fine motor stations and novel circus skills training.
- Subjective experiences (Participant feedback, experiences of children in a RCT: presentation of qualitative data)
- Changes in capacity and performance (Participant feedback, comparison to children with CP)
- Changes in participation and HRQOL (Feedback from RCT)
- Context of expected neurovascular changes – what is the research telling us?
- Panel

Discussion: The importance of motivation in therapy

Learning Objectives:
2. Understand how motor control and motor learning theories inform clinical practice in this group.
3. Identify and understand key elements of various approaches for improved upper limb motor control.
4. Learn current upper limb intervention models adopted in research settings and explore how these might be implemented in current clinical practice for children with hemiplegia.
5. Critique current approaches in measurement of outcomes of upper limb training in the context of capacity and performance.

Evidence-Based Goal-Directed Training: An Intervention Approach for People with Cerebral Palsy

Assoc Professor Ann-Christin Eliasson1, Ms Christine Imms2, Ms Cathy Morgan3

1Karolinska Institute, Sweden, 2La Trobe University; Murdoch Childrens Research Institute, 3The Spastic Centre New South Wales

Theory: Goal-directed training is an activity-based approach to intervention for children and adults with neurological impairments. The underlying principles stem from current theories of motor control and learning theory. The practice is based within an ecological framework where the focus is placed on the interdependence of the person, their environment and the tasks they wish to achieve. Current neuroscience research highlights important principles of practice related to learning-dependent and use-dependent organisation of the central nervous system. Individuals with central nervous system disorders need to learn the strategies to succeed at activity and they need to learn how their own nervous systems control movement. They need ample opportunity for task-specific practice and they also need to master the task under different environmental conditions.

Intervention strategies in the past have used a ‘bottom-up’ process focussed on remediation of foundational skills for movement and emphasising ‘normalisation’ of movement patterns. The efficacy of these traditional approaches for achieving functional gains has been questioned in systematic reviews. Goal-directed training uses a ‘top-down’ approach, where individualised functional goals shape the intervention plan and choice of therapeutic strategies.

The intervention: Observing, practicing and critiquing the process

Using expert and case-study vignettes of adults and children with cerebral palsy, participants will have the opportunity to watch, do and critique the four stage process of implementing goal-directed training. That is, Stage 1. Elicit a purposeful goal which takes into consideration the client’s age and level of cognitive impairment; 2. Analyse the task performance with careful attention to the contributions of the environmental and task factors that help or hinder performance, as well as the person’s skills and abilities; 3. Plan the intervention, including the use of structured practice and effective feedback; 4. Evaluate outcomes using validated tools.

Clinical Implications: Intervention plans are developed with attention to the appropriate selection of practice tasks, determination of frequency and intensity of practice and provision of varying types of feedback. Goal-directed training is an individualised, client-centred approach that can be applied across the life-span with clients with varying severity of motor and cognitive disability. Goal-directed training aims to change the client’s performance by targeting the task to be achieved rather than the impairments thought to limit performance. Participants in this workshop will gain knowledge related to the evidence-base of goal-directed training and experience in applying the principles of practice that can be used within their own clinical settings.

Potential References:
Research Based Guidelines for Rehabilitation of Children with Cerebral Palsy

Adj Prof Ilona Autti-Rämö1, MSc, PT Heidi Anttila2, MSc, PT Ira Jeglinsky3
1The Social Insurance Institute and Finnish Office for Health Technology Assessment, National Research and Development Centre for Welfare and Health, 2Finnish Office for Health Technology Assessment, National Research and Development Centre for Welfare and Health, 3Arcada, University of Applied Sciences, Helsinki

Theory: The increasing demand to use medical resources only on evidence based interventions has become a reality also in rehabilitation medicine. Accordingly, clinical guidelines are based on existing evidence when available and otherwise on best expert opinion.

Activity: A multiprofessional project was established to identify the evidence on effectiveness of various therapeutic interventions for children with CP, to compare the results with current practice, to analyze the variations and pitfalls of current practice and to reach a consensus on valid outcome measures to be used in clinical work when assessing the needs and effect of rehabilitation. The project has included systematic reviews on the effect of physiotherapeutic, occupational and logopedic interventions on children with CP and thorough analysis of the quality, reporting and clinical feasibility of existing physiotherapeutic RCT studies. Current practice was evaluated with questionnaires, cases studies and focus group interviews. Measurement of Process of Care (MPOC) was given both for parents and service providers. Rehabilitation plans were analyzed using the international classification of function as reference. The various steps and their results will be described at the workshop.

Clinical implications: The systematic reviews showed that RCTs are feasible in this heterogenous patient population. The evidence is only weak to moderate, mainly only for focused interventions and only of short-term effect. The identified wide variations in current practice and in the use of outcome measures raised a common need to reach a consensus. The feasibility of the identified valid and reliable outcome measures that are sensitive to measure change are to be tested autumn 2008 at the neuropediatric departments of the two University Hospitals involved. Developing guidelines for a heterogenous patient group needing multiprofessional interventions requires a joint understanding of the task and goal of rehabilitation.

Management of Drooling: Ultrasound-guided Botulinum Toxin A injection to Salivary Glands

Dr Heakyung Kim1, Dr. Anne Marie Cahill2, Dr. Zeeihn Lee3
1The Children’s Hospital of Philadelphia, 2The Children's Hospital of Philadelphia/Dept. of Radiology, University of Pennsylvania, Philadelphia, U.S.A., 3The Children’s Hospital of Philadelphia/Dept. of Rehabilitation Medicine, Catholic Univ. of Daegu, Daegu, Korea

Theory: Excessive drooling is a significant problem in 10–37% of affected children with Cerebral Palsy (CP). The drooling is secondary not to excessive production of saliva but is the result of pooling of saliva because of neurologic impairment and consequent compromise of swallowing function. Serious medical consequences of excessive drooling include choking, aspiration, diminished coughing ability, other signs of respiratory dysfunction, and pulmonary infections. Drooling also causes social embarrassment, thereby adversely affecting the quality of social integration and quality of life (QOL). Management may include feeding and oral stimulation, behavioral modification programs, medications or surgery. In severe cases, patients require frequent suctioning and pulmonary toilet, neither of which may be sufficient to maintain normal respiratory function. The investment of time and resources that such treatment obliges is very significant.

Studies have shown that injection of botulinum toxin A (BTX-A) into the salivary glands is a safe, minimally invasive and effective treatment for drooling in children and adults. Most studies have demonstrated a reduction of drooling, an enhancement in QOL and minimal side effects. There have been few reports that demonstrated an improvement of posterior drooling that improves respiratory condition and quality of life following BTX-A treatment. This advanced practitioner workshop describes the use of BTX-A to salivary glands with regard to dosing, selection of glands, injection techniques under ultrasound and safety. The live demonstration with ultrasound to visualize salivary glands promotes the understanding the injection technique.

Video Example (Expert in Practice): BTX-A injections to the child with CP.

Case Study Video (For Participant): Review of cases before and after BTX-A injections for excessive drooling.

Practice Intervention Plan: This advanced practitioner workshop will be interactive and “hands-on”.

Comparison With Expert Plan: In this advanced practitioner workshop, anatomy and physiology of salivation and the efficacy of BTX-A use for managing anterior and posterior drooling are described. By adding the live demonstration with ultrasound, we will improve the understanding of techniques of salivary injections with BTX-A.

Clinical Implication: We will be able to disseminate the use of BTX-A for drooling management to the clinicians whose main practice is for children with CP. Subsequently this workshop will help clinicians to improve the QOL of children with CP who have been suffering anterior and posterior drooling.
Use of the International Classification of Function to Facilitate Management of the Person with Cerebral Palsy

Ms Davina Richardson
Imperial College Healthcare NHS trust.

This workshop will examine the use of the International Classification of Function (ICF World Health Organisation), a Rehabilitation model piloted at Imperial College Health Care NHS Trust and a case study. These three tools will be used to illustrate the value of detailed assessment and treatment planning to optimise the management of adults with cerebral palsy experiencing progression/changes in their impairments, activity limitations and participation restrictions as they get older.

The objectives of the workshop will be to:

- Use the models to increase the awareness of the need for partnership working between specialties within health and across service delivery settings when managing adults with cerebral palsy.
- To improve the knowledge of the management of impairment of upper motor neurone syndrome and how it can impact on activity and participation.

The ICF model breaks down the component parts of the patients lived experiences, The Rehab pathway model breaks down the component parts of health and social care input into themes. These themes are: Assessment/Review to ascertain the nature and severity of the problem. Empowerment to educate and support patients to allow them to take an active role in their care. Supporting to help patient and family cope with the condition. Restorative to promote a lasting improvement in function with patients with new deficits. Maintenance to provide coping/compensation strategies to retain functions. Preventative to anticipate and prevent the development of difficulties. Enablement to maximise the use of existing functions and Conditioning to increase endurance and strength in activities for those people who have become deconditioned by prolonged acute/chronic illness to regain function.

The case is a 51 year old male who presented with left hip osteoarthritis secondary to hip dysplasia to the orthopaedic surgeon. The individual also had abnormal tone with spasms and spasticity in the lower limbs and increasing weakness in the upper limbs. The individual was living independently in the community prior to admission to the acute hospital setting for a left total hip replacement.

The workshop plan will be to describe the models. Then using the case study apply the models to the case to develop an optimum treatment plan and discuss the actual management plan. The group will be asked to break up into work groups to identify the impairments, activities and participation issues for the case and then identify which section of the health and social teams would best support, manage, restore, prevent, empower, enable or condition the case and how.

Evidence-based Guidelines for Management of Osteopenia in Children/Adults with Physical Disabilities

Dr. Darcy Fehlings
Bloorview Kids Rehab

Children with physical disabilities (GMFCS III, IV, V) are at risk of developing fragility fractures from osteopenia. Evidence-based practice guidelines have been developed to prevent and treat osteopenia in children who are at risk.

This workshop will be presented in the following format:

1) Review of the risk factors of osteopenia in children with physical disabilities
2) Discussion of the prevalence, clinical manifestations and impact of osteopenia in children with physical disabilities
3) Systematic Review of the literature on prevention strategies for minimizing the impact of osteopenia will be presented with a discussion of the level of evidence. These will be divided into three strategies: i) Weight-bearing activities, ii) Calcium supplementation, iii) Vitamin D supplementation
4) Systematic Review of the literature on treatment strategies for fragility fractures with a focus on the use and level of evidence of Bisphosphonates. Clinical options for using oral venus intravenous bisphosphonates will be discussed including a discussion of side effects and complications.
5) Presentation of “Practice Guidelines” including a clinical flow sheet for movement between prevention and treatment strategies and a review of investigations (urine, blood, and DEXA scans)
6) Discussion with workshop participants of a case study where participant sof the workshop will start a child on prevention strategies and move to treatment intervention
Using the Assisting Hand Assessment for Treatment Planning
Mr Brian Hoare¹, Ms Melinda Randall¹, Dr Lena Krumlinde-Sundholm²
¹Victoria Paediatric Rehabilitation Service; ²Karolinska Institute

The Assisting Hand Assessment (AHA) is a test intended for use with children who have a unilateral upper limb dysfunction, in particular children with hemiplegic cerebral palsy or obstetric brachial plexus palsy. The AHA describes and measures how effectively children with a unilateral dysfunction actually use the affected arm/hand with the well-functioning hand to perform tasks requiring bimanual performance. Unlike other activity based measures, the AHA is based on observations of actions performed in relevant activities and is meant to reflect the child's usual performance, not their best capacity.

During administration of the AHA, children play with toys that require the use of two hands. The Small Kids AHA version is intended for children 18 months to 5 years of age, and the School Kids AHA version has extended the target age range to include children aged 6–12 years.

By applying the Rasch measurement model for developing the AHA, test item hierarchies were created. The item difficulty hierarchy reflects steps of increasing ability of assisting hand function. This hierarchy is a useful aspect of the AHA and allows for the targeting of components of bimanual hand function treatment adjusted to the child's ability level. Independent of treatment approach chosen, the bimanual ability profile created by the AHA outcome can be used as a tool for designing treatment programs.

The aim of this workshop is to demonstrate and discuss:

- Clinical reasoning, design and targeting of treatment programs based on individual responses on the AHA.
- Clinical change following targeted treatment programs.

Content of the workshop:

- Development and construct of the AHA
- Reliability and validity of the AHA
- Administration and scoring of the AHA
- Outcomes obtained from published clinical trials utilising the AHA
- Analysis and interpretation of scores.
- Clinical utility of the ordered data obtained.
- Demonstration of the utility of the AHA analysis for program planning
  - After botulinum toxin-A injection
  - For constraint-induced movement therapy
  - For bimanual training
- Practicing treatment planning from AHA sessions

Video footage of case studies will be used to illustrate objectives outlined above.

Designing and Implementing Effective Home Program Intervention for Children with Cerebral Palsy
Iona Novak¹, Professor Anne Anne¹, Dr Natasha Lannin¹
¹Cerebral Palsy Institute, ²University of Western Sydney, ³University of Sydney

Theory: Home programs are a major strategy for addressing the health and development needs of children with cerebral palsy, because experts and parents consider programs essential. Somewhat surprisingly, up until recently there was no high quality research proving that home programs were effective, despite their widespread use. The author will present new data from a comprehensive research program that included a narrative systematic review; a double-blinded randomised controlled trial; and semi-structured interviews of parents' experiences and recommendations. New knowledge about how to design and implement home program intervention will be presented, including:

- Home programs for children with cerebral palsy are effective for improving function and satisfaction with function, when the home programs are designed using the model described in literature (Novak & Cusick, 2006).
- Home programs lead to greater goal attainment and improvements in upper limb quality of movement.
- Parents believe that home programs are an essential way of life for children with cerebral palsy and that 'practice makes perfect'. Parents wanted and needed support from health professionals to implement home programs including: home visits; progress updates; parent education and prognostic guidance. The provision of these supports motivated parents to keep using home programs and make the kinds of gains they were aiming for.

Interactive Learning: This workshop will provide participants with the opportunity to review two video case studies. One video will be used to demonstrate how to design and implement home programs underpinned by the new evidence base stemming from the author's research. A second video will be used as a case study for participants to design and implement a home program intervention plan that incorporates their learning from the new data presented. Opportunities for feedback from the presenter will be given along with an example of how the author would have devised the same case-study program.

Clinical Implications: Since home programs constitute a major part of standard clinical practice for children with cerebral palsy and their families, this workshop will provide an opportunity for health professionals to: (a) gain an understanding of the new evidence base supporting home program intervention; (b) gain an understanding of what parents want and need when using home programs; and (c) provide opportunities to reflect on how their current practice may need to change to translate this new research into their clinical practice.
Ambulatory and Physical Activity Assessment: Clinical and Research Issues

Dr Kristie Bjornson1, Dr Susan Stott2, Dr Anna MacKay3, Dr Catherine O’Connor4

1Pediatrics/SCHRI/University of Washington, Seattle, WA, 2Paediatric Orthopaedics, University of Auckland, Auckland, NZ, 3University of Auckland, Auckland, NZ, 4Pediatrics/University of Auckland, Auckland, NZ

Theory: This course will use an evidence based approach to explore the different forms of paediatric gait and physical activity assessments (excluding 3-D gait analysis) available in everyday clinical practice and examine their properties in terms of the International Classification of Health and Disability. Assessment of physical and ambulatory activity in children with cerebral palsy based on current evidence and research findings will be reviewed. Specific topics include: the different types of activity monitors commercially available; the reliability and validity of these monitors when used in children with cerebral palsy; outcomes of a cohort study and a calibration demonstration of the StepWatch monitor; and an outline of how activity monitoring can complement other measures of walking ability such as 3-D gait analysis. The use of these gait measures in both a clinical and research setting will be presented with discussion on selection of most appropriate outcome measure.

Outline for the course:
A. Overview of current ambulatory and physical activity measures:
   i). What aspects of walking ability do we currently measure and how do they relate to the ICF model?
   ii). Where are the gaps in current measures based on the ICF model: evidence from a systematic review of the literature
   iii). Walking ability - “capacity vs performance”
B. Discussion of accelerometers versus pedometers
   i) What’s the difference
   ii) History of accelerometers for ambulatory activity
   iii) Size, cost, ages and attachment sites considerations
   iv) Types of monitors
C. Demonstration of StepWatch monitor calibration and practical tips
D. Case studies
E. Summary and Management Algorithms:
   i). Elements and criteria for device selection in clinical practice & research
   ii). Clinical and research exemplars of ambulatory activity device selection
   iii). Choice of measures in clinical practice - what’s feasible at different ages and with differing levels of ability?

Interactive Discussions/Activity: The practical aspects of physical activity assessment and/or monitoring in children with neurological impairment will be addressed by a calibration demonstration of the StepWatch. Case studies illustrating the use of activity monitors to assess community ambulation and progress following surgical and non-surgical interventions will also be presented. Clinical and research scenarios for physical activity monitor/assessment selection for clinical and research will be explored with participants.

Clinical Implications: Clinically feasible and relevant outcomes will be presented to allow documentation of the impact of various interventions on daily ambulatory and physical activity in children and youth with CP.

Cerebral Palsy Partnerships: Creating Global Awareness and Promoting Research

Dr Hank Chambers
American Academy for Cerebral Palsy and Developmental Medicine

Background: Cerebral palsy affects children in every nation around the globe. Recent results released by the Centers for Disease Control and Prevention (CDC) in the United States indicate that the disorder affects approximately 1 in every 278 (8 year old) children. This seems to be true throughout the developed world. It is not clear what the incidence and prevalence are in the underdeveloped world. With so many affected by this disorder—what is being done globally to meet the needs of children and families? Who is advocating for greater awareness? Why are some countries more effective than others? What is being done and what’s needed to fully address CP globally? How are governments approaching this fairly common childhood disability? In the United States, local and national parent grassroots advocacy groups for autism research have teamed with professional organizations to effect great change in funding for research and treatment. It is our goal to replicate this effort throughout the world for people with cerebral palsy.

Objective: To highlight current efforts in CP advocacy and attempt to paint a picture of how CP affects both developed and underdeveloped countries. To examine the role partnerships play in advancing CP research. To establish the need for a global approach to CP advocacy and propose a vision for the future of CP surveillance and research.

Methods: Through the use of personal clinical experiences we will explore variations in how CP is diagnosed and treated worldwide. We will explore successful partnerships and models for advocacy around the world. We will highlight successful efforts throughout the world and discuss current strategies to improve research and provision of care to people with CP at all stages of life.

Conclusion: Cerebral palsy is a global concern long in need of attention. Only through collaboration using proven models for advocacy can we advance together in our understanding of this disorder and impact the lives of those affected.

Sleep, Behaviour and Learning in Children

Dimitrios Papadopoulos
The university of New South Wales

Sleep problems are common in children of all ages. In the school aged child, 30 to 50% have significant sleep disorders, and approximately one third of parents desire help with sleep difficulties in their children. Disordered sleep affects mood, behaviour and cognition and has an adverse impact on the family. The adverse impacts occur through repetitive hypoxia and sleep fragmentation causing neuronal damage, cardiovascular disease, growth failure, immune dysfunction and excess daytime sleepiness, which can manifest with inattention and hyperactivity. Adverse intellectual impacts may be irreversible. Childhood sleep disorders are relatively easy to diagnose and eminently treatable, leading to measurable social, behavioural and neurocognitive benefits for children and their families. Brief case presentations and digital sleep study data including video and sound will illustrate these disorders and help explain polysomnography (sleep studies). The audience will learn how to take a 5 minute paediatric sleep history. A referral algorithm will be suggested and ample time allowed for questions.

Interrater Reliability of the Selective Control Assessment of the Lower Extremity (Scale) for Patients with Spastic Cerebral Palsy

Dr. William Oppenheim, Dr. Eileen Fowler, Ms. Loretta Staudt, Ms. Marcia Greenberg
UCLA/Orthopaedic Hospital Center for Cerebral Palsy

Background: Normal selective voluntary motor control (SVMC) can be defined as the ability to perform isolated joint movement without using mass flexor/extensor patterns (synergies) or undesired movement such as mirroring. Individuals with spastic cerebral palsy (CP) have impaired SVMC resulting from damage to descending motor pathways responsible for voluntary movement. SVMC was found to be the most important predictor of gross motor function in a longitudinal study, but a valid and reliable assessment tool is not yet available for clinical use. The Selective Control Assessment of the Lower Extremity (SCALE) was developed to provide a standardized method for quantifying lower extremity SVMC for individuals with spastic CP. SCALE involves assessment of isolated movements of the hip, knee, ankle, subtalar and toe joints. A maximum of two points for each joint results in SCALE scores from 0–10 for each lower extremity. Content and construct validity have been reported.

Objective: To evaluate interrater reliability of SCALE administration in a clinical setting.

Design: Interrater reliability study

Participants: Twenty individuals with spastic CP (GMFCS levels I-IV, ages 7–23 years, 13 females, 7 males) participated. Raters were six clinicians with varying levels of experience in evaluating patients with CP (1–29 years). They included three physical therapists, a pediatric neurologist, a pediatrician and a pediatric orthopaedic surgeon.

Methods: Clinicians were standardized in the administration of SCALE and achieved at least 90% performance accuracy. To minimize potential patient fatigue, the maximum number of consecutive assessments was limited to three. Therefore, the six clinicians were divided into two teams, each containing three raters. A minimum of ten patients (20 limbs) were evaluated by each team. The order of raters was randomized and there was no communication among them regarding results. Intraclass correlation coefficients (ICCs) with 95% confidence intervals (CI) were used to examine agreement among three raters within each team.

Results: ICCs for the first team of three raters were .88 (CI .69-.97) and .89 (CI .72-.97), for the left and right limbs respectively. For the other three raters, the ICCs were .90 (CI .77-.97) for the left and .91 (CI .79-.97) for the right. All ICCs were significant at p < .001.

Conclusion: The SCALE tool for SVMC assessment of patients with spastic CP was found to be highly reliable when administered in a clinical setting by trained raters with varying specialties and experience.

References:
Validation of Accelerometry for Physical Activity Measurement in Ambulant Adolescents with Cerebral Palsy

Miss Kelly Clanchy1, Dr Sean Tweedy2, A/Prof Ros Boyd3, A/Prof Stewart Trotst
1University of Queensland, 2School of Human Movement Studies, University of Queensland, 3Centre for Cerebral Palsy Rehabilitation Research, Royal Children’s Hospital, Brisbane. School of Medicine, University of Queensland, 4Department of Nutrition and Exercise Sciences, Oregon State University

Background: Promoting participation in physical activity (PA) is an important means of promoting healthy growth and development in children with cerebral palsy (CP). The ActiGraph is a uniaxial accelerometer that provides a real-time measure of PA intensity, duration and frequency. Its small, light weight design makes it a promising measure of activity in children with CP. To date no study has validated the use of accelerometry as a measure of PA in ambulant adolescents with CP.

Objectives: To evaluate the validity of the ActiGraph accelerometer for measuring PA intensity in adolescents with CP, using oxygen consumption (VO2), measured using portable indirect calorimetry (Cosmed K4b2), as the criterion measure.

Design: Validation Study

Participants/Setting: Ambulant adolescents with CP aged 10–16 years, GMFCS rating of I-III. The recruitment target is 30 (10 in each GMFCS level).

Materials/Methods: Participants wore the ActiGraph (counts/min) and a Cosmed K4b2 indirect calorimeter (ml/kg/min) during six activity trials: quiet sitting (QS), comfortable paced walking (CPW), brisk paced walking (BPW), fast paced walking (FPW), a ball-kicking protocol (KP) and a ball-throwing protocol (TP). MET levels (multiples of resting metabolism) for each activity were predicted from ActiGraph counts using the Freedson age-specific equation (Freedson et al. 2005) and compared with actual MET levels measured by the Cosmed. Predicted and measured METs for each activity trial were classified as light (> 1.5 METs and <4.6 METs) or moderate to vigorous intensity (≥ 4.6 METs).

Results: To date 36 bouts of activity have been completed (6 participants x 6 activities). Mean VO2 increased linearly as the intensity of the walking activity increased (CPW=9.47±2.16, BPW=14.06±4.36, FPW=19.21±5.68 ml/kg/min) and ActiGraph counts reflected this pattern (CPW=1099±574, BPW=2233±797 FPW=4707±1013 counts/min). The throwing protocol recording the lowest VO2 (TP=7.50±3.86 ml/kg/min) and lowest overall counts/min (TP=31±27 counts/min). When each of the 36 bouts were classified as either light or moderate to vigorous intensity using measured VO2 as the criterion measure, the Freedson equation correctly classified 28 from 36 bouts (78%).

Conclusion/Clinical Implications: These preliminary findings suggest that there is a relationship between the intensity of PA and direct measure of oxygen consumption and that therefore the ActiGraph may be a promising tool for accurately measuring free living PA in the community. Further data collection of the complete sample will enable secondary analysis of the relationship between PA and severity of CP (GMFCS level).

Physical Fitness in Children with Cerebral Palsy; Reliability of Testing and Comparison with Typically Developing Children

Dr Annet Dalmeijer, Dr Vanessa Scholtes, Dr Merel-Anne Brehm, Prof Jules Becher
Dpt Rehabilitation Medicine, VU University Medical Center

Background: Reduced levels of physical fitness have been described in children with cerebral palsy (CP), compared to typically developing (TD) children. However, data are scarce, and little is known about the reliability of fitness testing in children with CP.

Objectives: To determine the reliability of fitness testing (isometric muscle strength, anaerobic capacity and aerobic capacity) in children with CP and to compare their fitness levels with TD children.

Design: Cross-sectional

Design: Participants/Setting: Subgroups from a total of 79 children with CP (Gross Motor Function Classification System (GMFCS) level I-III, age 6–13 years) and TD children (n=57) were tested at a university hospital, in special schools for disabled children, and in a day care center.

Materials/Methods: Isometric muscle strength was assessed using hand held dynamometry (HHD). Anaerobic capacity was measured as the mean power output in a 20-s sprint test on a bicycle ergometer. Aerobic capacity was measured as peak oxygen uptake (VO2peak) in an adapted shuttle run test (SRT), and in an incremental maximal exercise test on a bicycle ergometer. To determine reliability, all tests (except for the SRT) were performed twice in a subgroup of children with CP. Reliability was determined using the intraclass correlation coefficient (ICC) and standard error of measurement (SEM). Outcomes of the CP group were compared with age and gender matched TD children (HHD, anaerobic capacity, SRT) or with predicted values for TD children based on age and gender (aerobic bicycle test).

Results: Aerobic and anaerobic testing (n=10–14) showed excellent reliability (ICC > 0.95, SEM < 7%). HHD tests (n=14) showed lower but good reliability (ICC > 0.80, SEM: 10–12%), except for the hip plantar flexors, showing lower SEM values (16 and 17%). Compared to TD children (n=47), children with CP (n=62, GMFCS I-III) showed lower mean HHD values (hip flexors -24%, hip abductors -36%, knee extensors -35%, knee flexors -41%, and plantar flexors -53%), and a 51% lower mean anaerobic capacity. VO2peak measured in the SRT was 18% lower in children with CP (n=8, GMFCS I), compared to TD children (n=10), and VO2peak measured on the bicycle (n=10, GMFCS I-III) was 17% lower in CP compared to predicted values for TD children. Physical fitness levels decreased with larger motor involvement.

Conclusion/Clinical Implications: Children with CP show considerable lower physical fitness levels compared with TD children. Further, fitness testing seems to be reliable in children with CP, and should receive attention in rehabilitation treatment.
A Novel Method of Assessment of Upper Limb Useful Workspace Using a Virtual Representation of the Subject On-screen

Dr Tim Scott, Ms Veronica Vare
Royal North Shore Hospital

Background: Assessment of upper limb workspace is necessary to determine the ability of people to achieve its useful placement in three-dimensional (3D) space. This enables clinicians and researchers to determine functional deficit and the effectiveness of treatment modalities. Although measurements of range of motion are helpful, the focus was to provide a quantitative measure of effective workspace in which the subject could achieve tasks.

Objectives: Design and development of a novel system for assessment of upper limb workspace.

Design - Technical Development Paper: Electromagnetic sensors were placed on the upper limb and subjects asked to control an on-screen virtual representation of themselves which mimicked their movement. This virtual or ‘cartoon’ representation moved, in response to information from the sensor array, like a mirror. Virtual targets in 3D space were shown on screen and their placement mimicked activities of daily living. Assessment involved subjects starting in a neutral position and then moving their hand to the position indicated on screen relative to the virtual representation of themselves.

Participants/Setting: The system has been developed for assessment of the upper limb workspace of those with cerebral and thoracic spinal cord injuries and the non-injured. Nonetheless, the system will be amenable to assessment of useful workspace in people with other disabilities (including cerebral palsy) and the paediatric population.

Materials/Methods/Results: The upper limb was instrumented with Liberty six degree of freedom position sensors (Polhemus, USA). These were computer interfaced using Labview software (National Instruments, Tx) with monitor output viewed by the subject. Subject representations were shown on-screen in coronal, sagittal and horizontal planes to visualise 3D space. The software enabled menu selection of the activity to be undertaken and, accordingly, the target position. Menu selection also permitted choice of the right or left upper limb and patient position (both supine and upright). Preliminary testing of the system has shown it will permit quantitative measurement of the functional workspace including their accuracy and speed in reaching the target and errors made in movement direction. In addition, the coordination and synergistic control of the shoulder, elbow and wrist by the subject in achieving targets can be assessed.

Conclusions/Clinical Implications: Functional workspace directly impacts a person’s degree of disability. Provision of a system of assessment provides to the clinician and researcher a modality for evaluation of treatment and, in addition, a subject training tool for upper limb use in 3D space.

Coordination of the Arms During Unilateral and Bilateral Movements in Children with Hemiplegic Cerebral Palsy

Ms Hsiu-Ching Chiu, A/Prof Nicholas O'Dwyer, Dr. Mark Halaki
Discipline of Exercise and Sport Science, The University of Sydney

Background: Previous studies of children with hemiplegic cerebral palsy have shown that inter-limb coupling is facilitated and asymmetry between limbs is reduced when the arms work together and at higher speeds (e.g. Sugden and Utley 1995, Steenbergen et al 1996, Utley and Sugden 1998). The aim of this study was to further investigate the factors affecting control and coordination of the upper limbs, in order to provide a more rational basis for enhancing everyday activities in hemiplegic cerebral palsy.

Objectives: To investigate control of unilateral and bilateral movements at a range of speeds.

Design: Observational, cross-population study.

Participants: Nine children with hemiplegic cerebral palsy were recruited (mean age: 11y 10m, range: 8–18 y; Manual Ability Classification System: Level II). Ten typically developing children were also recruited for age-matched comparison.

Methods: Visual tracking was employed to assess control of elbow flexion and extension in unilateral and bilateral tasks. The participants were required to follow a moving target with a response cursor which they controlled via elbow flexion and extension movements (Figure 1). Rhythmic target movements (sinusoids at 0.1, 0.35 and 0.75 Hz) and irregular target movements (bandwidths of 0.25 and 0.75 Hz) were employed. These targets were tracked with the dominant and non-dominant limb (unilateral tracking) and with both simultaneously (bilateral tracking) in randomised order (the affected limb was the non-dominant limb in the hemiplegic children). The overall coherence between target and response signals and between dominant and non-dominant limb movements was computed as a quantitative measure of tracking performance and of inter-limb coordination.

Methods:

Participants:
Nine children with hemiplegic cerebral palsy were recruited (mean age: 11y 10m, range: 8–18 y; Manual Ability Classification System: Level II). Ten typically developing children were also recruited for age-matched comparison.

Results:
Children with hemiplegic cerebral palsy had poorer tracking than the typically developing children in all conditions (F1,17 = 5.4, p < 0.05). In both groups tracking was poorer at faster speeds (F 4,68 = 33.6, p < 0.001) and in the non-dominant limb (F 1,17 = 12.6, p < 0.001). Tracking was also poorer in bilateral compared to unilateral tracking in both groups (F 1,17 = 28.4, p < 0.001). In bilateral tracking, the asymmetry between limbs was reduced in both groups (F 1,17 = 7.7, p < 0.05) due to a greater decrement in performance of the dominant limb, but the coupling between limbs was higher in typically developing children (F 2,34 = 8.8, p < 0.001).

Conclusions:
The results provide no convincing evidence for the benefit of either bilateral movement or increased speed of movement on control and coordination of the upper limbs in hemiplegic cerebral palsy.

References:
Associated Reactions: What Are Their Characteristics in People with Hemiplegic Cerebral Palsy

Ms Hsiu-Ching Chiu, A/Prof Louise Ada, Ms Jane Butler, Dr. Susan Coulson

1Discipline of Exercise and Sport Science, The University of Sydney, 2Discipline of Physiotherapy, The University of Sydney

Background: Associated reactions are unnecessary involuntary movements which have been presumed to be linked to spasticity. However, associated movements occur in normal developing children suggesting that associated reactions may be the result of loss of dexterity. In addition, associated reactions may contribute to secondary impairment, such as contracture as a result of muscles spending time in a shortened position. Therefore, this research aimed to investigate the characteristics of associated reactions and their relationship with other impairments in people with hemiplegic cerebral palsy.

Objectives: To investigate (1) whether the presence of spasticity is essential for the expression of associated reactions (2) the relationship between associated reactions and a) spasticity, b) dexterity, and c) contracture.

Design: Observational, cross-population study.

Participants: 23 volunteers with hemiplegic cerebral palsy were recruited through placing advertisements at Spastic Centre and in the local newspapers.

Methods: Motor impairments were measured in the affected limb.
1) Associated reactions were measured as the abnormal amount of muscle activity (in uv) in the affected biceps/triceps during 50% MVC of elbow flexors/extensors in the unaffected limb.
2) Spasticity (biceps and triceps) was measured as hyperreflexia during ramp stretch recorded by electromyography (EMG) (in uv).
3) Loss of dexterity was measured using tracking task. The similarity between the target and the response was recorded as a ratio.
4) Contracture (biceps/triceps) was measured as loss of elbow extension/flexion range (in deg).

Results: Data was collected from 23 people with hemiplegic cerebral palsy aged from 15–47 years (mean [SD]: 28y10m [9y6m]; 13 males, 10 females). Of all participants, 26% had associated reactions, 52% had spasticity and 30% had contracture. Most participants with associated reactions had spasticity, but not all participants with spasticity exhibited associated reactions (Table 1). Associated reactions were linearly related to both spasticity and contracture, but not dexterity (Table 2).

Table 1 Contingency table of association between associated reactions and spasticity, and contracture.

<table>
<thead>
<tr>
<th>Associated Reactions</th>
<th>Spasticity</th>
<th>Contracture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>No</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td><strong>x² = 3.16, p = 0.08</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2 Correlations between associated reactions, spasticity, dexterity, and contracture

<table>
<thead>
<tr>
<th>Associated Reactions</th>
<th>Spasticity</th>
<th>Dexterity</th>
<th>Contracture</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r = 0.82</td>
<td>p = 0.0001</td>
<td>r = -0.16</td>
</tr>
<tr>
<td></td>
<td>p = 0.48</td>
<td>r = 0.51</td>
<td>p = 0.01</td>
</tr>
</tbody>
</table>

Conclusions: Associated reactions may appear to be a manifestation of spasticity. However, few participants had associated reactions and as the whole they were small, suggesting that they would not interfere with activity.

Complications During Postoperative Rehabilitation Following Single Event Multilevel Surgery in Cerebral Palsy

Dr Deepak Sharan, Mr Biju Nirmal Jacob, Mr Ajesh P S

RECOUP Neuromusculoskeletal Rehabilitation Centre

Background: The eventual functional results of Single Event Multilevel Orthopaedic Surgery for Cerebral Palsy are closely dependent on intensive and skilful post surgical rehabilitation.

Objectives: To quantify the complications encountered during post surgical rehabilitation following Single Event Multilevel Orthopaedic Surgery.

Design: Retrospective chart review of recorded problems and complications during the post surgical rehabilitation.

Participants/Setting: The present study analysed the complications during post surgical rehabilitation following Single Event Multilevel Orthopaedic Surgery in 600 consecutive patients with different type of cerebral palsies like Spastic diplegia (70%), Spastic Quadriplegia (12%), Spastic Hemiplegia (10%) and Spastic Athetoid Quadriplegia (8%) during a period of 8 years (2000–2008). The mean age at the time of surgery was 7 years (range 3–32). All the surgeries were performed by a single Pediatric Orthopaedic Surgeon.

Materials/Methods: The surgical procedures included myofascial releases (Orthopaedic Selective Spasticity Control Surgery) and restoration of lever arm dysfunctions, usually under a single anesthesia. The femoral rotational osteotomies or varus derotation osteotomies were stabilised by external fixators. The post operative plaster immobilisation period was between 5–10 weeks and was followed by physical therapy for at least 6 months. The data was collected from the patient's outpatient and physical therapy records. The follow up ranged from 1 year to 8 years (mean 3 years).

Results: During the post operative rehabilitation, the following complications were reported: Prolonged Joint Stiffness lasting over 4 weeks (82), Myofascial Pain Syndrome (66), Osteopenia (62), Hypertrophic Scar (26), Pathological Fractures (23), Superficial Pin Tract Infection (21), Wound Dehiscence (18), Pressure Ulcers (17), Meralgia Paresthetica (15), Patellofemoral Pain Syndrome (12), Rickets (5), Complex Regional Pain Syndrome (1), Patellar Tendinitis (1), Osteomyelitis (1), Myositis Ossificans (1) and transient Common Peroneal Nerve Palsy (1).

Conclusions/Clinical Implications: Single Event Multilevel Orthopaedic Surgery for Cerebral Palsy is associated with a relatively high rate of mild to moderate complications which may delay or interfere with the rehabilitation. However, none of the complications were life threatening, permanent or affecting long term outcome of surgery. To minimise the rate of complications we recommend a structured rehabilitation protocol carried out by experienced physical therapists and frequent follow up by the multidisciplinary medical team. Before the surgery, the patients, parents and care givers should be counselled regarding the prevalence of these complications, along with the available prevention and treatment options.
Correction of Severe Crouch Gait: Long Term Follow-Up

Dr. Jillian Rodda, Assoc Prof Richard Baker, Dr Paulo Selber, Prof Kerr Graham

1Royal Children’s Hospital, Melbourne, 2Gait CCRE, Murdoch Childrens research Institute, 3The University of Melbourne

Background: Improvements in single event multilevel surgery (SEMLS) to correct severe crouch gait in spastic diplegia are maintained at one and five years post SEMLS which differs to the natural history of gait in spastic diplegia which deteriorates with time. However it is unknown whether these improvements are maintained post skeletal maturity.

Objective: Are improvements post SEMLS for severe crouch gait in spastic diplegia maintained post skeletal maturity.

Design: Prospective cohort study.

Participants/Setting: Consecutive sample of children with spastic diplegic cerebral palsy (GMFCS level II-III) in severe crouch gait, were recruited. Severe crouch gait was defined: knee flexion >30 degrees and ankle dorsiflexion >15 degrees throughout stance. The study was conducted in a tertiary paediatric hospital.

Methods: SEMLS was based on pre-operative gait analysis. Mean of 7 procedures (range 5-10) were undertaken: lengthening of contracted muscle-tendon units, rotational osteotomies and bony stabilization procedures to correct lever arm dysfunction. Ground reaction ankle foot orthoses were worn and community based individually tailored physiotherapy provided in the year post SEMLS.

Gait analyses were undertaken barefoot with usual mobility aids. Post-operative changes were evaluated at one, five and eight-ten years: functional outcome by mobility scales, technical outcomes by 3D kinematics and kinetics. Outcomes were analysed with linear regression with robust standard errors.

Results: Mean age preoperatively was 11yr (range 8–14) and at follow-up 24yr (range 18–28). Improvements in gait that were maintained at five years post SEMLS were: maximum knee extension stance; achievement of knee flexor momentin stance; decreased maximum dorsiflexion stance; increased maximum ankle power late stance. However not all improvements were maintained post skeletal maturity. Mean anterior pelvic tilt continued increased. Mobility status improved on Functional Mobility Scale over 500m at 5 years (p= 0.02, odds ratio 3.9, 95% CI 1.2, 12.0) but again was not consistently maintained.

Conclusions/Clinical Implications: Dynamic knee and ankle function were markedly improved post SEMLS for severe crouch gait at one and five years but these were not consistently maintained post skeletal maturity. The hip and pelvis were not adequately addressed in the SEMLS prescription as increased anterior pelvic tilt continued. Surgical intervention in severe crouch gait should consider pelvic position before hamstring lengthening is undertaken and then be tailored to maintaining hip extension.

Parents’ concerning Issues and Satisfaction After Single Event Multilevel Surgery in Ambulatory Patients with Cerebral Palsy

Professor Moon Seok Park, Professor Chin Youb Chung, Fellow Sang Hyeong Lee, Professor In ho Choi, Professor Jae-joon cho, Professor Won Joon Yoo

1Seoul National University Bundang Hospital, 2Seoul National University children’s Hospital

Background/Objectives: This study is to analyze the concerning issues and satisfaction after single event multilevel surgery in ambulatory patients with cerebral palsy.

Study Design: Studies of Prognosis (Outcome research)

Participants & Setting: Two hundred seventeen ambulatory patients with cerebral palsy, GMFCS level I to III, had responded to the survey with response rate of 55% (217/396). All patients underwent single event multilevel surgery and were followed over 1 year.

Materials/Methods: Postal survey was performed for data acquisition. Parents’ concerning issues were evaluated by the 5-scaled Likert score (1 to 5) with 33 items, which are designed for this study. Satisfaction with the functional outcome of surgery was evaluated by visual analogue scale (10-scaled). For functional outcome analysis, pre- and postoperative Gillette functional assessment questionnaires (FAQ) were archived. Patients were categorized as hemiplegia (or unilaterally involved) and diplegia (bilaterally involved).

Results: Age at surgery averaged 9.0y (SD 6.2y), and average follow up was 5.2y (SD 3.9). There were 71 patients with hemiplegia and 146 patients with diplegia. Mean parents’ satisfaction was 7.3 (SD, 2.0 in 10-scaled VAS) after single event multilevel surgery. FAQ improved from 8.1 (SD, 2.1) to 8.8 (SD, 1.8) with statistical significance (p<0.001). Top three concerned issue after the surgery was operation scar, fear of recurrence and concern about play activity. Top three concerning issues for hemiplegia were unequal leg circumference, fear of recurrence, and concern about play activity. Top three concerning issues for diplegia were unequal leg circumference, functional scar, and fear of recurrence. While the top three of diplegia were fear of recurrence, concern about play activity and operational scar. Top three concerning issues which affect the satisfaction most were walking ability less than expectation, different looking from normal child, and pelvic obliquity.

Conclusion: For non-treatable issues like unequal limb circumference, the consensus and mutual understanding should be made with parents about the surgical outcome and its limitation prior to the single event multilevel surgery. Furthermore, the attentions and concerns should be made by the clinicians with the remediable issues.
Short Term Natural History of Pelvic and Trunkal Asymmetry in Adolescents with Asymmetric Diplegic CP. A Comparison of Computerized Static Trunkal Surface Analysis (Formetric) and Dynamic 3d Gait Analysis Over 2 Years

Dr. Jan Robert Matussek

Introduction: The goal of the study was to observe the natural short-term changes in trunkal and pelvic asymmetry in growing adolescents with an asymmetric diplegic CP. Mild sagittal and frontal plane deformities of the lumbar and thoraco-lumbar spine are therefore correlated with existing pelvic asymmetries.

Material and Methods: 11 adolescents (f:8; m:1) (GMFCS I-II) between 11 and 15 yrs (skeletal growth expectancy at first examination > 2 yrs.) with mild lumbar scoliosis (5°–15° Cobb) (n: 6 L lumbar/n:5 R lumbar) and single sided mild to moderate spastic hip dysplasia (Reimers index >0.5) (n:9) or post single sided VDRO (n:2) and consecutive pelvic asymmetry were studied: Gait analysis consisted of a 3D, 6-camera motion analysis system which computed 3D-segment positions of head, trunk and pelvis as well as the individual joint angles during walking and standing. The posture and 3D trunk symmetry was studied with an optometric system which computed trunkal surface parameters in all 3 planes (sagittal posture, rotation, frontal deviation). An pelvic and spine xRay was taken around the beginning of our study.

Results: All subjects walked at normal velocity (range: 1.07–1.32 m/s; height-adjusted: range 0.61–0.91 m/s). Significant asymmetry was observed in the trunk’s rotational behaviour in the transverse plane. According to the side of the hip dysplasia, the iliac crest was elevated (left side in n:6 left sided hip dysplasias)(right side in n:5 right hip dysplasias) and a marked offset of the whole pelvis to the elevated (dysplastic) side was noted. There was forward rotation in the transverse plane of the pelvis in the line of progression on the hip dysplastic side. This correlated with the side of the scoliosis (right spastic hip dysplasia with left lumbar curvature and vice versa). Asymmetric gait patterns deteriorated within two years of remaining skeletal growth. Optometric surface measurements could prove deterioration of the initial rotation of the lumbar trunk according to the side of convexity.

Discussion: The most significant natural changes and a marked asymmetry was seen in the transverse plane. According to the side of the hip dysplasia with increased hip adductor contracture optometric and motion analysis could show an unfavourable natural development of the pelvic and trunical asymmetry. Optometric surface measurements can sufficiently serve as means of screening trunkal rotational asymmetries as a predictor of a relevant future spine problem in respect of scoliosis. 3D motion analysis detects minute transverse plane changes as to predict the natural history.

Assessing the Wellbeing of Children with Severe Cerebral Palsy: A Comparison of the CPCHILD with Other Quality of Life Measures

Dr. Unni Naryanan1, Ms Jule Hughes2, Ms Shannon Weir2, Dr. Darcy Fehlings2

1The Hospital for Sick Children & Blooview Kids Rehab, 2The Hospital for Sick Children, Toronto, Bloorview Kids Rehab, Toronto

Background/Objectives: The Caregiver Priorities and Child Health Index of Life with Disabilities (CPCHILD®) has been shown to be a reliable and valid measure of health related quality of life (HRQL) of children with severe non-ambulatory cerebral palsy (CP). The purpose of this study was to establish the convergent validity of the CPCHILD with other measures of HRQL and to compare their respective discriminatory abilities (sensitivity).

Design: Outcome measure validation study

Participants/Setting: Primary caregivers of children (5 to 18 years) with severe CP (Gross Motor Function Classification System levels IV & V), recruited from 3 children’s rehabilitation centres and a tertiary children’s hospital.

Materials/Methods: 74 parents/caregivers completed the CPCHILD as well as the Health Utilities Index Mark 2 & 3(HUI®2/3), and the Pediatric Quality of Life Inventory (PedsQL™ generic & CP modules). CPCHILD total & domain scores were compared with the total & summary scores of both PedsQL™ modules & HUI®2/3 attributes using Spearman’s correlation coefficients. Relative efficiency was calculated to compare the ability to discriminate between GMFCS level IVs from Vs.

Results: The mean age of the children was 11y 6mo (SD: 3 y 11mo), 44 (59%) were male; 48 (65%) were GMFCS level V & 26 (35%) level IV. The mean (SD: Range) CPCHILD® score for the entire cohort was 50.6 (13.04; 19.1 to 80.01), with significantly different scores between GMFCS level IV (mean: 59.49) & level V (mean: 45.84) (p=0.001). Mean scores for the HUI®2 and HUI®3 were 0.26 (0.17; 0.06 to 0.62) & -0.10 (0.24; -0.30 to 0.47) respectively. The PedsQL™ Generic & CP Module scores were 44.28 (20.2; 0.00 to 96.65) & 27.02 (18.33; 0.00 to 85.71) respectively. CPCHILD® total & domain scores demonstrated significantly high correlations with the majority of conceptually related scales in the other measures. Relative efficiency was highest for the HUI®2/3 & the CPCHILD©, followed by the PedsQL™ CP module, and the least for the PedsQL™ generic module.

Conclusions/Clinical Implications: The HUI & CPCHILD showed the best sensitivity. The PedsQL CP Module was superior to the Generic module. The PedsQL & HUI showed floor effects in the most severely involved children. The negative scores of the HUI (derived from a societal perspective) rate many children with a QOL worse than death! This work provides further evidence of the validity and sensitivity of the CPCHILD© as a measure of wellbeing of children with severe CP.
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will be discussed. Implications for future research and strategies to support families
enable their child’s participation. Children participate through their mother’s
interventions that support the child and primary carer. Mothers frequently
participation in common daily activities. Families require collaboration and

Background:

La Trobe University, Bundoora, Australia, 2Mc Master University, Hamilton,
Canada

Mothers of Children with Disabilities

Measuring the Extent of assistance Provided
By MoThers of Children with Disabilities

Ms Helen Bourke-Taylor1, Professor Mary Law2, Associate Prof Linsey Howie1

1La Trobe University, Bundoora, Australia, 2Mc Master University, Hamilton,
Canada

Background: The Assistance to Participate Scale (APS) is an eight item scale
that measures the amount of assistance that a child with a disability needs from
their primary carer to engage in typical daily play and recreational activities.
Participation in regular activities provides an indication of how well a child is
successfully integrated into the local community and is a gauge of the child’s
health and quality of life. Participation restrictions can occur when the child’s
home life cannot provide support.

Objectives:

1) Describe the APS and present the psychometric properties.
2) Describe the range of assistance required by a diverse group of children
with disabilities.

Design: A mixed method research design was used to collect data over a two
year period.

Participants: 152 mothers of a school aged child with a disability participated.
Seventy-six conditions were reported pertaining to the child’s diagnosis, including
51 children with physical disabilities (30 with cerebral palsy); 94 children with
Autism; 46 with intellectual disability; and 31 with a psychiatric disorder.

Methods: A qualitative study informed item selection and responses. Quantitative
data were collected via mail out survey and phone interview.

Instruments used and analysis: Statistical analysis included descriptive, correlation
and regression models to investigate variables and establish relationships.

Results: The APS has good internal consistency with a Cronbach Alpha coeffi cient
of 0.89. Factor analysis provided strong evidence for a single scale. Strong
relationships were detected between the APS and the PEDI caregiver scales,
r=0.81. Correlation with the PedsQL was moderate overall, r=0.42, and strong
with the physical health summary score, r=0.64. Other significant relationships
included negative correlations with the number of assistive devices required,
r=0.62, and the number of necessary services, r=0.48. Required assistance
varied greatly across items and within the group. Half of children needed some
assistance to view television or listen to music, a third were unable to play at
a friends house, and nearly half were unable to participate in an organized
club. As measured on the APS, children with physical challenges required more
assistance for all activities, when compared to other challenges—cognitive,
sensory or behavioural.

Conclusions: Primary carers accept heavy responsibility for their child’s
participation in common daily activities. Families require collaboration and
interventions that support the child and primary carer. Mothers frequently
enable their child’s participation. Children participate through their mother’s
support. Implications for future research and strategies to support families
will be discussed.

Participation in Play and Recreation:

Seat Cushions for School Aged
Children with Cerebral Palsy

Dr Rachael McDonald, Monash University

Background: School aged children who have cerebral palsy of GMFCS types 4
and 5 often use adaptive or special seating in their wheelchairs or at school
in order to improve their access to activities and participation, but also to help
manage impairments of body functions and structure. Research This project
took one aspect of a seating system – the cushion base, and compared a
number of assessment tools to measure the effect in both functioning and
disability and contextual factors.

Objectives:

1) The development of objective measurements to enable researchers and
clinicians to make objective and reliable judgement regarding effectiveness
of seating systems
2) To use the above measures to perform a project using a randomised
crossover design address the effectiveness of a contoured ramped cushion
vs flat cushion for school aged children with complex disabilities.

Design: A randomised crossover project was performed, where children were
randomised to either a flat (standard) seat base, or a ramped contoured

cushion, then swapped.

Participants/Setting: Thirty five children of primary school age (4-11) (18
boys, 17 girls) with a neuromotor disorder participated.

Materials/Methods: Accelerometry, Pressure Mapping, Seated Functional
Activities, Manual Goniometry.

Results: Accelerometry Data: Statistically significant differences were found
between the two seat types, in mean average backwards and forwards
movement. Pressure Mapping: No statistically significant results were found for
average and peak pressure, but statistically significant differences (P<0.05)
were found for seat and back contact area. Seated Functional Activities: No
statistically significant differences were found for the comparative activities,
but there were mean differences in switch activities. Manual Goniometry: 13
joint angles showed statistically significant results for the angular deviation
from neutral.

Conclusions/Clinical Implications: On balance, it appears that using objective
measures, that ramped contoured seating is beneficial for children with complex
seating needs, rather than an alternative fl at seat. Our plan is to repeat and
develop batteries of measurement that are reliable, and perform regression
statistics on the tools so that we can minimise the number of measures
necessary. The measures of function and comfort are still in the early stage
of development, but initial results show a positive indication that with further
improvement they will be useful additions evaluating outcomes of seating
interventions for children with complex motor and cognitive difficulties.

School aged children who have cerebral palsy of GMFCS types 4
and 5 often use adaptive or special seating in their wheelchairs or at school
in order to improve their access to activities and participation, but also to help
manage impairments of body functions and structure. Research This project
took one aspect of a seating system – the cushion base, and compared a
number of assessment tools to measure the effect in both functioning and
disability and contextual factors.

Objectives:

1) The development of objective measurements to enable researchers and
clinicians to make objective and reliable judgement regarding effectiveness
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necessary. The measures of function and comfort are still in the early stage
of development, but initial results show a positive indication that with further
improvement they will be useful additions evaluating outcomes of seating
interventions for children with complex motor and cognitive difficulties.
Use of Locally Made Mobility & Seating Systems for Children with Severe Cerebral Palsy in District and Rural Areas of Malaysia

Dr Teck-Hock Toh1, Ms Sui-Hui Ling2, Dr See-Chang Wong1
1Paediatrician, Department of Paediatrics, Sibu Hospital, Sarawak, Malaysia, 2Physiotherapist, Lau King Howe Memorial Children Clinic, Sibu, Sarawak, Malaysia

Background: Children with severe cerebral palsy (CP) are often prescribed mobility and seating systems (MSS) to assist in daily activities, posture improvement and prevention of muscular-skeletal complications. However, many families in developing countries, especially those from district and rural areas, do not have easy access to this equipment. In a district paediatric centre in Malaysia, these systems became a reality with the joint effort of a Japanese volunteer physiotherapist, a non-government organisation and a local health team. The systems include wooden chair manufactured using locally available materials and modification of ordinary wheelchair. They are custom-made for the children with material costs only.

Objective: To determine the feasibility of this partnership program and the usefulness of MSS for families and their children with severe CP.

Design: Audit of medical notes and parental perception questionnaire.

Settings: All children who used MSS for at least 3 months between July 2004 and September 2008.

Methods: Retrospective collection of medical/demographic data and costs of MSS contributed by the parents. A 5-point Parental Perception Questionnaire was used to assess the usefulness of MSS and parental satisfaction.

Results: Seventy children received MSS during the study period and are eligible for the audit. Seventeen parents are not contactable because the family reside in remote areas. Amongst the 53 questionnaires completed, 43% and 49% of families have monthly incomes RM1000 or less and between RM1000–3000 respectively (RM1.00 = AUD$0.32). 57% of the parents indicated that their children spent more time sitting upright with the systems. More than 85% of the parents agreed that their children could sit longer/better, seemed happier and interacted more. Less than 35% of the parents felt the systems had a positive effect on constipation or drooling. About 50% of the parents felt it was easier to perform limb physiotherapy. Amongst those who used modified wheel chairs or buggy chairs (about 70%), 46% spent more time outside their homes. Almost all parents indicated that they would highly recommend MSS for other children, and 75% would purchase another similar system if necessary. 66% felt the cost was affordable and 89% felt the MSS was a good use of money. More analysis will be performed to study the relationship between use of MSS and parental perceptions. Limitation of the systems includes bulkiness and physical-unfriendly environment/access.

Conclusion: MSS is useful to most children with severe CP and their families and can be produced locally at an affordable cost. Pictures of MSS are available for reference.

Use of Upper Limb Orthoses, Adaptive Equipment and Therapy in a Community Based Sample of Children with Hemiplegic Cerebral Palsy

Dr Remo Russo1, Ms Renae Atkins2, Dr Eric Haan3, Prof Maria Crotty4
1Women's and Children's Hospital and Flinders University South Australia, 2Women's and Children's Hospital, South Australia, 3Women's and Children's Hospital and University of Adelaide, South Australia, 4Flinders University, South Australia

Background: Children with Hemiplegic Cerebral palsy (HCP) are known to have physical/cognitive limitations requiring support using orthoses, adaptive devices and therapy. Utilisation of these modalities, and characteristics of children who require this input is not known.

Objectives: To describe the type and utility of upper limb orthoses, adaptive equipment and therapy in a representative community based sample of children with HCP. To describe the characteristics of children requiring assistance to those not requiring this help.

Design: Cross-sectional survey.

Participants/Setting: 107 children with HCP recruited from a population register.


Results: There were 107 participants; mean age (95% CI) 8.9 years (8.2,9.7); 61 (57%) were male and 58 (54%) had hemiplegia affecting the right side. Fifty-six percent had been prescribed upper limb orthoses, 46% adaptive equipment and 85% some form of therapy. Therapy was intensive (≥1 session per week) and community based for 20 children. Only 48% of children prescribed an upper limb orthosis were using it, compared to 98% of children prescribed adaptive equipment. Children requiring intervention were worse affected according to impairment level function (p < 0.01). Children who did not require an assistive device or therapy reported better quality of life (p < 0.001), self-esteem (p < 0.034), better ability with self-care (p < 0.001) and higher levels of activity/participation (AMPS – p < 0.04) than those requiring this assistance. Logistic regression analysis revealed tone ≥2/4 on a MAS at the wrist was the best predictor of need for all three interventions (OR = 5.2).

Conclusion/Clinical Implication: Children with HCP more severely affected were more likely to use adaptive devices and be prescribed therapy. Adaptive equipment assisting daily function has a higher utility than orthoses in HCP. Clinicians managing children with HCP should consider these differences before prescribing expensive aids. Upper limb tone can be used to assess the need for future assistance in younger children with HCP.
Robotic Rehabilitation of Upper Limb in Hemiplegic Children

Dr. Enrico Castelli, MD Flaminia Frascarelli, MD Giuseppe Di Rosa, PhD Lorenzo Masia, PhD Maurizio Petrarca, PhD Paolo Cappa

1Children’s Hospital Bambino Gesù, Rome, Italy, 2Robotics Brain & Cognitive Science Dept, Genova, Italy, 3Department of Mechanics and Aeronautics, Rome, Italy

Background: The use of robotic technologies has increased in rehabilitation. Some previous studies have shown the effectiveness of robot-assisted therapy in acute and chronic phase of recovery on upper limb impairments in adult patients with stroke. Patients who received robotic therapy had significant gains in motor coordination and muscle strength of the paretic upper limb.

Objective: Our intent is to verify, through a clinical and robotic evaluation, if the robot therapy of hemiplegic children secondary to CP can lead to recovery of upper limb impairment.

Design: Uncontrolled pilot study with pre-post treatment outcome comparison.

Participants: 12 children, ages 5 to 15 years old, suffering from congenital upper limb motor impairment.

Materials/Methods: Patients were engaged in a robotic therapy program with InMotion2 performed 18 1-h sessions, at a frequency of three times a week, of robot-assisted upper limb therapy consisting of goal-directed planar reaching tasks over a period of 6 weeks. Modified Ashworth Scale, Passive Range of Motion of shoulder, elbow and wrist, Reaching Performance Scale, Melbourne Scale, Fugl-Meyer Scale, and robotic evaluation were administered to the children at the beginning and at the end of therapy.

Results: Robot-assisted training produced statistically significant improvements from admission to discharge in the Fugl-Meyer Scale, Melbourne Scale, Modified Ashworth Scale scores and in the quality of motion (quantified by the movement performance indexes Jerk Metric and Average Speed).

Conclusions: Our findings indicate that short-term, goal-directed robotic therapy can significantly improve motor abilities of the exercised limb segments in children with an injury of central neural system and that the time course of motor recovery can be influenced by repetitive and intensive exercise training without a modification of muscle tone having a negative impact on the performance. Therefore robot therapy can play a key role within the rehabilitation techniques for the recovery of post-lesion residual capabilities in children suffering from hemiplegia.


How Children with Cerebral Palsy Feel about On-Screen Keyboards

Dr. Denise Reid, Ms. Alysia Carpe, Ms. Katie Harder

University of Toronto

Background: Children with CP often have restricted participation in daily occupations such as using a computer to write. Occupational therapists (OTs) frequently prescribe on-screen keyboards to children with cerebral palsy (CP) to enable their participation in productive occupations like writing, however, little is known about this population’s perceptions of the technology.

Objective and Design: This qualitative study explored the perceptions of children with CP toward their on-screen keyboard technology.

Participants and Methods: Eight children with CP participated in in-depth interviews. They were recruited from a large children’s rehabilitation centre. One parent and two OTs who were known to the children participated in a focus group to validate and provide context to the children’s comments. A grounded theory perspective guided the analysis of the data.

Results: Participants identified many enablers as well as barriers to using on-screen keyboards. Enablers related to social and institutional supports, personal motivation and accessibility features of the technology. Barriers included physical factors, training and logistical issues. Participants felt they were more independent, had a greater sense of pride, autonomy, and self-confidence when using on-screen keyboards. Using on-screen keyboards also increased participation, and productivity at home and school.

Conclusions/clinical implications: These findings will help OTs and health care professionals better understand how children with CP feel about on-screen keyboards and why they use or don’t use this technology. This information and may be helpful to improve best practice.
Managing Drooling in Children with Cerebral Palsy – A Multi Disciplinary Team Approach

A/Prof Dinah Reddihough1, A/Prof Bruce Johnstone2, Dr David Chong2, Dr Maia Desai2, Ms Hilary Johnson1, Mrs Libby Ferguson1, Ms Sue Reid1, Ms Christine Westbury1

1Head of Developmental Medicine, Royal Children's Hospital, 2Department of Plastic and Maxillofacial Surgery, Royal Children's Hospital, Melbourne, 3Paediatric Dentist, Balwyn, 4Speech Pathologist, Manager of Communication Resource Centre, SCOPE, 5Speech Pathologist, Royal Children's Hospital, Melbourne, 6Murdoch Children's Research Institute

Theory: In young people with cerebral palsy, the incidence of severe drooling (sialorrhea) has been reported to be as high as 37%. In addition to the social implications for both the child and the parents, excessive drooling can cause significant skin irritation and require frequent changes of clothing and bibs.

A Melbourne saliva control clinic has adopted a hierarchical approach to the treatment of drooling, from the least to the most invasive. Many research projects have been conducted through the clinic, including evaluations of the use of medication, intraoral appliances, botulinum toxin injections and surgery.

Interactive Discussions/Activity: The objectives of this seminar are to
1) report the experience of a multi-disciplinary team in a saliva control clinic which was established 22 years ago. The team includes a speech pathologist, a paediatrician, a plastic surgeon, a dentist, a research nurse coordinator and research officer. Their role in the clinic will be described along with the assessment process and the interventions that are recommended.
2) present the results of research into the effectiveness of medication, an intraoral appliance, botulinum toxin injections and saliva control surgery.
3) share future research including the development of a drooling impact scale and a swallowing frequency device.
4) exchange information and treatment ideas with participants.

Drooling remains a stigmatizing problem, but there has been substantial improvement in outcomes with a thorough team assessment and appropriate intervention.

Although new treatment methods have emerged and information has been gathered with the help of research conducted in the clinic, there is still a need to find more long term non-invasive interventions and treatments.

To this end an interactive discussion will be conducted by presenting case studies and a forum for questions to stimulate discussion about other treatment options.

The clinical implications: This seminar will be of interest to a wide range of professionals in their own clinical practice. Information will be provided about the level of evidence for the various treatment approaches. This will be useful for clinicians who wish to know how best to assist young people presenting with drooling, that is, what interventions are likely to work best, what are the potential benefits and disadvantages of the various treatment approaches and when each of the treatment options should be recommended.

Knowledge Brokers: What Are They and How Can They Help Move Cerebral Palsy Research into Clinical Practice?

Dr. Dianne Russell1, Dr. Marjolijn Ketelaar2, Ms. Dianne Cameron2, Dr. Johanna Darrah1, Dr. J an Willem Gorter1, Dr. Peter Rosenbaum1, Ms. Lori Roxborough1

1CanChild Centre for Childhood Disability Research, 2NetChild Network for Childhood Disability Research in the Netherlands, 3B.C. Centre for Ability, 4University of Alberta, 5Children's and Women's Health Centre of British Columbia

Theory: The literature shows that didactic lectures, peer reviewed journal articles and distribution of educational materials are not effective strategies for changing clinical practice. Evidence is beginning to show that active exchange of information, ideas and experience between researchers and users of the research is likely to increase its use in policy, administration and clinical decision-making. One strategy which is beginning to garner interest and evidence is that of knowledge brokering (KB), an approach defined as “all the activity that links decision makers with researchers, facilitating their interaction so that they are able to better understand each other’s goals and professional cultures, influence each other’s work, forge new partnerships, and promote the use of research-based evidence in decision-making.”

Interactive Discussion/Activity: Presenters at this seminar will share their experiences from conducting two projects designed to evaluate the use of a knowledge translation strategy using Knowledge Brokers (KBs) in children's rehabilitation programs to help move evidence-based materials into clinical practice. One project evaluated changes in knowledge and use of a group of evidence-based tools concerning gross motor function for children with CP (GMFM, GMFCS, Motor Growth Curves) by physical therapists (PTs). The study involved 25 PT KBs in 28 organizations brokering to 122 front-line PTs. In the second project currently underway, a network of 16 KBs from varied disciplines, mainly PTs and OTs, and researchers from a large research program are working to improve knowledge and use of the PEDI, MACS, MPOC and the Transition Profile in addition to the above measures of gross motor function to improve evidence-based decision-making in pediatric rehabilitation

Topics for Discussion:
1) Current evidence about the effectiveness of Knowledge Brokering
2) Characteristics and skills important for a KB
3) Training and Supports for the KB
4) Supports and barriers to implementation
5) Evaluating the impact of the KB process
6) Lessons learned: Challenges and Successes

The audience will be encouraged to think through and discuss the possible supports, challenges and opportunities within their own clinical environments for moving evidence into practice.

Clinical Implications: There is growing pressure for busy front-line clinicians to provide services based on the best available evidence. Early results suggest that developing and supporting the role of a knowledge broker is an effective strategy to help clinicians and service organizations meet this important mandate.
Transition Programs:  
A Holistic Approach to Success

Ms. Susan Labhard, Shriners Hospital for Children

Theory: A Holistic Approach to a child’s healthy transition into adulthood requires 
a personalized program, drawing from a large assortment of resources in the 
environment to meet patient, family or caregiver’s transition needs. The increased 
longevity of children with chronic illnesses or developmental disabilities creates 
challenges for these youth in making a successful transition to medical and 
personal independence.

Interactive Discussions/Activity: The Transition Specialist is dedicated to the 
Transition Program and works with the Patient Care Team to maintain a “transition 
focus.” Participants will learn to accurately identify and document specific needs 
of individuals with cerebral palsy, and provide resources to meet those needs. 
An interactive positive approach to problems and solutions is demonstrated 
for developing and expanding transition programs and resources, including 
research, teaching and collaboration. Ultimately, helping the family and child to 
attain a sense of independence, is the goal of a successful transition program. 
A holistic and comprehensive program that goes beyond medical needs alone 
will be discussed as a best practice to achieve this goal. A set of innovative 
and successful transition techniques and resources will be illustrated using a 
variety of media:

1) Patient/Family Resource Room
2) Specialized “Assessment Tools”
3) Computer-based FreeMind-Transition Resources that can be adapted to any area
4) The “Transition Issues Board”
5) Camp SPIRIT-Transitions Camp

This creative approach to successful transitioning is applicable in a variety of 
settings. Providers will learn from case studies, demonstration of programs that 
work, and examples of resources that have international applicability.

Clinical Implications:
• A Transition Specialist is a critical factor in achieving success in developing 
a program to achieve success in youth’s transition to adulthood. This person 
should be caring, dedicated and highly motivated to provide direct open-ended 
support to patients/families, targeting their special needs and circumstances.
• Programs should be flexible and individualized to meet the needs of patients 
and families and the settings where transition planning occurs.
• Resources should be efficiently organized and accessible to meet the needs of 
youth, families and professionals.

Transition is more than transferring from one provider to the other. The 
importance of coordinating the transition process and teaching patients with 
cerebral palsy and their families how to access the care and services they need 
is emphasized. As survival rates are increasing, more than physical needs have 
to be considered for quality of life.

GMFCS as a Template for the Musculoskeletal Management of Children with Cerebral Palsy

Dr Adrienne Harvey1, Professor Ken Graham2
1Murdoch Children’s Research Institute, 2Department of Orthopaedics, Royal Children’s Hospital Melbourne

Theory: The Gross Motor Function Classification System (GMFCS) is now the 
recognised international method of classifying motor impairment in children 
with cerebral palsy (CP). The related gross motor curves provide evidence of 
prognosis of function for children within different GMFCS levels as they grow 
and develop. They also enable clinicians to prescribe interventions according to 
where a child sits on the curve. It stands to reason that interventions, such 
as orthopaedic surgery, should be tailored according to a child’s GMFCS level 
to ensure an optimal outcome from the surgery. This enables the aims of the 
surgery to be matched to a child’s potential function and consequently maximise 
their activity and participation.

Discussion/Activity: The instructors of this seminar have extensive experience in 
using functional outcomes and measurement for children with CP, particularly 
those having orthopaedic surgery. Over many years they have gained insights 
into dosing and prescribing interventions for children with CP using a range of 
diagnostic and functional measures. This seminar will instruct on classifying 
and measuring function in children with CP as background to prescribing 
surgical interventions. For children classified as GMFCS I-II the surgical 
discussion focuses on gait correction surgery. For those classified as GMFCS IV 
and V the focus is on managing hips, spine and feet. The seminar will present 
the principles of surgical management in CP as well as the different types and 
combinations of orthopaedic procedures based on the different GMFCS levels.

Clinical Implications: This seminar will provide clinicians with an understanding 
of surgical decision-making in children with CP. It will also provide them with 
guidelines of expectations of function after surgery and throughout the growing 
years of children with CP based on their GMFCS level. Tailoring surgical 
interventions to GMFCS levels provides realistic goal setting in this population 
of children and ensures that our interventions are directed individually to ensure 
optimal outcomes for the children.
Intensive Task Oriented Upper Limb Therapy
Dr Eugene Rameckers, MD Lucianne Speth, OT Anke Defoesehe, PT Marcel Coenen, PT Marjon Kissels, OT Sylvie Vanstipelen, OT Mirjam Linnartz, PHD Yvonne Janssen
Rehabilitation Foundation Limburg (SRL), location Franciscusoord, Valkenburg, The Netherlands

In this seminar two modes of intensive upper limb treatment will be discussed, i.e. Constrained Induced Movement Therapy (CIMT) and task oriented bimanual therapy.

CIMT has shown to be promising for improving upper-limb function in children with cerebral palsy (CP). The systematic review by Hoare (2007) showed a significant treatment effect using modified CIMT in a single trial. Furthermore, a positive trend favouring CIMT and forced use was demonstrated.

Intensive bimanual therapy is often used after hand surgery or Botulinum Toxin A injections. Thus far not much about the contents of such therapy is published. Charles and Gordon (2006) published the Hemiplegic Arm Bimanual Intensive Therapy (HABIT), which proved to be effective (Gordon, 2007).

In our rehabilitation centre both treatment modalities are applied. During summer holidays a modified CIMT program is offered to adolescents with unilateral spastic CP. The effect of Botulinum Toxin A injections and specific intensive rehabilitation therapy in children with unilateral CP is currently being investigated in a RCT (trial registration: ISRCTN69541857/BoBiVa). For this study a special task oriented therapy program was developed, based on goal setting, including strength training.

In both treatment modalities goal setting and specific individual task analysis are the main guiding principles for the therapy. The child's physiotherapist (PT) and occupational therapist (OT) perform individual task analysis by observing video recordings of the goal oriented tasks and by analysing the tasks together with the child. This analysis is performed for two reasons: 1) to determine the task specific motor learning stage (Fitts et al., 1967) and 2) to determine the influence of upper limb strength and range of motion on the performance of the specific task. Based on this analysis a task specific individual treatment protocol for PT and OT is established. The treatment protocol is readjusted by video observation, registration of the functional activities used and multidisciplinary meetings.

Details and principles of our CIMT camp and of the bimanual task oriented training, task analysis, motor learning and strength training will be discussed in this seminar including several case studies. Video material will be used to elucidate this.


Current Knowledge on Brain Structure and Function
Ingeborg Krägeloh-Mann
University Children's Hospital, Tübingen, Department of Developmental Neurology and Grenoble

The compensatory potential of the young nervous system following brain injury is considered to be superior to that of the adult brain (Kennard principle: 1). The healthy hemisphere plays an important role after unilateral lesions within the central motor system. In smaller lesions, not disrupting the motor tracts, an enlarged motor network involves also the healthy hemisphere (2). However, this is also described in adult patients following stroke (3). In larger lesions, disrupting the motor tracts, abnormal fast conducting corticospinal projections from the healthy hemisphere exert the primary motor control. Such ipsilateral projections are physiological in the neonate; they do not mature and can no longer be elicited in later normal development (4). They can apparently be maintained under pathological conditions, e.g. when the contralateral projections are severed (5). However, their functional role seems to decrease already during late gestation, as Staudt et al. (6) found evidence that hand function in patients with ipsilateral projections correlated with the timing period of the underlying brain lesions. In contrast to the possibility for interhemispheric reorganisation in the motor system, there is no clear evidence up to now that this can occur also in the sensory system. Rather is there evidence for dissociation between primary motor and primary sensory representation in larger unilateral lesions where the healthy hemisphere has taken over primary motor control of the paretic hand whereas the sensory representation is still remaining in the lesioned hemisphere with some evidence for axonal deviations but not substantial intrahemispheric reorganisation of the cortical representation (5, 6).

Conclusion: Plasticity in the sensorimotor system has mainly been studied following unilateral lesions. Reorganisation is mainly interhemispheric and homotopic. It involves the recruitment of ipsilateral tracts with limited functionality, however, which decreases already towards the end of gestation. There is no clear evidence for substantial reorganisation in the sensory system.

References:
The Visual System, Cerebral Palsy, and Why Visual Acuity Measures Just Isn’t Enough

**Dr John Ravenscroft and Cathryn Crowle**
RIDBC Renwick Centre, University of Newcastle

We all know that the brain is a very complex structure, and likewise so is the visual system, after all it is estimated that over 40% of the brain is dedicated to visual function. We all have limits to what we can see, and these limits are determined in the brain in a number of different ways. One such way is the reflex subconscious visual system and the other which is based at a higher level processing can be split into two categories. One is responsible for knowing where things are so we can move our bodies around through 3D space and the other is responsible for recognising what we are looking at.

Children with cerebral palsy and low vision from an early age ‘know’ their vision to be normal and do not have a model inside their head that represents the world that is visualised by people that do not have low vision. However, it is critically important that through careful assessment and continuing observation of visual behaviour that we determine what are the visual limitations and thus work within the child’s visual thresholds.

This seminar will discuss the issue of unless we know in detail what the visual thresholds are for each child with cerebral palsy, information which is presented to the child may simply not be seen. And as may parents will testify the failure of the child to respond to this information can easily be misinterpreted as either a lack of ability or even stubborness. Visual threshold though is not just about visual acuity, and visual field loss. We need to determine how well that child can see movement, or stationary objects. We need to examine how that child processes information about moving through the 3D world. If damage has occurred to a particular part of the visual system then we need to understand how the child deals with complexity and crowding.

Children who have poor vision due to damage of the brain can have significant impairment of the recognition processes. This can lead to poor recognition of faces (including mum and dad) and recognition of facial expression, (anger, sad, happiness, proudness etc).

Cortical Visual Impairment is complex and children that are known to have damage to the brain need to be evaluated in such a sturctured way that identifies the visual thresholds of the child. The implications for education, habilitation and dailily living are significant.

The Role of Multidisciplinary Assessment and Management of Dysphagia/Undernutrition and Respiratory and Bone Health in Cerebral Palsy

**Dr Helen Somerville¹, Dr Edward O’Loughlin², Dr Craig Munns³,**
**Dr Fiona Deady⁴, Mrs Anne Lawrence-Slater⁵**
¹Children’s Hospital Westmead & Westmead Hospital, ²Children’s Hospital Westmead, ³Allowah Children’s Hospital

**Background:** Gastro-oesophageal reflux disease (GORD) is common in cerebral palsy (CP) and impacts on health and wellbeing. Undernutrition due to dysphagia and reduced dietary intake is frequent. Improving nutritional status with gastrostomy feeding may improve clinical outcome and quality of life (QoL) in both patients and caregivers.

Recurrent aspiration and suppurative lung disease is common, frequently misdiagnosed as asthma and is a major cause of morbidity and mortality. Aggressive management may reduce the frequency of chest infections in some conditions but there is little evidence in CP.

Osteopaenia and fragility fractures are increasingly recognized in CP. Decreased weight bearing, poor nutrition, anticonvulsants and limited sunlight exposure contribute. Fractures are associated with pain and suffering and may be preventable. Bone health needs to be assessed regularly and managed to improve bone strength and QoL.

Barriers to investigations/interventions include cultural values, mealtime practices and the role of feeding in child nurturing. These factors need to be explored to inform management. Evaluation of feeding related QoL is important as caregivers and professionals do not always agree on the most appropriate action plan.

**Theory:** Multidisciplinary assessment and management of dysphagia/undernutrition and respiratory and bone health will improve health outcomes and QoL.

**Discussion/activity:** The seminar will be divided into 10 min presentations utilising data and case studies from multidisciplinary dysphagia/nutrition (n>500 children and adults) and bone clinics, followed by 30 min of discussion/activity.

**Nutrition:** An overview of nutritional studies including difficulties of accurate nutritional assessment will be addressed with presentation of an algorithm for assessment/monitoring of nutrition.

**Bone health:** Assessment of bone health and fracture risk will include discussion of body protein measurements, bone density studies and maximising lean tissue mass. Management strategies will be presented.

**Respiratory management:** Investigation and management of a subset of patients with GORD and chronic suppurative lung disease will be discussed.

**Barriers:** Societal/cultural factors influencing ‘willingness to treat’ and an approach to clinical decision-making will be presented.

**Clinical implications:** There is a paucity of evidence in the CP literature to inform clinical practice. Further evaluation of outcomes of assessment/intervention of dysphagia/nutritional and bone health problems in children and adults with CP is required. Clinical experience can establish a framework to develop practice guidelines but prospective collaborative clinical studies are required.
Are we Making a Difference? New Ways to Measure Outcomes for People with a Disability and the Communities with Whom They Engage

Dr Erin Wilson1, Dr Nick Hagiliassis2, Ms Kelli Nicola-Richmond2, Ms Anne Mackay2, Dr Robert Campain1

1Scope (vic)/Deakin University, 2Scope (vic)

The notion of ‘outcomes’ in the disability sector has had wide and varied interpretation. The WHO International Classification of Functioning and Disability has supported thinking about outcomes by identifying the broad classifications of function, activity, participation and environment, and identifying the domains of life experience within these. Academics have identified particular outcome domains and developed mechanisms to measure these, most frequently through methods of observation or ‘expert’ report rather than the self-report of people with a disability.

The workshop presents a new outcomes measurement framework, and three associated data collection instruments. The framework has been developed following an extensive literature review both within the disability fields and other human services related areas. Data collection tools have been developed based on an emancipatory research methodology that seeks to privilege the self-report and experiences of people with a disability. In particular, the three data collection instruments focus on collecting data about 1) the outcomes and impacts of services on a range of life or citizenship domains 2) the outcomes of services and supports responding to person directed goal setting and 3) the outcomes of person centred planning. These tools have been trialed in a range of service contexts including both adult and early intervention services. Data from these trial is available for discussion.

Workshop process: Presenters will explain the conceptual and theoretical underpinnings of this approach to outcomes measurement and compare and contrast with other published approaches. The workshop will include a focus on unpacking the confusion in disability services about outcomes measurement and specifically explain the difference between outcomes, outputs, and process or quality practice indicators (using definitions currently in use by the Australian government).

Presenters will explain the outcomes framework and each of the three data collection instruments including discussion about the limitations and strengths of each instrument, and their design principles. Finally, participants will engage in identifying outcome indicators for their own organisational or practice contexts as well as mapping the data available that may evidence outcomes in these areas.

Single Event Multi-Level Chemoneurolysis with Botulinum Toxin A and Phenol for Children with Spastic Cerebral Palsy

Dr Heakyung Kim1, Dr Zeeihn Lee2

1The Children’s Hospital of Philadelphia, 2The Children’s Hospital of Philadelphia/Dept. of Rehabilitation Medicine, Catholic University of Daegu, Daegu, Korea

Theory: Spasticity interferes with motor development and function in children. During the past 20 years, botulinum toxin has enabled the revolution of spasticity management from “invasive” to “less invasive” and from “management” to “preventive management” by equalizing growth between bone and spastic muscles that grow the comparatively slower than bone due to spasticity. The evidence for the safety and efficacy of botulinum toxin A (BTX-A) in the management of spasticity has made its use preferable to that of phenol. However it has been difficult to cover all the multiple spastic muscles with BTX-A only of patients with multilevel spasticity due to dosing limitations.

Single event multi-level chemoneurolysis (SEMLC) is designed to target multiple spastic muscles, using both BTX-A and phenol in a single procedure. By using a multi-level, multi-limb approach, a child’s overall function can be optimized in a single event, rather than limiting the focus of an intervention to a single problematic muscle or limb.

This powerful, less invasive therapy-SEMLC during childhood improves quality of life (QOL) by improving function and potentially decreasing the necessity of multiple orthopedic surgery. SEMLC is most effective when used in conjunction with comprehensive rehabilitation services, especially for strengthening rather than stretching purpose.

The evidence for the safety and efficacy of botulinum toxin A and Phenol, localization will be described as well as post-SEMLC therapy. The session will review concepts in use of SEMLC with BTX-A and Phenol. Complete course of SEMLC including design of SEMLC, dosing of botulinum toxin A and Phenol, localization will be described as well as post-SEMLC therapy.

Practice Intervention Plan: After the lectures for 70 minutes, the video presentation will be given to the attendees for practicing how to design SEMLC for children with diffuse spasticity. Presenters will review the attendees’ SEMLC plan with them for 30 minutes. 20 minutes will be for questions and answers.

Comparison With Expert Plan: We will discuss the basic pharmacology of BTX-A and phenol and physiology of spastic muscles. We will discuss dosing, sedation, localization (nerve stimulator, ultrasound or EMG guidance vs. muscle anatomy), and dilution to optimize the effects of the injections. Post SEMLC therapy will be discussed.

Clinical Implication: Upon completion, attendees will be able to discuss the importance of timely, well planned SEMLC and the continuum of care for children with diffuse spasticity. Early monitoring and spasticity management with SEMLC can enable young children to maximize their developmental, functional potentials and QOL.
Critical Issues in the Use of Ultrasound of Muscles in Children with Cerebral Palsy

Dr. Steffen Berweck1, Dr. A. Sebastian Schroeder1, Dr. Kristina Huss1, Prof. Volker Mall2, Prof. Florian Heineni1
1Hauners’ Children’s Hospital, Munich University, 2Children’s Hospital, Freiburg University

Theory: Ultrasound evolves as an increasingly used methodology in Neurology and Neuropediatrics. Here we focus on possibilities, limitations, unanswered questions and the practical approach when using ultrasound to investigate the muscle and to inject botulinum toxin (BoNT) in patients with cerebral palsy (CP). Within ten points we will highlight and discuss the current knowledge and state of the art approach:

1) Technical requirements
2) Controversies about muscle pathology in children with CP
3) Identification of muscles and motor end plates – practical approach and how to deal with limitations
4) Distribution & diffusion of BoNT within the muscle – what can we expect to learn from ultrasound?
5) Accuracy of injection – clinically meaningful?
6) A needle in a haystack? - how to proceed with needle and transducer when injecting BoNT
7) Information beyond control of injections – what can ultrasound offer in individual patients?
8) Pitfalls using ultrasound – clinical examples
9) How to start practice? – Aspects of learning and training
10) Future perspectives

Video examples will be presented especially in section 3, 4, 6, 7, 8, 9.

The goal of the course is 1. to critically appraise drawbacks and opportunities of ultrasound and 2. to assist to start or elaborate practice.

Video Workshop on Upper Limb Assessment and Treatment for Clinical Practice

Mrs Kylie Aroyan1, Ms Mary-Clare Waugh1, MS Ruth Evans3
1The Children’s Hospital at Westmead, 2Staff Specialist, 3Occupational Therapist

Neurological upper limb management options today include occupational therapy, medical and surgical treatments. Appropriate treatment choices and positive outcomes depend on correct identification of the impairments and their functional impact on activity and participation. Occupational therapy interventions such as constraint induced therapy, bimanual training, casting, splinting, goal directed motor learning can be effectively combined with medical interventions such as botulinum toxin injections, oral medications and or surgery.

This video based workshop will focus on upper limb assessment and treatment for use in clinical practice.

The workshop will cover assessment of spasticity, dystonia, weakness, selective motor control and sensation. Additional factors impacting on function such as mirror movements, developmental disregard (neglect), IQ and dexterity will be discussed. Identifying the ideal treatment framework based on assessment and current available evidence will be highlighted with videos of multidisciplinary treatment examples.

Target Audience: Occupational Therapists, Physiotherapists, Paediatricians, Rehabilitation Physicians, Clinicians working with children with cerebral palsy

Four key learning areas:

1) Identification of the specific UL impairment eg spasticity, dystonia, selective motor control, sensation
2) Functional impact and classification of the UL impairment eg Manual Abilities Classification System, Modified House Scale
3) Evidence based treatment options – OT, medical, surgical, botulinum toxin, splinting, Constraint Induced Therapy.
4) Clinical application of 1, 2, 3. Who should have what?
Early Clinical Markers of Brain Damage: Contribution of the Amiel-Tison Neurological Assessment

Prof Claudine Amiel-Tison
Port-Royal Hospital and Paris V University

Theory: Most of the recent follow-up studies on high risk infants rely on developmental and functional measurements. These measures are known to have low predictive validity with respect to long term outcome, especially when learning difficulties and other mild developmental disabilities are concerned. Therefore, researchers as well as families are in a “wait and see” situation which may lead to significant delays in intervention. The vanishing character of the so-called “transient dystonia” as well as the lack of consensus in the definition of “soft signs” may have contributed to the progressive loss of interest in the neurological assessment, often seen as being imprecise and time consuming.

Activity: Our seminar will address the challenge of defining the best early neurological markers which should be used in association with developmental and functional measurements to improve the identification of infants who will present late emergent developmental disabilities. In this perspective, the Amiel-Tison Neurological Assessment (ATNA) which has been extended to be applied from birth to 6 years of age with the same methodology will be presented. The physiopathological framework will be discussed to justify the recent reorganization of the items in favour of the ones testing the integrity of the upper brain structures. In fact, the ATNA remains largely traditional in nature with elicitation of deep tendon reflexes, primitive reflexes, and postural reactions. It also includes unique features related to cranial suture status and passive axial tone. The scoring system is maturation-dependent. Based on an analytical approach, symptomatic clusters of early neurological and cranial signs have been identified, allowing categorization from disabling cerebral palsy to mild neuromotor impairments. Recent studies support the construct validity of this categorization which follows a spectrum from severe to mild impairments. Furthermore, significant correlations have been demonstrated between the neurological status at 2 years and the concomitant developmental performances as well as with later intellectual performances at school age, supporting the very good criterion validity of the assessment. Finally, recent reliability studies show that the ATNA which takes less than 10 minutes to perform, is easy to learn and to use without certification for universal surveillance.

Clinical Implications: The ATNA provides early and permanent markers that can be tracked up to school age. Therefore, it allows anticipation in the neuromotor domain as well as in other domains of cerebral function. Such an early clinical identification of brain damage is pivotal to any accurate early intervention planning.

New Opportunities in Postural Alignment: Carbon Composite AFO and New Theories for a VAHO

Mrs. Jopi Siirtola, Mr. Brett Boudin
Orthotic Specialists Inc.

Theory: A variable abduction hip orthosis and a carbon composite dynamic response floor reaction ankle foot orthosis provide new opportunities to achieve postural alignment, positioning goals, and controlled joint mobility in combination with resisted dynamic motion for improvement in function of pathological gait.

Discussions: Advances in technology of materials, biomechanical analysis, and our understanding of orthopedic and neurologic conditions opens new doors every day to improve the design of orthoses and the contribution they can offer toward achieving the treatment goals for management of cerebral palsy. These advances have guided us to shift our clinical evaluation and treatment from a narrow focus of one joint segment (such as just the foot and ankle) to a holistic focus of the entire body mechanics. When designing or considering an orthosis one must consider multiple factors such as: ERD/IRD biomechanical models, hypertonic vs. hypotonic muscle tone, proprioception, and potential for ambulation vs. postural control. Our goal should remain that orthosis consideration must provide the maximum functional benefit with the minimum orthotic intervention.

From the first AFO (described in 1958) evolved the FRAFO (Floor Reaction AFO), TRAFO (Tone reducing AFOs), UCBL (University California Berkeley Laboratories), Articulating AFOs, SMO (Supra-malleolar Orthosis), and SAFO (Soft AFO). More recently, a carbon composite dynamic response floor reaction AFO when used in conjunction with sound biomechanical foot/ankle control has found to add a new dimension to encourage functional gait. The extensive variety of designs underscores the importance of understanding each design’s advantages and disadvantages and how the positioning for the foot contributes to whole body function in addition to foot and ankle stability. Hip abduction orthoses may improve stability and sitting balance by increasing the size of the support area, either in combination with a spinal orthosis or by encouraging independent control for the position of the center of mass of the trunk. A VAHO (Variable Hip Abduction Orthosis) provides required abduction for pelvic stability to offer enhanced cervical and spinal posture during sitting and standing, while helping to reduce the negative affects of excessive adduction whether sitting, standing, or walking. Roslyn Boyd, et al, reported “There was a positive delay in the progression to surgery for BTX-A and hip bracing [VAHO] in the conservative management of hip displacement compared to standard conservative management.”

Clinical Implications: Multiple case studies will be presented showing AFO and Hip Orthosis selection and results of the selections for a group of children with cerebral palsy including representations of spastic, athetoid, and ataxic cerebral palsy, including hemiplegic, diplegic, and quadriplegic distributions.
Advanced Therapeutic Orthotic Management Techniques for the Child with Spastic Cerebral Palsy

Mr Mark DeHarde¹, Mr Greg Kneebone²

¹Ultraflex Systems, ²Orthopaedic Appliances

Theory: Children with spastic cerebral palsy have altered musculoskeletal development in part due to the deforming forces of spasticity. Spasticity management is a comprehensive approach including therapy, casting, pharmacology and surgery. One critical aim of most approaches is to maintain muscle extensibility necessary for function. Therapy's impact is unfortunately limited by clinic and staff time. Casting can increase range of motion temporarily. Pharmacology, like Botulinum Toxin A, reduces spasticity temporarily, but may also weaken muscles. Soft tissue surgery increases range, but muscle extensibility may be lost again. All approaches have limited impact on the deforming forces of spasticity that are present 24 hours per day.

It is theorized that by adding significant therapeutic growth stimulus and duration to the growing spastic muscle with advanced orthotic management techniques, muscle extensibility can be maintained and improved, keeping pace with the growth of the long bones of the upper and lower extremity. Controlled dynamic stimulus at the end range of muscle extensibility may condition the muscle to accept more force and velocity during movement and stimulate growth to keep pace with the long bones, more closely modelling normal musculoskeletal growth and development.

Practice Intervention Plan: Techniques for evaluation of the R1 ("first angle of catch") and R2 ("torque range of motion") in both the upper and lower extremity will be reviewed along with their implications for the design of advanced therapeutic orthoses that will enable four to eight hours per day of muscle stimulus for growth for extended durations of six to twelve months. EO, EWHO, KAFO and AFO designs will be reviewed and recommended based on evaluation of R1 and R2 values. Case examples will be reviewed for one upper and one lower extremity patient.

Comparison with Expert Plan: Integration of advanced therapeutic orthotic management with existing comprehensive treatment plans including surgery, botulinum toxin A, casting and therapy will be reviewed. General treatment intervention timelines of the child with spastic cerebral palsy from 3–14 years old will be reviewed for periods of advanced therapeutic orthotic management.

Clinical Implications: The anecdotal and case series evidence for advanced therapeutic orthotic management continues to build and is further validated by larger retrospective and prospective studies. It may offer a conservative and complementary standard of care for the comprehensive management of the child with spastic cerebral palsy. Advanced therapeutic orthotic management may extend the benefits of therapy, casting, botulinum toxin A and surgery.

Living a Life with Cerebral Palsy Pride; The Theoretical, Sociological Frame Work and Its Significance Impacting on Disability Community

Prof Toru Funui¹, Ms Masayo Funui¹, Mr Kyoharu Shiraishi³

¹Osaka Kawasaki Rehabilitation University, Japan, ²Japanese Cerebral Palised Association, ³Office IL independent living center, Fukushima, Japan.

Theory: Historically, individuals with cerebral palsy have been contributing to disability community as pioneers of independent living and community choice of all life stages for people with disabilities. Over a few decades, a hierarchal ableism existed, not only within the general population but amongst people with disabilities. In nursing homes, special education and rehabilitation facilities, all interventions relied upon the ableism. This system fosters a sentiment suggesting that the more severely disabled segment of society had less worth than those with more subtle disabilities. In particular, people with CP, were consider to have very severe disabilities and were discriminated against most.

By an initiative of three young adults with CP, “Green Grass Association” formally started its activities in November 3, 1957 in Tokyo. In post-War period, reconstruction of national economy was a supreme priority to the government and the industry. Statutory measures for the disabled in this country were only for those who were as vocationally rehabilitable, and people with regarded severe disability from childhood such as CP were left to private maintenance by their families. Since sixties, more and more members of the Green Grass left their parental homes or institutions, and started independent living in community on public assistance, with constant dispute with local government workers who intended to cut benefit and push them back to family maintenance. The number of married couples among the members exceeded fifty already in 1966.

Soon it became clear to us that many members of the CP group were not eligible for tiny disablement benefit in newly enacted 1959 National Pension System, and they devoted to change it. They also had faced health issues of adulthood life in general community, and potential problems for successful aging of people with disability. Hence they had corabolated with researchers and physicians from 1986 in surveing their clleagues and friends. That is the reason why Japanese Cerebral Palised Association (JCP), a group driven to promote independence and equality for those living with the most severe disabilities.

Implication: Consumer perspective on health care can be an optimal concept in secondary problems among adults with CP.
Learning for Life
Ms Claire Cotter, Ms Lynn Carter, Ms Gayle Porter
Cerebral Palsy Education Centre
Families who are raising a child with severe cerebral palsy and complex communication needs (GMFCS 4 or 5) face lifelong challenges to both manage their child and their disability and to work towards meaningful goals. Young people with cerebral palsy can have limited access to a range of school options, leisure, and social networks (Eriksson & Granlund, 2004). The health status of these young people is frequently at risk due to secondary musculoskeletal problems, pain (Engel et al., 2005) and consequential debilitating physical and mental health issues. (Vami et al., 2005).

There has been a shift beyond therapies that try to fix the problem, towards approaches that promote activity and participation. (Rosenbaum & Skelton, 2007).

Families require a service which has a sound philosophical base for learning and inclusion; one that is capable of incorporating a range of current knowledge and strategies to facilitate participation, learning and development for each child and family.

The intervention and service provision model teaches children:
- independent communication to say all the things they want to say
- use technology independently
- an understanding of how their body works, how to move and function either independently or with the assistance of one adult

Video of a 15 year old student who has complex communication needs and attends her local school will be used to describe the service provision which enables her current level of participation and function with reference to the implications for service providers and practitioners.

Video of a 2-year-old will be explored in an interactive way for participants to problem solve and address the multiplicity of challenges to enable successful outcomes for the child and family.

Clinical Implications:
- a whole person orientation to services
- the vital role of families
- the importance of utilizing multipronged strategies to encourage participation aimed not only at the child, but at the family and environmental levels. (Law et al 2006).

Reflection: Encouraging and Enabling People with Cerebral Palsy to Narrate Their Stories
Ms Angela Dew1, Mr David Trembath1, Ms Leigha Dark1, Prof Susan Balandin2
1The University of Sydney, Australia, 2Molde University College, Norway

Theory: Having a strong sense of identity is an important aspect of adulthood. Reflection on experiences, achievements, and mistakes is an important part of identity development and indeed maturity. Reflection takes many forms and includes narratives which may be jointly constructed with others. Narratives are part of our culture and assist people to develop and define their place in the world and make meaning of their experiences. Narratives provide a window into the lived experiences of individuals and groups. Currently the use of narratives in research exploring the experiences of adults with cerebral palsy (CP) is rare.

Interactive/Discussion/Activity: In their research and clinical practice the authors use narrative methodologies to explore a range of life experiences of adults with CP, including those with complex communication needs. Many participants in recent research projects have difficulty constructing narratives that involve reflection. Participants with complex communication needs may experience additional problems if they do not have access to adequate augmentative communication systems or if they lack appropriate vocabulary items. Furthermore, adults with CP may have had limited opportunities in childhood to develop the language skills necessary for reflecting on and then narrating their experiences and feelings. Indeed people with disability are often asked only questions for which the answers are known already.

In this seminar we will provide an overview of our research using examples from interviews with adults with CP that illustrate some of the problems and solutions with reflection and narrative constructs. Using a range of activities including small group discussion, seminar participants will:
- Use their own experiences to understand how reflection informs narratives;
- Discuss the use of reflection and how reflective skills can be developed;
- Consider why reflection and narrative skills are important for the development of appropriate services and policies that meet the needs of adults with cerebral palsy.

Clinical Implications: Adults with cerebral palsy are encouraged and wish to live as independently as possible within the community. The ability to reflect upon and narrate experiences and worldviews are important for both participation and for a sense of identity and well-being. In this seminar participants will develop an understanding of the importance of reflection and narratives for people with cerebral palsy and how these skills can be developed and facilitated.
Promoting Fitness and Lifelong Physical Activity in Adults with Cerebral Palsy: Project ACT NOW

Dr. Debbie Thorpe
The University of North Carolina at Chapel Hill

Theory: The most prevalent condition among adults with developmental disabilities is cerebral palsy (CP). Although CP is considered a childhood disorder, 60% of persons with CP in the United States are over the age of fifteen and life expectancy is related to degree of severity. Secondary impairments in adults include osteoarthritis, loss of flexibility, muscle weakness, osteoporosis, musculoskeletal pain, and diminished cardiovascular fitness. The prevalence, causes, consequences, and severity of these secondary impairments and their relationship to loss of mobility and health related quality of life (HRQL) are not well understood. There is a paucity of evidence addressing the efficacy of current interventions to address mobility, activity, and health related quality of life (HRQL) in adults with CP. To address these limitations in evidenced-based practice, the specific aims of Project ACT NOW are to: (1a) Characterize secondary impairments and non-impairment-related factors in a cohort of adults with CP. (1b) Describe the relationships among secondary impairments, HRQL and activity and mobility levels in a cohort of adults with CP. (2) Determine the feasibility of an aquatic exercise intervention aimed at diminishing the severity of select secondary impairments and improving HRQL and activity level. In Aims 1a and 1b we will collect demographic information and measure body composition, strength, pain, cardiorespiratory fitness and health related quality of life (HRQL) in adults with CP. To address these limitations in evidenced-based practice, the specific aims of Project ACT NOW are to: (1a) Characterize secondary impairments and non-impairment-related factors in a cohort of adults with CP. (1b) Describe the relationships among secondary impairments, HRQL and activity and mobility levels in a cohort of adults with CP. (2) Determine the feasibility of an aquatic exercise intervention aimed at diminishing the severity of select secondary impairments and improving HRQL and activity level. In Aims 1a and 1b we will collect demographic information and measure body composition, strength, pain, cardiorespiratory fitness and health related quality of life (HRQL) in adults with CP.

Interactive Discussions/Activity: Participants will:
- Discuss current evidence on fitness and health outcomes for adults with CP
- Discuss methodological issues in developing community-based fitness programs (CBFP) to promote fitness and wellness in adults with CP, using Project ACT NOW as a model.
- Recognize personal and environmental factors that may act as facilitators or barriers to participation in fitness programs for adults with CP.
- Group discussion of a case example.

Clinical Implications: We expect that this community-based aquatic program will help to decrease the negative impact of secondary impairments and increase overall wellness in these adults with CP. A long-term goal is to better understand the effects of impairments experienced by adults with CP and to design, test, and implement targeted interventions that will improve their function and quality of life.

Rehabilitation Services for Children with Cerebral Palsy in Alberta, Canada

Dr. Jenna Demahy, Dr. Lynne Ray, Dr. Joyce Magill-Evans
1 Department of Physical Therapy, University of Alberta, 2 Faculty of Nursing, University of Alberta, 3 Department of Health Services, University of Alberta, 4 School of Public Health/Faculty of Arts, University of Alberta, 5 Faculty of Rehabilitation Medicine, University of Alberta, 6 Department of Pediatrics, Faculty of Medicine, University of Alberta

Background: Contemporary literature discussing rehabilitation services for children with cerebral palsy emphasizes the principles of: 1) family-centered service (FCS), 2) functional therapy goals, and 3) transition planning when children move to different programs.

Objectives: To determine the extent to which these 3 principles are present in programs providing occupational therapy (OT) and physical therapy (PT) services for children with cerebral palsy in Alberta.

Design: Mixed methods design with both quantitative and qualitative analyses.

Participants/Setting: Fifty-nine pediatric programs representing both rural and urban areas. In total, 37 program managers, 54 therapists (22 OTs, 32 PTs) and 39 parents provided information. Two representatives from each of the Ministries of Children & Youth Services, Health & Wellness, and Education participated in individual interviews.

Materials/Methods: Trained interviewers met individually with program managers and therapists for a one-hour interview. Families attended focus groups in their geographical region. Questions related to three areas:

1) perceptions of FCS and how the program delivery reflects FCS,
2) how goals for therapy are set, and
3) issues related to transition planning when children move from one program to another.

Results:
1) Family-centered Services (FCS): Therapists are committed to the FCS model and acknowledge that true FCS is challenging. Most therapists identified collaboration with families as an important FCS concept, but collaboration was often described as a one-way flow of information from therapist to families. Parents shared that parent-to-parent support is important, but opportunities for this interaction are limited.

2) Functional Goals: Therapists have integrated the concept of functional goals into their practice. Programs do not have standardized goal setting processes. Thus families in the same program may experience different goal setting processes depending on a therapist’s approach. Families welcome input from therapists about goals, particularly when their children are young.

3) Transition Planning: Transition to full-time school (6 years) often occurs without parents having information about all the program options available. Transition when leaving school (18 years) is challenging. Transition between programs is largely informal with the assumption that information sharing is sufficient. Health policy documents value both FCS and transition planning but do not give specific guidelines for implementation.

Conclusions/Clinical Implications: The three concepts are visible in current service delivery for children with cerebral palsy. Service could be enhanced with more standardized participation by parents and with specific policy guidelines.
Rehabilitative Everyday Life to Support the Child

Mrs Salla Sipari1, Doctor Matti Koivikko2
1Helsinki Metropolia University of Applied Sciences, 2Tampere University Hospital, Department of Paediatric Neurology

Background: The aim of the study was to standardize and promote the culture of collaboration in education and rehabilitation of children with special needs. The paradigms of education and rehabilitation have changed and now emphasize the ecological model and empowerment, but education and rehabilitation activities are nevertheless scattered and based on different professional policies. The study was based on the way the substance, arguments and whole of a common activity had been formed rather than on different means to carry out collaboration.

The study determined nationally the collaboration of education and rehabilitation experts in multidisciplinary and multi-organizational regional level networks.

Objectives: The specific aims of the study were: (1) How do dimensions of collaboration appear along with their arguments and conflicts in experts discussions? (2) How were meanings produced from dimensions of collaboration in experts discussions? (3) How did lines of thinking and policies change in experts discussions?

Design: The study data comprised of experts group interviews that were carried out in two different parts. First experts discussed case examples (children with CP) that had been told by children’s parents and next they deepened the results out in two different parts. First experts discussed case examples (children with CP) that had been told by children’s parents and next they deepened the results.

Participants: There were 11 groups (I part n=66, II part n=57). Experts were paediatricians n=12, therapists n=24, counselor of rehabilitation n =9, special education n =6, other n= 11 and parents of children with special needs.

Methods: Data analysis was based on social constructionism and discourse analysis.

Results: In experts discussions the collaboration of education and rehabilitation formed a multiple entity of meanings, where organizing rehabilitative everyday life, policies and values are in dynamic interaction. Individuality and solidarity, specialty and normality were accents discussed based on the context. The importance to define contiguously family, service system and attitudes was emphasized in the results, because there were different visions of how these supported the child’s participation and meaningful activity.

Conclusions: Arranging everyday life to be rehabilitative demands a local plan and forming a functional network for the child. The results indicated the profound importance of discussion in order for collaboration to succeed.

Effects of Long-Term Intensive Rehabilitation in Children with Cerebral Palsy: Our View on the Neuronal Group Selection Theory

M.D. MSc Svetislav Polovina1, M.D. MSc Tanja Škori2, M.D.PhD Tajana Prološ3, M.D.MSc Andrea Polovina4
1Polyclinic for Physical Medicine and Rehabilitation, 2Clinical Hospital Center Zagreb, Zagreb, Croatia, 3University Hospital Osijek, Osijek, Croatia, 4University Hospital “Sestre milosrdnice”, Zagreb, Croatia

Background: Cerebral palsy (CP) is one of major forms of developmental disorders. There are different approaches and controversies in rehabilitation treatment. The Neuronal Group Selection theory could provide theoretical explanation of self developed method.

Objectives: The aim of this ongoing study is to evaluate long term impact of intensive and continuously performed rehabilitation on motor autonomy level in children with CP.

Methods: Motor autonomy levels, defined according to the Gross Motor Function Classification System (GMFCS) and Gross Motor Function Measure (GMFM), were analysed in 24 children (11 male and 13 female) with CP at the beginning of the study and at the last visit. Patients were divided in two groups: one consisted of patients treated only with physiotherapy (N1 =12) while the other consisted of patients treated with physiotherapy combined with orthopaedic surgery and/or botulinum toxin treatment (N2 =12). The median age at the first assessment and consequently beginning of intensive rehabilitation was 19.5 months (min=12, max=55) and the median duration of rehabilitation was 56.5 months (min=23, max=99). In all children, rehabilitation was performed by educated parents, continuously, several times per day. The complex rehabilitation treatment used consisted of a self-developed method, incorporating selected elements of therapy according to Bobath and Vojta. GMFCS analyses at the first visit include the use of assistive mobility devices in children who already used them while GMFCS analyses at the last visit exclude any assistive mobility devices because they were not used during rehabilitation. The treatment was individually adapted to patients.

Results: At the first assessment, the number of children (N1+N2) per GMFCS Level was as follows: Level II-one, Level III-five, Level IV-eight, Level V-four, while at the last visit: Level I-two, Level II-three, Level III-eight, Level IV-seven, Level V-four. The GMFCS Levels were statistically significantly higher before rehabilitation was performed. During rehabilitation GMFM scores in majority of patients have increased above expected for initial GMFCS level. Groups did not differ significantly either according to age, sex distribution, duration of rehabilitation or GMFCS Levels (p>0.05). In both groups, significantly higher GMFCS Levels were observed at the beginning of the study in comparison to Levels observed at the last visit (p1=0.043, p2=0.018).

Conclusion: Intensive rehabilitation had significant influence on motor improvement in children with CP.
Hand Function in Relation to Underlying Brain Lesion and Cortical Organization in Children with Unilateral Spastic Cerebral Palsy

PT: MSc Linda Holmstrom1, MD, PhD Brigitte Vollmer2, MD Kristina Tedoff3, MD Mominal Islam4, MD, PhD Jonas KE Persson5, OT, PhD Ann-Christin Eliasson1

1Department of Woman and Child Health, Karolinska Institutet, Stockholm, Sweden, 2Neurophysiology Unit, Karolinska University Hospital, Stockholm, Sweden

Background: Motor outcome in unilateral cerebral palsy (CP) is likely to be influenced by location, extent and timing of the underlying brain lesion. Previous research suggests that functional re-organization is possible, i.e. the undamaged hemisphere can take over functions from the injured hemisphere. However, the relationships between underlying brain lesion, organization of motor projections, and hand function is still largely unexplored.

Objectives: To investigate relationships between hand function, brain lesion and organization of motor projections in children with unilateral CP.

Design: A multiple case study.

Methods: Sixteen children (9 males, 7 females) with unilateral CP mean age 11.9 years (SD 2.4) participated in the study. Conventional structural T1 and T2-weighted magnetic resonance imaging (MRI) was used to assess type, location and extent of lesions. Single pulse Transcranial Magnetic Stimulation (TMS) provided information on organization of motor projections. Motor evoked potentials (MEPs) were recorded via surface EMG from M. abductor pollicis brevis. The hemispheres were stimulated to find the optimal point that elicited reproducible MEPs. Absence of ipsilateral MEPs was recorded by increasing stimulator output to 100% if necessary. Hand function was assessed with the MACS, Box&Blocks test, and Assisting Hand Assessment.

Results: Lesions identified on visual inspection of MR images ranged from periventricular white matter lesions (n=6) to grey matter lesions (n=5). Lesions affecting both white and grey matter (n=4) were also seen. TMS showed contralateral projections, ipsilateral projections and a mixed projection pattern in 5 subjects respectively. Children with Periventricular white matter lesions and no grey matter involvement had the best performance on the functional tests. Children with ipsilateral projections independent of lesion type showed a poorer performance.

Conclusions/Clinical Implications: This study provides clinically useful information for therapists and physicians for prediction of outcome.

Potential of Neurophysiological Measures to Better Understand Hand Function in Young People with Hemiplegia Cerebral Palsy

Dr Anna Mackey1, Dr Cathy Stinear2, Dr J John Wilson3, A’Prof Winston Byblow4, A’Prof Susan Stott6

1Dept of Surgery, University of Auckland, 2Dept of Sport & Exercise Science, University of Auckland, 3Auckland Radiology Group, 4Dept of Sport & Exercise Science, University of Auckland, 5Dept of Surgery, University of Auckland

Background: The type of adaptive brain motor pathway re-organisation following an initial insult to the developing brain may relate to the upper limb functional deficits seen in individuals with hemiplegia cerebral palsy. Information from parameters derived from functional Magnetic Resonance Imaging (fMRI) and Transcranial Magnetic Stimulation may provide information to aid understanding and management for the upper limb.

Objectives: Investigate the association between hand function and brain organisation in subjects with hemiplegia.

Design: Descriptive study

Participants/Setting: 18 subjects with hemiplegia (mean age 15.5 years; 10 male; 10 right hemiplegia).

Materials/Methods: Hand function assessed by bimanual (Manual Ability Classification System (MACS)) and unimanual measures (Melbourne Assessment; Box & Block; Purdue Pegboard). Subjects underwent structural and functional Magnetic Resonance (fMRI) and diffusion tractography imaging (General Electric, HDx 3 Tesla scanner), completing hand motor grip-release tasks to assess Blood Oxygen Level Dependent (BOLD) activation and fractional anisotropy (FA). Reduced FA values can indicate a disrupted corticospinal tract. Significance was tested using Fisher’s exact test, comparing fMRI findings to median clinical scores (p<0.05).

Results: MRI lesions were classified as periventricular (n=10); cortical/sub-cortical (n=3); cortical malformations (n=4) or normal (n=1). Eight subjects were MACS level I (handle objects easily); median Melbourne score 98% (range 89–100%). Ten subjects were MACS level II (handles most objects, with reduced quality); median Melbourne score 68% (range 41–93%). MACS level and Melbourne score were strongly associated (p=0.0004). Subjects who performed better on the unimanual Box & Block task (>20 blocks in 60 seconds with affected hand) were more likely to show normal (contralateral hemisphere) BOLD activation during the affected hand task (p=0.02). There was a positive relationship between higher scores on other unimanual tasks and the presence of normal BOLD activation, with 8/9 subjects who scored >87% on the Melbourne and 9/10 subjects who scored >2 pegs on Purdue having appropriate BOLD activation, though this did not reach significance (Melbourne: p=0.2; Purdue p=0.1). 10 subjects had normal FA values, with 8 subjects having reduced FA values. There was no association between MACS functional level and presence of normal FA within the white matter tracts (p=0.63).

Conclusions/Clinical Implications: Functional MRI measures have potential to validate clinical measures for subjects with cerebral palsy, with associations found between unimanual clinical assessments and fMRI findings. Further investigation is required on the use of diffusion tractography as a predictive tool for determining hand function and planning treatment options.
Dissociated Hand – Foot Reorganization in Congenital Malformation of Cortical Development: Different Brain Reorganization Pattern for Different Homolateral Somatotopical Area's

M.D. Marijke Eyssen1, Prof. M.D. Paul De Cock2, Prof. M.D. Stefan Sunaert2
1Catholic University Leuven Belgium; Federal Health Care knowledge Centre Belgium, 2University Hospitals and Catholic University Leuven Belgium

Objective & Methods: Recent studies, evaluating hand function in congenital hemiplegia, demonstrated that motor reorganization involving ipsilateral corticospinal tracts occurs, but congruent sensory reorganisation towards the ipsilateral, non-lesional hemisphere is uncommon, thus exhibiting sensory-motor dissociation (Guzzetta A et al. 2007, Wilke M et al. 2008).

The present study further describes the sensorimotor reorganization potential by presenting a 13-year old girl with a bilateral congenital brain malformation, but clinically a left hemiplegia most pronounced in the lower limb. Clinical evaluation is compared with results of 3-Tesla fMRI using a right versus left side and upper versus lower limb motor and sensory paradigm.

Results: The girl presented with a mild left hemiparesis most prominent in her leg, including an equinovarus of the foot (GMFCS level 1). Fine touch was normal bilateral; proprioception was normal for the right big toe but disturbed for the left. Partial spontaneous use of the left hand was reported (House Classification 7). Upper limb fine touch was normal bilaterally but proprioception, 2-point discrimination and stereognosis were disturbed at the left side.

Conventional MRI depicted a schizencephalic cleft in the left hemisphere and bilateral fronto-parietal polymicrogyria.

For the fMRI motor paradigm, the left hand knob was difficult to recognize due to the schizencephaly; the main activation by the right hand movement was considered to be the primary sensorimotor cortex (SM1) for the left hemisphere. Movement of the left hand caused some ipsilateral activation of SM1 and a strong contralateral activation at the hand knob in the right hemisphere, partially including the polymicrogyria.

Right foot movements activated left SM1. Left foot movements elicited no activation in the right hemisphere; however, prominent activity in the ipsilateral SM1 was observed, and additional activation of left instead of right lentiform nucleus and thalamus.

For the sensory task, stimulation of both hands or the right foot projected to SM1 of the expected hemisphere. For the left foot, left SM1 was involved and cerebellar projections were found contralateral to the expected side.

Conclusion: Imaging results suggest a dissociated upper-lower limb brain reorganization in very early brain injury, corresponding to asymmetric upper-lower limb functional impairment. Apparently, for motor and for tactile sensory activation, intra- and interhemispheric reorganization can occur together. This patient demonstrates that probably the brain can handle separately different somatotopical regions in one area, in order to get maximal functional recovery for each region. The findings of this case-study remain to be confirmed.

Health Status More Than Ten Years After Selective Dorsal Rhizotomy

Dr Kristie Bjornson1, Dr John McLaughlin2, Ana Kobayashi2, Vanessa White3
1Pediatrics/University of Washington, Seattle, WA, 2Children’s Hospital & Regional Medical Center, Seattle, WA, 3UNC, Chapel Hill, NC

Background: Selective dorsal rhizotomy (SDR) has been employed for the treatment of spasticity in cerebral palsy (CP) for over 20 years. Short-term results have been extensively reported in clinical series and randomized trials. A meta-analysis of three randomized trials supported the view that SDR not only reduces spasticity, but, when combined with physical therapy (PT) and other rehabilitation measures, also improves function. Improved locomotor function has been documented 20 years post SDR. The long term impact on functional health has not been solidly documented.

Objectives: Describe the long term health status of children and youth who have received SDR and intensive PT to a clinical comparison non-SDR cohort.

Design: Clinical cohort comparison

Participants/Setting: Fifty-six of 221 children with spastic cerebral palsy recommended for SDR by a multidisciplinary spasticity management team between 1988 and 1997 at a single tertiary care North American children’s hospital were enrolled. Average age of participants <18 years (n=34, 25 diplegic) at enrollment was 15.4 (4.6), while those > 18 years (n=22, 20 diplegic) was 19.7 (3.1). Age at SDR averaged 7.1 (3.1) and 8.6 (3.2) respectively.

Materials/Methods: The Child Health Questionnaire (CHQ-CF87 or PF50) was used for participants <18 years at enrollment and the SF-36 for those >18. Self-report or parent report was accepted.

Results: No significant differences were noted between SDR and non-SDR groups for bodily pain, family activities, family cohesion, physical function, behavior, general health, cerebellar and mental health (p=.17–91) subscales of the CHQ. There were no significant differences in the SF-36 domains of bodily pain, general health, mental health, physical function and role emotional scores (p=.11 -.80) by treatment group.

Conclusion/Clinical Implications: The results suggest that SDR in childhood does not appear to influence self/report of functional health at 8-10 years follow-up. Data is consistent with the functional outcomes of a randomized control trial of SDR. Potential limitations include sample size, mixed responders and use of generic functional health status measures rather than condition specific outcomes.
Gross Motor Function Development During 10 Years After Selective Dorsal Rhizotomy

Mrs Annika Lundqvist Josenby1, Dr Gun-Britt Jarnlo2, Dr Lena Westbom2, Dr Eva Nordmark2
1Lund University, 2Division of Paediatrics, Department of Clinical Sciences, Lund University, Lund, Sweden

Background: Selective Dorsal Rhizotomy (SDR) is the only intervention that permanently reduces spasticity in children with cerebral palsy. Combined with physiotherapy treatment it has been shown to be beneficial for the development in gross motor function in short-term follow-up. The few published studies on long-term effects have mainly been focusing on the function in the components of body function and body structures according to International Classification of Functioning, Disability and Health (ICF). Long-term follow-ups of gross motor development 10 years after SDR have not been published yet.

Objective: The objective was to study gross motor function capacity measured with Gross Motor Function Measure (GMFM-66) during 10 years postoperatively in children with spastic diplegia undergoing SDR.

Materials/Methods: Thirty children with spastic diplegia, consecutively undergoing SDR-operation during 1993–1998 have regularly been followed by the same team. The children have been assessed at pre- and 6, 12, 18 months, 3, 5 and 10 years postoperatively. Mean age (SD, range) at operation was 4.4 (1.2, 2.5—6.6) years. Preoperatively the children’s gross motor functions were classified according to the Gross Motor Function Classification System (GMFCS) levels: I (n=1), II (n=7), III (n=8), IV (n=13) and V (n=1). Internal review board approval was obtained.

The GMFM-88 assessments were performed GMFM-66 scores were obtained by the Gross Motor Ability Estimator software (GMAE). Non-parametric statistical methods will be used; Friedman’s test to detect change over time and Wilcoxon’s signed rank’s test to detect at what time during follow-up change occurred.

Results: Collection of data are continuing during 2008. The results of changes in gross motor capacity with GMFM-66 over 10 years will be presented for the whole group, subgroups according to GMFCS levels, as well as for individuals.

Conclusion/Clinical Implications: Changes in gross motor capacity during 10 year follow-ups after SDR showed large individual variability in children with spastic diplegia, which is a very heterogeneous group. Most children have improved or maintained their gross motor function capacity; however a few of them showed deterioration over the 10 years. Clinical implication will be further discussed.

Health Status of Caregivers of Children with Cerebral Palsy in Ireland

Ms Marie Byrne1, Ms Deirdre Hurley2, Ms Caitiona Cunningham2
1Central Remedial Clinic, 2Senior Lecturer in UCD School of Physiotherapy

Background: While a “Family-Centered” approach to care is accepted as best practice in the context of childhood disability, it may lead to increased demands on family members by requiring them to be active participants in their child’s care (Law et al., 2005). This may impact upon the physical and mental health of the caregiver (Raina et al., 2005) and therefore needs to be investigated.

Objectives: To establish the health status and Low Back Pain (LBP) prevalence among Caregivers (CGs) of children with CP in Ireland, and to identify vulnerable subgroups.

Design: A cross-sectional postal survey was conducted using a researcher designed questionnaire, in accordance with Dillman’s “Total Design Method” (Dillman, 2000).

Participants/Setting: Male and female CGs (n=312) of 156 children (18 years or under) with varying GMFCS levels of CP, accessed via the physiotherapy database of a clinic specialising in paediatric disability, were included.

Materials/Methods: An 8-page questionnaire, incorporating a demographics section, the SF-36v2.0 health survey (Ware & Kosinski, 1997), and a modified version of the Nordic Back Pain questionnaire (Kuorinka et al., 1987) was circulated. Two questionnaires were sent to each child’s home for the two main CGs to complete. Data were entered into SPSS version 12.0 and responses of the entire CG group were analysed initially, followed by sub-group analysis in line with the study aims.

Results: 161 CGs of 101 children returned questionnaires, giving a response rate of 52%. CGs of children with CP, particularly females, were found to have poorer health than the Irish general population for whom normative data were previously established (Blake et al., 2000). Female CGs had significantly poorer physical (51.3) and mental (42.5) health than male CGs (55.4 and 53.3 respectively, p<0.05). CGs who spent more time caring had significantly poorer mental health (42.9) than those spending less time caring (48.9, p<0.05).

Low Back Pain prevalence was established at 66%, 56% and 26% for lifetime, annual and point prevalence respectively. LBP prevalence did not differ between the subgroups except for a significantly higher annual prevalence among CGs of children in GMFCS level II (70%, p<0.05).

Conclusion/Clinical Implications: Inferior health of CGs of children with CP in Ireland, particularly of females, and higher LBP prevalence, has been established. Service planners need to target vulnerable subgroups of CGs. Future research should further explore potential causes of inferior health with a view to developing appropriate services/strategies.
Assessment of the Relationship with Siblings of Mentally Handicapped Children Who Have Specific Education

PhD. Filiz Arslan, M.Sc. Aysegul Korkmaz
Gulhane Military Medical Academy School of Nursing

Background: Sibling relationships are unique in a number of ways. Siblings of children with disability had greater incidence of behavior problems, withdrawal, and shyness. Somatic, social, affective, and behavioral symptoms in siblings were reported in the literature.

Objectives: This study aims to determine the relationship between the healthy and the mentally handicapped siblings point of view the healthy siblings and their mothers.

Design: This study is descriptive and cross-sectional.

Participants/Setting: The population of the study was consisted of the healthy children with mentally handicapped siblings who have specific education and their mother in the two military specific education and rehabilitation center. The sample of the study was consisted of the healthy siblings between the ages of 7–18 and their mothers who willing to participate in.

Materials/Methods: In collecting data “an information form about the handicapped children and their families”, “The Sibling Problems Questionnaire” and “Schaeffer Sibling Behaviour Rating Scale” were used. In analyzing the data, frequency, medium, standard deviation, student's t test, Mann-Whitney U, Wilcoxon, One way ANOVA, Kruscal Wallis, Spearman test were used.

Results: In this study, it was found that problems experienced by healthy sibling related to handicapped siblings were decreased with increasing education level, increasing siblings number and increasing ages of the healthy siblings. If handicapped siblings have apparent disability in addition to the mental disability, relationships between the healthy and handicapped siblings were affected negatively. It was also determined that mothers perceived relationships between healthy and handicapped siblings more negatively. Birth rank of the healthy siblings, age gap between healthy and handicapped siblings, number of the siblings, diagnosis, level of disability and additional apparent disability of handicapped siblings have affected siblings’ relationship according to some sub scales of the Schaeffer’s Sibling Behavior Rating Scale.

Conclusions/Clinical Implications: in conclusion of this study, obtained results can be used as guide by health professionals during the education and counselling activities for healthy siblings and families of handicapped children. Thus, families of handicapped children can evaluate needs of healthy siblings easily and make some arrangements to solve problems possibly will be experienced by siblings according to siblings characteristics such as age, age gap between siblings, birth rank, level of disability and appearance of disability etc.

The Impact of Caring for a Child with Cerebral Palsy: Quality of Life for Mothers and Fathers

Dr. Elise Davis1, Ms Amy Shelley2, Prof Elizabeth Waters3, Assoc Prof Roslyn Boyd4, Dr Kay Cook2, Ms Elizabeth Casey2, Assoc Prof Dinah Reddihough5
1University of Melbourne, 2Deakin University, 3University of Queensland, 4Royal Children’s Hospital

Background: Although it is expected that caring for a child with cerebral palsy (CP) can impact on the quality of life (QOL) of caregivers, the QOL of carers’ has yet to be adequately examined. The aims of this study are to a) explore the QOL of mothers and fathers of children with CP aged 3–18 years and b) examine whether the impact of caring for a child with CP changes from childhood to adolescence.

Method: A qualitative study was conducted utilising a grounded theory framework. Twenty four mothers and 13 fathers of children and adolescents with CP aged 3–7 years (N=15), 8–12 years (N=10) and 13–18 years (N=12) and with varying levels of impairment (GMFCS level I=1, II=4, II=3, IV=5, V=12) participated in semi-structured interviews about their QOL. The transcripts were analysed to identify issues affecting parental QOL.

Results: There were no differences in parental QOL among sub-groups (i.e., mothers and fathers, age groups, GMFCS levels). Parental QOL ranged across a wide spectrum. Caring for a child with CP affects a parent’s physical wellbeing, social wellbeing, freedom and independence, family wellbeing and financial stability. Parents indicated that they often feel unsupported by the services they access.

Conclusions: Caring for a child with CP can both positively and negatively impact on a parent’s life. There is value for both parents and children if parental concerns and determinants of quality of life are considered in overall program planning and service delivery for children and their families.
Relationship Between Physical Fitness and Gross Motor Capacity in Children and Adolescents with Cerebral Palsy

Dr Olaf Verschuren1, Dr Marjolijn Ketelaar1, Dr Jan Willem Gorter2, Prof Dr Paul Heiders3, Dr Tim Takken4

1Centre of Excellence, Rehabilitation Centre ‘De Hoogstraat’, Utrecht, The Netherlands, 2Canchild Centre for Childhood Disability Research, Institute for Applied Health Sciences, McMaster University, Hamilton, Ontario, Canada, 3Department of Pediatric Physical Therapy & Exercise Physiology, University Hospital for Children and Youth “Het Wilhelmina Kinderziekenhuis” University Medical Centre Utrecht, Utrecht, the Netherlands

Background: A link between low physical fitness and a low functional capacity in children with neuromuscular disorders is suggested in the literature. However, little is known about the relation between specific physical fitness components and the gross motor capacity in children with cerebral palsy (CP).

Objectives: To determine the relationship between physical fitness (aerobic capacity, BMI, short-term muscle power, agility, functional muscle strength) and gross motor capacity in children with CP who are able to walk.

Design: Cross-sectional study.

Participants/Setting: 68 children with CP (Mean age 12.1 years, range 7 to 18 years), classified at Gross Motor Function Classification System (GMFCS) level I or II participated in this study.

Materials/Methods: All participants performed a maximal aerobic exercise test (10-meter Shuttle Run test), a short-term muscle power test (Muscle Power Sprint test), an agility test (10 x 5 meter sprint test) and a functional muscle strength test (30-sec Repetition Maximum) within two weeks. Gross motor capacity was concurrently assessed using dimension E (walking, running and jumping) of the Gross Motor Function Measure (GMFM).

Pearson’s partial correlation test (corrected for age and sex) was performed to assess the relationship between physical fitness and gross motor capacity.

Results: Mean GMFM Dimension E score was 88.1% (SD 12.0). The correlations between short-term muscle power, agility, functional muscle strength and dimension E of the GMFM were strong (Rs=0.6 to 0.7). No relationship between aerobic capacity, BMI and dimension E of the GMFM was found.

Conclusion/Clinical Implications: The strong relations found between short-term muscle power, agility, functional muscle strength and gross motor capacity show the importance of these components of physical fitness for children with CP. These results may give further directions to exercise training interventions for improvement of the gross motor capacity in children with CP, classified at GMFCS level I or II.

Physical Activities in 5 and 7 Years Old Children with Cerebral Palsy

MSC Petra van Schie1, Mrs Nathalie Zwiër1, PhD, MJD Ujes Becher1, MSC Dirk-Wouter Smit2, PhD, MD Jan Willem Gorter2, PhD Annet Dallmeijer1

1VU University Medical Center, 2Rehabilitation Center De Hoogstraat, 3CanChild

Background: Regular participation in physical activity during childhood provides both short and long term benefits on physical, psychological and social well-being. The Dutch norm for physical activity recommends that children should be physically active all days of the week, for at least one hour a day.

Objectives: The aim of this study was (i) to describe the physical activity level of 5 and 7 year old children with cerebral palsy (CP), (ii) to compare their physical activity level with able-bodied peers and with the Dutch norm and (iii) to determine physical, psychological and contextual factors influencing the physical activity level of children with CP.

Design: Cross-sectional analysis of the baseline measurement in a prospective longitudinal cohort study (PERRIN CP 5-9).

Participants/Setting: 97 children with CP, aged 5 and 7 years, GMFCS level I to IV (without children who were dependent on an attendant-propelled wheelchair). Participants were assessed in a rehabilitation center or university medical center. A control group of 57 typically developing children, aged 5 and 7 years, was recruited from two regular primary schools.

Materials/Methods: The primary outcome, hours spent on sports and physical activity per week was measured by a standardized questionnaire filled in by the parents.

Physical determinants (severity of CP (GMFCS level), GMFM-66, body mass index, handfunction and quadriceps strength) were measured as part of an comprehensive examination. Psychological (global self-worth) and contextual factors (parental educational level, number of siblings, rural, semi-urban or urban living environment and school type) were assessed by questionnaires.

Results: Mean duration of physical activity for children with CP was 3.4 (+/- 1.9) hours per week and 5.8 (+/- 2.3) hours per week for able-bodied peers. Of the children with CP, 92% did not meet the Dutch norm for physical activity, compared to 70% of able-bodied peers. Multiple regression analyses showed that only younger age and lower educational level of the mother were significantly associated with lower levels of physical activity for children with CP, while severity of the CP was not associated with physical activity level. Twenty-two percent of the parents reported that more facilities in sport and games are required for children with CP.

Conclusion/clinical implications: Five and 7 years old children with CP showed less physical activity than able-bodied peers, and insufficient level of physical activity when compared to the Dutch norm. Results suggest that physical activity needs to be promoted in young children with CP.
Physical Activity and Physiotherapy – Experiences from Adults with CP

RPT MSc Karin Sandström, OT PhD Kensti Samuelsson, RPT Professor Birgitta Öberg
Linköping University; Sweden

Background: To promote health and to and to prevent secondary impairments, people with CP are supposed to carry out physiotherapy and other physical activities. We know that physiotherapy and physical activity often decrease in adulthood, but knowledge about the persons’ experiences and what factors that motivates to carry out physical activity is insufficient.

Objective: The aim was to get an understanding in how adults with cerebral palsy (CP) experience physical activity/physiotherapy in a perspective from childhood to adulthood.

Design: A qualitative study with ‘qualitative content analysis’.

Participants: Twenty two persons from five counties in Sweden, with functional levels II-IV according to Gross Motor Classification System (GMFCS), participated. Mean age was 47 years (range 35–68).

Results: The narratives from the 22 informants resulted in descriptions of important prerequisites for carrying out physical activity/physiotherapy. They are summarized in five themes: Being enjoyable, Giving effects, Being comprehensible, Being integrated in daily life, Supportive health care with competent professionals. Experiences of these prerequisites varied among persons and there was a typical pattern through life span: In childhood there was a limited comprehension about the meaning of physiotherapy, and many experiences of physical activities that were not enjoyable. Despite this, the informants experienced support from the paediatric organisation.

Adolescence was a critical period for continuing with physical activities and they often were fed up with training.

In adulthood there is a deeper comprehension about benefits with being physically active, but there is sometimes insecurity about the effects of physical activity. Obvious activity improvements and wellbeing are pointed out as important factors, but more explanations in relation to cerebral palsy and ageing are welcomed. To integrate physical activity in daily life is also a common challenge in adulthood. The importance of support from health care and competence from professionals is a unanimous wish and this is also expressed as limited or absent as an adult. There are problems in finding where to turn when there is a need for support and treatment related to the disability. The informants stressed that there must be a structured follow-up from health care and physiotherapists with knowledge of CP.

Clinical Implications: Professionals must have knowledge and ability to identify hindering and facilitating factors in order to back up and give possibilities to physical activity, especially in the transition from adolescence to adulthood.

Physical Activity Assessment of Children with Mild Cerebral Palsy and Typically Developing Children

Dr Kristie Bell1, A/Professor Peter Davies2
1Queensland Cerebral Palsy and Rehabilitation Research Centre, University of Queensland, 2Children’s Nutrition Research Centre, Discipline of Paediatrics and Child Health, University of Queensland, Royal Children’s Hospital

Children with cerebral palsy (CP) are frequently shorter, lighter and have lower body fat stores than their typically developing peers. However, the neuromuscular complications associated with CP combine to make accurate anthropometric and body composition measurements difficult. Children with CP have a high rate of oral motor and swallowing dysfunction affecting the amount of nutrition able to be ingested, and relative safety in terms of oropharyngeal aspiration and consequent affects on pulmonary health. Poor nutrition and growth, related to the severity of the injury and subsequent motor dysfunction, may have a secondary impact on brain growth, habitual physical activity levels, participation and quality of life. Habitual physical activity is an established determinant of health and, the best available evidence indicates that people with mobility impairment are among the least physically active groups in society; consequently children with CP have increased risk of inactivity related illness. Our multidisciplinary panel will present the state of the clinical science of linear growth, body composition, feeding and swallowing function and habitual physical activity in young children with CP. The presenters will highlight the current research and present data from their own research and clinical experiences in presentations and a panel discussion.

The following topics will be addressed by the four speakers:

1) Growth and Nutritional Status
   • growth charts used in Australia
   • growth patterns of children with CP
   • assessment of growth and nutritional status in children with CP
   • implications of the WHO and CDC growth charts in measuring linear growth and development of children with CP
   • clinical implications of poor growth and nutritional status in children with CP

2) Oral Motor and Feeding Dysfunction
   • current knowledge about the nature of oral motor and swallowing dysfunction in children with CP
   • evaluation and management of oral motor and swallowing dysfunction in children with CP
   • research questions: the impact of oral motor and swallowing dysfunction on health outcomes in children with CP

3) Habitual Physical Activity
   • current knowledge on the levels of habitual physical activity in children with CP and typically developing children.
   • evaluation in the community of habitual physical activity: validity and reliability of Stepwatch and Actigraph.
   • research questions: the effect of interventions for spasticity management for young children with CP on habitual physical activity.
Contribution of Motor Impairments to Limitation in Physical Activity (Disability) and Participation in People with Cerebral Palsy

Ms Hsiu-Ching Chiu, A/Prof Louise Ada, Ms Jane Butler, Dr. Susan Coulson
1 Discipline of Exercise and Sport Science, The University of Sydney, 2 Discipline of Physiotherapy, The University of Sydney

Background: People with hemiplegic cerebral palsy tend to overuse unaffected arm to accommodate their everyday activities, because of muscle weakness, spasticity, contracture, and loss of dexterity of affected upper limb. Therefore, the prognostic of affected upper limb in people with hemiplegic cerebral palsy is relatively poor or progressive decline. This research evaluated the relative contribution of the motor impairments to physical activity and participation to provide more rational basis for clinical intervention

Objectives: (1) To determine which motor impairments (muscle weakness, spasticity, contracture, and loss of dexterity) had the most significant influence on hand activity. (2) To determine whether there was a linear relationship between physical activity and participation.

Design: Observational, cross-population study

Participants: 23 volunteers with hemiplegic cerebral palsy over 15 years of age were recruited from the Spastic Centre and through placing advertisements in the local newspapers.

Methods: Four motor impairments (weakness, loss of dexterity, spasticity and contracture) were measured by experimental setup. Physical activity was measured by Spiral Test and Motor Assessment Scale (Item 6, 7, & 8) to quantify upper limb activity. Normalised score (%) of Spiral Test and Motor Assessment Scale was used to describe physical activity. Life Satisfaction 9 Checklist (LiSat-9) was used to gauge participation in society of people with cerebral palsy. Multiple linear regression was used to determine the relative correlation between motor impairments and physical activity.

Results: Data was from 23 people with hemiplegic cerebral palsy aged from 15–47 years (mean [SD]: 28y10m [9y6m]; 13 males, 10 females). The total 4 motor impairments accounted 63% of the variance to physical activity. Simple linear regression was used to determine the correlation between motor activity and participation.

Table 1 Correlation between motor impairments and physical activity. *= p<0.05.

<table>
<thead>
<tr>
<th>Motor impairments</th>
<th>Contribution to physical activity (r)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weakness (separate)</td>
<td>0.01, p=0.44</td>
</tr>
<tr>
<td>Loss of dexterity (separate)</td>
<td>0.21*, p=0.01</td>
</tr>
<tr>
<td>Spasticity (separate)</td>
<td>0.09*, p=0.05</td>
</tr>
<tr>
<td>Contracture (separate)</td>
<td>0.07, p=0.09</td>
</tr>
<tr>
<td>Shared</td>
<td>0.25</td>
</tr>
<tr>
<td>Total</td>
<td>0.63, p&lt;0.001</td>
</tr>
</tbody>
</table>

Table 2 Correlation between physical activity and participation.

<table>
<thead>
<tr>
<th>Physical activity</th>
<th>Contribution to participation (r2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normalised score (%)</td>
<td>0.13, p=0.09</td>
</tr>
</tbody>
</table>

Conclusions: The findings indicate that loss of dexterity makes the largest contribution to physical activity suggesting it is an important impairment to focus on in rehabilitation. However, physical activity makes little contribution to participation suggesting that life satisfaction is dependent on non-physical factors.
Whose Life is it Anyway? Measuring Meaningful Outcomes for Children with Severe Disabilities

**Dr. Unni Narayanan**1,2, **Ms Shannon Weir**3, **Dr. Darcy Fehlings**2

1The Hospital for Sick Children, Toronto, 2Bloorview Kids Rehab, Toronto

**Theory:** Interest in patients’ perspectives and the concepts of patient-centred care have grown from our understanding that the impact of health care interventions are more meaningfully assessed using patient based outcome measures including measures of quality of life. Although the imperative for measuring quality of life (QOL) of children with severe disabilities has long been recognized, the challenges involved in conceptualizing quality of life for this population, when one does not have direct access to the patients’ perspective, has been an obstacle to the development of such measures.

**Interactive Discussions/Activity:** This seminar will present details of one such effort that has led to the development and validation of the Caregiver Priorities and Child Health Index of Life with Disabilities (CPCHILD©) questionnaire in Canada. The CPCHILD© has been shown to be a reliable and valid proxy measure of health related quality of life of children with severe disabilities due to (non-ambulatory) cerebral palsy or acquired brain injury, from the parental or caregivers’ perspective. The purpose of the seminar is to introduce this instrument to an international audience in order to begin the process of generalizing the questionnaire to other jurisdictions and to assess more widely its utility to evaluate the effectiveness of the various interventions used to treat children with severe disabilities. Following this seminar, participants will become familiar with the conceptual underpinnings and the validation of the instrument as well as the use and application of the questionnaire. The seminar will be used as a forum to explore with the participants the next steps of the validation process and provide an unique opportunity for interested participants to enroll in a multicentre longitudinal collaborative study to assess the validity of the CPCHILD© in their own environments.

**Clinical Implications:** Reliable and valid measures of HRQOL or quality of life can help identify individual priorities that are problematic, so that therapeutic objectives, programs and policies may be aligned with needs and priorities of patients and caregivers. Since the goal of most interventions for these children is to preserve or improve quality of life, these outcomes must be included in clinical trials of these interventions whenever possible. Evidence gleaned from trials using such outcome measures will assist in decision-making about interventions. Furthermore the routine use of such measures may also have the potential in clinical practice to evaluate individual patients’ responses to interventions that can guide on-going treatment or alteration in management.

Growth, Nutrition and Habitual Physical Activity in CP

**Dr Kristie Bell**, Associate Professor **Peter Davies**, Ms **Kelly Weir**, **Dr Kristie Bjornson**

1Queensland Cerebral Palsy and Rehabilitation Research Centre, University of Queensland, 2Children’s Nutrition Research Centre, University of Queensland, 3Royal Children’s Hospital and Paediatrics and Child Health, University of Queensland, 4Seattle Childrens Hospital, Spasticity Management Clinic, Research fellow, Washington State University, Oregon

Children with cerebral palsy (CP) are frequently shorter, lighter and have lower body fat stores than their typically developing peers. However, the neuromuscular complications associated with CP combine to make accurate anthropometric and body composition measurements difficult. Children with CP have a high rate of oral motor and swallowing dysfunction affecting the amount of nutrition able to be ingested, and relative safety in terms of oropharyngeal aspiration and consequent affects on pulmonary health. Poor nutrition and growth, related to the severity of the injury and subsequent motor dysfunction, may have a secondary impact on brain growth, habitual physical activity levels, participation and quality of life. Habitual physical activity is an established determinant of health and, the best available evidence indicates that people with mobility impairment are among the least physically active groups in society; consequently children with CP have increased risk of inactivity related illness. Our multidisciplinary panel will present the state of the clinical science of linear growth, body composition, feeding and swallowing function and habitual physical activity in young children with CP. The presenters will highlight the current research and present data from their own research and clinical experiences in presentations and a panel discussion.

**Speakers:**

A/Professor **Peter Davies**, Director, Children’s Nutrition Research Centre, University of Queensland

• growth charts used in Australia
• assessment of growth and nutritional status in children
• implications of the WHO and CDC growth charts in measuring linear growth and development of children with CP

Dr **Kristie Bell**, Dietitian and Postdoctoral Research Fellow, Queensland Cerebral Palsy and Rehabilitation Research Centre, Royal Children’s Hospital, University of Queensland

• growth patterns of children with CP
• assessment of nutritional status in children with CP
• clinical implications of poor growth and nutritional status in children with CP

**Kelly Weir**, Speech Pathologist, Royal Children’s Hospital and Paediatrics and Child Health, University of Queensland

• current knowledge about the nature of oral motor and swallowing dysfunction in children with CP
• evaluation and management of oral motor and swallowing dysfunction in children with CP
• research questions: the impact of oral motor and swallowing dysfunction on health outcomes in children with CP

**Dr Kristie Bjornson**, Physiotherapist, Seattle Children’s Hospital, Spasticity Management clinic, Research fellow, Washington State University, Oregon

• current knowledge on the levels of habitual physical activity in children with CP and typically developing children.
• evaluation in the community of habitual physical activity: validity and reliability of Stepwatch and Actigraph.
• research questions: the effect of interventions for spasticity management for young children with CP on habitual physical activity.
New Approaches To Protecting The Neonatal Brain

Presenters:
Laura Bennett: Timing is everything: understanding the early phase of post-asphyxial recovery.
Paul Colditz: Global hypoxia-ischaemia in the human newborn: interactions between brain and heart.
David Walker: Exploiting neurosteroids as endogenous protectants.

Exploiting Neurosteroids as Endogenous Protectants

David Walker J on Hirst, Tamara Yawno, Bobbi Fleiss, Helena Parkington, Harry Coleman
Fetal & Neonatal Research Group, Monash university-Clayton Campus, Melbourne, Australia, 3800; 'School of Biomedical Sciences, University of Newcastle, NSW, Australia, 2308

Neurosteroids are compounds derived from progesterone or oestrogen which are active in the brain. In addition to the well-characterized genomic actions of steroids, neuroactive steroids have important actions at membrane-bound receptors, usually by interacting with receptors for neurotransmitters and modulating their actions. The most important neurosteroid – allopregnanolone – has modulatory actions at the GABAA receptor in the brain and increases GABAergic inhibition and reduces excitation, effectively protecting the brain from excitotoxicity. Our studies in fetal sheep show that allopregnanolone synthesis and release is increased rapidly in response to hypoxia in utero, and that this increase limits the extent of cell death that ensues. Neurosteroids might also be involved in regulation of brain development, as inhibition of allopregnanolone synthesis results in decreased cell division and increased apoptotic cell death even in the normally developing, well oxygenated fetus.

Birth asphyxia is known to alter synaptic function and to contribute to many of the neurological deficits that arise in childhood, including poor memory, learning, and seizure susceptibility. In a study on the effects of birth asphyxia on the hippocampus of the 6 day-old neonatal spiny mouse (Acomys cahirinus), we have shown that both short-term (paired-pulse facilitation, msec) and long-term potentiation (hours) are affected. Pretreatment of the pregnant dam with the neurosteroid allopregnanolone immediately before birth prevents the disruption to long-term potentiation, indicating the potential use of neurosteroids as prophylactic agents to prevent the evolution of neurological deficits following traumatic birth.

Neurosteroids concentrations in fetal blood and the brain increase as term approaches. Thus, a problem that arises with pre-term birth is that the metabolic and cardiovascular stresses that often arise, can occur when neurosteroid levels are too low to prevent brain damage. As neurosteroids such as allopregnanolone have few, if any, other actions except in the brain, their use at the time of threatened pre-term delivery should be considered to protect the immature brain from damage at this time.

Stepping Stones Triple P: A Parenting Program for Parents of a Child with a Disability

Dr Kate Sofronoff, University of Queensland

Stepping Stones Triple P (SSTP) is a behavioural family intervention that has been designed for use with families of children with developmental disabilities. We will provide information on the theoretical basis of the program, the strategies that underlie this intervention program, and the outcomes of research evaluating the effectiveness and social validity of the intervention. Both the standard and group-based versions of SSTP will be discussed. Data will be presented on the outcomes for parents and children, in terms of behaviour problems, parenting practices and adjustment, and consumer satisfaction with the intervention. The seminar will include presentation of video materials, available resources, and the opportunity for interactive discussion. It will be presented by four key researchers/practitioners involved in the development, evaluation and dissemination of the program.

We will introduce trials that have been undertaken with discrete populations including children with autism, Down’s syndrome and Cerebral Palsy. Two randomized controlled trials will be described and outcomes discussed. Outcomes will be shown for both children and parents. The issue of addressing specific disorder-related concerns within a standard program will be discussed and a brief case study will be described for a child with Cerebral Palsy.

SSTP has been adapted to suit the needs of busy families who can not or need not attend more than four brief sessions to learn ways to promote their child’s development and independence. Primary Care SSTP is delivered by health or primary care professionals and is optimal for an inter/transdisciplinary team approach. It comprises a brief targeted intervention that focuses on helping parents identify discrete areas of their child’s development or behaviour and to develop parenting plans to address their concerns. For children with Cerebral Palsy, an important focus is on teaching the child to become as independent as possible, given their physical limitations. The program promotes a range of parenting strategies that can be used to teach new skills and behaviours. These strategies will be discussed and demonstrated in regard to children with cerebral palsy.

Primary Care resources including a range of booklets with parenting plans for common behavioral problems and developmental issues will also be displayed. The benefits and challenges of integrating this level of SSTP Triple P into a family centred inter/transdisciplinary early childhood development program will be discussed.

We will end the seminar with a discussion of the issues surrounding the dissemination of SSTP both nationally and internationally. Disseminating evidence-based programs for families of children with special needs in a quality assured yet cost-effective and sustainable manner is a challenging endeavour. We will review the dissemination model that is used for the SSTP system of behavioural family interventions with consideration given to program design, skills training, practitioner confidence and self-regulation and workplace support. Predictors of dissemination outcomes, obstacles to effective dissemination and recommendations for organizational uptake of evidence-based programs will be discussed. Future directions for the dissemination model for SSTP will also be explored.
Video Gait Analysis to Support Clinical Decision Making in Cerebral Palsy

Dr Adrienne Harvey¹, Assoc Professor Richard Baker²
¹Murdoch Children’s Research Institute, ²Murdoch Children’s Research Institute

Theory: Instrumented three dimensional gait analysis (3DGA) is used in many centres nationally and internationally to quantify gait deviations and guide the management of children with cerebral palsy (CP). 3DGA is expensive to run, requires high technological equipment and extensive training of clinicians for effective interpretation. As a result, not all centres have the access or resources to use it.

Two plane video gait analysis (VGA) has been developed by a multi-disciplinary team at a tertiary paediatric institution with extensive experience of 3DGA to support clinical decision making that does not warrant the expense and/or inconvenience of full 3DGA. Such techniques are also applicable to centres which do not have access to 3DGA and is relevant to developed and developing countries.

This workshop presents an instructional program to promote the routine clinical use of VGA which is currently being implemented in a number of centres across Australia and Asia.

Interactive Discussions/Activity: Clinical decision making must integrate VGA recordings with other measurements such as physical examination, radiology, clinical history and classifications and measures of gait and function. Collectively these form the diagnostic matrix.

Topics covered in the seminar will be the components of the diagnostic matrix, and the technical and practical requirements for setting up VGA including the hardware, software and training of clinicians. Standardisation of video data capture and incorporation of this within the diagnostic matrix will be outlined. There will be discussion of differences between 3DGA and VGA and indications for and limitations of VGA. Techniques using classification of gait patterns as a key stage in tailoring interventions to individual children will be outlined. The model of teaching will be through case examples involving participants identifying various aspects of the diagnostic matrix. The seminar will assume some understanding of the issues involved in management of gait deficits in children with CP.

Clinical Implications: This innovative program of inexpensive and clinically applicable gait analysis is a feasible and exciting initiative for clinicians in both developed and developing countries. It offers appropriate and cost-effective options for managing gait deviations for patients within centres with access to 3DGA and new opportunities for centres without such resources.

Whole-Body Vibration Compared with Resistance Training: Effect on Spasticity, Muscle Strength and Motor Performance in Adults with Cerebral Palsy

Mrs Lotta Ahlborn¹, PT, PhD Christina Andersson², MD, PhD Per Jolin³
¹Department of Rehabilitation Medicine Stockholm, ²Department of Neurotec, Karolinska Institutet, ³Danderyd University Hospital

Background: The effect of WBV on muscle strength has been evaluated with a variety of results. One study on healthy subjects showed similar effect as progressive resistance training.

Objective: The aim of this study was to evaluate the effect on spasticity, muscle strength and motor performance after eight weeks of whole-body vibration compared with resistance training in adults with cerebral palsy.

Design: Randomized study with two different training groups.

Participants: Fourteen persons with spastic diplegia (21–41 years).

Methods: The participants were randomized to intervention with either whole body vibration training (n=7) or resistance training (n=7). Pre- and post training measures of spasticity using the modified Ashworth scale, muscle strength using isometric dynamometry, walking ability using Six-Minute Walk Test, balance using Timed Up and Go test and gross motor performance using Gross Motor Function Measure were done.

Results: Spasticity decreased in knee extensors in the whole body vibration group (p<0.04). Muscle strength increased in the resistance training group at the velocity 30°/s (p<0.04) and in both groups at 90°/s (p<0.04). Six-Minute Walk Test and Timed Up and Go test did not change significantly. Gross Motor Function Measure increased in the whole body vibration group (p<0.04).

Conclusion: These data suggest that an 8-week intervention of whole body vibration or resistance training can increase muscle strength, without negative effect on spasticity, in adults with cerebral palsy.
The Impact of Neuro-Developmental Treatment on the Performance of Daily Living Tasks in Children with Cerebral Palsy

Ms. Kathryn Bain1, Dr. Christine Chapparo2
1Health Sciences Doctoral Candidate, University of Sydney, 2Principal Investigator, Faculty of Health Sciences, University of Sydney

Background: Evidence supporting the efficacy of Neuro-Developmental Treatment (NDT) has not been established.

Objectives: This research project aimed to investigate changes in occupational performance of children with CP following intensive NDT.

Design: A randomised, controlled pilot study of 24 children was carried out. Videotaped task performance before and after intervention was scored by raters who were blinded to the condition of intervention.

Participants/Setting: 26 children were filmed at pre and post treatment and follow up during an NDT certification course held at San Francisco State University in June/July 2008.

Methods: Multiple methods were used to investigate the research question.
1) A literature review of NDT effectiveness determined the difficulties in prior research methodologies.
2) A pilot study established the usefulness of two outcome measures: Goal Attainment Scales and video motion analysis software.
3) A randomised, controlled pilot study where expert raters were blinded to the conditions of intervention, was carried out with 26 children during an NDT certification course. Raters viewed randomly chosen videotapes of children during task performance & scored their performance according to pre-set performance criterion established by motion analysis and goal attainment scaling.

Results:
1) Difficulties in conducting NDT research included the following: only small heterogeneous groups of children with CP exist; ethical difficulties regarding control groups; NDT is not ‘one treatment’, but a treatment ‘approach’; lack of clear operational definitions of NDT; motor scales, not sufficiently sensitive to measure small but important functional gains by children with CP; determination of the role of maturation in outcome gains; the large range of possible functional outcomes and the varied physical and social environments for functional tasks; the time needed to consolidate functional gains post NDT and insufficient NDT research to ‘lead’ research.
2) Acceptable interrater reliability was established in the GAS pilot study. Videopoint ™ was found to be a simple, inexpensive, motion analysis software which is portable to community & clinical environments. It converts parameters of ‘on screen’ motion, such as range of movement and velocity, to quantitative data presented in graphs and charts.
3) The paper will discuss the difference found between the baseline performance, treatment performance and follow up performance of children in the treatment and control groups.

Conclusion/Clinical Implications: This research project aims to generate evidence of the clinical efficacy of NDT in improving occupational performance, for choice by families, colleagues, administrators, funding and insurance bodies.

Case Study to Illustrate the Use of the Movement Analysis Profile (MAP) in Children with Cerebral Palsy

Dr Richard Baker1, Dr Oren Tirosh2, Dr Jenny McGinley2, Ms Pamela Thomason1, Prof H Kerr Grahame1
1Royal Children’s Hospital, 2Murdoch Childrens Research Institute

Background: The MAP has been developed to summarise much of the complex information contained within the kinematic data arising from 3-dimensional gait analysis. It comprises the root mean square (RMS) difference between a kinematic variable for a particular subject and the average values of that variable from people without pathology calculated over the gait cycle for the clinically relevant kinematic variables.

Objectives: This case presentation allows a demonstration of the power of the MAP to summarise change in children with CP following single event multi-level surgery.

Patients/Materials and Methods: The patient has spastic diplegia (GMFCS level III). He presented for gait analysis for surgical decision making and subsequently had bilateral femoral derotation osteotomies, psoas recessions and percutaneous adductor tenotomies. In addition, he had medial hamstrings lengthening, gastro-soleal lengthening and tibialis posterior recession on the left and a gastrocnemius recession on the right. One year later he had repeat gait analysis Fig (1a). This showed considerable improvement, however hip adduction and knee flexion on the right showed only partial correction. At plate removal he thus had repeat bilateral percutaneous adductor tenotomies and transfer of the right semitendinosus to the adductor tubercle. A year later he had a 3rd gait analysis (Fig 1c)

Results: Patient 1 showed high scores for many kinematic parameters on first presentation. After the initial surgery there was considerable improvement in many of these but the MAP draws attention to the residual problem in knee flexion on the right. The final MAP shows that the further surgery has further improved the gait pattern.

Discussion: These examples illustrate that the MAP conveys useful clinical information that can summarise changes in a patient’s gait pattern following interventions such as orthopaedic surgery.
Reduced Maximal Torque and Submaximal Torque Steadiness of Ankle Dorsi and Plantarflexion in Children with Cerebral Palsy

MSc Thomas Bandholm¹, BSc Martin Heyer Rose¹, BSc Rikke Sleik¹ MD, DSc Stig Sonne-Holm², PhD Bente Rona Jensen²

Background: Plantarflexion in Children with Cerebral Palsy

This hypothesis awaits future experimental verification.

Objectives: To investigate if children with CP, who walk with equinus, demonstrate reduced (1) maximal voluntary torque and (2) submaximal torque steadiness of isometric dorsi and plantarflexions with the ankle compared to healthy children.

Design: Case-control study.

Participants/Setting: Fourteen children with hemiplegic CP (mean ± 1 SD, 11 ± 3 yrs, GMFCS = 1), and 14 healthy age-matched (control) children were included by convenience sampling.

Material/Methods: All participants performed maximal and submaximal dorsi and plantarflexions with the ankle. For the submaximal contractions – performed at target torques required for normal sagittal kinetics in healthy gait – fluctuations in exerted torque were determined. The target and exerted torque were generated in real-time using a PC oscilloscope, and displayed using a PC screen placed in front of the participant. Muscle (EMG) activity of the tibialis anterior, medial gastrocnemius, and soleus muscles was recorded during the attempted steady contractions.

Results: Both maximal torque and submaximal torque steadiness of dorsi and plantarflexions were reduced, and muscle activity generally increased in children with CP compared to controls (P < 0.05). Plantarflexion torque steadiness was related to plantarflexor spasticity in the children with CP (r > 0.722, P < 0.02). Moreover, in the children with CP, dorsiflexion torque steadiness was related to the degree of antagonist (plantarflexor) co-activity (r > 0.596, P < 0.041).

Conclusion/Clinical Implications: Compared with healthy children, children with CP demonstrate reduced maximal voluntary torque and submaximal torque steadiness of isometric dorsi and plantarflexions with the ankle. Both muscle groups may benefit from strength training, as they are weak and with poor submaximal control. This will likely reduce the degree of equinus during gait. This hypothesis awaits future experimental verification.

The Use of Force Plate Center of Force Data in Quantifying Equinus in Children with Hemiplegic Cerebral Palsy

Dr Jesper Bencke, Ms Ida Regitze Krag, Mr Derek Curtis, Mr Thomas Thomas

Gait Analysis Laboratory, Department of Orthopaedic Surgery, Hvidovre University Hospital, Denmark

Background: In daily clinical practice, the clinician assesses functional equinus by observing the degree of foot contact during gait, whilst three-dimensional clinical gait analysis measures ankle kinematics and kinetics during gait. Ankle dorsiflexion does not, however, necessarily reflect the degree of foot contact, and calculations of Centre of Force (CoF) from force plate data may be more appropriate for estimation of foot contact, when plantar pressure measurements are not available.

Objectives: (1) to establish normal data for the medio-lateral and anterior-posterior distribution of CoF during gait in healthy children, and (2) to establish whether distribution of CoF data is significantly different between children with unilateral spastic plantarflexors and normal age-matched subjects.

Design: Cross-sectional study.

Participants/Setting: Nine children (mean age (SD): 9.7 (2.6) yrs) with hemiplegic cerebral palsy (CP) and mild equinus gait were included for investigation in a biomechanical gait laboratory together with a reference group (RG) of nine healthy children (mean age (SD): 12.0 (3.2) yrs).

Materials/Methods: For CP, RoM for dorsiflexion was measured, and spasticity assessed using modified Ashworth score. Gait analysis was performed at a self-selected speed using 2 AMTI force plates. Peak dorsiflexion angle during stance and dorsiflexion at heel-strike were derived as measurements of ankle position. Standard deviation of CoF-distribution in anterior-posterior direction (SDap) and medio-lateral direction (SDml) during stance phase (normalised to individual foot length) were calculated as measures of the extent of whole foot contact in gait direction and transverse direction respectively.

Results: The mean RoM (SD) for dorsiflexion was 14 (3) degrees, and the median spasticity of the plantarflexors for the affected leg was 1+ (range: 1–2). The SDap of the affected leg was significantly smaller for CP compared to RG (0.18 vs. 0.25, respectively, p<0.001), but no differences were found for the non-affected leg for CP in SDap or in SDml for either leg. There was a difference between the affected leg for CP and RG in dorsiflexion angle at heel-strike (p=0.04), but not in peak dorsiflexion angle during stance.

Conclusion/Clinical Implications: While measurements of the maximal dorsiflexion angle during stance could not distinguish between healthy children and children with a mild degree of hemiplegic equinus gait, the SDap clearly showed a smaller distribution in CoF for CP. This indicates a potential for the use of this parameter as a diagnostic and evaluation tool before and after intervention in patients with equinus gait.
Comprehensive in Vivo Long-Term Follow-Up of a Singular Botulinum Toxin A Injection Using MRI, Muscle Histopathology, Myosonography and EMG

Dr. Steffen Berweck1, Dr. A. Sebastian Schroeder1, Dr. Stefanie Britsch2, Prof. Wolfgang Müller-Felber1, PD Birgit Ertl-Wagner2, Prof. Florian Heinen1
1Hauners’ Children’s Hospital, Munich University, 2Institute of Clinical Radiology, Munich University

Background: The need for research on disease-related and treatment-related changes within the muscle of children with CP is demanding. Basic research on botulinum toxin A (BoNT/A) has shown the molecular mode of action. Animal experiments describe morphologic alterations following injection of BoNT/A.

Objectives: In vivo structural and functional measurements of changes within the muscle to depict treatment effects within the muscle after a single intramuscular injection of BoNT/A.

Design: Single subject, prospective study with multiple follow-up investigations.

Participants/Setting: 100 Units of BoNT/A (Xeomin®, Merz Pharmaceuticals, Frankfurt am Main, Germany) diluted in 2 ml isotonic saline solution were injected on two injection sites into the lateral head of gastrocnemius muscle in each of two healthy adults using ultrasound guidance in a double blinded procedure with the contra-lateral muscle receiving 2 ml of NaCl 0,9% solution only. Approval by the local ethics committee was obtained prior to this study.

The following investigation tools were used for both the injected and non-injected muscle: Magnetresonance imaging (MRI), muscle-histopathology, myosonography and electromyography (EMG). For MRI and myosonography muscle circumference, area and diameter were measured. For EMG neurography with CMAP, repetitive stimulation, H-reflex, needle- and surface EMG were assessed. Examinations were carried out prior to injection (T0), immediately after injection (T1), 4–6 weeks (T2), 5–6 months (T3), 8–9 months (T4) and one year after injection (T5). Up to date assessments are still ongoing in monthly intervals.

Results: The BoNT/A injected muscle showed significant atrophy at timepoint T2 and even more at T3 and T4 using MRI. The corresponding histopathology showed neurogenic atrophy. Myosonography and more so EMG proved less reliable as an objective assessment tool in quantification of the BoNT/A effect, but evaluation is still ongoing.

Conclusions/Clinical Implications: MRI proved as a sensitive method to show significant muscle alterations over a period of more than 1 year after a single BoNT/A injection in healthy adults. Alterations in EMG and myosonography were less pronounced. The combined structural and functional measures allow to quantify muscle alterations due to BoNT/A treatment and to correlate them to functional and histological alterations. Research with imaging techniques could be possibly expanded to study muscle pathology as well as treatment effects in children with CP.

Long-Term Outcome of Tendo Achilles Lengthening in Spastic Diplegia

Dr Faith Bischof1, Prof Einhard Erken2
1University of the Witwatersrand, 2Emeritus Professor of Orthopaedic Surgery, University of the Witwatersrand

Background: Tendo Achilles lengthenings (TALs) were commonly performed to correct equinus deformity in scholars with diplegic Cerebral Palsy (CP) attending special education schools.

Objectives: The purpose of this study was to evaluate the gait pattern and functional mobility of these scholars in a long-term follow up.

Design: Retrospective case control study

Participants: A convenience sample of scholars with spastic diplegia attending four special schools. Children who had undergone bilateral TALs (n = 16) were compared with all the diplegics in these schools who had no surgical intervention (16 controls). Ages in the surgical group ranged from 11–17 years (mean 13, SD 2.13) and in the controls 6–17 years (mean 11, SD 3.8). Follow up post-surgery was 3–13 years (mean 8). Bilateral TALs were combined with surgery to the hamstrings in 8 cases, and other lower limb procedures in 3 cases.

Materials/Method: Two dimensional gait analysis was used and the gait characteristics assessed. The Functional Mobility Scale (FMS) was employed to rate walking ability in the home, at school and in the community.

Results: Fishers exact test was used, and p < 0.05 considered significant. There was a significantly greater occurrence of crouch gait in the TAL group than in the control group (p = 0.012) FMS ratings were significantly lower in the TAL group (p = 0.044) in the community setting. The difference between the groups in the school setting was marginally significant (p=0.058) with lower scores in the surgical group.

Conclusion/Clinical Implications: The significant presence of crouch and functional mobility limitations in the group who had undergone bilateral tendo Achilles lengthenings indicates that this operation should be avoided in spastic diplegia.
**A Decision Tree for Monitoring Hip Disorders in Cerebral Palsy and Its Consequences for Intervention**

**Mr Eric Boldingh**, Mrs Carola Bouwhuis, Mrs Hélène vanderHeijden, Mr Cees Bos, Mrs Monique Jacobs-vanderBruggen, Mr Guus Lankhorst, Mr Lex Bouter

1Sophia Rehabilitation Center, Den Haag, The Netherlands, 2Rijnland Rehabilitation Center, Leiden, The Netherlands, 3Pediatric Orthopaedic Department Juliana Children’s Hospital, Den Haag, The Netherlands, 4National Institute of Public Health and the Environment (RIVM), Bilthoven, The Netherlands, 5Department of Rehabilitation Medicine, VU University Medical Center, Amsterdam, The Netherlands, 6Institute for Research in Extramural Medicine, VU University Medical Center, Amsterdam, The Netherlands

On a poster we present a decision tree for the monitoring of hip disorders in cerebral palsy and its consequences for intervention. The algorithm is based on the GMFCS classification.

Intervention measures are founded on our own research and a review of international literature on the indication and results of tenotomies and bony surgery. This review will be published separately.

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**A Systematic Review of the Clinimetric Properties of Upper Limb Activity Measures for 5–16 Year Old Children with Congenital Hemiplegia**

**A/Prof Roslyn Boyd**, Ms Rose Gilmore, Ms Leanne Sakzewski

1Queensland Cerebral Palsy and Rehabilitation Research centre, University of Queensland, 2Brain Research Institute, Melbourne, 3Queensland Cerebral Palsy and rehabilitation Research Centre, University of Queensland

**Objective:** To identify all measures of upper limb activity which have been used with children aged 5–16 years with cerebral palsy (CP), and evaluate them in terms of their psychometric properties and clinical utility.

**Study Design:** Systematic review – Clinimetric study

**Methods:** Databases were searched for the included criteria: components measured >50% upper limb activity, bimanual or unilateral use of upper limb measures and data on CP. Exclusion were those not in English; that classified or assessed impairment; participation; body functions or HR-QOL; published prior to <1960; and those that primarily assessed hand writing or visual motor integration skills. Identified measures were rated on the CanChild Outcome Measure Scale by two independent raters. Evidence for each clinimetric property was scored as excellent (score 3), adequate (2), poor (1), or no evidence available (0).

**Results:** 38 assessments were identified and 6 met the inclusion criteria (2 independent raters). The Assisting Hand Assessment (AHA), Melbourne Assessment of Unilateral Upper Limb Function (MUUL) and ABILHAND-Kids showed the strongest clinimetric properties for children with hemiplegia. All three measures scored highly for validity (3/3), highly for reliability with the AHA and MUUL (both 3) though the ABILHAND had the best clinical utility.

**Conclusion:** A large number of activity measures for children with CP were identified, however few were of high quality. The performance based activity measure with the best psychometric properties which measures bimanual upper limb activity was the Assisting Hand Assessment (AHA). The MUUL was found to be the best measure of unimanual capacity, and the ABILHAND-Kids is a questionnaire, performance based measure with excellent clinical utility and psychometric properties. Clinicians may choose to use more than one of these measures to detect changes in unimanual or bimanual activity.
Exploratory Study of Informal Caregiver’s Burden of Youth with Cerebral Palsy

Dr Diana Brandão, Prof. José Luis Pais Ribeiro
Faculty of Psychology and Educational Sciences, Oporto University, Portugal

Background: Cerebral Palsy (CP) describes a group of chronic conditions characterized by motor dysfunction, whose main cause is a non progressive brain damage, occurred during fetal development (UCP, 2001). It extends over the individual’s whole life, causing disability in various degrees, imposing an adjustment and adaptation, to promote their psychological well-being. Any handicap generates a crisis with repercussions on the individual and his family (Martins, Pais Ribeiro & Garret, 2003). In many cases, the female familiars are the ones who support the individual, playing the informal caregiver’s role. This role has influences on their personal, familiar, work and social life. The informal caregivers are more prone to conflict, evolving, often in crisis situations, manifesting symptoms of tension, embarrassment, fatigue, stress, frustration, reduction of social life, depression and self-esteem alterations (ibid.). This tension or burden can bring physical, psychological, emotional and economic problems, which affects the wellbeing of the individual and his caregiver (George & Gwyther, 1986). The caregiver’s burden is a continuous process, and almost always irreversible, resulting of dealing with physical dependence and/or mental incapacity of the handicapped individual (Brailhwaite, 1992).

Objectives: This study aims to assess the physical, emotional and social burden of caregivers of youth with CP.

Design: This is a transversal descriptive study, using the correlational method.

Participants: The sample was constituted by 42 subjects, aged between 27 and 67 years (M = 49), 16,7% male and 83,3% female.

Materials: There were used self-response questionnaires, anonymous: socio-demographic questionnaire and the Questionnaire of Informal Caregiver’s Burden Evaluation (Martins, Pais Ribeiro & Garret, 2003).

Results: For the Informal Caregiver’s Burden it was found an average value of 46.76. The results show average values of 14,14 for Emotional Burden, 16,34 for Caregiver’s Life Implications, 21,13 for Financial Burden, 11,55 for Reactions to Demands, 82,74 for Perception of efficacy and control mechanisms, 68,45 for Family Support and 89,52 for Caregiver’s Satisfaction. There were found significant statistical differences between sexes, on the Informal Caregiver’s Burden, showing that male individuals reported less burden than female; and on the Financial Burden, highlighting that male individuals reported less Financial Burden than female.

Conclusions: The results show low burden values for the informal caregivers. The lowest result was obtained for Reactions to Demands and the highest for Caregiver’s Satisfaction. These results highlight that caregivers of youth with CP feel low burden, seeing more positive than negative aspects associated with taking care of the youth.

Pedal Power: Increasing Endurance and Participation in Physical Activity for Children with a Physical Disability

Miss Tambi Butterfield, The Spastic Centre

Background: Inadequate physical fitness is a major problem affecting the function and health of children with cerebral palsy (Fowler et al. 2007). Physical activity options for children with a physical disability can be limited due to their ability and decreased access to fitness activities. Access can be provided to these children in the form of adapted bike riding. The Life Needs Model of Service (King et al. 2002) identifies participation and quality of life as key goals of service delivery. Riding a bike can be seen as a milestone in a child’s life. The Pedal Power Model is based on a family – community centered approach.

Objectives: This study evaluates the effects of a bike riding program for children with a physical disability. The objectives of the program are: to increase the participant’s physical endurance; and increase participation in physical activities in the school setting, with the family, and in the wider community.

Design: Pilot case study

Participants/Setting: A purposive sample of five students, unable to ride a bike independently and whose abilities range between GMFCS Level 2 to Level 4, participated in the Pedal Power Package. The program was conducted in school and community settings. The program involved collaboration with the participants and their families, physiotherapist, teachers and teacher’s aides.

Materials/Methods: Participants were provided with an individually modified bike and a bike riding program for group implementation. The program was conducted three times a week for ten weeks. Families and friends were also involved in three bike riding Family Fun Days.

Outcome Measures: PAQ (Physical Activity Questionnaire) – PAQ-C (older children), PAQ-A (adolescents); 6 minute walk test; time/distance cycle test; GAS goals. Review of the outcome measures and goals were at weeks 5 and 10 of the program, and at a 6 week follow-up.

Results: It is envisaged that on completion of the bike riding program, each participant will show improved levels in individual physical, functional and participation outcome measures.

Conclusions and Clinical Implications: Adapted bike riding for children with a physical disability is a viable way of increasing physical activity. It can broaden the opportunities for families to participate in physical activity together. The Pedal Power Package is versatile and can be used successfully in a variety of locations. Further research into the intensity, frequency and duration of adapted bike riding is required to investigate the optimal level required to improve cardiovascular fitness.

Implementation and Preliminary Evaluation of a New Model of Paediatric Rehabilitation Services

Ms Chantal Camden1, Dr Bonnie Swaine1, Dr Sylvie Tétreault1, Ms Marie-Michèle Brodeur1, Ms Sophie Bergeron1

1Université de Montréal, 2Université Laval, 3Centre de Réadaptation Estrie

Background: In 2006, a paediatric rehabilitation programme in Québec, Canada, began reorganizing their service delivery to address long waiting times for children and their families. A new service delivery model was developed and implemented in September 2007.

Objectives: To determine whether indicators (e.g. waiting times and families’ and services providers’ perceptions of service quality) changed over the first year of implementation.

Design: A before and after design was used in this participatory action research.

Participants/Setting: The interdisciplinary programme provides care annually to over 1000 children (about 5% with CP) and their families. Random samples of families receiving services in 2007 (n=69) and of those receiving services in 2008 (n=94) were created. Service providers working in the programme pre and post implementation also participated (n=45 and n=50, respectively).

Materials/Methods: Accessibility indicators were collected throughout the study period in a standardized way using the administrative information system. The Measure of Processes of Care (MPOC) (King et al., 1996) was mailed to families who either completed the questionnaire and returned it by mail (65% and 79% in 2007 and 2008, respectively) or answered the questions by telephone (33% and 21%, respectively). Service providers completed the MPOC-SP (Woodside et al., 2001). Descriptive analysis and independent t-test were performed.

Results: In general, waiting times diminished from 2007 to 2008 (e.g. 16.7% reduction). The waiting list for a first encounter decreased from 95 to 42 children and the number of children receiving services increased (972 to 1081). Families’ perception of service quality ranged from 4.68/7 (SD 1.91) to 6.30/7 (SD 1.91) in 2007. In 2007 and 2008, items pertaining to Providing general information received the lowest scores while Respectful and supportive care were rated highest. Both years, service providers’ scores were lower than those of families. Mean service provider scores in 2007 ranged from 3.67/7 (SD 0.80) to 5.66/7 (SD 0.94) for Providing information to 5.66/7 for the Treating people respectfully. Both years, service providers’ scores were lower than those of families. Mean service provider scores in 2007 ranged from 3.67/7 (SD 1.24) for Providing information to 5.66/7 for the Treating people respectfully. Mean scores for the different subscales for both versions of the MPOC did not differ significantly from year to year. Accessibility to care thus improved while the perception of the quality of the services remained stable.

Conclusion/Clinical Implications: This new model of paediatric rehabilitation services is a promising alternative to the old model. Although challenges remain to fully implement new aspects of service delivery, data after one year suggest we can increase the number of children receiving services and decrease waiting times while maintaining service quality.

The Effect of HippoTherapy on Children with Spastic Diplegic Cerebral Palsy

MD Hyung Jung Chang1, MD Ji Hye Hwang1, MD Yun-Hee Kim1

PT Dae Sung Park2, PhD Nam Kyun Kim1, PT Ji-Young Lee4

1Department of Physical Medicine and Rehabilitation, Samsung Medical Center, Sungkyunkwan University School of Medicine, 2Center for clinical Medicine, Sungkyunkwan University School of Medicine, 3Division of Bionics and Bioinformatics, Chonbuk National University, 4Samsung Equestrian team

Objectives: The aim of this study was to investigate whether hippotherapy could improve functional performance and postural control of children with spastic cerebral palsy (CP).

Methods: Nineteen children with spastic diplegic CP who could sit alone were included. The thirty-minute hippotherapy was conducted twice a week for 8 consecutive weeks. Gross Motor Function Measure (GMFM) and sitting balance were evaluated before and after hippotherapy. Sitting balance was assessed using specially designed device that consisted of unstable platform, force plate, frame, safety harness, monitor and computer. Force plate on unstable platform enabled to monitor the center of pressure (COP) of subject. COP sway (time to maintain COP on circle at center of monitor and distance away from central location), COP maintaining time (time to maintain COP on desired target) and COP moving time (time to move COP to desired target away from central location) were recorded before and after hippotherapy.

Results: There was a significant improvement in gross motor function of children with CP after hippotherapy. Dimension B (sitting) and E (walking, running, jumping) scores of GMFM were especially increased significantly. In COP sway, the time maintaining at center was significantly increased. COP moving time to all directions except posterior were significantly decreased and COP maintaining time to all directions except posterior were significantly increased (p<0.05).

Conclusions: Hippotherapy could improve functional performance and sitting balance without adverse effect, therefore, it can be considered as an additional therapeutic method for rehabilitation of children with spastic diplegic CP. Long-term effect of hippotherapy with randomized controlled design needs to be investigated in future.
The Test-Retest Reliability of the Pediatric Evaluation of Disability Inventory-Chinese Version in Children with Cerebral Palsy

Ms Kuan-Lin Chen¹, Prof. Mei-Hui Tseng²

¹School of Occupational Therapy, College of Medicine, National Taiwan University, ²School of Occupational Therapy, College of Medicine, National Taiwan University, & Department of Physical Medicine and Rehabilitation, National Taiwan University Hospital, Taiwan.

Background: To evaluate daily function for children with cerebral palsy (CP) following interventions, a reliable measure is needed. The Pediatric Evaluation of Disability Inventory (PEDI) is frequently used as an outcome measure for evaluating daily function in children with CP. The PEDI includes Functional Skills Scale (FSS) and Caregiver Assistance Scale (CAS) for measuring capacity and real performance respectively in daily life in 3 domains: self-care, mobility, and social function. However, the test-retest reliability of the PEDI has not been determined when used exclusively in children with CP.

Objectives: To assess the test-retest reliability of a Chinese version of the PEDI (PEDI-C) in children with CP with both relative reliability and absolute reliability.

Design: A reliability study

Participants: Fifty-eight children with CP (mean age=65.4 months; SD=29.9 months) were recruited from pediatric rehabilitation clinics and their parents participated in the study. The sample included children with spastic quadriplegia (n=32), spastic hemiplegia (n=10), spastic diplegia (n=6), dyskinetic (n=2), hypotonic (n=6), mixed (n=2). Seventeen children were classified at level I according to the Gross Motor Function Classification System (GMFCS), 15 at level II, 11 at level III, 6 at level IV, and 9 at level V.

Methods: All the caregivers were interviewed by a trained interviewer twice within a 2-week interval. Intraclass correlation coefficient (ICC), a relative reliability index, was used to examine the level of agreement between repeated measurements. Smallest real difference (SRD), an absolute reliability index, was used to determine how much change a child made is real with 95% confidence level.

Results: The ICC was high (ICC2,1=0.98–0.99) for each domain in both the FSS and the CAS, indicating excellent test-retest agreement. The SRD of each domain ranged from 3.0 to 4.3 in the FSS, and from 2.5 to 3.2 in the CAS.

Conclusion: The PEDI-C is a reliable measure for assessing daily function in children with CP. Furthermore, the SRD of each domain in both the FSS and the CAS provides clinicians and researchers a smallest change threshold that indicates a real change of daily function. Thus, the SRD helps clinicians and researchers interpret change scores of the PEDI-C in children with CP.

Active Support-Poster

Ms Valerie Crowther, Leveda Inc

Active Support is an evidence-based approach to the design and delivery of community-based support services for people with disabilities, especially for those with complex support needs. It involves training staff in specific skills and organisational procedures that focus their work on the direct support of consumer participation in meaningful activity. A fundamental reason for implementing Active Support is the well-documented low level of participation by people with disability in everyday activities that affect their quality of life. This phenomenon arises from a service model that currently emphasises the need to do things for people, rather than with people. Active Support emphasises the importance of doing things with people, maximising their opportunity for participation and choice in every day activity. (Emerson & Hatton 1996; Stancliffe et al. 2001; Felce et al. 2002).

Leveda is an accommodation and community support service for individuals with a disability and complex support needs. Leveda was formed 19 years ago by a group of parents who sons and daughters moved from Ru Rua Nursing Home to live in the community. The young people had severe physical and cognitive disabilities, many with cerebral palsy and the majority never had the opportunity to attend school as they were perceived as not being able to be educated. The impact of many years of support services underpinned by a medical model, limited or no access to education and no professional support such as communication programmes and high personal care and complex health care needs has resulted in clients receiving services that are based on care, safety and protection.

Leveda in collaboration with two other service providers SCOSA and Disability SA have introduced Active Support to their services. The initial focus of each agencies implementation of Active Support has been with adults with a disability and complex support needs including individuals with a severe physical disability many who have cerebral palsy. All three agencies support individuals who previously lived at Ru Rua Nursing Home.

The poster will outline:
- photographic examples of Active Support in action
- evidence related to the increase in client participation and engagement
- experiences of direct support staff
- examples of the system redevelopment and processes developed to underpin the Active Support Methodology
- adaptations made to accommodate individuals with cerebral palsy
- results of the Australian Active Support Research Project
- examples of the recording tools developed
The Presence of Physiological Stress Shielding in Load Bearing Articulations in Patient with Cerebral Palsy

Mr. Mark Driscoll, Mr. Leonid Blyum
Advanced Bio-Mechanical Rehabilitation

Introduction: Cerebral palsy (CP) is defined by a non progressive neurological deficiency with inadequate control of the motor system, which results in hypertonia and spasticity of muscles. These muscular discrepancies often progress limiting controlled movement and distorting the musculoskeletal system. Recent studies have quantified the increase in passive muscle forces in spastic muscle groups. This local change in material properties may cause force imbalances between co-contractors in articulating joints leading to the distorted postures observed in CP. These irregular properties may also restrict force and stress stimulation of the non spastic muscle group leading to hypotonia and stress shielding. It is these irregular muscle tone mechanisms that this study interprets from a biomechanical perspective in order to demonstrate the presence of stress shielding in patients with cerebral palsy.

Objectives: To interpret the influence of irregular muscle material properties on the force and stress distributions in load bearing articulations of patients with cerebral palsy.

Methods: Two simplified biomechanical models of an elbow joint in a prone press up position were constructed. One simulating an articulation with healthy muscles and the other represents a spastic CP patient. Material properties of bone and muscle respect mean values from the literature while the spastic muscle properties arise from recent publications. Partial body weight was modeled over the shoulder joint while it was constrained in the translational plane with the hand contact constrained in all directions. A static linear analysis was performed while the forces and stresses of the biceps and triceps were quantified and compared between the healthy and CP models for a variety of configurations.

Results: Results from the healthy model agree with similar studies demonstrating the corroboration of the simulations. There was a significant increase in force and stress in the spastic biceps with a completing decrease in the triceps of the CP model. Further, the change in load distribution between the biceps and triceps in the CP model showed a close correlation to their relative difference in material properties. Different reaction forces were also observed at the hand contact with an increase of medial force measured in the CP model.

Conclusion: This biomechanical analysis demonstrates the presence of stress shielding in the spastic load bearing articulations due to the irregular muscle material properties in patients with cerebral palsy. This study highlights the need to address these asymmetrical material properties between co-contractors prior to enforcing load bearing rehabilitation activities in spastic individuals.

Kinematic Analysis of Two Functional Upper limb Tasks in Children

Ms Leanne Dwan1, Assoc Prof Andrew McIntosh2, Dr Kevin Lowe2
1University of New South Wales/NSW Paediatric Clinical Motion Analysis Service, 2Sydney Childrens Hospital NSW Paediatric Clinical Motion Analysis Service

Abstract: Research methods in upper limb movement analysis are developing towards clinical tools. The identification of repeatable movement patterns of the upper limbs in a normal child population was investigated. Characteristics of movement patterns measured appeared repeatable, moving closer to forming a basis for comparison to pathologic movement.

Background: Recent research methods in the measurement of upper limb motion have progressed towards 3D motion analysis, to develop understanding of upper limb dynamic movement (Rau 2000). Upper limb movement measurement is complex (Veeger 2003, Rau 2001) due to the degrees of freedom available for movement completion (McIntosh et al. 2002, Schmidt 1999). There is a need to develop a valid protocol to measure function to allow application in clinical settings.

Design: The study was a cohort of children aged 8 to 10 years, with no pathology, for kinematic analysis of two functional upper limb movements.

Participants/Setting: Subjects from local schools were invited to participate. 20 subjects took part in the study. Testing was done at the University of New South Wales Biomechanics and Gait Laboratory.

Materials/Methods: 3D Motion capture was done using a Vicon Workstation system (Oxford Metrics). Two functional movements were measured: 1) Hand to mouth and 2) Hand over head. An upper limb model was run on the data (McIntosh 2002). Joint angles for shoulder, elbow and wrist joints, as well as the thorax segment were extracted. The maximum and minimum values for each degree of freedom were found. Time series data were then time-normalised, giving the timing of the maximums and minimums. Data from both limbs of each subject were measured and included for analysis, giving 40 limbs from 20 subjects. Comparisons between dominant and non-dominant limbs were investigated.

Results: Further analysis to establish repeatability within individuals of the angles measured is needed. When studying the timing of joint angle peaks during the movements, both movements demonstrated consistent timing of all maximum and minimum peaks of upper limb angles measured, except for the elbow extension peak.

Conclusions/Clinical Implications: The timing of peak joint angles of movements measured within a group of normal children appear to be largely consistent. Further investigation of dynamic functional upper limb tasks will provide clinicians with a tool to assist in the investigation and treatment of upper limb movement disorders.
Investigating Internalized Stigma in Adults with CP Living in Iran Isfahan
Dr Salar Faramarzi1, Ms Akram Akkafi2
1Isfahan University, 2Organization Of Education Of Exceptional Children

The purpose of this study was investigating internalized stigma in adult with cp living in Isfahan. Questions’s research was: 1) was there internalized stigma in adult with cp? 2) What factors was predicting stigma? 30 adults with cp living in Isfahan selected through random selection. Instrument that used in this study was developed and validated by researchers. Data analyzed through one sample t-test and multiple regression. The results indicated that internalized stigma exist in adult with cp and education level was the best predictor for stigma. The findings indicated that adult with cp were at risk of stigmatization.

Repeatability of a Three-Dimensional Upper Limb Movement Analysis in Children
Prof Hilde Feys1, MSc Ellen Jaspers2, Prof Herman Bruyninckx3, Prof Herman Bruyninckx3, Prof Guy Molenae4, Prof Kaat Desloovere5
1PT, PhD/Department of Rehabilitation Sciences – K.U.Leuven, Belgium, 2PT/PhD fellowship of the Research Foundation – Flanders, Belgium; Department of Rehabilitation Sciences – K.U.Leuven, Belgium, 3Eng, PhD/Department of Mechanical Engineering – K.U.Leuven, Belgium, 4MD, PhD/Department of Musculoskeletal Sciences – K.U.Leuven, Belgium, 5PhD/Clinical Motion Analysis Laboratory – University Hospital Pellenberg, Belgium

Background: While gait analysis has widespread use in many clinical applications in CP, few studies used three-dimensional (3D) analysis to study upper limb movement patterns in this patient group. Studies showed marked methodological differences and there seems no consensus on the upper limb movement protocol.

Objectives: To develop a clinically feasible 3D measurement procedure (upper limb model and movement protocol) and to evaluate the repeatability of this measurement procedure.

Design: The within and between session repeatability of 3 tasks was tested in normal children, who were tested on 2 occasions (2-10 days apart).

Participants/Settings: Eight typically developing children (mean age 9.8 ± 3.5 years) were tested in the Clinical Motion Analysis Laboratory (University Hospital Pellenberg).

Material/Methods: The movement protocol consisted of 3 functional tasks, performed with the non-dominant arm: reach forwards (RF), reach to grasp (RTG) and hand to mouth (HTM). Children were seated in a custom-built chair that allowed individualized reaching distance/height, and foot/foam support. The biomechanical model (marker model and mathematical definitions) was based on the International Society of Biomechanics recommendations [1]. Movements were captured with 12 Vicon-cameras (Oxford Metrics, UK), and data was further processed using BodyMech (MOVE, Amsterdam) and Matlab. The angular movement cycles (waveforms) were time-normalized and similarity of the waveforms was assessed with the coefficient of multiple correlation (CMC), and averaged for the total group [2]. Within session repeatability was assessed by comparing the waveforms of 3 trials per task within the 1st session. Between session repeatability was based on the comparison of the averaged waveforms per task of the 2 test sessions.

Results: During RF and RTG, glenohumeral elevation and rotation, elbow flexion-extension and scapular protraction-retraction and rotation had good to excellent within and between session repeatability (mean CMC 0.80–0.96). Repeatability of wrist movements was lower (mean CMC < 0.74). HTM resulted in good to excellent elbow flexion-extension, pronation-supination, wrist ulnar-radial deviation and glenohumeral plane of elevation repeatability (mean CMC 0.80–0.99). Scapular movements in all 3 planes were poorly repeatable for HTM, especially between sessions (mean CMC < 0.40).

Conclusions: Although results are promising, further standardization is required to maximize repeatability. The lower repeatability of some waveforms also seemed to depend on the selected task, especially for the wrist. Therefore, additional upper limb tasks should also be tested for repeatability. A next step will be the exploration of the applicability and repeatability of the procedure in children with hemiplegic CP.

Does the Weekly Frequency of Therapeutic Intervention Contributes to the Development of the Functional Global Profile of the Children, Between 5 and 10 Years Old, with Cerebral Palsy, According to the Parental Perspective?

Mrs Marta Figueiredo
Associação De Paralisia Cerebral De Braga

This research is directly related with the specific need of specialized therapeutic intervention in children with C.P., according to the parental identified needs, promoting their involvement and active participation.

The research design is centered in the use of the Pediatric Evaluation of Disability Inventory in two moments, with approximately one year of difference, in which the inventory is fulfilled by parents, after a brief explanation of the procedures of completion.

There are several primary variables such as:

- geographic/cultural context of family
- context of the therapeutic intervention: individual or group sessions
- therapeutic intervention of more than one area of knowledge: Occupational Therapy, Speech Therapy and Physiotherapy

The results of the research will be present crossing over the variables with the result criteria of the P.E.D.I.: in which areas occurred a more significant development and which is the total percent of development in that child.

When thinking of the potential impact of the results of this project on the connaissance of Cerebral Palsy, we are directly forwarded to the real therapeutic intervention influence in the Functional Global Profile of the child, as perceived by parents, empowering the need of creating therapeutic services directed, exclusively, to children with Cerebral Palsy.

Rare Etiology of Hemiparesis in Infancy and Early Childhood

Dr Gabriella Filiczki¹, Dr Mária Balázs², Kálmán Rábai³

¹András Institute for Conductive Education of the Motor Disabled & Conductors College, ²II. Department of Pediatrics, Semmelweis University Budapest, ³Semmelweis University Budapest

Introduction: The authors report a case of a presently four-year-old cerebral paretic boy, whose right hemispherial intracerebral haemorrhage was noticed when he was nine weeks old. Leukemia was detected in the background of the stroke.

Case study: He was born from IVF twin pregnancy on the 37th gestational week, with 2600 grams, Apgar scores were 9 and 10. His early adaptation was uneventful. On the ninth week he got antibiotic treatment for pneumonia. Two days later his status worsened suddenly, and he was admitted to the hospital with pathologic neurological symptoms (aprehension, screaming, pallor and disturbance of tone). Extended haemorrhage was detected with cranial ultrasonography and CT in the right hemisphere. Extreme leucocytosis, thrombocytopenia and atypical cells were found in the blood smear. Beside the pathologic neurological symptoms, hepatosplenomegaly was significant. Acute lymphoid leukemia was verified with bone-marrow examination. His haematological treatment was undertaken according to the 'Interfant 99' protocol. The neurotherapy was started according to Katona’s method, and later complex physiotherapy was started. Cystic laesions around the previous haemorrhage were detected with cranial ultrasonography and MRI. Chemotherapy and neurotherapy were done side by side all timelong. His chemotherapic treatment was accomplished a year ago. Hematologically he is in remission. At the age of four, minimal left sided hemiparesis can be detected. The synkinesis of his left hand is slightly delayed, and the flexion of his left foot is slightly weaker. He is able to climb up a wall bar on his own. He can speak and the psychomotor developmental status is normal.

Discussion: In the background of a sudden envolved cerebral haemorrhage and hepatosplenomegaly of a nine week old infant, acute lymphoid leukemia was verified. In spite of the serious etiology the suitable treatment of acute lymphoid leukemia and the neurohabilitation-rehabilitation of the child effected convalescence with only minimal neurologic remainder symptoms.
Using 3D Motion Analysis to Quantify Change in Co-ordination of Upper Limb Reaching in Children with Hemiplegic Type Cerebral Palsy Who Received Botulinum Neurotoxin Toxin Type A (BONTA) Injections to Manage Spasticity

Ms Noula Gibson1, Prof Peter Hamer2, Adjunct Assoc Prof Eve Blair3, Dr Brendan Lay4, Dr Jane Valentine4

1Princess Margaret Hospital for Children, Department of Paediatric Rehabilitation, Perth, Western Australia, 2The University of Western Australia, School of Sport Science, Exercise and Health, Perth, Western Australia, 3The University of Notre Dame Australia, Physiotherapy, School of Health Sciences, Perth, Western Australia, 4Telethon Institute for Child Health Research, Perth, Western Australia, 5The University of Western Australia, School of Sport Science, Exercise and Health, Perth, Western Australia, 6Princess Margaret Hospital for Children, Department of Paediatric Rehabilitation, Perth, Western Australia

Background: Reaching movements require coordination of multiple joints, involving integration of musculoskeletal and neural systems, with the goal being smooth and accurate movement. Jerk (the 3rd derivative of displacement) is proposed as a measure of smoothness of movement. In the present study, analysis of jerk is directed towards quantifying movement outcomes when botulinum toxin A (BoNTA) is used as an adjunct therapy with intent to reduce focal muscle spasticity so as to improve upper limb function and performance in children with cerebral palsy (CP). Being able to quantify quality of movement may assist therapists decide the aspects of a child’s motor repertoire most responsive to BoNTA therapy, thus enabling more focussed rehabilitation.

Objective: To determine the principal descriptors of the variable jerk that quantifies differences in quality of task-directed movement and to use this to quantify co-ordination of upper limb reaching in children with CP who received BoNTA injections to manage upper limb spasticity.

Design: A randomised, controlled intervention trial

Setting: Tertiary referral centre

Participants: 8 subjects with congenital hemiplegic palsy, aged seven to sixteen years, pair matched for age and function

Method: After baseline assessment for function, one child in each pair was randomly assigned to the treatment group and received BoNTA injection into the upper limb. Subjects in the control group did not receive upper limb BoNTA injections. Outcomes were measured one, three and six months after BoNTA injection. Participants were asked to reach, at a self-selected pace, toward a target placed at the end of the subjects available arm extension. Each subject completed five trials. A 3D motion analysis system recorded the trajectory of the wrist joint during the reaching task. The spatio-temporal variables derived from the calculation of 3D jerk for the reaching movement were computed and analysed.

Results: Preliminary review of the data indicates a wide variation within and between subjects and between the control and experimental subjects. Continuing work is directed towards refining the analysis to determine the most appropriate variables that can be used to describe any differences after the intervention. The most promising variables appear to be a measure of movement directness and the normalised jerk in the primary and secondary phases of the movement.

Conclusion/Clinical Implications: Measurement of movement smoothness may be applied as a valid and sensitive index to quantify the level of coordinative motor performance for subjects with spastic movement disorder.
Emerging Victorious! Case Studies of Children who Attended EIP at AmarJyoti

Ms Rakhi Gill, Dr. Rita Malhotra
AmarJyoti Rehabilitation And Research Centre

Background and Objectives: The activities of the Early Intervention Programme (EIP) at AmarJyoti Rehabilitation and Research Centre are unique. It works in a systematic manner with children and parents and coordinates with various departments.

1) Developmental Assessment by a Psychologist is the first essential step in EIP.
2) The second step is the training programme wherein the Early Interventionist assesses children with the help of Portage Guide to Early Education on five essential areas of development: Infant development, Socialization, Self-Help, Language, Cognition, & Motor
3) After the initial assessments, case records are prepared so that Occupational therapist (OT), Physiotherapist (PT) can formulate an intervention programme for the children with disability.

The purpose of the study was to identify various areas in which development delay occurs and review need based EIP and its effectiveness in a particular case. It also studies the role of interdepartmental support services.

Design/Participants/Setting: The study is mainly qualitative and descriptive in nature. Purposive sampling was used for sample selection. The study was done within the premise of the Rehabilitation Centre, which caters to children between ages 0 to 6, with various disabilities including Cerebral Palsy. The participants include 4 children, their parents and a team of professionals.

Method: Data was collected through observations, analysis of case records and formal/informal interviews. Case study approach was used to organize the data.

Results: in the form of Case narratives and Graphs represent progress made by each child. Table below shows results at a glance

<table>
<thead>
<tr>
<th>CASE</th>
<th>Socialization</th>
<th>Language</th>
<th>Self Help</th>
<th>Cognitive</th>
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<tbody>
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<td>Above 5-6 age level</td>
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<td>5-6 age level</td>
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Conclusions/Clinical Implications: In the present study the efforts of the integrated team of professionals facilitated the identification of developmental delay in five essential areas of development in cases of children with cerebral palsy. The unique narratives highlight the personal growth of each child in varied facets of development.
Improved Measurement of Calf Contracture in Children with Cerebral Palsy

Ms Tandy Hastings-Ison 1, Ms Christine Blackburn 2, Prof Kerr Graham 3, AProf Barry Rawicki 4, AProf Rory Wolfe 5, AProf Richard Baker 6

1 Royal Children’s Hospital, Melbourne, 2 Monash Medical Centre, Southern Health Victoria, 3 The Royal Children’s Hospital, Melbourne, NHMRC – Gait CCRE, 4 Monash Medical Centre, Southern Health Victoria, 5 Monash University, Melbourne, 6 The Royal Children’s Hospital, Melbourne, NHMRC – Gait CCRE

Background: The assessment of spastic equinus typically utilizes either a static clinical test or instrumented gait analysis, with known disagreement between the two measures. To address this, a new technique was developed where a standardized 50% bodyweight moment was applied at a known distance and direction onto a stabilized foot.

Objectives: To investigate the hypothesis that a new technique assessing passive ankle dorsiflexion in children with cerebral palsy is more reliable than the standard measures reported in the literature.

Design: Repeated measures.

Participants and Setting: 34 from an eligible 36 ambulatory children with cerebral palsy aged 2–9 years were assessed in a tertiary hospital. Inclusion criteria included GMFCS level I-III and presentation for a procedure requiring mask anaesthesia (MA). Exclusion criteria were previous calf surgery and Botulinum Toxin A injections within the preceding 3 months.

Methods: In supine with hip and knee extended, a measured 50% bodyweight dorsiflexion force was applied to the sole of foot via a footplate. A digital photograph was taken and software applied to assess dorsiflexion angle. Two masked assessors took turns in a randomized sequence, assessing each subject twice in two conditions, awake and MA.

Results: 15 boys and 19 girls were assessed. 21 children had hemiplegia, 11 diplegia and 2 quadriplegia. A randomized sequence determined that the dominant side was assessed in 6 and the non-dominant side assessed in 7 of the 13 subjects with bilateral lower limb involvement. The intra-rater ICC with 95% CI for the awake and MA conditions ranged between 0.84 (0.74, 0.94) to 0.95 (0.91, 0.98) for assessor 1 and 0.90 (0.84, 0.96) to 0.89 (0.81, 0.96) for assessor 2 respectively. The inter-rater ICC for the awake and MA conditions for within assessors was 0.83 and 0.91, and for between assessors was 0.60 and 0.88 respectively. The standard deviation for between assessors was 5.90 awake, 2.01 MA.

Conclusions: Intra-rater reliability was very good in both the awake and MA conditions suggesting that although the condition is assessor influenced, both assessors rater highly. Inter-rater reliability was very good asleep and fair when awake suggesting conscious factors contribute to increased variability. SD between assessors demonstrated that this new technique is highly reliable in the asleep condition and compares favorably to previously reported measures assessing passive ankle dorsiflexion in awake children with cerebral palsy. This new technique improves the reliability of passive ankle range of motion, vital for both clinical assessment and research.

Upper Extremity Motion Analysis: Can This Be Useful for assessing and Measuring Complex Upper Limb Disorders in Children with Cerebral Palsy?

Dr Robyn Grote, Ms Teresa Philips

Queensland Children’s Gait Laboratory, Royal Children’s Hospital, Brisbane

Background: For many children with cerebral palsy (CP) upper limb dysfunction is a major functional and aesthetic concern. Children can have a range of neuro-motor impairments which affect movement and these respond differently to the treatment options (medical, surgical, pharmaceutical and clinical therapies) currently available. For clinicians working with these children, diagnosing the underlying impairments is challenging. In particular, it is sometimes difficult to distinguish between dystonia and spasticity. Routine clinical measures cannot reliably distinguish between the different causes of resistance to passive movement, including neural and passive mechanical causes, making intervention planning difficult and outcomes variable. Recent developments in our ability to quantify movement of the upper extremity offer the potential for more sophisticated assessment procedures.

Objective: The Upper Extremity Motion Analysis (UEMA) project aims firstly to develop a method of quantifying upper extremity movement, including range and quality. Secondly, the movement of typically developing children will be recorded to assess the intra subject reliability and variability of the measures. Finally, we will measure children with CP who could be categorised as predominantly dystonic or spastic, and compare their data with that from the typically developing children. It is hoped that the findings will enable clinicians to more accurately diagnose movement disorders, make more effective use of currently available interventions, and therefore optimise outcomes. The first aim is the focus of this abstract and will determine if UEMA is a valid and reliable tool which may be used for evaluating the effectiveness of interventions, assessing individuals over time, or for research.

Method: Pilot participants were marked up for 3-dimensional motion analysis (8-camera VICON motion analysis system and Plug-in-Gait upper extremity model). They performed up to 20 repetitions of five tasks: drawing a square, hammering a nail, tapping a drum, reaching between a target and their own nose and grasping/releases a ball. Given qualitative aspects of movement are important in identifying dystonia, measures of smoothness (velocity and acceleration data), variability during trajectory, endpoint error, inter-joint coordination, length of pauses during reversals of direction and cycle time at preferred speed were derived from the data.

Results: Example motion data, including the qualitative movement parameters and motor patterns have been produced graphically for the pilot participants. In addition, reliability estimates have been determined.

Conclusion: This project has enabled objective measurement of upper limb movement quality during functional tasks. The clinical application of upper extremity motion analysis is yet to be evaluated.
Constraint Induced Movement Therapy Effects on Motor Behaviour of Children with Hemiplegic Cerebral Palsy

Dr Anne-Fabienne Huffenus1, Dr Martin Lemay2, Dr Céline Lamarre3, Dr Mindy Levin4

1Centre de recherche – CHU Sainte Justine, 2Centre de recherche – CHU Sainte Justine – Montréal (Canada), 3Programme Cerebral Motor Deficiencies – CHU Sainte Justine – Montreal (Canada), 4Physical Therapy Program – McGill University – Montreal (Canada)

Previous studies described various motor deficiencies of children with cerebral palsy: crouched posture, inappropriate sequencing and delayed responses in muscles, increased coactivation of agonists/antagonists (Chen and Woolacott, 2007), increased displacement of the center of pressure while postural control (Usdinova et al., 2004) and asymmetric locomotor pattern. Moreover, in daily tasks, strategies of children with hemiplegic cerebral palsy (HCP) generally use their non-affected hand and neglect the affected hand.

Constraint-induced movement therapy (CIMT) was recently shown to improve movement efficiency in the involved hand of children with HCP (Charles et al., 2007; Gordon et al., 2007; Taub et al., 2004). Upper limb motor capacities were there evaluated by clinical scales. However, mechanisms underlying this enhancement are widely unknown; but studies using cerebral imagery suggested that CIMT induced cortical neuromodulations (Jung et al., 2007).

Our study aims at evaluate the CIMT effects on the overall motor behaviour of children with HCP. We use objective and sensitive measures to appreciate motor organization in postural control, in walking, in anticipatory postural adjustment (APA) task and in reaching-grasping movement. We hypothesize that CIMT would influence not only affected hand movement efficiency, but also postural and locomotor control.

Eight children with HCP (mean age: 10.6 ± 1.3) participate in a therapeutic 12 days-summer-camp; there, with the non-involved arm immobilized, they do physical and manual activities 6 hours a day.

Children are evaluated immediately before and after the CIMT and 6 months later. Position signals (VICON), ground reaction force data (AMTI) and electromyographic data are collected during 4 tasks: (1) stand up on a force platform for two 30 sec-trials, (2) walk on 8 meters-trajectory for 6 times, (3) point forward while standing and (4) reach and grasp an apple piece. For both last tasks, trials with each arm are randomised.

With regard to our pilot-study and previous studies, we expect CIMT effects: a lateral adjustment (towards the center) of center of pressure displacement and a lower delay of affected side muscles activations during postural and APA tasks, modifications of kinematic gait parameters (step length and affected arm swaying) and an improvement in reaching-grasping task realized with involved arm (decreased movement time and increased joint rotation amplitudes).

Since children should easily realize reaching-grasping task, CIMT definitely improves functionality of affected hand and upper limb. Upper limb is involved in dynamic postural control, and the system integrates its enhanced motor capacities to optimize the whole body coordination control.

Caregivers’ Knowledge of Young Children Development in Taiwan

Dr Jen Wen Hung1, Dr Hsin Chi Wu2

1Department of Rehabilitation, Chang Gang Memorial Hospital, Kaohsiung, Taiwan, 2Rehabilitation department, Tzu Chi General Hospital, Taipei, Taiwan

Background: Early intervention of developmental delay depends on early detection Early detecting the developmental problems of children usually relies on the correct developmental knowledge of caregivers of young children. The purpose of this study was to determine caregivers’ knowledge about child development in Taiwan.

Study Design: Cross section surveys

Study Participants: Caregivers of children aged <or=3 years who visited a tertiary hospital any reasons were invited to join this study.

Methods: The caregiver knowledge of child development was assessed by a questionnaires modified from the developmental check boxes of pathways awareness foundation and Social Bureau of Taipei city. It consisted of questions on when children begin to demonstrate developmental skills and when caregivers consider to searching for intervention if children did not get the skill in the certain time.

Results: In total, 422 caregivers of children aged <or=3 years were recruited. Three hundred ninety nine caregivers were parents, thirteen were grand-parents. Seventy three caregivers were male, and the mean age of caregivers is 33-year-old (17 to 65). The median questionnaire score was 10 (highest possible score 22). Caregivers had better knowledge of physical development (correct rate 60%) as compared with speech development (correct rate 40%) and play development (correct rate 36%). Few caregivers(20%) knew children can releases small objects into a small container in fifteen-month-old, most caregivers(76.5%) knew children can walks independently and seldom falls in fifteen-month-old. Only 4% caregivers will search for intervention immediately if children did not get the skill in the certain time, nearly one quarter of caregivers will wait and see for more than 3months, especially for speech delay. In a linear regression model with the sum score as the dependent variable and caregiver’s characteristics, including age, sex, education level, marriage status, nationality, living location, family income, age of the youngest child, number of children and if having child with developmental delay or not as the independent variables, lower level education and single parent were found to be independent predictors of lower sum scores (P =0.009, 0.011).

Conclusions: These results illustrate the caregivers in Taiwan may be lacking information on early childhood development and had low insight for early intervention. Effective propaganda to promote the knowledge of young child development of caregivers should be planned.
Exploring Personal and Systemic Barriers Experienced by Adults with Cerebral Palsy When Accessing Sex Worker Services

Mr Saul Isbister¹, Dr Russell Shuttleworth¹, Dr Bronwyn Hemsley¹, Dr Patricia Weerakoon²
¹University of Sydney, ²Chief Supervisor, University of Sydney, ³Supervisor, University of Sydney

Background: In 1995, sex work was fully decriminalised in New South Wales (NSW), Australia. However, to date there is little information available on the perspective of people with cerebral palsy accessing the sex industry. Anecdotal evidence suggests that adults with cerebral palsy face many barriers in gaining appropriate support and assistance to access sex worker services in NSW.

Objectives: The aim of this project is to identify (a) barriers adults with cerebral palsy experience when seeking to access sex worker services, and (b) strategies these adults find helpful in accessing sex worker services.

Design: This qualitative study involved a constant comparative content analysis of in-depth conversational-style interviews.

Participants/Setting: A purposive sample of 8–10 men and women with cerebral palsy will be recruited through organisations providing supported accommodation. Eligibility criteria includes: having a functional method of communication in English; being at least 18 years old; living in supported accommodation in New South Wales; having accessed sex worker services; and being able to provide informed consent. Interviews will take place in 2008 at a participant’s residence, or another location of their choice with suitable privacy.

Materials/Methods: Participants will be interviewed on at least two occasions in order to gain an in-depth understanding of their experiences. Interviews will be digitally audio-recorded, transcribed verbatim, and analysed prior to subsequent interviews. Researchers will verify the content of the transcribed interviews with the participants. Through a content analysis of each transcript, the researchers will identify the main themes and sub-themes relating to (a) personal and systemic barriers in accessing sex workers, and (b) strategies to address these barriers.

Results: We will present preliminary findings outlining the barriers encountered and strategies participants employed in accessing sex workers. Results will be discussed in relation to a wide range of socio-cultural, organisational and personal attitudes and values, along with individual circumstances. The authors will discuss the findings in relation to the literature and identify policy and practice implications for service providers supporting adults with cerebral palsy.

Conclusions/Clinical Implications: The findings of this research will have implications for government and community based policy makers, disability advocacy groups and service providers. It will increase the understanding of the experiences of adults with cerebral palsy in accessing sex workers and identify areas for future research.

Applicability of the ICF Checklist to Cerebral Palsy Habilitation Setting

PT, MSc Ira Jeglinsky¹, Adj Prof, MD Ilona Autti-Rämö²
¹Arcada University of applied sciences, Helsinki, Finland, Karolinska Institutet, Stockholm, Sweden, ²The Social Insurance Institution, Helsinki, Finland

Background: The International Classification of Functioning, Disability and Health (ICF) is developed to provide a common language and a framework for health professionals in describing health-related states. In order to facilitate the use of ICF, WHO developed the ICF checklist. This checklist enables to generate a profile of the patient using the most important ICF categories.

Objectives: To investigate the applicability of the ICF checklist in describing the Functioning and Health in children with CP.

Design: A cross-sectional retrospective content analysis.

Participants/Setting: Randomly chosen written health documents from the register of the Social Insurance Institution (SII) for 20 children with CP were systematically analyzed using the ICF checklist. These documents are used when deciding on the content of habilitation.

Materials/Methods: Health documents of 20 children with CP from the register of the SII were evaluated and coded according to the ICF checklist (2.1a). Two raters with content expertise and of different profession independently extracted the documents including statements from medical doctors, physiotherapists, occupational therapists, speech therapists and neuropsychologists. The domains for the activity and participation components were coded using the performance qualifier.

Results: The codes for body functions (b1–8) showed that only mental functions (b1) and neuromusculoskeletal movement related functions (b7) were well described. Descriptions for these domains were found in 19/20 records. The codes for impairments of body structure (s1–8) were in general poorly described, only structures for cardiovascular, immunological, respiratory systems (s4) and systems related to movement (s7) were described in 5/20 medical records. In the domains for activity and participation (d1–9) communication (d3) (17/20), mobility (d4) (20/20) and self-care (d5) (19/20) were well described. For the environmental factors products and technology (e1) were described in 16/20 documents. For the other domains in the various components of the ICF checklist the descriptions were poorly or not at all described.

Conclusions: Important areas such as sensory functions, relationships, learning and applying knowledge and all other environmental aspects than the use of assistive technology were hardly ever mentioned in the documents. The decision on the content and amount of individual interventions may thus omit important areas of function.

Clinical Implications: The descriptions of the rehabilitation needs of the child need to take into account all areas of function as described in the ICF framework. The ICF checklist is a useful clinical tool.
Botulinum Toxin Type A Treatment in Children with Spastic Cerebral Palsy: A Neurophysiological Study

Dr. Jae Yong Jeon1, MD In Young Seong2, MD Min Ho Chun3, MD Kyoung Hyo Choi4, MD Daion Yong Yoo4, MD Dal Youl Kim1

1Asan Medical Center, University of Ulsan College of Medicine, 2Department of Rehabilitation Medicine, Asan Medical Center, University of Ulsan College of Medicine

Objectives: The purpose of this study was to verify the neurophysiological effects of botulinum toxin type A (BoNT-A) in the treatment of spastic cerebral palsy children.

Methods: In fifteen spastic cerebral palsy patients, gastrocnemius muscles of spastic lower extremities were treated with BoNT-A. The evaluation for spasticity included modified Ashworth scale, range of motion in ankle and neurophysiological evaluation (motor nerve conduction, H reflex and F wave study). Measurements were obtained before and 1 months after BoNT-A injections.

Results: The degree of spasticity, which was measured with modified Ashworth scale, decreased significantly (p<0.05) after BoNT-A treatment. The range of motion in ankle was also improved from -3.70° to 4.57°(p<0.05). The Compound Muscle Action Potential (CMAP) amplitude of treated gastrocnemius muscles was reduced (p<0.05), while CMAP onset latency, H-wave amplitude, central conduction time (CCT), F wave conduction velocity, H/M ratio were not changed significantly after BoNT-A treatment.

Conclusions: The effect of BoNT-A treatment on the spinal neuronal circuitries was not definite in the neurophysiological evaluation.

Motor Strategies Performed By Children with Cerebral Palsy and Children with Typical Development During Seated Reach Task: Preliminary Results (Scientific Poster)

Ms. Yun-Huei Ju1, PhD Rong-Ju Cherng2, PhD Jia-Yuan You3

1Faculty of Physical Therapy, College of Health Sciences, Kaohsiung Medical University, Kaohsiung Medical University & Institute of Allied Health Sciences, College of Medicine, National Cheng Kung University, 2Institute of Allied Health Sciences, College of Medicine, National Cheng Kung University & Department of Physical Therapy, College of Medicine, National Cheng Kung University, 3Department of Physical Therapy, I-Shou University Department of Physical Therapy, College of Medicine, National Cheng Kung University

Background: Postural control is essential for a successful reach. Children with different postural control abilities may adopt different motor strategies to concurrently maintain balance and perform a successful reach task.

Objectives: To examine the different motor strategies adopted by children with cerebral palsy (CP) and children with typical development (TD).

Design: Cross-sectional Design

Participants/Setting: Two children with CP (mean age, 10 years, 4.5 months, GMFCS level III and IV) and two children with TD (mean age, 10 years, 6.5 months) were examined at the Human motion lab in an University.

Materials/Methods: Motion capture system was used to capture children's motor performance at a sampling rate of 150 Hz. Children were asked to perform a reach out and return task in a seated position on a chair. A stuffed puppy target was set a distance of 120% arm-length. Reach speed was modulated by a metronome, 46 beats/min. Ten trials were recorded in 3 different reach directions (anterior, medially, and laterally). We use a 11-link model for the study. The motion of the center of mass (COM) was examined and compared between children with CP and children with TD.

Results: Children with CP initiated trunk COM earlier before the onset of hand reach compared to that in children with TD. Early onset of COM displacement of lower limb (mean delay=0.17 s) was also noted in children with CP, but not in children with TD (mean delay=0.06 s). The medial-lateral displacement of lower limb was greater at medial and lateral reach than anterior one (p<0.0001) in children with CP, but not in children with TD while reaching out. In addition, children with CP demonstrated trunk COM displacement smaller in the anterior-posterior direction but bigger in the vertical direction than those in children with TD as returning.

Conclusions/Clinical Implications: Children with CP tend to recruit trunk and lower limb early to prepare for the reach task. They move trunk segment more vertically than in the anterior-posterior directions. It may be a compensatory strategy for their postural control deficit. More data are needed to confirm our tentative conclusion.
Extended Scope Practice in UK
PhysioTherapy – Administration of Botulinum Toxin in Paediatric Practice

Ms Lesley Katchburian, Ms Stephanie Cawker, Dr Lucinda Carr
Great Ormond Street Hospital, London, UK

Background: The need for timely and appropriate access to treatment (both on an inpatient and outpatient basis) within the Botulinum Toxin service at a large children’s hospital, prompted the design of a physiotherapy led service. Multidisciplinary working was already well established within the Botulinum Toxin Service however demand outweighed capacity with the traditional medical model with doctors being the only professional able to administer Botulinum Toxin via injection.

A change in legislative procedure in UK has enabled Clinical Specialist Physiotherapists to administer Botulinum Toxin via a hospital specific Patient Group Direction (PGD)

Currently there are two accredited routes routes to becoming a non-medical injector in the UK
A. Mentor Led-hospital based training
B. Masters Level modular training in injection therapy

Objective: Clinical Specialist Physiotherapists adopted an additional extended practitioners role in order to administer Botulinum Toxin therapy as well as their already established role within the Botulinum Toxin Service

Design: Two clinical specialists experienced in working with Botulinum Toxin underwent mentor led hospital based training. Mentoring was provided by the two medical colleagues working in the established service (Consultant Paediatric Neurologist and Consultant Paediatrician) and took place over a year

Method: The Role of the Physiotherapist in the Botulinum Toxin service includes

Pre-injection screening
• Standardised baseline assessment (including assessment of tone, range, muscle power & selectivity, Function inc video recording)
• Muscle Selection
• Dose calculation
• Goal setting

Toxin administration (Day case)
• Topical analgesia
• Oral sedation/entonox
• Intramuscular injection of Botulinum toxin under Ultrasound guidance

Post-injection (3 & 17/52)
• Reassessment using video and standardised measures
• Evaluation of outcome and goals
• Modification of therapy and orthotics to potentiate the effects of Btx

Conclusion/Clinical implications: The Botulinum Toxin Service has benefitted from having both medical and non medical injectors. Multidisciplinary working continues within the Botulinum Toxin service, with both doctors and physiotherapists performing injections. The additional training of Physiotherapists as injectors has resulted in a more flexible service which is not restricted by professional boundaries. This has resulted in a more responsive service for patients requiring Botulinum Toxin Therapy, with a resultant increase in capacity for the service.

The Effect of Phenol Nerve Block on Functional Ambulation in Cerebral Palsy Child: A Dynamic Gait Evaluation with Digital Video Camera

Dr. Samerduen Khamwan1, Dr Rattana Vichiansiri2, Dr Kitiwan Vipulakorn3
1Department of Rehabilitation, Faculty of Medicine, Khon Kaen University, 2Department of Rehabilitation, Faculty of Medicine, 3Department of Orthopaedics, Faculty of Medicine

Background: Gait analysis machine can give a detail before and after treatment in spastic cerebral palsy(CP). However, limitation for routine use were associated with, high cost, required clinical and technical experience. The study was conducted to objectively demonstrated gait pattern in CP before and after nerve block with 5% phenol via the digital VDO camera recorded.

Objective: Digital VDO camera was recorded to obtain the gait pattern before and after phenol nerve block in CP.

Design: Prospective clinical trial

Setting: Tertiary care, Khon Kaen University Hospital, Thailand, between May 2006 and March 2008.

Participants: Thirty-three patients, volunteer sample(23 boys, 10 girls), hemiplegic and diplegic CP, mean age were 5.3 years, who had spastic equinus and/or scissoring gait.

Methods: After a digital VDO of the CP child was recorded and reviewed, one or combind tibial, obturator or sciatic nerve was blocked with 5% phenol. The gait parameter was assess by physician rating scale (PRS) at base line, 1, 3 and 6 months. Modify Asworth Scale (MAS), pain and others side effect were recorded.

Result: Pair t-test with 95% CI was used for evaluation of PRS outcomes. The mean base line PRS was 7±3.2 on the left side (95% CI 5.8–8.2), 6.3±3.0 on the right side (95% CI 5.2–7.5), respectively. PRS at 1 month in the order of left and right side were 9.1±3.2(95% CI 7.9–10.2), 8.8 ±2.7(95% CI 7.8–9.8); 3 month 8.7±3.5(95% CI 7.4–10.0), 8.3±2.9(95% CI 7.2–9.4); 6 month 8.7±3.8(95% CI 7.2–10.1), 7.9 ±3.1(95% CI 6.7–9.2). The improvements were statistically significant (p<0.05).

Conclusion: Improving of gait after 5% phenol block clearly demonstrated via a digital VDO camera. Limitation for routine use of gait analysis due to the high cost, required clinical and technical experience, a digital VDO camera is practically useful in clinical practice to demonstrated the gait pattern change in CP.
Use of Botulinum Toxin A for Posterior Drooling Management in Children with Cerebral Palsy: Safety and Efficacy

Dr. Heakyung Kim¹, M.D. Zeeihn Lee², M.D. Chong Tae Kim³, M.D. Anne Marie Cahill⁴
¹The Children’s Hospital of Philadelphia, ²The Children’s Hospital of Philadelphia/Dept. of Rehabilitation Medicine, Catholic University of Daegu, ³The Children’s Hospital of Philadelphia/Dept. of Pediatric Rehabilitation Medicine, University of Pennsylvania, ⁴The Children’s Hospital of Philadelphia/ Dept. of Radiology, University of Pennsylvania

Background/Objectives: To study the efficacy and safety of botulinum toxin type A (BTX-A) injections into the salivary glands in children with cerebral palsy (CP) to prevent posterior drooling which refers to saliva that is spilled over the tongue through the faucial isthmus.

Design: Case series

Participants and Setting: We reviewed the charts of 16 children with cerebral palsy (9 males and 7 females) who received BTX-A injections to the salivary glands for posterior drooling/aspiration management from to October 2006. Dosage of BTX-A was one unit/kg/gland, with each patient receiving no more than 100 units during each procedure. Nine out of 12 patients had positive findings for aspiration to lung on salivagram. Four patients had no salivagram study done. Average age of the first BTX-A injection was at 7.8 years of age (range: 1.5–17.5 years old). All patients had hypertonia in all 4 limbs. GMFCS of 16 children with cerebral palsy was V. Fifteen children were fed exclusively via gastrostomy or gastro-jejunostomy tubes.

Materials/Methods: The Posterior Drooling/Aspiration Scale (PDAS; 0 for none – 4 for profound) was used to assess the effect of BTX-A on posterior drooling/aspiration.

Results: All 16 children showed a positive outcome with regard to posterior drooling/aspiration management after each injection. On average, PDAS improved from an average score of 2.8 to 0.4. The effect of BTX-A lasted approximately 3–7 months. Total 125 salivary glands (76 submandibular glands and 49 parotid glands) were injected. Each patient had average 2.3 procedures (range: 1-6 procedures). There were minor adverse effects reported, such as mild transient thickening of saliva in two patient and transient taste change in another.

Conclusions/Clinical Implication: This retrospective study shows BTX-A treatment to be both safe and efficacious for management of posterior drooling and aspiration in children with cerebral palsy. Further research including a well designed prospective study needs to be considered.
Physiological Rationale Behind Intensive Therapy for Patients with Cerebral Palsy

Mrs Izabela Koscielny¹, Mr Richard Koscielny²

¹Therasuit LLC; ²Co-Owner Therasuit LLC

Cerebral Palsy is viewed as a non-progressive disorder. Although as a result of immobility, secondary morpho-physiological changes occur in many systems. These changes are very often the true reasons for disability and lack of development. Lack of daily mobility and the severely compromised fitness level in children with CP leads to muscle atrophy and bone demineralization. It is well documented that during immobility muscle tissue undergoes rapid changes. Morphological changes in muscle structure are responsible for poor postural control and balance, poor endurance and accuracy of movement, and high-energy expenditure. In order to prevent deterioration in CP patients and reverse some of these negative changes, physical therapy is using different methods and tools. Most of the current methods are based on principles and theories more than a century old. Advancements in exercise science allow for the creation of new scientific based methods. One of them is Intensive Therapy with the use of the TheraSuit. Intensive Therapy for children diagnosed with CP is based on principles of physiology of exercises and child development. A variety of tools and techniques are utilized during a treatment session. One of them is the TheraSuit (Soft Dynamic Proprioceptive Orthosis). The TheraSuit is based on space technology developed primarily for cosmonauts and later modified and adapted for patients with neuro-motor disorders. The intensive model of therapy has been used for over 15 years and is based on physiological principles of strength training. From the evidence-based research and our empirical experience, we have found that the Intensive Suit Therapy program provides significant stimulation to restore function of muscles and mobilization of the nervous system. A number of recent studies have suggested that Intensive Suit Therapy significantly improves the patient’s functional abilities in a relatively short time comparing with other methods. Further studies are currently being conducted by many facilities in the United States and abroad.

Sexuality for Young Adults with Cerebral Palsy

Ms. Susan Labhard, Shriners Hospital for Children

Theory: Of all the tasks adolescents and young adults with cerebral palsy face, the topic of sexuality is often overlooked or “deferred” by parents as well as health care providers. It is important to find a way to initiate a talk about sexuality, early in the adolescent years. This presentation is in response to questions asked by young adults with disabilities, parents, caregivers and partners.

Interactive Discussions/Activity: Adolescents and adults need to know that it is possible to develop a satisfactory type of sexual relationship. Developing friendships are important for a successful transition to adulthood and steps should be taken to encourage a variety of socialization and recreational activities in the early years. Adolescents with special needs tend to learn mostly about sex from their able-bodied caregivers. If the information is lacking or does not meet certain needs or expectations, the teen will find out about sex elsewhere (if able) and information could be harmful or incorrect. References on physical as well as developmental disabilities will be provided as resources for adolescents, adults, caregivers and health professionals.

The presentation takes an individual from how to approach the subject of sexuality for an individual with developmental/physical disabilities, to healthy relationships and sexual development. Useful tips are provided to allow the participant to explore options. Family planning and avoiding sexually transmitted diseases are also discussed. Illustrations and videos are appropriate for a variety of audiences and topics are presented in a creative and professional manner.

Clinical Implications: In summary, the absence of sensation does not mean absence of feeling. Young adults are encouraged to find a balance to life and view themselves like a potential partner would. As Kroll and Klein state “Every person has the right to sexual expression...it is up to each person to discover the kind of sexual expression that works for him or her and the best way to achieve it.” Dealing with the sexual consequences of cerebral palsy can offer unique challenges. However with the participant’s help, even the most severe disability need not be an obstacle to sexual fulfillment. The style of the presentation is practical and facilitates discussion and learning. Physicians, therapists, nurses and other professionals will come away from this experience with knowledge to make a difference for those adolescents and adults that they care about.
Effects of the Constraint-Induced Movement Therapy on Motor Recovery and Cortical Reorganization in Patient with Hemiplegic Cerebral Palsy

Dr Zee Ihn Lee¹, Director Seungdeuk Byun¹, MD Soonmo Kwon¹, MD Insoon Kang³, Professor Zeeihn Lee³
¹Daegu Fatima Hospital, ²Department of Rehabilitation Medicine Of Daegu Fatima Hospital, ³Department of Rehabilitation Medicine Of Daegu Catholic University Hospital

Background: Constraint-induced movement therapy (CIMT) has been shown recently to be promising for improving upper-limb function in children with cerebral palsy (CP).

Objective: This preliminary study investigated the effects of modified CIMT (child-friendly CIMT) on associated motor function and cortical reorganization in young children with hemiplegia.

Design: Pre-post, case series

Setting: Outpatient rehabilitation hospital

Participants: Five young children with hemiplegic cerebral palsy participated in this study.

Material/Method: Children were treated with a 4-week protocol of modified CIMT, consisting of twice-weekly 1-hour sessions of structured activities with one physical therapist and one occupational therapist and a home program for non-treatment days. Children wore a brace on their non-involved upper extremity for 6 hours per day, during which time they were engaged in play, functional activities and 2-hour protocol of motor tasks. They were studied with standardized motor tests and single photon emission computerized tomography (SPECT) at rest before and after the CIMT period.

Result: Improvements in upper-extremity function were found in standardized motor tests.

In left hemiplegic patients, regional cerebral perfusion increased in the motor cortex area in the affected hemisphere, but in right hemiplegic patients, regional cerebral perfusion increased in the non-affected hemisphere.

Conclusions/Clinical implications: Intensive movement therapy appears to change local cerebral perfusion in areas known to participate in movement planning and execution. These changes might be a sign of active cortical reorganization processes after CIMT in the young children with hemiplegic cerebral palsy. Results of this pilot study suggest that this modification of CIMT may be an effective way of treating young children with hemiplegia. Future work is planned to consolidate and develop these results.

New Approaches in Neurologic Equinus Gait Treated By Nonsurgical Management

Mr Sergio Lerma, Mr Ignacio Martinez, Dr Andrés Castillo, Dr Tomás Epeldeguí
Hospital Niño Jesús

Background: Different studies comparing Botulin toxin A (BTA) alone, or in combination with casting for spastic equinus gait, have been already published. To our knowledge, this is the first time the BTA is used during a casting treatment, and its results kinematically studied.

Objectives: The efficiency of a new procedure in the treatment of spastic equinus combining BTA and casting was compared against other standard ones for this purpose.

Design: Non randomized clinical trial design with a simple blind was selected to this study.

Three treatment groups, were established: Group 1- Only BTA treatment.
Group 2- Casting after BTA treatment.
Group 3 - BTA between casting (BBC) treatment.

All the patients included (n=30) were distributed in hemiplegic and diplegic condition, and the kinematic values obtained after each treatment were compared, looking for statistically significative differences among them.

Participants/Settings: All the participants were cerebral palsy kids, GMFCS level II, with a mean age of 9 years, (range 5-16) from the Ortophaedic Surgery and the Physical Therapy Dept. of our Hospital. 21 patients were hemiplegic and 9 diplegic with a equinus gait.

Material/Method: The cases were distributed in the three different treatment groups. Computerized clinical gait analysis was done. The post therapeutic Kinematic gait analysis was performed 4–5 weeks after treatment.

Three Kinematic Values obtained from the sagital graphs were used to evaluate the Results
KV I- Flexion ankle angle at initial contact.
KV II- Maximum dorsiflexion in stance phase.
KV III- Range of motion between maximun dorsiflexion in stance and maximun plantar flexion at the swing phase.

Results: Good clinical results were reported in KV I, KV II and KVIII in every group. Comparing the Kinematic data, the Group three (the BBC group) obtained the best results (p<0.01) in KV I (average value 4.77) and KV III (average value 2.59).

Conclusions/Clinical Implications: According to our study, BTA treatment during a casting period for spastic equinus gait is proved to be worth considering.
Analysis of Characteristics of Speech-Language Development and the Treatment Selection in Children with Dyskinetic and Spastic Cerebral Palsy

Prof Xiaojie Li, Lecturer Liping Wang, Teaching assistant Junli Zhu, Lecturer Ying Sun
College of rehabilitation medicine of Jiamusi University

Objective: Analyzed the characteristics through the speech-language assessment and the treatment selection in children with spastic and dyskinetic cerebral palsy (CP), to provide the evidences for making the correct treatment plans and programs in clinic.

Methods: 100 children with CP aged from 2 years to 6 years were evaluated by dysarthria test and delayed language development test and observed the modalities of language treatment.

Results: Speech-language assessment: The conditions were better in the group of spastic CP than in the group of dyskinetic CP with hydrostomia, twist, smacking one’s lips, opening and closing the lower mandible. The conditions were better in the group of dyskinetic CP than in the group of spastic CP with perceptivity, communication attitude, licking the lateral lips, and out-stretching of tongue. Treatments: The treatments of breathing training, labia oris movement training and mycteroophonia-surnount training were used in the group of dyskinetic more than used in the group of spastic. The treatments including No-Linguistic symbol learning and communication training were used in the group of spastic CP more than used in the group of dyskinetic CP.

Conclusion: There are different results of speech-language assessment and treatment selection between the children of spastic CP and dyskinetic CP.

Analysis the Characteristics of Gross Motor Development in Children with Dyskinetic and Spastic Cerebral Palsy

Prof Xiaojie Li, Lecturer Liping Wang, Teaching Assistant Junli Zhu, Lecturer Ying Sun
College of rehabilitation medicine of Jiamusi University

Objective: To analyze the characteristics of gross motor development in children with spastic cerebral palsy (CP) and dyskinetic CP, to provide the evidences of collecting treatment strategy.

Methods: 153 children with CP aged from 2 years to 6 years, 105 spastic and 48 dyskinetic among them, were selected to analyze the characteristics of gross motor development according to the information of the medical record in the centre.

Results: 1. The reflex development: the primitive reflexes sustained longer and stronger in the group of dyskinetic CP than in the group of spastic CP, especially ATNR. The corrective reflex and the equilibrium reaction were better in the group of spastic CP than in the dyskinetic CP. 2. The speed and quality of the movement: It was better in the group of spastic CP than in the dyskinetic CP. 3. The muscle power and the muscle tone: The muscle tone was mainly increased in the flexor of the trunk and upper limbs, the extension muscle and the partial flexor muscle of lower limbs in the group of diplegia spastic CP than in the group of the dyskinetic CP. The muscle power was lower in the extension muscles of the trunk and upper limbs as well as in the partial of flexion muscles of lower limbs. It was not steady of the muscle power and immediately increased when the movement happened in the group of dyskinetic CP. 4. The characteristics of posture and movement pattern: Diplegia spastic CP mainly presented flexion pattern all over the body, the range of movement diminished, extension to counteract gravity were worse; The extent of movement diminished the director were fixative the speed of movement were slow. Dyskinetic CP presented asymmetry posture; involuntary movement were more serious in upper limb than in lower limb, distal end were more serious than proximal end, the balance were worse.

Conclusion: There are differences in gross movement development characteristic between spastic CP and dyskinetic CP, accordingly to establish different treatment strategy.
Long-Term Follow Up of Selective Dorsal Rhizotomy – A Two-Case Study

RPT MSc Asa Lidstrom, RPT MSc Anette Hoglund, RPT Marie Sandstrom, RPT PHD Simone Norrlin
Uppsala University Hospital, Department of Woman and Child

Background: Selective Dorsal Rhizotomy (SDR) is a neuro-surgical treatment to reduce spasticity in children with cerebral palsy (CP). Long-term outcomes have shown improvement in gait and functional performance. Our aim was to give further examples of long-term follow-up outcomes.

Methods: Two girls with spastic bilateral CP, GMFCS level II underwent SDR at 6.5 and 7 years respectively. Assessment of body function and structure and activity was performed before SDR and at follow-ups at 3 and 11 years after surgery. Muscle tone according to modified Ashworth scale, range of motion, level of functioning according to Gross Motor Function Classification System (GMFCS), Gross Motor Function Measure (GMFM), and Physiological Cost Index (PCI), were assessed. All data were collected from the medical records. At the 11-year follow-up both girls offered their spontaneous reflections on the outcomes in participation in daily life.

Results: Body function and structures: Spasticity in the leg muscles decreased from grade 1–2, to grade 0 in both cases at follow-ups. Range of motion was almost the same at follow-ups as before SDR.

Activity: The GMFCS level changed in both cases from II to I. GMFM, part E improved from 67/32 % to 83/88% and PCI values decreased by 8/36 % at follow-ups.

Participation: Before SDR both girls could walk freely only in protected areas (GMFCS II), indicating that they were to some extent restricted in participation in daily life activities. At 11-year follow-up, both girls could move around without any restrictions in the community (GMFCS I). One girl independently used the community bus every day after school to take care of her horse. The other girl attended a public drama school where she had to walk long stairs to get to her classrooms. She was rehearsing to act as Nurse Mildred Ratched in the play One Flew Over the Cuckoo’s Nest, which was to be performed at the City Theatre.

Environmental factors: At the 11-year follow-up, neither of the girls could identify any factors in the environment that restricted their participation.

Conclusion: Assessments before and after SDR were mainly performed at the levels of body function and activity. However, the spontaneous descriptions by the girls revealed the remarkable changes in life that they ascribed to the SDR. This highlights the importance of structured assessments and evaluations also at the participation level to catch possible changes and results after SDR.

Outreach Service in Hong Kong Influences the Improvement of the Teachers’ Ability About Conductive Education

Professor Li Lin, Guangzhou Rehabilitation and Experimental School

This study is mainly about the training on Conductive Education in Hong Kong during two year of 2005 and 2006. The aim of this study is that outreach service in Hong Kong influences the improvement of the teachers’ ability about Conductive Education by four times of each year and five days of each time. The training was involved in theory study and practice about Conductive Education. The standard assessment is that the score of both theory studying and practice is more than 85 is regarded as be great, the score is more than 75 is regarded as be good, the score is more than 60 is regarded as be passing, the score is less than 60 is regarded as be failed. The result is this training is that among 36 teachers, 5 teachers are great, 16 teachers are good, 13 teachers are passing and 2 teachers are failed. The total rate of pass is 94.44%. The conclusion is that Outreach Service in Hong Kong could improve the Teachers’ Ability about Conductive Education.
We Don’t do Wees Well!: Identification of Bladder Dysfunction in Children with CP
Miss Sarah Love, Ms Natalie Kane, Ms Christina Anastas, Ms Rebecca Crawford, Ms Sarah Love
Princess Margaret Hospital for Children, Child and Adolescent Health Service, WA
Background/Objectives: Bladder and bowel control develops in the second or third year of life in the typically developing child.1,2 Literature review reveals bladder and bowel dysfunction occurs in 1–20% of school age children with typical development.2,3 The development of continence is delayed in children with cerebral palsy (CP), and the prevalence of bladder and bowel dysfunction in children with CP is significantly greater than in the typically developing child.1,2,4,5 66% of children with CP have clinical symptoms of bladder dysfunction with concurrent bowel dysfunction being present in approximately 36%.4 Pathologic urodynamic findings have been identified in asymptomatic patients, 6,7 suggesting bladder dysfunction is under-reported in the CP population. Urodynamics is an invasive but important assessment in determining covert voiding dysfunction. An alternative tool – uroflowmetry, is non-invasive, easy to administer, quick to perform, and allows immediate identification of voiding dysfunction. This study investigated the rate of identification of bladder dysfunction in children with CP within Australian community facilities.

Study Design & Study Participants and Setting: This is a qualitative report from a questionnaire. Seven Australian community centres providing intervention for children with CP were included.

Materials/Methods: A questionnaire was developed and distributed through personally addressed emails to the identified senior physiotherapist in each facility. Demographic data included but was not limited to experience in management of CP, and experience in management of continence.

Results: Six out of seven facilities responded to the survey. All six respondents identified bladder dysfunction in their caseload. Symptomatic monitoring of bladder dysfunction was reported by four of the six respondents. There was notable variety in the professions involved in assessment of bladder function. None of the facilities reported assessment of voiding dynamics with urodynamic or uroflow. Only two respondents reported bladder dysfunction at a rate comparable with the literature. There was no obvious correlation between the years of experience of the respondent and the detail of assessment and/or management of bladder dysfunction in a child with CP.

Conclusions/significance/clinical implications: Within Australian community centres there is no uniform or standardised practice for assessment and management of children with CP who present with bladder dysfunction. The literature reveals a very high prevalence of bladder dysfunction (66%) in children with CP suggesting this is under-identified or not prioritised in this client group in Australian community facilities. Inclusion of a standardised continence assessment for children presenting with bladder and bowel problems should include uroflowmetry and/or urodynamics to screen for covert dysfunction.

The Inter- and Intrarater Reliability of an Observational Gait Assessment Tool in Adults with Cerebral Palsy
PT Kerstin Lundberg Larsen1, MD Grethe Månum1, PhD PT Reidun Jahnsen2, Statistician Kathrine Frey Freslie1
1Sunnaas Rehabilitation Hospital, Oslo, Norway, 2Section of Child Neurology, Rikshospitalet, Oslo, Norway
Background: Visual observation of gait is often used in clinical practice to describe gait pattern and evaluate treatment. Video recording and then evaluation by structured observation can often be used as an alternative to the more advanced 3-dimensional gait analysis, which demands expensive technology and educated personal. Several studies have been published that describe different scales for visual gait observations. They have showed moderate to good reliability. Salford Gait Tool (SF-GT) was first published in 2007 and described good interrater and intrarater reliability when testing children with Cerebral Palsy (CP). In SF-GT the rater measures angles in hip, knee and ankle at 6 events during the gait cycle.

Objectives: To evaluate interrater and intrarater reliability of SF-GT in a population of adults with CP.

Design: Reliability study with repeated assessments of SF-GT.

Participants/Settings: 10 adults, men and women, 5 with unilateral and 5 with bilateral spastic CP, GMFCS I – II, age range 19–63 years. Video, in sagittal view, were recorded in a rehabilitation hospital’s gait analysis laboratory.

Materials/Methods: Videotapes of 10 adults were evaluated twice by 10 physiotherapists using SF-GT. Reliability were calculated using the Intraclass Correlation Coefficient (ICC), using a two-way random design, based on absolute agreement.

Results: Interrater reliability was moderate, mean ICC for all events and joints was 0.47 (range: 0.23–0.69). Mean ICC for the hip was 0.31 (range: 0.23–0.40), for the knee 0.53 (range: 0.27–0.68) and for the ankle it was 0.58 (0.47–0.69). The intrarater reliability was better than interrater reliability. Variation between test 1 and 2 represented by medians of the intrarater ICCs were in the range 0.49–0.85. 75% of the 180 individual intrarater ICCs were in the range 0.50–0.98.

Conclusion/Clinical Implications: Visual gait observation by use of SF-GT was found to have moderate interrater reliability, with best results for ankle and knee. Intrarater reliability was better, and this implicates that in a clinical setting it is advisable to use the same rater and priorities measurements of knee and ankle.
Use of Ground Reaction Force for Clinical Judgment in Children with Cerebral Palsy: A Case Study

Dr Karel Maathuis1, Dr Patrick Maathuis2

1Center for Rehabilitation, Motion Laboratory, University Medical Center Groningen, 2Department of Orthopaedic Surgery, University Medical Center Groningen

Background: In our outpatient clinic we observe the deviating gait patterns of children with Cerebral Palsy (CP). In order to improve their gait, decisions have to be made for orthopaedic intervention and/or conservative treatment. However, observation of gait without force information limits clinical judgment in gait analysis in children with CP.

Objectives: The objective is to introduce visible force measurements in clinical gait observation in order to make clinical judgment easier.

Design: Case study

Participants/Setting: Boy (age: 9 year); his gait pattern before and after surgery was observed in a Motion Laboratory. Achilles tendon lengthening, medial Hamstrings release and transposition of posterior Tibial muscle was proposed.

Materials/Methods: In the Motion Laboratory the subject walked on a walkway with embedded force plates. The vector of the measured Ground Reaction Force (GRF) was projected on the sagittal plane of the body. The vector enables the clinician in assessing effects of the external force on the ankle -, knee -, and hip joints. Clinical decision how to proceed was based amongst others on defining desirable position of the GRF after operation and conservative treatment.

Results: When the location of the GRF and direction are clearly visible the line of action is known during the stance phase. In the case study a posterior shift in position of the GRF was defined. The shift was realised by the effects of orthopaedic surgery as well as the AFO. Orthopaedic surgery was prerequisite for shifting the position of the GRF, where as the AFO was essential for further orthopaedic surgery as well as the AFO. Orthopaedic surgery was prerequisite for shifting the position of the GRF, where as the AFO was essential for further conservation treatment.

Conclusion/Clinical Implications: Clinical judgment based on observation of gait can benefit from the use of projection of the GRF. The on line projection of the measured GRF provides immediate additional information for clinicians about the line of action of the vector. In this way the clinician gets a hands-on in the visible external moments at the ankle -, knee-, and hip joints.

The location and direction of the vector are an important aid in initial discussion and decision making for orthopaedic intervention and/or conservative treatment. Clinical observers (without extensive biomechanical knowledge) indicate that they feel safer when observing and analysing gait with the projection of the GRF beforehand any intervention.

Planning and Assessing Extra-Mural Activities for Children with Cerebral Palsy: Application of an Interdisciplinary Tool

Dr Francine Malouin1-2, Dr Donna Anderson3, Dr Line Nadeau1-2, Ms Marie-Hélène Ouellet1-2, Ms Leila Azzaria1-2

1CIRRRIS, 2Laval University

Background: Rehabilitation Centers have the mandate to not only improve the functional capacity of children with Cerebral Palsy (CP) but also to enhance their social participation. Therefore, rehabilitation programs have expanded their interventions to extra-mural activities to include environments of the general population such as the community. In order to promote the quality and effectiveness of these extra-mural activities a new Interdisciplinary Tool (ITEM) has been developed.

Objective: The aim of this study was to demonstrate the use of ITEM by evaluating an extra-mural project that was planned according to habitual practice.

Design: This study consists in a retrospective evaluation of an extra-mural project.

Participants/Setting: Five teenagers with CP (3 boys) aged between 13 and 16 years old participated in an extra-mural project designed to promote their participation in the planning and realization processes of a series of social activities in the community.

Materials/Methods: First, an empirical evaluation of the extra-mural project was carried out. One independent observer recorded indices of social interactions between participants and between teenagers and practitioners at each of the 20 sessions of the 10-week project. Second, a focus group helped to identify the positive and negative aspects of the activity. Third, each aspect of the project was revised to determine how the use of ITEM would have influenced the planning of the activity.

Results: The analysis of the observational data did not reveal any increase of social interactions between participants over the 10-week period. The main shortcoming was the lack of homogeneity of the participants in terms of cognitive development, functional ability and social background. The focus group confirmed that these prerequisites should have been identified in the planning process. Furthermore, the revision process showed that other aspects of the study would have benefited from ITEM.

Conclusions/Clinical implications: Each step of this study shows that the use of ITEM could be beneficial to help clinicians in the planning of extra-mural activities and to assist researchers in the evaluation process.
Reverberation

Mr Kuvinder Mann¹, Mr Sandeep Kumar Singla²
¹Guru Nanak Dev Engineering College Ludhiana Punjab India, ²Ptu Jalandhar Punjab India

Abstract: Performance of current speech recognition systems severely degrades in the presence of noise and reverberation. While rather simple and effective noise reduction techniques have been extensively applied, coping with reverberation still remains as one of the toughest problems in speech recognition and signal processing. Reverberation lowers the intelligibility of the speech message. So, the listener’s ability to understand the message suffers. The aim of speech enhancement is to improve the performance of speech communication systems in noisy environments. Noise reduction is desired with minimal signal distortion. Attempts are made of improving the quality of the noisy signal while minimizing any loss in its intelligibility.

Physical Management of Adult CP – A Physiotherapy Perspective

Ms Ailish McGahey, Central Remedial Clinic Dublin Ireland

Background: Adults with CP present with secondary problems such as pain increasing weakness, spasticity, contractures and loss of mobility, many authors world wide have documented this. Physiotherapy for adults with CP is a challenge because of their complex physical problems, often physiotherapists feel ill equipped to treat these clients

Objectives: To determine if there is a relationship between age and main reason for referral to physiotherapy

To discuss the evolving clinical picture into adult life and its implications for physiotherapy management

Design: Retrospective audit of 106 adult clients files in 2005 looking at age and primary reason for referral to physiotherapy

Participants/settings: All Adults with CP over 18yrs of age who had an assessment carried out by a physiotherapist in our clinic

Materials and methods: 106 adults were divided into age ranges 19–25, 26–34, 35–44 and over 45yrs, main reasons for referral were pain, loss range of joint movement, loss mobility and increasing fatigue

Results: In 19–25 yr group main reason for referral was loss in joint range, in 26 to 34 group it was more mobility issues and lesser extent joint range, in 35–44 group, pain and mobility were both more equally represented. In 45 and over group pain was most common reason. This correlates with other authors Murphy et al 1995, Engel 2002, Turk et al, Harada 1993, deterioration in walking skills related to age was also compared to J hsen 2004 figures and they confirm our results that older adults over 35yrs complain of deterioration in mobility

Conclusion: There is a lot of evidence to prove that adult with CP experience age related problems at a younger age than normal population. Ideally more physiotherapy resources should be invested into management and treatment of younger adults to hopefully minimise later age related complications or at least delay their onset.
The Role of Microbial Infections on Preterm Birth

**Professor George Mendz**, Dr Sarah McIntyre, Professor Julie Quinlivan
1School of Medicine, Sydney. The University of Notre Dame Australia, 2The Spastic Centre of NSW

**Background:** The causes of cerebral palsy (CP) are still not completely understood, and multiple factors contribute to CP risk, but systemic fetal inflammatory response is a strong and independent risk factor of the development of CP. Preterm birth (PTB) is worldwide a major cause of perinatal mortality and serious neonatal morbidity. It is strongly associated with brain injury and later neurodevelopmental impairment. Chorioamnionitis is the only pathologic process for which a firm causal link with prematurity has been established; and intrauterine infection complicates up to one third of PTB. Thus, it is important to understand the roles that maternal infection during pregnancy have in the onset of PTB and CP.

**Objectives:** The aim of this study was to review the current knowledge of protozoan, fungal, bacterial and viral infections in pregnant women, in order to determine the types of flora that pose high risk profiles for pregnancy complications.

**Results:** Clinical chorioamnionitis was associated with a five-fold increase in the risk of CP in a meta-analysis of studies on term infants, with severe histological chorioamnionitis further increasing the risk. A meta-analysis of studies on preterm infants showed that the prevalence of CP decreases significantly with gestational age, but no relationship was found between severity of CP and gestational age.

Trichomoniasis is the most common protozoan uterine infection; and it has a significant association with PTB. Candidiasis is the most common fungal infection, but it is not usually associated with increased risk of PTB. Screening for viruses is not conducted routinely during pregnancy unless abnormalities are detected, but infections with herpes viruses and HIV are causes of neonatal mortality. In contrast, numerous studies have established that that the leading cause of infection-associated PTB are intrauterine bacterial infections.

Understanding the role of different types of pathogenic microbes in adverse pregnancy outcomes is complicated by the fact that most of them are subclinical in nature. Although there is a considerable information about the composition of the vaginal bacterial flora, cultivated bacterial isolates do not represent all species in the complex female urogenital ecosystem, and there are pathogens associated with various urogenital diseases and with PTB that have yet to be identified.

**Conclusion:** Molecular epidemiological studies are required to identify, characterise and compare the bacterial microbiota of women in health and disease in order to understand the colony structures. This knowledge will serve to design better evidence-based approaches to minimise PTB and CP.

The Clinimetric Properties of Neonatal Neurobehavioral/Neuromotor Assessments for the Premature Infant up to Four Months Corrected Age: A Systematic Review

**Mrs Yolande Noble**, Assoc Professor Roslyn Boyd, Ms Alicia Spittle
1Royal Children's Hospital, Brisbane, 2Cerebral Palsy Research RCH Brisbane, Dept Paediatrics UQ, 3Royal Women's Hospital, Melbourne

**Background:** There is increasing evidence that premature birth impacts on early brain development. In order to determine which infants require early intervention there is a need for a valid and reliable assessments from the perinatal to postnatal period.

**Objectives:** To analyse the psychometric properties and clinical utility of published neonatal longitudinal neurobehavioural and neuromotor assessments.

**Design:** Clinimetric Systematic Review

**Methods:** Standardised assessments suitable for pre-term infants (i.e. <37 weeks gestation) up to 4 months corrected age, which are discriminative, predictive or evaluative and/or criterion or norm referenced. Exclusion Criteria were those not published in English, nor peer-reviewed, and screening assessments. Databases searched included Medline Advanced, CINAHL and PsycINFO (1996-March 2008). Clinimetric properties were evaluated using a modified Outcome Measures Rating form by two independent reviewers.

**Results:** Nine assessments met criteria. These were the Assessment of Preterm Infants’ Behaviour (APIB), the Neonatal Intensive Care Unit Network Neurobehavioural Scale (NNNS), the Test of Infant Motor Performance (TIMP), Prechtl’s Assessment of General Movements (GM’s), the Neurobehavioural Assessment of the Preterm Infant (NAPI), the Einstein Neonatal Neurobehavioural Scale (ENNAS), the Dubowitz Neurological Assessment of the Preterm and Full-term Infant, the Neuromotor Behavioural Assessment (NMBa) and the Brazelton Neonatal Behavioural Assessment Scale (BNBAS). The primary purposes included prediction (TIMP, GM’s, Dubowitz) discrimination (all assessments) and evaluation of change (NBAS, NNNS, TIMP, GM’s, NAPI, Dubowitz, APIB). Most assessment demonstrated moderate to strong content validity. Construct validity was not reported for the NBAS, Dubowitz, NNNS or the NMBa. The APIB demonstrated strong concurrent validity with EEG and MRI, the NAPI with the ENNAS and the GM’s and ENNAS with neurological exams. Intrater reliability was demonstrated in all the tests except the NMBa and ranged from strong in the APIB, ENNAS (r = 0.97) to moderate in the NAPI (r = 0.67–0.99). Intra-rater reliability was only provided in the TIMP ICC 0.98–0.99 and GM’s K=0.84. Test-retest reliability was demonstrated in the ENNAS (r = 0.30–0.44), the APIB, and the NAPI (r = 0.41–0.85). Clinical utility was highly variable for administrative burden, ease of scoring, interpretability, cost of training and access.

**Conclusion:** Nine longitudinal neuromotor/neurobehavioural assessments were identified. The NNNS and APIB have strong psychometric properties with more utility for the research setting due to the complexity of administration, training and accessibility. The GM’s and TIMP have strong psychometric properties and have better utility for the clinical setting.

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American Collaborative Study of Genomic and Environmental Factors Associated with Cerebral Palsy

Mr Michael O’Callaghan1, Dr Catherine Gibson1, Professor Alastair MacLennan1, Associate Professor Paul Goldwater2, Professor Eric Haan3, Prof Gai McMichael1, Ms Bronwen Paine1, Ms Jessica Broadbent1, Professor Gustaaf Dekker1, K Priest4

1The University of Adelaide, Australia Discipline of Obstetrics and Gynaecology, 2Departments of Microbiology and Infectious Diseases, Women’s and Children’s Hospital, Adelaide, South Australia, 3Genetic Medicine, Women’s and Children’s Hospital, Adelaide, South Australia, 4Epidemiology Branch, Department of Health, South Australia

Background: Cerebral palsy is a non-progressive disorder of posture and movement with largely pre-birth origins. Retrospective studies examining blood samples of babies born in SA have identified fetal cytokine and thrombophilia polymorphisms associated with cerebral palsy. These candidate genes along with the maternal environmental risk factors will be studied in children with cerebral palsy and their mothers throughout Australia.

Objectives: DNA will be collected from volunteer participants and specific SNPs will be examined. Candidate genes to be studied are cytokine and thrombophilia genes identified in our retrospective studies and other polymorphisms that have been associated in the literature with an altered fetal inflammatory response or preterm delivery.

Design: This is a prospective case-control Australian study.

Participants: Caucasian families with and without cerebral palsy will be recruited from across Australia. Target recruitment is 2,500 families with cerebral palsy and 2,500 case matched control families. Power calculations show that these numbers will be sufficient to detect a 20% increase in odds ratio with 95% confidence interval and 80% power for the common polymorphisms.

Materials/Methods: National recruitment of cerebral palsy families is through register contact (SA, QLD and NSW), poster advertising in relevant waiting areas and advertisement in cerebral palsy support group newsletters and websites. A toll free phone number and email address have been established to encourage communication with the research team. Control families are contacted through the media (newspapers, television and the website) but principally through school visits in SA and NSW. Participants will be mailed the following: 1. a detailed study information sheet, 2. a study consent form, 3. 2 x buccal swabs, 4. a DNA sampling instruction sheet, 5. a questionnaire and 6. a reply paid envelope. DNA samples from participants will be self collected and returned to us for SNP analysis and linkage with questionnaire and medical case note details. Where available permission to access stored neonatal blood spots will be obtained for perinatal viral exposure studies.

Results: Recruitment advertising has been greatly helped by support groups and cerebral palsy registers across Australia. The trial launch date was June 2009. Recruitment and progress will be reported in this poster (February 2009).

Conclusions: This study shows that Australian cerebral palsy health units can collaborate effectively and produce a unique and large data base for the study of genomic susceptibility factors that may be triggered by environmental risk factors such as infection, resulting in cerebral palsy.

The Cultural Differences: Assessment of Life Experiences of Parents with Disabled Children Using the Neuman’s Systems Model

Dr Fahriye Oflaz, Dr Cigdem Yuksel

Gulhane Military Medical Academy/School of Nursing

Background: The challenges of parenthood are intensified by the experience of having a disabled child who has special needs. Parents of children with disabilities experience both the typical stressors of parenting and stressors unique to their child’s care. A large majority of the studies about disabled children’s parents were conducted in western cultures, and it has been difficult to transfer the results to different cultures.

Objectives: The aim of the study is to identify the experiences and difficulties of parents of disabled children in a non-western country. The philosophy of Betty Neuman underpinned the study.

Design: This study is a descriptive qualitative study.

Participants/Setting: The sample of the study is consisted of those parents who are willing to participate in research and whose children attend to a Special Education and Rehabilitation Center in a non-western country.

Materials/Methods: The qualitative data were collected mainly through in-depth interviews with disabled children’s parents (n:40) to determine their life experiences. Neuman’s evaluation form and data collection form containing sociodemographic characteristics were used for individual interviews. The data was analysed using the concepts of Neuman’s System’s Theory.

Results: Three themes and five categories for each theme emerged from the data analysis. The themes were intra-personal stressors, inter-personal stressors and extra-personal stressors. The categories were; Physiological Variables, Psychological Variables, Developmental Variables, Sociocultural Variables and Spiritual Variables. The attachment of parents and children emerged as a sub-theme and named “living together and dying together” another important thought of parents was “keep going to live for the disabled child”. Finding spiritual meaning were helping the parents to cope. Some of the parents accepted disability as a punishment from god but felt happy for paying for their sins in this world. They were experiencing the disability of child as their own and feel shame in social situations in the name of their child. In each variable cultural characteristic of stresses experienced by parents are defined.

Conclusion: The Neuman’s evaluation form is an effective tool to assess the life experiences of parents with disabled children and to describe the cultural differences of stressors.

Conclusions/Clinical Implications: In conclusion of this study, obtained results can be used as a guide by health professionals during the education and counselling activities for parents of disabled children.
What Happens When Your Patients with CP Grow Up? How to Treat Successfully for a Functional Lifetime

Dr. Roberta O'Shea¹, Ms. Ellen Hamilton², Ms. Antoinette Doty²
¹Governors State University, ²Kent University

Adults with Cerebral Palsy are experiencing difficulty with maintaining functional skills secondary to musculoskeletal impairments, cardiopulmonary complications, and a lack of medical professionals that understand cerebral palsy. Traditionally, many individuals never survived into adulthood. With medical and general health improvements, this is no longer the case. As individuals with lifelong disabilities age, they are experiencing issues of aging in a magnified way. Currently there are up to 500,000 individuals over the age of 60 in the US with lifelong disabilities. At present there is no formalized transition pathway for individuals with cerebral palsy to leave the pediatric medical arena and transition into the adult medicine arena. These individuals have difficulty locating medical and rehabilitation professionals that understand the implications and impact of life long disability. Several secondary complications have been documented that affect individuals with lifelong disabilities in a unique way. These include age related changes occur at an earlier age, need for increased support at an earlier adult age, obesity, depression, fitness concerns, cardiovascular health, and low frustration tolerance. Additionally, many young adults with cerebral palsy have never had to manage their own rehabilitation or general health and are now finding it frustrating and difficult to self manage their health. For example, women with CP have a very difficult time maintaining general health due to lack of accessible doctors offices in the US. Many individuals who ambulate with Cerebral Palsy experience significant back pain and or shoulder pain. Adult medicine is familiar with these conditions but not with the impact of hypertonia and spasticity. This proposal will outline the current state of healthcare US for adults with Cerebral Palsy and other lifelong disabilities. Case studies using video and photo clips will be used to demonstrate the clinical implications0 and offer solutions for treatment interventions. Treatments will include strategies for adult and pediatric therapists to use within clinical settings.

Barriers to Receiving PT and OT Services for Individuals with CP

Dr. Roberta O'Shea, Dr. Beth Cada, Governors State University

Historically, many individuals have difficulty accessing therapy services due to a myriad of factors. These factors include a significant disparity in the availability medical services, knowledge of the value of health care services and the resources to access services when needed. These disparities are consistent with the paradoxical characteristics of the region. This study investigated which factors impacted service delivery from the therapy providers’ perspectives and the recipients’ point of view.

The primary issues families reported were lack of funding for services, availability of convenient appointment times and the location of services. In contrast the therapists’ perception of the top three barriers that families face when scheduling an evaluation were scheduling conflicts, transportation and the lack of funding. This is most interesting as transportation did not rank high with the families concerns but ranks high as a perceived barrier from the therapists’ point of view.

Although each group recognized the impact of availability of the therapists and appointment time availability as barriers, it was interesting that the location of therapy services was more significant for the families. To be successful, families must successfully negotiate the availability of the therapy provider, location of services and scheduling an appointment for an evaluation with other family demands. The combination of lack of availability of therapists, lack of appointment times available that can coexist with families’ already busy schedules, and potential difficulty to reach a location may pose a more significant barrier. Therapists perceived that transportation was a significant issue for families.

The need for ongoing therapy services creates a burden. Funding ongoing services is the primary issue for families, followed by finding a suitable appointment time. The availability of a therapist and a reasonable location are also key issues for the family.

The researchers have undertaken new strategies and investigations that include continuing collaborative initiatives for families and therapy providers. The findings of the study will also be utilized to help therapists develop and implement alternative models of service delivery that provide greater access to therapy services. A website is also being designed to build a virtual community for individuals with cerebral palsy. This website will act as a registry as well as an information exchange tool.
Exploration of Unmet Needs of Families of Children with Cerebral Palsy

Ms Bronwen Paine1, Ms Jayne McLaren2, Mr Peter Van Der Lindon3, Prof Alastair MacLennan4

1University of Adelaide, 2Women's Social Work, Children, Youth and Women's Health Service, Women's and Children's Hospital, Adelaide, Australia, 3Paediatric Social Work, Children, Youth and Women's Health Service, Women's and Children's Hospital, Adelaide, Australia, 4Discipline of Obstetrics and Gynaecology, The University of Adelaide

Background: Adequate health care, therapy, social support and financial resources are essential to people with cerebral palsy (CP) and like disabilities to support independence, facilitate participation and contribute to overall wellbeing. Our recent focus groups indicated that parents of children with CP felt there were social, personal and financial barriers affecting their ability to care for, and maintain the quality of life of, their child.

Objectives: The purpose of this study was to explore:
1) the perceived adequacy of health care, social and financial support for families with children diagnosed with CP
2) opinions about areas of service provision requiring improvement for families with children diagnosed with CP
3) understanding of the causes of CP, and the perceived helpfulness of medical counselling in assisting this understanding.

Design: A questionnaire-based qualitative/quantitative study

Participants: 35 parents with a child aged 5 years or older with a diagnosis of cerebral palsy and registered with the South Australian Cerebral Palsy Register located at the Women's and Children's Hospital.

Materials/Methods: Interviews were conducted between July and November 2007 in person or via telephone and tape recorded. Parents were asked to comment on the adequacy of health care treatment received at birth, and before and after diagnosis, their understanding of the cause of CP, their opinions on the helpfulness of medical counselling, the adequacy of their social support networks and perceived adequacy of financial support. Parents also rated (from 0–10) their satisfaction with each of these areas.

Results: The majority of parents were satisfied with their health care treatment at the time of birth and prior to diagnosis of CP. However, comments of not feeling listened to or being treated insensitively by medical staff were common, as well as reports that they received insufficient information about the implications of their child's CP and support resources they could access. Most parents did not receive formal medical counselling with regard to the cause of their child's CP, but believed this may be helpful (in tandem with emotional counselling). One-third of interviewees believed that hypoxia was the main cause of CP. Parents with severely affected children found it difficult to meet the costs associated with caring for their child.

Conclusions: Given the wide spectrum of needs of families with a child with CP, service providers must be prepared to take a more flexible approach. There needs to be a greater level of communication, understanding and information provided to these families.

Tibial Torsion in Cerebral Palsy-Validity and Reliability of Physical Examination

Professor Moon Seok Park1, Fellow Sang Hyeong Lee1, Professor Chin Youb Jung1, Professor In Ho Choi2, Professor Tae-Joon Cho2, Professor Won Joon Yoo2

1Seoul National University Bundang Hospital, 2Seoul National University Children's Hospital

Background/Objectives: The aim of this study was to describe the validity and reliability of the physical measurement of tibial torsion, that is, thigh foot angle, transmalleolar axis, and second toe test.

Study Design: Studies of Diagnosis (validating cohort study)

Participants/Setting: Priori precision analysis revealed the minimal sample size as 36. Eighteen patients with 36 limbs were included in the study. Inclusion criteria is as follows, cerebral palsy, planning to perform single event multilevel surgery, and who needs CT scan to define torsional abnormality to include femoral derotation osteotomy or tibial derotation osteotomy in surgical session.

Materials/Methods: In reliability session, four raters with various orthopaedic experiences independently measure the tibial torsion with three different methods without the knowledge of patients and data of other raters in a single day prior to the surgery. In validity session, validity was assessed by the correlation study between physical examination and widely accepted method of measurement using two-dimensional computed tomography. Intraclass correlation coefficient and pearson correlation were used to delineate the reliability and concurrent validity.

Results: Interobserver reliability was found to be highest for the transmalleolar axis, followed by thigh foot angle and then by 2nd toe test with intraclass correlation coefficients of 0.92, 0.74, and 0.57 respectively. All physical examinations showed fair correlation with CT measurement(r=0.62, 0.52, 0.55, respectively).

Conclusion: When depicting the tibial torsion with physical examination, all three methods has significant validity, however, the reliability and validity of tests are highest in the measurement with transmalleolar axis.
Using assistive Technology to Participate in School Activities: Utility and Satisfaction Among Children with Cerebral Palsy in South Australia

**Miss Helen Parkyn, Ms Sonya Murchland**  
Novita Children's Services

**Background:** Occupational therapists often recommend the use of assistive technology to assist children with physical disabilities to participate in school activities. A research study was conducted to explore patterns of assistive technology use among children with physical disabilities in SA.

**Objectives:** The research sought to answer these questions:
1. What assistive technology items are in use by children aged 8-18 years who have a physical disability?
2. What is the children's satisfaction with assistive technology devices and services?

**Design:** A mailed survey method was used. Participants were asked to complete two questionnaires designed specifically for use by children.

**Participants/Setting:** 134 children with physical disabilities participated in the survey. The results from 76 of these children who have cerebral palsy and participated in the survey are the focus of this presentation.

**Materials/Methods:** The QUEST 2.0 was adapted to be suitable for self-report by children. With permission from the original author the questionnaire was called QUEST 2.1: Children's Version. An Assistive Technology survey was also developed to collect detailed information about the range of technology items in use.

**Results:** Participants reported using between 0 and 10 items of technology. The mean number of items was 3.41 (SD=2.14). The most frequently reported items of technology in use are desktop computer (n=54), laptop computer (n=30), software that allows you to make your own activities (n=24), maths software (n=17), a switch (n=16), an alternative or adapted mouse (n=15) and a typing tutor (n=13). Children had high levels of satisfaction with the technology items and services. The average satisfaction score was 2.64 (SD=0.97) on a 7 point scale where 1 is delighted and 7 is terrible.

**Conclusions/Clinical Implications:** The results show that children are using both mainstream and specialised technology items with high levels of frequency and satisfaction.

Development of an Integrated and Holistic Sleep Service for People with Cerebral Palsy: Identifying Key Issues for Clients and Their Families

**Ms Anne Pearce, Ms Linda Mercer**  
The Centre for Cerebral Palsy, Western Australia

**Background:** Sleep disturbance is a common concern for people with developmental disabilities, and has a significant impact on their health and wellbeing and that of their families and caregivers.

The Sleep Solutions service initially focused on the provision of postural support during sleep. With growing awareness of clients' complex sleep needs, a more holistic service has evolved. A multidisciplinary approach is used, promoting liaison between clients and their families, carers, therapy teams and medical specialists. Diverse factors affect our clients' sleep. It is important to recognise these so that appropriate clinical solutions can be provided.

**Objectives:** To identify and describe the diverse and complex factors that affect the sleep of people, of all ages, with cerebral palsy.

**Design:** A retrospective review of records of clients who were referred to the Sleep Solutions service between March 2005 and March 2008.

**Participants/Setting:** 179 people were referred to the Sleep Solutions service over the period analysed, with 43 excluded from this study because they had been referred from external agencies and had a diagnosis other than cerebral palsy. We analysed 136 records of clients with cerebral palsy, of whom 73 were male and 63 were female. Ages ranged from 1 year to 60 years.

**Methods:** Clients' records were analysed and key issues were identified and categorized. In most cases, more than one issue was evident. Where multiple key issues were identified, these were all recorded.

**Results:** The key issues associated with the sleep of clients with cerebral palsy were: postural management, pain management, effects of uncontrolled movements, pressure care, breathing difficulties, settling routines and night waking, behavioural difficulties, management of the sleep environment, regulation of body temperature, effects of seizures and related medication, reflux and digestive difficulties, continence management, daytime routines, general health issues and safety during sleep.

**Conclusions/Clinical Implications:** Sleep disturbance affects people of all ages with cerebral palsy. The factors affecting their sleep are diverse, and complex. In most cases, investigation of sleep difficulties uncovers more factors than those for which the client was initially referred. Therefore, an integrated, multi-disciplinary approach is required for effective provision of sleep interventions.
Punching and Postural Adjustments in Children with Cerebral Palsy While Standing in a Whole-Body Orthosis

Mrs Anna Pettermann1, PhD Erik Stenninger2, PhD Helga Hirschfeld2

1Motor Control and Physical Therapy Research Laboratory, Department of Neurobiology, Care Sciences and Society, Division of Physiotherapy, Karolinska Institutet, 2Department of Paediatrics, Örebro University Hospital, Örebro, Sweden

Background: Improvements of voluntary arm movements and standing abilities are usual targets of training programmes for children with cerebral palsy (CP). Throughout Sweden the standing-shell is commonly used as standing-device. That is a whole-body orthosis, custom-shaped to the individual and with aim to resemble the mechanical alignment and somatosensory input of normal standing. Our hypothesis is that the body orientation as provided by the shell would allow children with CP to make postural adjustments required to successfully complete a punching task with maintained equilibrium while standing.

Objectives: To characterize a voluntary punching movement and the associated postural adjustments in children with cerebral palsy (CP), GMFCS III-V, while standing in a whole-body orthosis (standing-shell).

Design: This was a prospective experimental study

Participants: Eleven children with CP Gross Motor Function Classification Level III-V and 15 control children, age 5–14 years.

Methods: Hand kinematics (Elite) and ground reaction forces (Kistler) were monitored bilaterally during a punching movement.

Results: The children with CP punched with lower hand peak velocity (P=0.005), had shorter acceleration phase (P=0.013) and required longer time to hit the target (P=0.016) than the control children. The children with CP exerted backward forces beneath both feet, whereas the control subjects demonstrated an inter-limb coordination with respect to anterior and posterior forces. On the non-punch side the lateral gastrocnemius muscle activity was lower in children with CP, though it seemed to be elevated during the punch.

Conclusions: Children with CP were punching with lower velocity and shorter acceleration phase compared to children without CP, while standing in the standing-shell. Postural adjustments could be elicited in the shell as reflected in refinements of anterior/posterior forces and muscle activity. Without the shell the three children with CP needed more time to target hit compared to when standing in the shell, probably due to that they cannot rely on a stable reference posture in association with task planning and performance.

3D Analysis of Upper Limb Movements During Gait in Healthy Subjects and in Children with Spastic Hemiplegia

MD Luigi Piccinini1, PhD Veronica Cimolin2, Prof Gionio Albertini3, Prof. Reinald Brunner4, Dr J aqueline Romkes5, MD Anna Carla Turconi1 Prof. Manuela Galli1

1IRCCS Eugenio Medea, Bosisio Parini, Lecco, Italy, 2Bioeng. Dept. Politecnico di Milano, Milano (ITALY), 3IRCCS “San Raffaele Cassino” Hospital -Tosinvest Santità, Roma, Italy, 4Children’s University Hospital Basel (UKBB), Basel, Switzerland, 5Bioeng. Dept. Politecnico di Milano, Milano (ITALY), IRCCS “San Raffaele Cassino” and “San Raffaele Cassino” Hospital -Tosinvest Santità, Roma, Italy

Introduction: Upper limb movement has a great role during gait, in particular in pathological subjects for body advancement. While lower limb strategy has been deeply investigated and quantified using Gait Analysis (GA), the upper limb movement during gait is limited. Some total body protocols exist, but they generally use a high number of markers and application of these configurations during a standard GA session wouldn’t be suitable, especially for clinical applications. In this study an experimental set-up for acquisition of upper limb movement during Gait Analysis (GA) was developed and applied to healthy subjects and to patients with spastic hemiplegia.

Methods: 12 patients with clinical diagnosis of spastic hemiplegia and 24 healthy subjects (CG) were evaluated using an optoelectronic system (ELITE, BTS, Italy), 2 force plates (Kistler, CH) and a Video system (BTS, Italy). The passive markers were positioned as described by Davis [1] and additional markers (one for the elbow and two for the wrist) were positioned bilaterally. Shoulder and elbow kinematic (angles) and kinetic (moments and powers) plots were evaluated. Some parameters of upper limbs and of lower limbs were defined. Statistical analysis was conducted (p< 0.05).

Results: The application of experimental set-up on CG allowed defining normative graphs of upper limb movements in terms of kinematics and kinetics. The same experimental set-up was then applied to patients, making the distinction between affected and non-affected side. In the patients, the main differences on the sagittal plane concerned the elbow position at initial contact and its ROM, which was significantly limited in both limbs. On frontal plane at Initial Contact both shoulder were significantly more abducted than CG. In particular the affected sides were generally more compromised than the contralateral side.

Discussion: In this study normative ranges of upper limb motion during gait were defined and the application to hemiplegic patients allowed describing the deviation from healthy group in terms of upper limb strategy.

References:

The Communication Profile of Children with Worster-Drought Syndrome

Dr Luigi Piccinini1, Dr Maria Clark2, Ms Nicola Jolleff3, Ms Rebecca Harris4
1IRCCS Eugenio Medea, La Nostra Famiglia Association, 2Wolfson Neurodisability Service, Great Ormond Street Hospital, 3Dysphagia Service, Royal London Hospital

Background: The Worster-Drought syndrome (WDS) is described as a congenital pseudobulbar palsy. It is associated with a mild four limb motor disorder, epilepsy, behaviour problems, and learning impairment. The description is associated with multiple bulbar function deficits (drooling, feeding and speech). Children often present to services with feeding problems and ‘late speech’, and may present as severely dyspraxic.

Objectives: Previous retrospective case series have broadly defined the profile (Worster-Drought 1956, Clark et al 2000). Our study aimed to guide on appropriate clinical assessment and management of the complex oromotor, speech and feeding issues seen.

Design: 42 children with a description of pseudo-bulbar palsy were recruited from Neurodisability clinics for augmentative communication, neuro-development, feeding and neurology. Children were older than 4 years (mean age 7.8 years, SD 3.1 years) to allow a confident diagnosis (as motor findings can be transient in younger children). Cross-sectional clinical data was collected by members of the multi-disciplinary team.

Methods/Materials: Measures included: full history and neurological examination; oromotor assessment; receptive and expressive language, functional speech intelligibility; nonverbal ability; feeding skills; videofluoroscopy; behavioural profiles and fine motor skills.

Results: Many of the preconditions for successful communication can be disturbed for children with WDS. Our group had high rates of hyperactivity, social communication difficulties and history of conductive hearing loss (63% glue ear; 54% grommets). Most had severe motor speech problems, and a history of intensive traditional speech and language therapy with little improvement. 80% used alternative communication systems, but even under ideal test conditions often did not appear to achieve their communicative potential, with receptive language skills much in advance of their expressive skills. There did not appear to be any evidence of specific language difficulties, although the incidence of slowed learning was high.

Conclusions: Children with this complex pattern of motor and developmental difficulties are often diagnosed late, and SLT intervention may, therefore, be poorly targeted. There were methodological difficulties with the study, including the selection of appropriate measures for a group with such widespread behavioural and communication deficits. The implications of the persistence of speech difficulties will also be discussed, to include the role of early intervention of AAC.


The Clinical Utility of the Comparative Analysis of Performance – Motor (CAP-M) for Children with Cerebral Palsy

Miss Nicole Rae1, Dr Jodie Copley2
1Cerebral Palsy League of Queensland, 2University of Queensland

Background: Assessment of upper limb function for clients with neurological injury has changed in recent years. The International Classification of Functioning has shifted therapists’ focus from assessing impairment characteristics (spasticity, range of motion) to assessing activity and participation (completing occupational tasks) (Duncan, 2006). However, due to the interventions available that target upper limb impairment, several authors contend that it is still important to consider impairment level factors (Campbell 1999, Copley and Kuipers 1999, Rosenbaum and Stewart 2004, Kuipers et al 2006). Few assessment tools exist that link information about impairment factors with activity and participation. The Comparative Analysis of Performance – Motor (CAP-M) is an assessment tool currently under development that employs task analysis methods to identify motor capacities of the client that support and interfere with activity performance (Ranka 2005).

Objectives: This study aimed to investigate the clinical utility of the CAP-M with children with cerebral palsy and determine whether modifications were required for its use with this population.

Design: A basic interpretive qualitative research design was employed.

Participants/Setting: Participants were ten occupational therapists working at a Brisbane community based organisation servicing children with cerebral palsy.

Materials/Method: Participants received education about the CAP-M and then trialled the tool with a child from their caseload. Participants were then involved in 1 of 3 focus groups aimed at investigating the perceived clinical utility of the CAP-M. Constant comparative analysis was used to guide data collection and identify key themes from the data.

Results: Findings suggest that some of the tool’s benefits included its ease of use, its occupational task focus, its effectiveness as an observational, educational and clinical reasoning tool, and its applicability to a wide range of children. The CAP-M provided therapists with a systematic way of documenting clinical reasoning decisions regarding hypertonicity management. The tool’s ability to link impairment level factors with activity performance was viewed as unique in comparison to other upper limb assessments. The CAP-M’s use of a meaningful occupational task would aid therapists in providing specific explanation and education to families regarding a child’s upper limb movement. The CAP-M’s main limitation appears to be its need to be used in conjunction with other impairment and outcome measures.

Conclusion/Clinical Implications: This study revealed an overall positive view of the CAP-M’s applicability to children with cerebral palsy and indicated that it is a useful addition to the current upper limb assessments available to therapists.
Implementing Progressive Resistance Training in the Physical Therapy Rehabilitation of Children with Cerebral Palsy After Treatment with Botulinum Toxin Type A – 4 Cases

Ms Helle Rasmussen1, Ms Lone Nielsen1, Mr Thomas Bandholm2
1Department of Pediatrics, Hvidovre University Hospital, 2Department of Physical Therapy, Hvidovre University Hospital

Background: Children with spastic hemiplegic cerebral palsy (CP) often have an equinus gait pattern, with weak dorsiflexors and spastic plantarflexors. The spastic muscles can be treated with Botulinum toxin type A (BTX). It is not known which type of rehabilitation, following treatment with BTX, is the most efficient.

In our clinic, the children usually receive physical therapy rehabilitation twice weekly. Each session lasts 45 minutes, and includes gait training (25 min), stretching (5 min), and balance training (10 min).

Objectives: The purpose of this study was to investigate changes in voluntary strength, resulting from the incorporation of progressive resistance training of the affected leg in the post BTX rehabilitation of children with hemiplegic CP.

Design: Descriptive case study.

Participants/setting: Children with spastic hemiplegic CP in a hospital outpatients children ward.

Materials/Methods: Four children with spastic hemiplegic CP, ranging in age from 8 to 12 years, GMFCS level I, participated (Table 1). The children all had an equinus gait pattern, but had enough dorsiflexor control to perform a dorsiflexion against gravity.

We replaced 15 minutes of gait training with progressive resistance training for each session in a total of 24 sessions. The exercises were resisted ankle dorsiflexions, heel raises, and leg extensions with loads of 10RM (weeks 1–4), 8RM (weeks 5–8) and 6RM (weeks 9–12). Maximum dynamic strength (1RM) was estimated using Brzycki’s equation (1RM = Load in kg/(1.0278 - (0.0278 × Number of repetitions))). The child’s progress was documented in a training journal. The training started immediately after treatment of the gastrocnemii muscles (4 units/kg bodyweight) and the soleus muscle (2 units/kg bodyweight) with BTX.

Results: The four children attended 22–23 sessions during a period of 12–14 weeks (Table 1). The improvement in estimated 1RM in dorsiflexion was 2.3–5.1 kg, in heel raise 2.6–10.5 kg and in leg extension 18.9–44.7 kg (Figures 1, 2, 3 and Table 2). The four children were all pleased to participate, felt stronger in their affected leg and wanted to continue with strength training.

Conclusions/Clinical Implications: Our four cases demonstrate that progressive resistance training can be implemented in physical therapy rehabilitation following treatment with BTX, and that our rehabilitation program produces a marked increase in maximum dynamic strength. Further controlled studies are needed to determine the specific benefits of implementing progressive resistance training in the rehabilitation following BTX treatment.

Table 1 Presentation of the participants.

<table>
<thead>
<tr>
<th>Child</th>
<th>Age (yrs)</th>
<th>Bodyweight (kg)</th>
<th>Attendance (sessions/weeks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>8.2</td>
<td>21.8</td>
<td>23/12</td>
</tr>
<tr>
<td>B</td>
<td>10.6</td>
<td>46.0</td>
<td>23/13</td>
</tr>
<tr>
<td>C</td>
<td>8.0</td>
<td>29.9</td>
<td>22/14</td>
</tr>
</tbody>
</table>

Table 2 Individual improvements in estimated 1RM (kg) pre and post rehabilitation incorporating progressive resistance training after BTX treatment.

<table>
<thead>
<tr>
<th>Child</th>
<th>Dorsiflexion Increase</th>
<th>Heel raise Increase</th>
<th>Leg extension Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.7 15.2 5.6</td>
<td>0.0 10.5 12.5</td>
<td>0.0 15.7 58.0</td>
</tr>
<tr>
<td>B</td>
<td>0.7 5.8 5.1</td>
<td>4.0 13.4 9.4</td>
<td>20.0 73.5 43.5</td>
</tr>
<tr>
<td>C</td>
<td>0.0 2.9 2.9</td>
<td>0.0 2.6 12.6</td>
<td>33.3 92.3 18.9</td>
</tr>
<tr>
<td>D</td>
<td>0.7 2.9 2.2</td>
<td>0.0 5.8 5.8</td>
<td>13.3 58.0 44.7</td>
</tr>
</tbody>
</table>

Figure 1 Individual improvements in estimated 1RM (kg) for the 24 training sessions for Dorsiflexion.

Figure 2 Individual improvements in estimated 1RM (kg) for the 24 training sessions for Heel raise.

Figure 3 Individual improvements in estimated 1RM (kg) for the 24 training sessions for Leg extension.
The Quebec Adult Cerebral Palsy Study: 2. Environmental Factors that Facilitate and those that are Obstacles to Social Participation

PhD Carol L Richards, MSc Francine Dumas, PhD Normand Boucher, PhD Desiree Maltais
Centre For Interdisciplinary Research In Rehabilitation And Social Integration And Laval University

Background: There is a lack of information on environmental factors that facilitate or act as obstacles to the social participation of adults with cerebral palsy (CP).

Objectives: The purpose of this study was to obtain information on the effect of environmental factors on the lifestyle of persons with CP.

Design: Questionnaire-based survey.

Methods: Adults who had been patients as children from 1984–2004 at the Children’s Rehabilitation Centre in Quebec City were contacted to participate. Data were obtained via an in-house health and socio-demographic questionnaire and the Measure of the Quality of the Environment (MQE) (Fougeryllas P. et al 2003). The MQE scale estimates the environment’s influence on the accomplishment of a person’s daily activities while taking into account abilities and personal limits. Specific factors in the environment are rated from major obstacle to major facilitator, where -3 is a major obstacle, 0 exerts no influence and + 3 is a major facilitator.

Participants: The mean age of the respondents was 28.0 yrs (range: 18–41 yrs, n=139, 71 women). The anatomic distribution of the motor disorder was: quadriplegic (41%), diplegic (27%), hemiplegic (25%) and other (7%). The severity level, according to the gross motor function classification system (GMFCS) was: level I (30%), II (19%), III (15%), IV (22%) and V (13%).

Results: The support of a social network (89% of the participants) and the accessibility of sidewalks in the individual’s community (57%) were the most important facilitators of life activities, while the weight of objects encountered during daily activities (68%), winter climatic conditions (66%), and the accessibility of sidewalks in the individual’s community (57%) were the most important environmental obstacles. The physical accessibility of the homes of friends and family (37%) and the availability of accessible housing (38%) were also important environmental obstacles.

Conclusion/Clinical Implications: These data confirm the importance of family support and friends to facilitate life activities while obstacles to mobility such as weight of objects encountered in the community hinder the accomplishment of these activities. Programs and policies to promote the social participation of adults with CP should thus take these facilitators and barriers into consideration.

Acknowledgements: This work was supported by grants from the Laval University Research Chair in Cerebral Palsy and the Centre for Interdisciplinary Research in Rehabilitation and Social Integration.

The Role of Models in the Management of Adults with Cerebral Palsy

Ms Davina Richardson, Ms Jenny Holden
Imperial college Health care NHS Trust

This workshop will examine the use of the International Classification of Function (ICF World Health Organisation), a Rehabilitation model piloted at Imperial college Health Care NHS Trust and a case study. These three tools will be used to illustrate the value of detailed assessment and treatment planning to optimise the management of adults with cerebral palsy experiencing progression/changes in their impairments, activity limitations and participation restrictions as they get older.

The objectives of the workshop will be to:
• Use the models to increase the awareness of the need for partnership working between specialties within health and across service delivery settings when managing adults with cerebral palsy.
• To improve the knowledge of the management of upper motor neurone syndrome and how it can impact on activity and participation.

The ICF model breaks down the component parts of the patients lived experiences, The Rehab pathway model breaks down the component parts of health and social care input into themes. These themes are: These themes are Assessment/Review to ascertain the nature and severity of the problem. Empowerment to educate and support patients to allow them to take an active role in their care. Supporting to help patient and family cope with the condition. Restorative to promote a lasting improvement in function with patients with new deficits. Maintenance to provide coping/compensation strategies to retain functions. Preventative to anticipate and prevent the development of difficulties. Enablement to maximise the use of existing functions and Conditioning to increase endurance and strength in activities for those people who have become deconditioned by prolonged acute/chronic illness to regain function.

The case is a 51 year old male who presented with left hip osteoarthritis secondary to hip dysplasia to the orthopaedic surgeon. The individual also had abnormal tone with spasms and spasticity in the lower limbs and increasing weakness in the upper limbs. The individual was living independently in the community prior to admission to the acute hospital setting for a left total hip replacement.

The workshop plan will be to describe the models. Then using the case study apply the models to the case to develop an optimum treatment plan and discuss the actual management plan. The group will be asked to break up into work groups to identify the impairments, activities and participation issues for the case and then identify which section of the health and social teams would best support, manage, restore, prevent, empower, enable or condition the case and how.
Pressure Mapping Analysis of Hoist Slings under Seated Clients with Cerebral Palsy

Mrs Susan Robison, Mrs Coral Niethe, Dr Leanne Johnston

Cerebral Palsy League of Qld

Background: Clinicians, carers and clients who participate in frequent hoist-to-chair transfers may be exposed to a range of risks during the removal and re-application of a hoist sling. These risks may include the clinician/carer sustaining musculoskeletal injury and/or the client sustaining skin breakdown due to shearing of the sling material during removal/re-application. It is proposed that these risks could be ameliorated by leaving the sling in place once the client is safely seated. However, introducing this practice needs to be balanced against information regarding the potential risk of clients developing pressure areas due to retaining the sling over their sitting surface. As a literature review returned no research or clinical guidelines relating to the risks and/or benefits of leaving hoist slings in place, further research was warranted to determine whether this practice may impact on client care.

Objectives: Determine whether vertical interface pressure (between a client’s legs/buttocks and their seat surface) is increased due to sustained hoist sling placement during sitting for clients with Cerebral Palsy.

Design: Cross Sectional

Participants/Setting: Ten adults with Cerebral Palsy who participate in hoist transfers into their wheelchair. Data collection was completed at client’s homes using their own equipment (hoist, sling, wheelchair, pressure cushion).

Materials/Methods: The XSENSOR pressure mapping system was used to measure vertical interface pressure when sitting in a wheelchair with and without a hoist sling in place. The XSENSOR incorporated a 36x36cm pressure mat with 1296 sensors connected to a laptop with custom software that calibrates and records data. When placed between the participant and their support surface, the XSENSOR samples vertical interface pressure at 10Hz to calculate four variables: peak pressure, average pressure, contact area and centre of pressure. Under each condition, pressure was recorded for 10min with the participant in their typical sitting posture, with two minutes of stable data exported for analysis.

Results: Preliminary analysis (data from the first 7 participants) demonstrated no significant difference in interface pressure with and without a hoist sling in place.

Conclusions/Clinical Implications: Sustained sling placement does not increase pressure generated between a client’s legs/buttocks and their wheelchair seat surface. This provides preliminary support for opting to retain a hoist sling during wheelchair sitting to reduce clinician/carer risk. However, further research is required to fully evaluate client comfort (sling in/out preference) and safety (long term pressure area monitoring) which should be factored into any clinical recommendations.

Trunk Position and Physical Activity in Daily Life in Children with Cerebral Palsy

Dr Haruhiko Sato1, Dr Toshiyuki Iwasaki2, Dr Takenobu Inoue3, Dr Paul Andrew4

1Kitasato University, 2Departments of Pediatrics, Kitasato University School of Medicine, 3Research Institute, National Rehabilitation Center for the Disabled, 4Hyogo University of Health Sciences

Background: The effect of gravity is regarded as one factor involved in the development of spinal deformity in cerebral palsy (CP). But little is known about how long the CP children stay in the same position, or how much the physical activity is observed in daily life.

Objectives: To find out about body position and trunk activity in daily life in a sample of trunk-controlled (can move trunk in sitting) and trunk-uncontrolled (cannot move trunk in sitting) children with CP.

Design: Cross-sectional study.

Setting: Community-based.

Participants: Fourteen children with severe spastic quadriplegic CP participated (8 boys; mean age 8.6 ± 3.1 years; 6 girls; mean age 8.0 ± 6.3 years).

Methods: On each participant were placed a body position recorder (BodyTrac) at the chest and a physical activity recorder (ActiTrac) at the waist. They wore these devices in the midst of their normal daily activities for 24 hours. The body position recorder detected five body positions (sitting upright, supine, prone, and left and right lateral lying) once every 30 seconds during 1 day of ordinary life. The physical activity recorder, which contains accelerometers, registered once every 2 seconds during the same day. To measure ability to control the trunk, voluntary trunk motion during sitting was recorded for 3 minutes by a 3-D motion recorder (Pocket-MU). Children were classified as "trunk uncontrolled" if they could not move the trunk more than 20 degrees in flexion/extension and abduction/adduction during sitting.

Results: Seven of the children with CP were classified as trunk-uncontrolled. The trunk-uncontrolled children showed significantly less frequency of postural change and longer duration of posture than trunk-controlled children (frequency: 164.3 ± 104.7 vs. 345.9 ± 86.3 times per day, p < 0.01; duration: 7.6 ± 3.5 vs. 2.9 ± 1.7 hours per day, p < 0.05). But there was no significant difference in total time of being upright. Level of physical activity in daytime was significantly lower for trunk-uncontrolled children (6.2 ± 4.7 vs. 13.3 ± 6.2 mG, p < 0.05).

Conclusions: Trunk-uncontrolled children with severe CP tended to stay in the same position longer than trunk-controlled children with CP.

Clinical Implication: This work could provide with quantitative information about body position, frequency of changing body position, and period of time spent in an upright position, possibly with implications for preventing spinal deformity.
Muscle Strengthening in Children with Cerebral Palsy: A Systematic Review

Mrs Aline Scianni, Mrs Jane Butler, Mrs Louise Ada
The University of Sydney

Background: Impairments such as weakness, spasticity, and incoordination in people with cerebral palsy result in difficulty with activities of daily living. Improving the ability to walk or to perform other activities are often the primary therapeutic goals for people with cerebral palsy.

Objectives: The purpose of this study is to address the following questions: Is strengthening in children with cerebral palsy effective (i.e., does it increase strength) and is it worthwhile (i.e., does it improve activity)?

Design: Systematic Review with meta-analysis of randomised trials

Participants: Children with cerebral palsy (any level of GMFCS) from school age to 20 years old.

Materials/Methods: Intervention: The experimental intervention has to be of a type and dose that could be expected to improve strength, i.e., it has to involve attempts at repetitive, strong, effortful muscle contractions, and it had to be stated or implied that the intervention was progressed as the participant’s abilities changed. The activity must make up at least half of any exercise program. Outcome measures: Impairment: measures of muscle strength (maximum voluntary force production), Continuous measures (force, torque, work, EMG) or ordinal measures (manual muscle test).

Activity: Scales and tests of upper and lower limb performance.

Search: Searches will be performed without language restrictions using words related to cerebral palsy; muscle strength training and randomized, quasi-randomized controlled trials or controlled trials.

Comparisons: We will review studies investigating comparisons of muscle strengthening with placebo; or studies comparing muscle strength training plus conventional physiotherapy versus conventional physiotherapy (standard treatment) alone, but exclude those comparing muscle strength training with another intervention.

Results: The search returned 1880 papers. 1824 of these were excluded on the basis of reading the abstract. 56 full text papers were retrieved for further examination. These were independently assessed against the inclusion criteria and any disputes were resolved by a third assessor. The results will be finalized by September 2008.

Good Practise in Habilitation of Children – In the Real World

M.Sc Eeva Seppala1, MD Matti Koivikko2, M.Sc Salla Sipari2, Mr Aimo Stromberg1, M.Sc Taaja Nieminen1
1Helsinki Polytechnic Metropolia, 2Vajaaliikkeisten Kunto ry

Background: Vajaaliikkeisten Kunto organisation in Finland created a good practice into habilitation of children and adolescents, as defined by the results of questioning the specialists and societies 2002–2005

Objectives: To implement a good practice into habilitation of children and adolescents, as defined by the results of questioning the specialists and societies 2002–2005

1) A good practice in habilitation of children and adolescents which is useful in whole Finland
2) The special features of each district form the background for rehabilitation plan and practice.
3) The local, district-based framework forms the basis for individual planning.
4) This framework makes individual habilitation planning quick and easy and yet preserves its individual character

Participants: The subjects consist of 15 local groups of rehabilitation specialists all over Finland and six national societies. The specialists represent health and social care, education, day care and families of children and adolescents with special needs.

Methods:

- From each local group two project workers will make a plan how to organize habilitation locally in their own district.
- The local workers make a habilitation plan for their district, including local needs, capabilities, local and outside resources.
- Local workers coordinate and organize the local district-based habilitation plan.
- Open forums in which habilitation of children and young is discussed from different aspects.

Results and Implications:

Aims until 2011:

- The child and the whole family will get an individual habilitation plan, which is based on their needs and aims, and their understanding of good life.
- The parents will get a comprehensive view of habilitation.
- The good practice in habilitation of children is a tool for comprehensive way of habilitation.
- Services can be organized locally with local resources taken into account.
- Information of the good practice in habilitation of children and adolescents will become more accessible by internet (www.vlkunto.fi) and printed material.
- The co-operation between families, workers and various other sectors will grow.
- Views of the professionals will change more towards the needs and aims of the child and family.
- produce data about implementing, applying and integrating the good practice in habilitation.
Complications During Post Surgical Rehabilitation Following Single Event Multilevel Surgery in Cerebral Palsy

Dr. Deepak Sharan, Mr. Biju Nirmal Jacob, Mr. Ajeeb PS
RECOUP Neuromusculoskeletal Rehabilitation Centre, Bangalore, India

Background: The functional results of Single Event Multilevel Surgery (SEMLS) for Cerebral Palsy are closely dependent on the quality of post surgical rehabilitation.

Objectives: To quantify the complications encountered during rehabilitation following SEMLS.

Design: Retrospective chart review of recorded complications during rehabilitation.

Participants/Setting: The present study analysed the complications during post surgical rehabilitation following SEMLS in 600 consecutive patients with different type of cerebral palsies like Spastic diplegia (70%), Spastic Quadriplegia (12%), Spastic Hemiplegia (10%) and Spastic Ataxia (8%) during a period of 8 years (2000–2008). The mean age at the time of surgery was 7 years (range 3–32).

Materials/Methods: The surgical procedures included myofascial releases and restoration of lever arm dysfunctions. The post operative plaster immobilisation period was between 5–10 weeks and was followed by physical therapy for at least 6 months. The data was collected from the patient's outpatient and physical therapy records. The follow up ranged from 1 year to 8 years (mean 3 years).

Results: The following complications were reported: Prolonged Joint Stiffness lasting over 4 weeks (82), Myofascial Pain Syndrome (66), Osteopenia (62), Hypertrophic Scar (26), Pathological Fractures (23), Superficial Pin Track Infection (21), Wound Dehiscence (18), Pressure Ulcers (17), Meralgia Paresthetica (15), Patellofemoral Pain Syndrome (12), Rickets (5), Complex Regional Pain Syndrome (1), Patellar Tendinitis (1), Myositis Ossificans (1) and transient Common Peroneal Nerve Palsy (1).

Conclusions/Clinical Implications: SEMLS is associated with a relatively high rate of complications which may delay or interfere with the rehabilitation. However, none of the complications were life threatening, permanent or affecting long term outcome of surgery. To minimise the rate of complications we recommend a structured rehabilitation protocol carried out by experienced physical therapists and frequent follow up by the multidisciplinary medical team. Before the surgery, the patients, parents and care givers should be counselled regarding the prevalence of these complications, along with the available prevention and treatment options.

Change in Gross Motor Function, Quality of Movement and Everyday Activities Following an Intensive PhysioTherapy Program in a Group Setting for Children with Cerebral Palsy

Ms Anne Brit Sorndahl, Prof Rolf Moe-Nilssen, Dr Liv Inger Strand
Department of Public Health and Primary Health Care, Section for Physiotherapy Science, and Department of Physiotherapy, Bergen University College

Optimising participation in everyday activities is seen as the main goal in interventions for children with cerebral palsy (CP). Recent work in the fields of neuroscience and movement science suggests that intensive training may influence and accelerate motor function development in children with CP; however the results of studies are sparse. There is lack of knowledge regarding what are the most effective contents and dose of intervention, and in which age groups and functional levels intervention may have effect. The aim of the study was to investigate the impact of a 3 weeks period of intensive physiotherapy in a group setting on gross motor function, quality of movements and everyday activity level in children with CP.

A repeated measures design was used in groups of children with CP, with three baseline assessments prior to the intervention period and two follow up assessments in the first and third weeks after the intervention. 22 children (3–9 y, mean 5.5y) with hemiplegia (7), diplegia (11), quadriplegia (2) and ataxia (2) participated. The intensive physiotherapy aimed to improve functional activities important to the child and prevent secondary impairments. Parents and professionals were active participants in goal setting and training. Mean participation was 42 hour of training (range 39–45) in the three weeks period.

The results showed significant increase in self-care, mobility and social function domains in the children's functional skills dimension of the PEDI, and a significant decrease in caregiver assistance in the same three domains. The children's gross motor function as measured by the GMFM significantly improved in the intervention phase, but not quality of movements. The combination of involvement of the children's environments as well as intensive individualized training within a social context in a limited time period, gave a feasible and well-tolerated opportunity of optimising function in preschool children with CP.
Effect of Botulinum Toxin A Injections and Specific Intensive Rehabilitation Therapy in Children with Hemiparetic Cerebral Palsy on Upper Limb Functions and Skills

Mrs Lucianne Speth1, PhD Yvonne Janssen-Potten2, PT Eugene Rameckers1, OT Anke Defesche2, MSc Pieter Leffers3, Prof. Hans Vles4

1SRL/Franciscusoord, 2Stichting Revalidatie Limburg (SRL), 3Maastricht University, 4University Hospital Maastricht

Background: There is not sufficient evidence to support or refute the use of intramuscular injections of Botulinum toxin A (bTA) as an adjunct to managing the upper limb in children with spastic Cerebral Palsy (CP). The effect of the therapy program afterwards is not clear.

Objective: Aim of the present study was to determine whether bTA injections, intensive bimanual skill training, or a combination of both leads to more and better use of the affected arm in play, school and personal care.

Study Design: A factorial design with four study groups in which bTA alone, intensive rehabilitation therapy aimed at improving bimanual skills alone, a combination of these two and a control group will be compared to each other. The bTA injections are administered in the day care department of the hospital under general anaesthesia. The rehabilitation therapy programme is a task oriented training based on goal setting and consists of half an hour physiotherapy and one hour occupational therapy each two times a week during 12 weeks. Six measurement sessions will take place in a period of 30 weeks (two baseline, than at 6, 12, 18 and 24 weeks after bTA and start of the therapy programme). The study aims to include 60 children with CP, spastic hemiparesis, aged 2.5–12 years.

Main Outcome Measures: Study parameters are the Assisting Hand Assessment (AHA), a measurement instrument in which the performance and capacity of use of the affected hand in bimanual play is scored in a standardized way by video observation. The ABILHAND-Kids, a questionnaire, will be administered to measure manual ability. A video of the most important bimanual goal for the child and their parents will be scored by Goal Attainment Scaling (GAS). These are all measurements at activity level of the International Classification of Functioning Disability and Health (ICF, WHO 2001). Also measurements at function level will be used, like passive and active ROM, muscle strength and spasticity. Finally, two fine motor and one gross motor bimanual task will be recorded and evaluated using a video observation instrument called OSAS (Observation and Scoring of Arm and hand Skills). With help of the OSAS programme inferences can be made about the duration and quality of use of the affected hand.

Trial Registration: This ongoing study is registered in the ISRCTN trial register: http://www.controlled-trials.com/ISRCTN69541857/BoBiVa

Impact of Surgery on Knee Kinematics in Cerebral Palsy

Dr Sean Suttor, Dr Matthias Axt, Dr Paulo Selber

The Children’s Hospital at Westmead

Background: Orthopaedic surgery is commonly used to maintain and improve gait function in patients with cerebral palsy. Pathological knee kinematics are an important and sometimes challenging component to correct.

Objectives: To ascertain the success of surgical procedures in correcting knee kinematics in the cerebral palsy patient, in particular hamstring lengthening and tendon transfers. Also to assess any adverse impact on pelvic tilt of hamstring procedures.

Design: Retrospective review of prospectively collected data.

Participants/Setting: All patients undergoing orthopaedic surgery between 2003 and 2007 at the children’s hospital at Westmead who had attended pre and post-operative gait analysis assessments.

Materials/Methods: Prospectively collected gait analysis data and medical records were reviewed. Patients were divided according to type of cerebral palsy into hemiplegic and diplegic groups. Pre and postoperative results were analysed for significant changes.

Results: 20 patients were eligible for inclusion. 12 diplegics and 8 hemiplegics. In the diplegic group there was a significant decrease in knee flexion through stance phase. In the hemiplegic group there was a significant increase in ROM throughout the gait cycle. There was no adverse effect on pelvic tilt in either group.

Conclusion: Judicious use of hamstring lengthening and tendon transfers can produce significant improvement to knee kinematics without adverse consequences on pelvic orientation.
A New Insole to Control the Spasticity for the Children with Cerebral Palsy

Dr Hidetoshi Takahashi1, Youko Komune2, Meigen Liu3
1National Center for Child Health and Development, 2Department of Rehabilitation Medicine, National Center For Child Health, 3Department of Rehabilitation Medicine, Keio University

Background: For the children with cerebral palsy, brace therapy is effective to control the spasticity of their lower extremities and correct the alignment of walking. Their positive supportive reflex on foot causes increasing the spasticity and deteriorating the deformity of lower extremities.

Objectives: We develop a new insole to decrease the reflex and control the spasticity of lower extremities. By use of this insole, their foot fingers are stretching to the dorsiflexion and their MP joints do not contact on the floor. To fix their heel, the insole includes a counter support around the heel part and a plantar arch support. The purpose of this study is to evaluate the effect of this insole to decrease the spasticity.

Material/Method: 6 cases of cerebral palsy children with spastic diplegia or hemiplegia in age between 5 to 13 years old took part in this study. They all could walk without cane or brace, however all the participants did not contact their heel during the walking. Surface electromyography (EMG) electrodes were attached to the muscle berry on the both sides of biceps femoris, rectus femoris, tibialis anterior, and gastrocnemius medialis. We recorded muscle activities while they were walking on the tread mill. Gait speed was set at 1 to 3 m/sec. We calculated integrated EMG activity for 1minute and compared the data with and without the use of this insole.

Design: case series study

Results: In their clinical features, their heel contacts for all children were obtained during the stance phase with the insole on the treadmill. By use of the insole, integrated EMG activity decreased in gastrocnemius medialis and biceps femoris significantly, and improved reciprocal gait patterns. Their posture of the crouching stile during the walking was corrected by use of this sole.

Conclusion: This new insole will benefit to the walking performance for children with cerebral palsy.

Project ACT NOW: Adults with Cerebral Palsy Training to iNcrease Overall Wellness

Dr. Debbie Thorpe, The University of North Carolina at Chapel Hill

Background: There is a paucity of evidence addressing the efficacy of current interventions to address mobility, activity, and health related quality of life (HRQL) in adults with CP.

Objectives: (1a) Characterize secondary impairments and nonimpairment-related factors in a cohort of adults with CP. (1b) Describe the relationships among secondary impairments, HRQL and activity and mobility levels in a cohort of adults with CP. (2) Determine the feasibility of an aquatic exercise intervention aimed at diminishing the severity of select secondary impairments and improving HRQL and activity level. Participants are included in Part 1 if they are 21 years or older, can communicate, GMFCS Levels 1-4, have functional use of at least one arm. Additional Inclusion for Part 2: GMFCS Level 1-3, independent with dressing or personal care attendant, low to medium risk on the American Association of Cardiovascular and Pulmonary Rehabilitation.

Design: Prospective Cohort Study of convenience sample

Participants/Setting: In Part 1, one hundred volunteer adults with CP, 21 years and older, will be studied cross-sectionally within a tertiary research centre (Currently n=24). In Part 2, a subset of 30 of these adults will be studied longitudinally over a 9-month period as they participate in a community-based (CB) aquatic exercise program (currently n=16). Part 1 inclusion criteria: 21 years or older, can communicate, GMFCS Levels 1-4, functional use of at least one arm. Inclusion criteria for Part 2: GMFCS Level 1-3, independent with dressing or personal care attendant, low to medium risk on the American Association of Cardiovascular and Pulmonary Rehabilitation.

Materials/Methods: Pre, post and 6-month follow-up data is collected during a 3 hour session on the following outcomes: demographics, pain, leg range of motion, leg strength, Submax and Peak VO2, body composition, functional mobility, HRQL and activity level. Part 2 participants have a one-on-one exercise trainer for each of 36 aquatic sessions.

Results: Cross Sectional data on 24 subjects; 14 females and 10 males with median age 30 years (range 22–56 years); 75%Caucasian, 13% Black, 4% American Indian, 8% Asia/Pacific Islander; GMFCS levels 1-2 = 54% of participants, GMFCS levels 4-5 = 13% of participants; GMFM Dimension D median 51% (range 0–85%), GMFM Dimension E median 43% (range 0–86%); 37% in musculoskeletal pain.

Conclusions/Clinical Implications: We expect that this CB aquatic program will help to decrease the negative impact of secondary impairments and increase overall wellness in these adults with CP.
Use of ICF and ISO 9999 to Investigate Ideal Matches Between assistive Devices and Children with Cerebral Palsy

Mr Deborah Vickers¹, Mr Peter Jeschke², Assoc. Prof. Andrew McIntosh², Mrs Deborah Vickers²

¹TU Dortmund, ²School of Safety Science, University of New South Wales

Background: The current process of prescribing assistive devices (ADs) does not acknowledge individual criteria and often results in AD abandonment. The criteria which are commonly used focus on functional and structural impairments, but fail to accommodate individual demands resulting from biological, psychological, and social characteristics.

Over the past two decades various experts have investigated criteria relating to AD use and abandonment (Scherer, 1990; Johnson, 1999; Riemer-Reiss and Wacker, 2000; Kintsch and DePaula, 2006). It has been demonstrated that inadequate consideration of a user’s opinion, comfort, and individual needs may lead to AD abandonment and wasted resources. Applied by health professionals, this method may enhance user-centered and individual participation focussed AD provision; which in return may reduce costs due to increased AD acceptance.

Objectives: The objective of this project was to develop a method of linking the International Classification of Functioning (ICF) with the ISO 9999 “Technical Aids for persons with disabilities” to improve the match of ADs with an individual’s needs. To test the method, children with Cerebral Palsy (CP) in New South Wales, Australia, were selected as a focus group.

Method: The ICF and ISO 9999 were linked, compared, and visualised in a 3-dimensional Cartesian coordinate system (Figure 1). This process was achieved by describing both CP and an AD’s intended use with ICF categories from body-functions, structures, and activities and participation. To improve reproducibility, the results of the linking process were entered into a purpose-built database.

Results: The linking process identified 126 potentially useful ADs for a CP population comprising children, adolescents, and adults; with all severity levels of CP. From these 126 ADs only 43 were useful for children with CP. These included respiratory devices, adapted toys, car adaptations, input devices for computers and electronic equipment, communication devices, door and window-openers, aids for exercise and sport, and construction elements in the home and other locations.

Conclusion: The description of an AD’s intended use by ICF domains was beneficial to identify its application. In this paper, the match of ADs with an individual’s needs was tested with the focus group of children with CP at population level. It has not yet been refined to inform individual AD prescription. In addition to developing individual search routines, further work will be necessary to refine the linking process of ICF and ISO 9999.
Gastro-Intestinal Side Effects After Botulinum Toxin A Injection in Lower Limb Muscles in Children with Cerebral Palsy

Prof Johan Vles1, Student Georges Vles2, Dr Catharina Faber2, MD Mieke Hermans3, Dr Anton Louw de4, Dr Elisabeth Raak van2, Prof Johan Vles2

1University Hospital Maastricht, 2Department of Child Neurology, University Hospital Maastricht, The Netherlands, 3Department of Neurology, University Hospital Maastricht, The Netherlands, 4Epilepsy Centre Kempenhaeghe, Heeze, The Netherlands

Background: Treatment of spasticity in cerebral palsy with BTX-A may be limited by the escape of the toxin from the muscle causing local and distant side effects in children already suffering from additional medical and functional problems

Objectives: This study examined prospectively the side effects of BTX-A injections in the lower limbs 6 and 12 weeks after treatment

Design: prospective observational study

Participants: 55 children with CP (25 males), mean age 8.3 years (SD:3.3), received 74 BTX-A interventions under general anaesthesia in the day-care department of the University Hospital Maastricht. Maximum dosage 23MU/kg, limited to no more than 400 units per limb(Dysport)

Materials/Methods: 6 respectively 12 weeks after the intervention, side effects were scored during an outpatient visit, using an extensive standard list.

Results: Side effects were observed in five children. Three children had gastro-intestinal complaints: diarrhea in two (self limiting), and severe constipation in one for which treatment with macrogulum was necessary for 4.5 months. After a second intervention this child again developed constipation, for which treatment with macrogulum was necessary. In this period we performed repetitive stimulation of a motor nerve and an average of 11% decrement in amplitude of compound muscle action potential was visible, indicating a generalized blockage of acetylcholine release in nerve terminals. Both times, with lessening of the positive effects of BTX-A on spasticity related problems, this side effect fade away.

Conclusion: We conclude that severe constipation may be an autonomic systemic side effect of BTX-A treatment due to blockade of autonomic neurons via systemic spread. Knowledge of this possible side effect is important for those who treat patients already at risk for gastro-intestinal dysfunction

Levetiracetam Therapy for Treatment of ChoreaAthetosis in Dysskinetic Cerebral Palsy: A Report of Two Cases

Student Georges Vles1, Dr Lucianne Speth2, PhD Jos Hendriksen3, Dr Joost Nicolai1, Prof Johan Vles1

1Department of Child Neurology, University Hospital Maastricht, The Netherlands 2Rehabilitation Centre for sick children Franciscusoord, Valkenburg, The Netherlands, 3Kempenhaeghe Epilepsy Centre, Department of Behavioral Science, Kempenhaeghe, Heeze, The Netherlands

Background: Dyskinetic cerebral palsy (CP) presents involuntary, uncontrolled, recurring and occasionally stereotyped movements. The symptomatic treatment of this movement disorder is still very difficult. On the basis of a recent report about levetiracetam efficacy in the treatment of movement disorders, we started levetiracetam in two patients with dyskinetic CP.

Objectives: Studying levetiracetam as an alternative to standard therapy of involuntary, uncontrolled movements in dyskinetic CP

Design: case report of two patients.

Participants: case 1: 5 year old girl; perinatal asphyxia (umbilical artery pH 6.8); dysskinetic CP; formulated goals: improve balance control and grasping. case 2: 8 year old girl; perinatal asphyxia (umbilical artery pH 7.12: reanimated); dysskinetic CP; formulated goals: improve balance control and grasping

Methods: After informed consent, the dose of levetiracetam was titrated over several weeks, based on response as well as tolerability. The parents regularly used the Visual Analog Scale (VAS), an ordinal scale that ranges from 0–10, to score improvements on goals defined before treatment. Score 0: very satisfied; score 10: very dissatisfied. Moreover, video was used to compare movement patterns before and after medication

Results: Both children improved on the formulated goals with a difference in VAS of more than 2 points. The initial and best VAS are shown below. Comparing videos before and after medication showed uncontrolled movements and ranges of motion have decreased in both children. No side effects of levetiracetam were observed. Final levetiracetam dose for case 1: 5mg/kg/day; case 2: 10mg/kg/day. Follow-up: case 1 >1 year; case 2 > 2 years.

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<th>VAS balance</th>
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<td>before</td>
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Conclusion: Levetiracetam may offer an alternative in patients with dyskinetic Cerebral Palsy, who are unresponsive to conventional drugs mostly used in such cases.
Muscle Length in Severe Crouch Gait

Mr Peter Wong, Dr Jillian Rodda, Dr Paulo Selber, Prof Kerr Graham, Dr Richard Baker
The Royal Children's Hospital, Melbourne

Objective: Studies of muscle lengths in crouch have been limited by lack of quantitative definitions. Uncertainty of hamstring length creates difficulty in clinical decision making. This study investigates muscle lengths in severe crouch gait.

Design: Retrospective cohort study.

Method: A convenient sample of 16 children with spastic diplegic cerebral palsy (GMFCS level II-III) in severe crouch gait attending a tertiary paediatric hospital/gait analysis laboratory. Severe crouch gait was defined on sagittal plane kinematics as: greater than 30° knee flexion throughout stance phase, ankle dorsiflexion >15°, maximum hip extension <1SD above normal range, pelvic position not specified. Normal data was obtained from an additional 14 subjects. Muscle lengths were calculated from 3D kinematics. Individual muscle lengths were plotted for key sagittal plane motors: psoas, semitendinosus, rectus femoris, the vastus intermedius, gastrocnemius, soleus and tibialis anterior. Individual plots of mean muscle length in stance phase were compared to normal reference range. Statistical analysis was undertaken using analysis of variance.

Results: In severe crouch gait, muscle lengths showed (p<0.05): uniformly long soleus (not gastrocnemius), long vastus intermedius (not rectus femoris), hip extensors and short hip flexors. Pelvic tilt was variable. Pelvic tilt was categorised into three groups by anterior tilt: anterior >19° (n=5), neutral between 8° and 19° (n=6) and posterior <8°. Semitendinosus length was strongly related to pelvic tilt (ANOVA p<0.05). Compared with normal, semitendinosus length was no different in the anterior group and short in the neutral and posterior tilt groups.

Conclusion: Hamstrings may not be short in severe crouch gait. Assessment of pelvic tilt in severe crouch gait is required to accurately evaluate the need for hamstring lengthening surgery. Excessively long muscle groups (quadriceps, hip extensors and soleus) must also be considered for comprehensive management of severe crouch gait. This may include patellar tendon shortening for re-tensioning of quadriceps, support of excessively long soleus by a ground reaction AFO and strengthening of long and weak hip extensors.

Adeli Suit Treatments in Children with Cerebral Palsy – Case Report

Dr Jung-In Yang, PT Sung Hee Hong, PT Ji A Hong, Dr Sung Min Park
Samyool Rehabilitation Hospital

Adeli suit (Ayurveda Co, Russia) was created in 1971 by Russian space program for cosmonauts to offset zero gravity conditions in space and has been used to treat patients with cerebral palsy in several units. Adeli suit treatment (AST) technique uses intensive exercise protocol paired with wearing a form-fitting garment that provides resistance to movement. The theory is that once the body is in proper alignment, aggressive movement therapy can be performed that will re-educate the brain to recognize correct movement of the muscles. But, very little research has been reported in AST for cerebral palsy (CP). We had an experience to treat a 8 year-old boy with severe cerebral palsy (Gross Motor Function Classification System, GMFCS, Level V) using the AST. He had no improvement about one year even if we supplied daily neurodevelopmental treatment (NDT) program. So we tried to apply the AST program to him (the program was run 5 days per weeks, one hour per day, and 8 weeks program). Using the Tetrax balance system (Sunlight co, Korea), stability score (SS) values were estimated and gross motor function measure (GMFM-88) was also measured. After 8 weeks AST program, he had 2 points improvement of GMFM scores and one grade improvement of SS values. Eventhough we just had an experience for one case, we expect that AST might be powerful program for a patient with CP in case of having no improvement by conventional physical therapy and/or NDT program.
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<td>Brooke</td>
<td>Royal Children’s Hospital</td>
<td><a href="mailto:brooke.adair@rch.org.au">brooke.adair@rch.org.au</a></td>
</tr>
<tr>
<td>Adams</td>
<td>Fiona</td>
<td>Whyalla Hospital and Health Services</td>
<td><a href="mailto:fiona.adams1000@yahoo.com.au">fiona.adams1000@yahoo.com.au</a></td>
</tr>
<tr>
<td>Adams</td>
<td>Jane</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:janeadams1000@yahoo.com.au">janeadams1000@yahoo.com.au</a></td>
</tr>
<tr>
<td>Addenley</td>
<td>Marion</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:maddenley@tscnsw.org.au">maddenley@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Ahlborg</td>
<td>Lotta</td>
<td>Rehabilitationsmedicinska Universitetsklinik Stockholm</td>
<td><a href="mailto:lotta.ahlborg@ds.se">lotta.ahlborg@ds.se</a></td>
</tr>
<tr>
<td>Ahlin</td>
<td>Kristina</td>
<td>Institute of Obstetrics and Gynaecology</td>
<td><a href="mailto:kina.ahlin@hotmail.com">kina.ahlin@hotmail.com</a></td>
</tr>
<tr>
<td>Akersdett</td>
<td>Anita</td>
<td>Children and Youth Rehabilitation</td>
<td><a href="mailto:anita.akersdett@ijl.se">anita.akersdett@ijl.se</a></td>
</tr>
<tr>
<td>Al Khatib</td>
<td>Iphana</td>
<td>Al Noor Training Centre for Children with Special Needs</td>
<td><a href="mailto:iphana@gmail.com">iphana@gmail.com</a></td>
</tr>
<tr>
<td>Alam</td>
<td>Mansoor</td>
<td>Institute of Child Development</td>
<td><a href="mailto:mansooralam100@yahoo.com">mansooralam100@yahoo.com</a></td>
</tr>
<tr>
<td>Alexander</td>
<td>Jodhua</td>
<td>University of North Carolina School of Medicine</td>
<td><a href="mailto:joshua_alexander@jmed.unc.edu">joshua_alexander@jmed.unc.edu</a></td>
</tr>
<tr>
<td>Ahusani</td>
<td>Adel</td>
<td>The University of Sydney</td>
<td><a href="mailto:aadl9036@syd.edu.au">aadl9036@syd.edu.au</a></td>
</tr>
<tr>
<td>Almasa</td>
<td>Jorgen</td>
<td>Haemophilia specialist A/S</td>
<td><a href="mailto:jorgen@hm-spasc.no">jorgen@hm-spasc.no</a></td>
</tr>
<tr>
<td>Altorpe</td>
<td>Jemma</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:jemama.altorpe@yahoo.com.au">jemama.altorpe@yahoo.com.au</a></td>
</tr>
<tr>
<td>Amiet-Ion</td>
<td>Claudine</td>
<td>Hôpital Saint Vincent De Paul</td>
<td><a href="mailto:amiet-ion@ck-internet.fr">amiet-ion@ck-internet.fr</a></td>
</tr>
<tr>
<td>Anaf</td>
<td>Sophie</td>
<td>Children’s Community Therapy Service</td>
<td><a href="mailto:sophie.anaf@health.qld.gov.au">sophie.anaf@health.qld.gov.au</a></td>
</tr>
<tr>
<td>Andersen</td>
<td>Guro Lillemoen</td>
<td>Norwegian Cerebral Palsy Register</td>
<td>guro.andersen@skno</td>
</tr>
<tr>
<td>Anderson</td>
<td>Peter</td>
<td>The University of Melbourne</td>
<td><a href="mailto:peterja@unimelb.edu.au">peterja@unimelb.edu.au</a></td>
</tr>
<tr>
<td>Anderton</td>
<td>Catherine</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:catherine.anderton@dadhc.nsw.gov.au">catherine.anderton@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Andrada</td>
<td>Maria Graca</td>
<td>Centro Paralisis Cerebral De Lisboa</td>
<td>mail@<a href="mailto:maria@agrupa.com">maria@agrupa.com</a></td>
</tr>
<tr>
<td>Andrews</td>
<td>Markella</td>
<td>University of Wisconsin Hospital and Clinics</td>
<td><a href="mailto:marknew@uwhealth.org">marknew@uwhealth.org</a></td>
</tr>
<tr>
<td>Angland-Boepp</td>
<td>Mango</td>
<td>Angland Physiotherapy</td>
<td><a href="mailto:mango.angland@anglandnet.net">mango.angland@anglandnet.net</a></td>
</tr>
<tr>
<td>Anglas</td>
<td>Helen</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:hanglas@tscnsw.org.au">hanglas@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Angsanuntakih</td>
<td>Chanka</td>
<td>Ramathibodi Hospital</td>
<td><a href="mailto:onoook@hotmail.com">onoook@hotmail.com</a></td>
</tr>
<tr>
<td>Anschau</td>
<td>Kelly</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:kelly.anschau@dadhc.nsw.gov.au">kelly.anschau@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Antonijevic</td>
<td>Natasa</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:natasaantonijevic@dadhc.nsw.gov.au">natasaantonijevic@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Anttila</td>
<td>Heidi</td>
<td>Finnish office for Health Technology assessment</td>
<td><a href="mailto:heidi.anttila@stakes.fi">heidi.anttila@stakes.fi</a></td>
</tr>
<tr>
<td>Appavu</td>
<td>Revathi</td>
<td>AI Noor Training Centre for Children with Special Needs</td>
<td><a href="mailto:skiesenthi@gmail.com">skiesenthi@gmail.com</a></td>
</tr>
<tr>
<td>ARMstrong</td>
<td>Emily</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:earmstrong@tscnsw.org.au">earmstrong@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Armstrong</td>
<td>Margaret</td>
<td>Came Tingley Hospital</td>
<td><a href="mailto:marmstro@gmail.com">marmstro@gmail.com</a></td>
</tr>
<tr>
<td>Amelie</td>
<td>Catherine</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:catherine.amelie@dadhc.nsw.gov.au">catherine.amelie@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Aironchote</td>
<td>Wanasanun</td>
<td>Hamad Medical Corporation</td>
<td><a href="mailto:waronchote@hmc.org.qa">waronchote@hmc.org.qa</a></td>
</tr>
<tr>
<td>Aroyan</td>
<td>Kyle</td>
<td>The Children’s Hospital at Westmead</td>
<td><a href="mailto:kylea@chw.edu.au">kylea@chw.edu.au</a></td>
</tr>
<tr>
<td>Arstan</td>
<td>Filz</td>
<td>Gulhan Military Medical Academy</td>
<td><a href="mailto:arstan@yahoo.com">arstan@yahoo.com</a></td>
</tr>
<tr>
<td>Atkinson</td>
<td>Zoe</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:zaatkinson@tscnsw.org.au">zaatkinson@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Auld</td>
<td>Megan</td>
<td>University of Queensland</td>
<td><a href="mailto:maud@uq.edu.au">maud@uq.edu.au</a></td>
</tr>
<tr>
<td>Autti-Ramo</td>
<td>Ilona</td>
<td>The Social Insurance Institution</td>
<td><a href="mailto:ilona.autti-ramo@kela.fi">ilona.autti-ramo@kela.fi</a></td>
</tr>
<tr>
<td>Avedlo</td>
<td>Kate</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:kate.avedlo@dadhc.nsw.gov.au">kate.avedlo@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Babinanuni</td>
<td>Ana</td>
<td>Monash University</td>
<td><a href="mailto:ana.babinnani@monash.edu.au">ana.babinnani@monash.edu.au</a></td>
</tr>
<tr>
<td>Bacall-Arenstein</td>
<td>Betlina</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:betlina.bacall-arenstein@dadhc.nsw.gov.au">betlina.bacall-arenstein@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Badghan</td>
<td>Caroline</td>
<td>Disability Services Queensland</td>
<td><a href="mailto:painedavid@hotmail.com">painedavid@hotmail.com</a></td>
</tr>
<tr>
<td>Bailey</td>
<td>Susan</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:sballey@tscnsw.org.au">sballey@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Bain</td>
<td>Kathryn</td>
<td>Kids+ Foundation</td>
<td><a href="mailto:kandrbain@primus.com.au">kandrbain@primus.com.au</a></td>
</tr>
<tr>
<td>Baker</td>
<td>Felicity</td>
<td>Novita Children’s Services</td>
<td><a href="mailto:felicity.baker@novita.org.au">felicity.baker@novita.org.au</a></td>
</tr>
<tr>
<td>Baker</td>
<td>Isabel</td>
<td>Vision Australia and Northcott Disability Services</td>
<td><a href="mailto:izy_79@yahoo.com">izy_79@yahoo.com</a></td>
</tr>
<tr>
<td>Baker</td>
<td>Marlon</td>
<td>Bathurst Base Hospital</td>
<td><a href="mailto:marlon.baker@bigpond.com">marlon.baker@bigpond.com</a></td>
</tr>
<tr>
<td>Baker</td>
<td>Richard</td>
<td>Murdoch Children’s Research Institute</td>
<td><a href="mailto:richard.baker@tch.org.au">richard.baker@tch.org.au</a></td>
</tr>
<tr>
<td>Baker</td>
<td>Winsome</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:winsomewinsome@dadhc.nsw.gov.au">winsomewinsome@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Baskowicz</td>
<td>Chris</td>
<td>Catholic care Early Childhood Intervention</td>
<td><a href="mailto:chris.baskowicz@catholiccare.org">chris.baskowicz@catholiccare.org</a></td>
</tr>
<tr>
<td>Balin</td>
<td>Margaret</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:margaret.balin@dadhc.nsw.gov.au">margaret.balin@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Ballin</td>
<td>Leah</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:leahlabil@tscnsw.org.au">leahlabil@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Ballin</td>
<td>Liana</td>
<td>The University of Sydney</td>
<td><a href="mailto:lioraballin@gmail.com">lioraballin@gmail.com</a></td>
</tr>
<tr>
<td>Bandholm</td>
<td>Thomas</td>
<td>Hvidovre University</td>
<td><a href="mailto:thomas.bandholm@hvh.regionh.dk">thomas.bandholm@hvh.regionh.dk</a></td>
</tr>
<tr>
<td>Bangel</td>
<td>Natalie</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:natalie.bangel@dadhc.nsw.gov.au">natalie.bangel@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Barber</td>
<td>Kylie</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:kandpbarber@optusnet.com.au">kandpbarber@optusnet.com.au</a></td>
</tr>
<tr>
<td>Bardasz</td>
<td>Elizabeth</td>
<td>UCP of Metro Boston</td>
<td><a href="mailto:eballas@ucpmetro.org">eballas@ucpmetro.org</a></td>
</tr>
<tr>
<td>Barnes</td>
<td>Tanja</td>
<td>Royal Children’s Hospital</td>
<td><a href="mailto:tanja.banes@tch.org.au">tanja.banes@tch.org.au</a></td>
</tr>
<tr>
<td>Bartlett</td>
<td>Bill</td>
<td>CP Foundation</td>
<td><a href="mailto:bill.bartlett@cpfoundation.org">bill.bartlett@cpfoundation.org</a></td>
</tr>
<tr>
<td>Bartlett</td>
<td>Frances</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:frances.bartlett@dadhc.nsw.gov.au">frances.bartlett@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Bartlo</td>
<td>Emily</td>
<td>Queensland Health - Mackay Base Hospital</td>
<td><a href="mailto:emily.bartlo@health.qld.gov.au">emily.bartlo@health.qld.gov.au</a></td>
</tr>
<tr>
<td>Bartly</td>
<td>Elizabeth</td>
<td>The Centre for Cerebral Palsy</td>
<td><a href="mailto:eabartly@gmail.com">eabartly@gmail.com</a></td>
</tr>
<tr>
<td>Basheer</td>
<td>Sarah</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:sbasheer@tscnsw.org.au">sbasheer@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Batalha</td>
<td>Isabel Maria</td>
<td>Grunenthal S.A.</td>
<td><a href="mailto:sofia.martins@grunenthal.com">sofia.martins@grunenthal.com</a></td>
</tr>
<tr>
<td>Bateman</td>
<td>Vanessa</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:vanessa.bateman@dadhc.nsw.gov.au">vanessa.bateman@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Bau</td>
<td>Karen</td>
<td>The Children’s Hospital at Westmead</td>
<td><a href="mailto:karenb1@chw.edu.au">karenb1@chw.edu.au</a></td>
</tr>
<tr>
<td>Last Name</td>
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<tr>
<td>Bear</td>
<td>Natasha</td>
<td>Princess Margaret Hospital</td>
<td><a href="mailto:tashamasha@ja2i.net">tashamasha@ja2i.net</a></td>
</tr>
<tr>
<td>Beaumont</td>
<td>Renae</td>
<td>Triple P International Pty Ltd</td>
<td><a href="mailto:rene@triplep.net">rene@triplep.net</a></td>
</tr>
<tr>
<td>Bech</td>
<td>Anna</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:abech@tsc.nsw.org.au">abech@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Becher</td>
<td>Jules</td>
<td>Department of Rehabilitation Medicine</td>
<td><a href="mailto:jg.becher@vumc.nl">jg.becher@vumc.nl</a></td>
</tr>
<tr>
<td>Beckett</td>
<td>Cain</td>
<td>The Spastic Centre New South Wales CP Foundation</td>
<td></td>
</tr>
<tr>
<td>Bell</td>
<td>Kristie</td>
<td>Queensland Cerebral Palsy and Rehabilitation Research Centre</td>
<td><a href="mailto:kristie_bell@health.qld.gov.au">kristie_bell@health.qld.gov.au</a></td>
</tr>
<tr>
<td>Bellomo</td>
<td>Iommaisha</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:bellomo@tsc.nsw.org.au">bellomo@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Benicke</td>
<td>Jeeper</td>
<td>Midwesite University Hospital</td>
<td><a href="mailto:jeeperbenicke@whh.regionh.dk">jeeperbenicke@whh.regionh.dk</a></td>
</tr>
<tr>
<td>Benedict</td>
<td>Ruth</td>
<td>University of Wisconsin-Madison</td>
<td><a href="mailto:nbenedict@education.wisc.edu">nbenedict@education.wisc.edu</a></td>
</tr>
<tr>
<td>Bengtsson Nilsen</td>
<td>Ingela</td>
<td>Oslo University Hospital</td>
<td><a href="mailto:nlc@uus.no">nlc@uus.no</a></td>
</tr>
<tr>
<td>Bennet</td>
<td>Laura</td>
<td>The University of Auckland</td>
<td><a href="mailto:lbennet@uuckland.ac.nz">lbennet@uuckland.ac.nz</a></td>
</tr>
<tr>
<td>Berg</td>
<td>Natalie</td>
<td>The University of Sydney</td>
<td><a href="mailto:nber5756@nus.edu.au">nber5756@nus.edu.au</a></td>
</tr>
<tr>
<td>Bony</td>
<td>Jane</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:jbenyj@tsc.nsw.org.au">jbenyj@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Bertana</td>
<td>Sandra</td>
<td>Maggiore Hospital</td>
<td><a href="mailto:sandra.bertana@aus.bologna.it">sandra.bertana@aus.bologna.it</a></td>
</tr>
<tr>
<td>Bertocchi</td>
<td>Leda</td>
<td>Private Doctor</td>
<td><a href="mailto:leda.bertocchi@libero.it">leda.bertocchi@libero.it</a></td>
</tr>
<tr>
<td>Benweck</td>
<td>Steffen</td>
<td>Hauner's Children's Hospital</td>
<td><a href="mailto:steffen.benweck@med.uni-muenchen.de">steffen.benweck@med.uni-muenchen.de</a></td>
</tr>
<tr>
<td>Best</td>
<td>Neroli</td>
<td>The Spastic Centre New South Wales</td>
<td></td>
</tr>
<tr>
<td>Boston</td>
<td>Danielle</td>
<td>Sydney Children's Hospital</td>
<td><a href="mailto:danielle.boston@syd.es.nsw.gov.au">danielle.boston@syd.es.nsw.gov.au</a></td>
</tr>
<tr>
<td>Shatti</td>
<td>Salamat</td>
<td>Pakistan Community Peace Foundation</td>
<td><a href="mailto:info@pcpf.org">info@pcpf.org</a></td>
</tr>
<tr>
<td>Bhopit</td>
<td>Anoo</td>
<td>Yooralla</td>
<td><a href="mailto:anoo.bhopit@yooralla.com.au">anoo.bhopit@yooralla.com.au</a></td>
</tr>
<tr>
<td>Binger</td>
<td>Lynette</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:lynette@tsc.nsw.org.au">lynette@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Bischof</td>
<td>Faith</td>
<td>University of the Witwatersrand</td>
<td><a href="mailto:faith.bischof@gmail.com">faith.bischof@gmail.com</a></td>
</tr>
<tr>
<td>Bjorkman</td>
<td>Tracey</td>
<td>The University of Queensland</td>
<td><a href="mailto:tj.bjorkman@uq.edu.au">tj.bjorkman@uq.edu.au</a></td>
</tr>
<tr>
<td>Bjornson</td>
<td>Kristie</td>
<td>Seattle Children's Research Institute</td>
<td><a href="mailto:kristie.bjornson@seattlechildrens.org">kristie.bjornson@seattlechildrens.org</a></td>
</tr>
<tr>
<td>Blackbum</td>
<td>Christine</td>
<td>Centre for Developmental Disability and Health Monash University School of Prima</td>
<td><a href="mailto:chris.blackbum@keyyopoint.com.au">chris.blackbum@keyyopoint.com.au</a></td>
</tr>
<tr>
<td>Blair</td>
<td>Eve</td>
<td>Telethon Institute for Child Health Research</td>
<td><a href="mailto:eve@christie.org.au">eve@christie.org.au</a></td>
</tr>
<tr>
<td>Blake</td>
<td>Vivian</td>
<td>Queensland Cerebral Palsy Health Service</td>
<td><a href="mailto:vivian.blake@health.qld.gov.au">vivian.blake@health.qld.gov.au</a></td>
</tr>
<tr>
<td>Bealessen</td>
<td>Marcus</td>
<td>The Spastic Centre New South Wales</td>
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</tr>
<tr>
<td>Blunt</td>
<td>Jocelyn</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:jocelyn.blunt@dad.nsw.gov.au">jocelyn.blunt@dad.nsw.gov.au</a></td>
</tr>
<tr>
<td>Byhum</td>
<td>Leonid</td>
<td>aBR Asia Pte Ltd</td>
<td><a href="mailto:tooley2000@gmail.com">tooley2000@gmail.com</a></td>
</tr>
<tr>
<td>Boldingham</td>
<td>Eric</td>
<td>Sophia Rehabilitation Centre</td>
<td><a href="mailto:e.boldingam@wanadoo.nl">e.boldingam@wanadoo.nl</a></td>
</tr>
<tr>
<td>Bolger</td>
<td>Kate</td>
<td>Rehab On The Move</td>
<td><a href="mailto:info@caswellhealthcare.com.au">info@caswellhealthcare.com.au</a></td>
</tr>
<tr>
<td>Bolton</td>
<td>Arlene</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:arlene.bolton@gmail.com">arlene.bolton@gmail.com</a></td>
</tr>
<tr>
<td>Booth</td>
<td>Kate</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:kbooth@tsc.nsw.org.au">kbooth@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Bosshard</td>
<td>Tomas</td>
<td>Danderyd University Hospital</td>
<td><a href="mailto:tomas.bosshard@vgregion.se">tomas.bosshard@vgregion.se</a></td>
</tr>
<tr>
<td>Bosnjak</td>
<td>Vlatka</td>
<td>Croatian academy of Child Disability</td>
<td><a href="mailto:vbosnjak@kdb.hr">vbosnjak@kdb.hr</a></td>
</tr>
<tr>
<td>Botman</td>
<td>Antoinette</td>
<td>The Children's Hospital at Westmead</td>
<td><a href="mailto:antoinette.botman@gmail.com">antoinette.botman@gmail.com</a></td>
</tr>
<tr>
<td>Bourke-Taylor</td>
<td>Helen</td>
<td>La Trobe University</td>
<td><a href="mailto:h.bourke-taylor@latrobe.edu.au">h.bourke-taylor@latrobe.edu.au</a></td>
</tr>
<tr>
<td>Boyd</td>
<td>Roslyn</td>
<td>University of Queensland</td>
<td><a href="mailto:r.boyd@uq.edu.au">r.boyd@uq.edu.au</a></td>
</tr>
<tr>
<td>Bradshaw</td>
<td>Margaret</td>
<td>Barwon Health</td>
<td><a href="mailto:maryb@barwonhealth.com.au">maryb@barwonhealth.com.au</a></td>
</tr>
<tr>
<td>Brandão</td>
<td>Diana</td>
<td>Oporto University</td>
<td><a href="mailto:brandao.diana@apo.pt">brandao.diana@apo.pt</a></td>
</tr>
<tr>
<td>Bratel</td>
<td>Joan</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:jbratel@tsc.nsw.org.au">jbratel@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Bray</td>
<td>Sue</td>
<td>Sydney Children's Hospital</td>
<td><a href="mailto:sue@yooralla.com.au">sue@yooralla.com.au</a></td>
</tr>
<tr>
<td>Brawn</td>
<td>Jessica</td>
<td>Orange and District Early Education Program</td>
<td><a href="mailto:odeep@netcit.com.au">odeep@netcit.com.au</a></td>
</tr>
<tr>
<td>Brehm</td>
<td>Merle-Anne</td>
<td>VU University Medical Center</td>
<td><a href="mailto:m.brehm@vumc.nl">m.brehm@vumc.nl</a></td>
</tr>
<tr>
<td>Bridger</td>
<td>Kate</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:kate.bridger@dadhc.nsw.gov.au">kate.bridger@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Brignull</td>
<td>Amanda</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:abrignull@tsc.nsw.org.au">abrignull@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Bodie</td>
<td>Dawn</td>
<td>The Centre for Cerebral Palsy</td>
<td><a href="mailto:dawn.watts@ccp.com.au">dawn.watts@ccp.com.au</a></td>
</tr>
<tr>
<td>Brookbank</td>
<td>Jane</td>
<td>Movement Solutions</td>
<td><a href="mailto:jane.shor@bigpond.com">jane.shor@bigpond.com</a></td>
</tr>
<tr>
<td>Brown</td>
<td>Ashleigh</td>
<td>Children's Hospital at Westmead</td>
<td><a href="mailto:ashleigh@chwu.edu.au">ashleigh@chwu.edu.au</a></td>
</tr>
<tr>
<td>Brown</td>
<td>Janet</td>
<td>R Gies Society</td>
<td><a href="mailto:brown@rgies.com.au">brown@rgies.com.au</a></td>
</tr>
<tr>
<td>Brown</td>
<td>Lee</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:lbrown@tsc.nsw.org.au">lbrown@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Brown</td>
<td>Lucinda</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:lucinda.brown@tsc.nsw.org.au">lucinda.brown@tsc.nsw.org.au</a></td>
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<tr>
<td>Brown</td>
<td>Sue</td>
<td>The Spastic Centre New South Wales</td>
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</tr>
<tr>
<td>Browne</td>
<td>Kristy</td>
<td>Kumjang Early Intervention Service</td>
<td><a href="mailto:kbrowne@kumjangwaataah.org.ar">kbrowne@kumjangwaataah.org.ar</a></td>
</tr>
<tr>
<td>Brunt</td>
<td>Harvey</td>
<td>Cerebral Palsy Society of NZ</td>
<td><a href="mailto:harvey@cpsociety.org.nz">harvey@cpsociety.org.nz</a></td>
</tr>
<tr>
<td>Bryant</td>
<td>Mark</td>
<td>The Spastic Centre New South Wales CP Foundation</td>
<td></td>
</tr>
<tr>
<td>Buck</td>
<td>Julie</td>
<td>Yooralla</td>
<td><a href="mailto:j.buck@yooralla.com.au">j.buck@yooralla.com.au</a></td>
</tr>
<tr>
<td>Bunyard</td>
<td>Julie</td>
<td>Tasmanian Cerebral Palsy Register</td>
<td><a href="mailto:julie.bunyard@utas.edu.au">julie.bunyard@utas.edu.au</a></td>
</tr>
<tr>
<td>Bums</td>
<td>Jillian</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:jillian.bums@dadhc.nsw.gov.au">jillian.bums@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Burtchett</td>
<td>Joanna</td>
<td>Cerebral Palsy League of Queensland</td>
<td><a href="mailto:joannac@pcpld.org.au">joannac@pcpld.org.au</a></td>
</tr>
<tr>
<td>Butler</td>
<td>Erin</td>
<td>Therapy Focus</td>
<td><a href="mailto:erin.butler@therapies.com.au">erin.butler@therapies.com.au</a></td>
</tr>
<tr>
<td>Last Name</td>
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<tr>
<td>Butler</td>
<td>Jane</td>
<td>The University of Sydney</td>
<td><a href="mailto:j.butler@usyd.edu.au">j.butler@usyd.edu.au</a></td>
</tr>
<tr>
<td>Butler</td>
<td>Kate</td>
<td>School Therapy Team St. George Hospital</td>
<td><a href="mailto:katherine.butler@sesahs.health.nsw.gov.au">katherine.butler@sesahs.health.nsw.gov.au</a></td>
</tr>
<tr>
<td>Butterfield</td>
<td>Tambi</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:tbutterfield@tscnsw.org.au">tbutterfield@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Byrne</td>
<td>Marie</td>
<td>Central Remedial Clinic</td>
<td><a href="mailto:marie.byrne@ucl.ac.uk">marie.byrne@ucl.ac.uk</a></td>
</tr>
<tr>
<td>Caesar</td>
<td>Rebecca</td>
<td>Nambour General Hospital</td>
<td><a href="mailto:caesarmailey@bigpond.com">caesarmailey@bigpond.com</a></td>
</tr>
<tr>
<td>Celia</td>
<td>Olivia</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:o.celia@tscnsw.org.au">o.celia@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Cain</td>
<td>Shannon</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:shannon.cain@dadc.health.nsw.gov.au">shannon.cain@dadc.health.nsw.gov.au</a></td>
</tr>
<tr>
<td>Calado</td>
<td>Eulalia</td>
<td>Hospital Dona Estefania</td>
<td><a href="mailto:susana.henriques@ucb-group.com">susana.henriques@ucb-group.com</a></td>
</tr>
<tr>
<td>Calcott</td>
<td>Ansie</td>
<td>Specialist Paediatric Services</td>
<td><a href="mailto:calcott@hug.co.nz">calcott@hug.co.nz</a></td>
</tr>
<tr>
<td>Caldas</td>
<td>Carla</td>
<td>Hospital Das Clinicas-USP-RP</td>
<td><a href="mailto:carla.rbs@hotmail.com">carla.rbs@hotmail.com</a></td>
</tr>
<tr>
<td>Camden</td>
<td>Chantel</td>
<td>Montreal University</td>
<td><a href="mailto:c.camden@sesahs.health.nsw.gov.au">c.camden@sesahs.health.nsw.gov.au</a></td>
</tr>
<tr>
<td>Cameron</td>
<td>Dianne</td>
<td>BC Centre for Ability</td>
<td><a href="mailto:dcameron@centreforabilitybc.ca">dcameron@centreforabilitybc.ca</a></td>
</tr>
<tr>
<td>Campagna</td>
<td>Emma</td>
<td>Southern Health</td>
<td><a href="mailto:emmacampagna@yahoo.com.au">emmacampagna@yahoo.com.au</a></td>
</tr>
<tr>
<td>Campain</td>
<td>Robert</td>
<td>Copare Victoria</td>
<td><a href="mailto:rccampain@copevic.org.au">rccampain@copevic.org.au</a></td>
</tr>
<tr>
<td>Campbell</td>
<td>Cameron</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:cameron.campbell@tscnsw.org.au">cameron.campbell@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Campbell</td>
<td>Jacqueline</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:jcampbell@tscnsw.org.au">jcampbell@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Campbell</td>
<td>Lanie</td>
<td>Cerebral Palsy Institute</td>
<td><a href="mailto:lcampbell@tscnsw.org.au">lcampbell@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Cannon</td>
<td>Tony</td>
<td>The Spastic Centre New South Wales</td>
<td></td>
</tr>
<tr>
<td>Cans</td>
<td>Christine</td>
<td>RHEOP/SCOPE/THEMAS</td>
<td><a href="mailto:c.cans@chu-grenoble.fr">c.cans@chu-grenoble.fr</a></td>
</tr>
<tr>
<td>Capizzi</td>
<td>Jann</td>
<td>WSAHS</td>
<td><a href="mailto:jann.ca@wshahealth.nsw.gov.au">jann.ca@wshahealth.nsw.gov.au</a></td>
</tr>
<tr>
<td>Carlon</td>
<td>Stacey</td>
<td>Yooniala</td>
<td><a href="mailto:stacey.carlon@gmail.com">stacey.carlon@gmail.com</a></td>
</tr>
<tr>
<td>Campton</td>
<td>Vanessa</td>
<td>Christchurch District Health Board</td>
<td><a href="mailto:vanessa.campton@chdh.govt.nz">vanessa.campton@chdh.govt.nz</a></td>
</tr>
<tr>
<td>Cantilo</td>
<td>Rupen</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:rupen.cantilo@tscnsw.org.au">rupen.cantilo@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Carabao</td>
<td>Fionia</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:fiona.carabao@dadc.health.nsw.gov.au">fiona.carabao@dadc.health.nsw.gov.au</a></td>
</tr>
<tr>
<td>Carter</td>
<td>Arlene</td>
<td>Cerebral Palsy Education Centre</td>
<td><a href="mailto:arlene.carter@dadc.health.nsw.gov.au">arlene.carter@dadc.health.nsw.gov.au</a></td>
</tr>
<tr>
<td>Carter</td>
<td>Catherine</td>
<td>Cerebral Palsy Education Centre</td>
<td><a href="mailto:cathcarter@gmail.com">cathcarter@gmail.com</a></td>
</tr>
<tr>
<td>Carter</td>
<td>Lynn</td>
<td>Cerebral Palsy Education Centre</td>
<td><a href="mailto:lcarter@aphilink.com.au">lcarter@aphilink.com.au</a></td>
</tr>
<tr>
<td>Carter</td>
<td>Memen</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:jcarter@bigpond.net.au">jcarter@bigpond.net.au</a></td>
</tr>
<tr>
<td>Case</td>
<td>Veronica</td>
<td>Cerebral Palsy League of Queensland</td>
<td><a href="mailto:vccase@cplqlq.org.au">vccase@cplqlq.org.au</a></td>
</tr>
<tr>
<td>Castelli</td>
<td>Enrico</td>
<td>Children’s Hospital Bambino Gesu</td>
<td><a href="mailto:enrico.c.castelli@jobgb.net">enrico.c.castelli@jobgb.net</a></td>
</tr>
<tr>
<td>Casamitova</td>
<td>Marjorie</td>
<td>Monash University</td>
<td><a href="mailto:margie.casamitova@med.monash.edu.au">margie.casamitova@med.monash.edu.au</a></td>
</tr>
<tr>
<td>Cato</td>
<td>Steven</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:steven.cato@dadhc.health.nsw.gov.au">steven.cato@dadhc.health.nsw.gov.au</a></td>
</tr>
<tr>
<td>Cavadi</td>
<td>Jacqueline</td>
<td>Evider Seals UCP North Carolina</td>
<td>j.cavadi@eviderson culp.com</td>
</tr>
<tr>
<td>Cavanagh</td>
<td>Vicki</td>
<td>Children’s Hospital at Westmead</td>
<td><a href="mailto:vkc@chw.edu.au">vkc@chw.edu.au</a></td>
</tr>
<tr>
<td>Cawkier</td>
<td>Stephanie</td>
<td>Great Ormond Street Hospital London</td>
<td><a href="mailto:cawkier@gosslhs.nhs.uk">cawkier@gosslhs.nhs.uk</a></td>
</tr>
<tr>
<td>Caynes</td>
<td>Katy</td>
<td>Cerebral Palsy League of Queensland</td>
<td><a href="mailto:kmayers@cplqlq.org.au">kmayers@cplqlq.org.au</a></td>
</tr>
<tr>
<td>Ceccato</td>
<td>Anika</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:aceccato@tscnsw.org.au">aceccato@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Chadwick</td>
<td>Jaye</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:jayechadwick@bigpond.net.au">jayechadwick@bigpond.net.au</a></td>
</tr>
<tr>
<td>Chaitow</td>
<td>Lauren</td>
<td>Sydney West Area Health Service</td>
<td><a href="mailto:lauren.chaitow@swahs.health.nsw.gov.au">lauren.chaitow@swahs.health.nsw.gov.au</a></td>
</tr>
<tr>
<td>Chamberlin</td>
<td>Gail</td>
<td>Education Queensland</td>
<td><a href="mailto:gcm.chamberlin@toptalent.com.au">gcm.chamberlin@toptalent.com.au</a></td>
</tr>
<tr>
<td>Chambers</td>
<td>Hank</td>
<td>American Academy for CP and Developmental Medicine</td>
<td><a href="mailto:hchamberlin@iann.rc.org.au">hchamberlin@iann.rc.org.au</a></td>
</tr>
<tr>
<td>Chan</td>
<td>Eva</td>
<td>Glenallen School</td>
<td><a href="mailto:chan.eva@edumail.vic.gov.au">chan.eva@edumail.vic.gov.au</a></td>
</tr>
<tr>
<td>Chan</td>
<td>Ricky</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:ricky.chan@dadhc.health.nsw.gov.au">ricky.chan@dadhc.health.nsw.gov.au</a></td>
</tr>
<tr>
<td>Chan</td>
<td>Tiffany</td>
<td>Windermere’s Early Childhood Development Services</td>
<td><a href="mailto:tiffany.chan@windermereecz.fcs.com.au">tiffany.chan@windermereecz.fcs.com.au</a></td>
</tr>
<tr>
<td>Chaney</td>
<td>Isla</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:isla.j.chaney@dadhc.health.nsw.gov.au">isla.j.chaney@dadhc.health.nsw.gov.au</a></td>
</tr>
<tr>
<td>Chang</td>
<td>Hyun Jung</td>
<td>Samsung Medical Centre PM&amp;R</td>
<td><a href="mailto:reh.c.jh@gmail.com">reh.c.jh@gmail.com</a></td>
</tr>
<tr>
<td>Chaplin</td>
<td>Sally</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:skalphy@scnsw.org.au">skalphy@scnsw.org.au</a></td>
</tr>
<tr>
<td>Chaplin</td>
<td>Annie</td>
<td>Disability South Sydney</td>
<td><a href="mailto:annie.chaplin@dfde.scnsw.org.au">annie.chaplin@dfde.scnsw.org.au</a></td>
</tr>
<tr>
<td>Charlton</td>
<td>Sue</td>
<td>Private Practice</td>
<td><a href="mailto:sue@charlton.com.au">sue@charlton.com.au</a></td>
</tr>
<tr>
<td>Chen</td>
<td>Kuan-Lin</td>
<td>School of Occupational Therapy</td>
<td><a href="mailto:194429004@ntu.edu.tw">194429004@ntu.edu.tw</a></td>
</tr>
<tr>
<td>Chilcott</td>
<td>Maria</td>
<td>The Spastic Centre New South Wales</td>
<td></td>
</tr>
<tr>
<td>Chin</td>
<td>Anthony Ying Kong</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:anthony.chin@dadhc.health.nsw.gov.au">anthony.chin@dadhc.health.nsw.gov.au</a></td>
</tr>
<tr>
<td>Chiu</td>
<td>Hsi-Ching</td>
<td>The University of Sydney</td>
<td><a href="mailto:chih98999@mail.usyd.edu.au">chih98999@mail.usyd.edu.au</a></td>
</tr>
<tr>
<td>Chong</td>
<td>David</td>
<td>RCH</td>
<td><a href="mailto:davidkchong@gmail.com">davidkchong@gmail.com</a></td>
</tr>
<tr>
<td>Christensen</td>
<td>Lothar</td>
<td>Gro Christine</td>
<td><a href="mailto:gro.c.lothar@ntu.no">gro.c.lothar@ntu.no</a></td>
</tr>
<tr>
<td>Christie</td>
<td>Catherine</td>
<td>Children’s Community Therapy Service</td>
<td><a href="mailto:cathan@hght.com">cathan@hght.com</a></td>
</tr>
<tr>
<td>Chung</td>
<td>Alison</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:alison.chung@dadhc.health.nsw.gov.au">alison.chung@dadhc.health.nsw.gov.au</a></td>
</tr>
<tr>
<td>Chung</td>
<td>Myung Eun</td>
<td>Catholic University Medical College</td>
<td><a href="mailto:myung.eun@cmch.edu.au">myung.eun@cmch.edu.au</a></td>
</tr>
<tr>
<td>Chung</td>
<td>Stephen</td>
<td>North Sydney Central Coast Area Health Service</td>
<td><a href="mailto:chunghstephen@hotmail.com">chunghstephen@hotmail.com</a></td>
</tr>
<tr>
<td>Clancy</td>
<td>Kelly</td>
<td>University of Queensland</td>
<td><a href="mailto:kc.lancy@uq.edu.au">kc.lancy@uq.edu.au</a></td>
</tr>
<tr>
<td>Clarke</td>
<td>Linda</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:linda.clark@kghhealth.nsw.gov.au">linda.clark@kghhealth.nsw.gov.au</a></td>
</tr>
<tr>
<td>Clarkson</td>
<td>Deborah</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:dl.clarkson@tscnsw.org.au">dl.clarkson@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Clayworth</td>
<td>Kim</td>
<td>Northern Territory Department of Health and Families</td>
<td><a href="mailto:km@clayworth.nt.gov.au">km@clayworth.nt.gov.au</a></td>
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<tr>
<td>Last Name</td>
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<td>Clements</td>
<td>Lyn</td>
<td>Yooralla</td>
<td><a href="mailto:lyn.clements@yooralla.com.au">lyn.clements@yooralla.com.au</a></td>
</tr>
<tr>
<td>Clunes</td>
<td>Jo</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:jclunes@scnsw.org.au">jclunes@scnsw.org.au</a></td>
</tr>
<tr>
<td>Clunes-Ross</td>
<td>Jenny</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:j.clunes@bigpond.com">j.clunes@bigpond.com</a></td>
</tr>
<tr>
<td>Coggan</td>
<td>Marianne</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:marianne.coggan@dadhc.nsw.gov.au">marianne.coggan@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Cohen</td>
<td>Michele</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:mcohen@scnsw.org.au">mcohen@scnsw.org.au</a></td>
</tr>
<tr>
<td>Cobitz</td>
<td>Paul</td>
<td>The University of Queensland</td>
<td><a href="mailto:p.cobitz@uq.edu.au">p.cobitz@uq.edu.au</a></td>
</tr>
<tr>
<td>Collins</td>
<td>Kevin</td>
<td>Royal Children’s Hospital Melbourne</td>
<td><a href="mailto:kjc@yahoo.com.au">kjc@yahoo.com.au</a></td>
</tr>
<tr>
<td>Conn</td>
<td>Shirley</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:shirley.conn@dadhc.nsw.gov.au">shirley.conn@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Cooley</td>
<td>Hidecker</td>
<td>Michigan State University</td>
<td><a href="mailto:hidecker1@msu.edu">hidecker1@msu.edu</a></td>
</tr>
<tr>
<td>Cooper</td>
<td>Laureen</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:l.cooper@scnsw.org.au">l.cooper@scnsw.org.au</a></td>
</tr>
<tr>
<td>Copeland</td>
<td>Lisa</td>
<td>Queensland CP Health Service</td>
<td><a href="mailto:lisa_copeland@health.qld.gov.au">lisa_copeland@health.qld.gov.au</a></td>
</tr>
<tr>
<td>Cotter</td>
<td>Claire</td>
<td>Cerebral Palsy Education Centre</td>
<td><a href="mailto:claire.cotter@cpeduc.com.au">claire.cotter@cpeduc.com.au</a></td>
</tr>
<tr>
<td>Coul</td>
<td>Catherine</td>
<td>Paediatric Rehab Team</td>
<td><a href="mailto:c.coul@xtra.co.nz">c.coul@xtra.co.nz</a></td>
</tr>
<tr>
<td>Cowan</td>
<td>Renate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cox</td>
<td>Judy</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:j.cox@scnsw.org.au">j.cox@scnsw.org.au</a></td>
</tr>
<tr>
<td>Craig</td>
<td>Sall-Ann</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:s.craig@scnsw.org.au">s.craig@scnsw.org.au</a></td>
</tr>
<tr>
<td>Crawford</td>
<td>Jane</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:j.crawford@scnsw.org.au">j.crawford@scnsw.org.au</a></td>
</tr>
<tr>
<td>Crompton</td>
<td>Angela</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:angela.crompton@dadhc.nsw.gov.au">angela.crompton@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Crompton</td>
<td>Jodi</td>
<td>Yooralla</td>
<td><a href="mailto:jodic@yooralla.com.au">jodic@yooralla.com.au</a></td>
</tr>
<tr>
<td>Cronan</td>
<td>Deborah</td>
<td>Cerebral Palsy League of Queensland</td>
<td><a href="mailto:jcronan@cppld.org.au">jcronan@cppld.org.au</a></td>
</tr>
<tr>
<td>Crock</td>
<td>Rebecca</td>
<td>Nepean School</td>
<td><a href="mailto:rebeccacrock85@hotmail.com">rebeccacrock85@hotmail.com</a></td>
</tr>
<tr>
<td>Crowe-Mai</td>
<td>Ros</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:rcrowe-mai@scnsw.org.au">rcrowe-mai@scnsw.org.au</a></td>
</tr>
<tr>
<td>Crwolke</td>
<td>Cathryn</td>
<td>RIDBC Renwick Centre University of Newcastle</td>
<td><a href="mailto:cathryn.crwolke@ridbc.org.au">cathryn.crwolke@ridbc.org.au</a></td>
</tr>
<tr>
<td>Cruz</td>
<td>Wanda</td>
<td>Leveda Incorporated</td>
<td><a href="mailto:leveda@leveda.org.au">leveda@leveda.org.au</a></td>
</tr>
<tr>
<td>Csepcseny</td>
<td>Barbara</td>
<td>Focus 2000 Ltd</td>
<td><a href="mailto:bcepcseny@foc2000.org.nz">bcepcseny@foc2000.org.nz</a></td>
</tr>
<tr>
<td>Cullen</td>
<td>Amanda</td>
<td>Michelle French and Associates</td>
<td><a href="mailto:amanda@michellefrench.com.au">amanda@michellefrench.com.au</a></td>
</tr>
<tr>
<td>Cullenard</td>
<td>Julie</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:julie.cullenard@dadhc.nsw.gov.au">julie.cullenard@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Cummins</td>
<td>Robyn</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:r.cummins@scnsw.org.au">r.cummins@scnsw.org.au</a></td>
</tr>
<tr>
<td>Cuppers</td>
<td>Ria</td>
<td>Physiotherapist</td>
<td><a href="mailto:ra.cuppers@pandora.be">ra.cuppers@pandora.be</a></td>
</tr>
<tr>
<td>Curby</td>
<td>Gail</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:gcurby@scnsw.org.au">gcurby@scnsw.org.au</a></td>
</tr>
<tr>
<td>Cuman</td>
<td>Judy</td>
<td>The Spastic Centres of South Australia Inc</td>
<td><a href="mailto:gsemmler@scosa.com.au">gsemmler@scosa.com.au</a></td>
</tr>
<tr>
<td>Cumle</td>
<td>Lyndsay</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:l.cumle@scnsw.org.au">l.cumle@scnsw.org.au</a></td>
</tr>
<tr>
<td>Daase</td>
<td>Vathne</td>
<td>Anatomie St/Telmenmiddelpolieisisten</td>
<td><a href="mailto:anvath@online.no">anvath@online.no</a></td>
</tr>
<tr>
<td>Dagweil</td>
<td>Robyn</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:rdagweil@scnsw.org.au">rdagweil@scnsw.org.au</a></td>
</tr>
<tr>
<td>Dallmeijer</td>
<td>Annet</td>
<td>VU University Medical Center</td>
<td><a href="mailto:d.allmeijer@vumc.nl">d.allmeijer@vumc.nl</a></td>
</tr>
<tr>
<td>Daly</td>
<td>Anne</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:adaly@scnsw.org.au">adaly@scnsw.org.au</a></td>
</tr>
<tr>
<td>Daniels</td>
<td>Louise</td>
<td>SPOTforKids</td>
<td><a href="mailto:louise.daniels@spotkids.com.au">louise.daniels@spotkids.com.au</a></td>
</tr>
<tr>
<td>Daniloff</td>
<td>Rebecca</td>
<td>Cerebral Palsy League of Queensland</td>
<td><a href="mailto:jrunsell@cppld.org.au">jrunsell@cppld.org.au</a></td>
</tr>
<tr>
<td>Darcy</td>
<td>Margaret</td>
<td>Margaret Darcy Physiotherapy Service</td>
<td>robert.melbourne.hokey.net.au</td>
</tr>
<tr>
<td>Dark</td>
<td>Lezlie</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:k.dark@scnsw.org.au">k.dark@scnsw.org.au</a></td>
</tr>
<tr>
<td>Dartch</td>
<td>Johanna</td>
<td>University of Alberta</td>
<td><a href="mailto:john.dartch@ualberta.ca">john.dartch@ualberta.ca</a></td>
</tr>
<tr>
<td>Davey</td>
<td>Sarah</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:sarah.davey@dadhc.nsw.gov.au">sarah.davey@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Davidson</td>
<td>Emma</td>
<td>The Centre for Cerebral Palsy</td>
<td><a href="mailto:emma.davidson@tcp.com.au">emma.davidson@tcp.com.au</a></td>
</tr>
<tr>
<td>Davidson</td>
<td>Marianne</td>
<td>Therapy ACT</td>
<td><a href="mailto:marianne.davidson@act.gov.au">marianne.davidson@act.gov.au</a></td>
</tr>
<tr>
<td>Davidson</td>
<td>Marilyn</td>
<td>Central Fergal Physio for Kids</td>
<td><a href="mailto:mdohms.davidson@bigpond.com">mdohms.davidson@bigpond.com</a></td>
</tr>
<tr>
<td>Davidson</td>
<td>Sue-Anne</td>
<td>Princess Margaret Hospital</td>
<td><a href="mailto:sue-anne.davidson@health.wa.gov.au">sue-anne.davidson@health.wa.gov.au</a></td>
</tr>
<tr>
<td>Davis</td>
<td>Else</td>
<td>University of Melbourne</td>
<td><a href="mailto:eda@unimelb.edu.au">eda@unimelb.edu.au</a></td>
</tr>
<tr>
<td>Davis</td>
<td>Lyn</td>
<td>Wiradjuri District Health Board</td>
<td><a href="mailto:lyn.davis@dh.org.nz">lyn.davis@dh.org.nz</a></td>
</tr>
<tr>
<td>Day</td>
<td>Kirsy</td>
<td>Department of Ageing Disability and Home Care</td>
<td>k繇<a href="mailto:y.day@dadhc.nsw.gov.au">y.day@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>De Cock</td>
<td>Paul</td>
<td>Faculty of Medicine</td>
<td><a href="mailto:paul.decock@uueluven.be">paul.decock@uueluven.be</a></td>
</tr>
<tr>
<td>De Groot</td>
<td>Jan</td>
<td>Telethon Institute for Child Health Research</td>
<td><a href="mailto:jang@tchruwa.edu">jang@tchruwa.edu</a></td>
</tr>
<tr>
<td>De Koning</td>
<td>Peter</td>
<td>Heliomare Rehab Center</td>
<td><a href="mailto:dekoning@worldmail.nl">dekoning@worldmail.nl</a></td>
</tr>
<tr>
<td>De La Cruz</td>
<td>Javier</td>
<td>SERMa5 / Euronostat / Dinas - SC PE</td>
<td><a href="mailto:jdcruz@hall2.es">jdcruz@hall2.es</a></td>
</tr>
<tr>
<td>De Leeuw</td>
<td>Alfred</td>
<td>Disability Enterprises</td>
<td><a href="mailto:healthteam@disabilityenterprises.com.au">healthteam@disabilityenterprises.com.au</a></td>
</tr>
<tr>
<td>Defesche</td>
<td>Anke</td>
<td>SRL / Franciscusoord</td>
<td><a href="mailto:a.defesche@sr1.nl">a.defesche@sr1.nl</a></td>
</tr>
<tr>
<td>Dekkers</td>
<td>Humet</td>
<td>RC Heliomare</td>
<td><a href="mailto:h.dekkers@heliomare.com">h.dekkers@heliomare.com</a></td>
</tr>
<tr>
<td>DeLacy</td>
<td>Michael</td>
<td>Cerebral Palsy League of Queensland</td>
<td><a href="mailto:mdelacy@cppld.org.au">mdelacy@cppld.org.au</a></td>
</tr>
<tr>
<td>Delcour</td>
<td>Maxime</td>
<td>CNRS/UNIV: UMR 6149 Neurosciences Integratives ET Adaptatives</td>
<td><a href="mailto:maxime.delcour@etu.univ-provence.fr">maxime.delcour@etu.univ-provence.fr</a></td>
</tr>
<tr>
<td>Den Hartog</td>
<td>Jan Willem</td>
<td>Fysiotherapie Rijnstraat Amsterdam</td>
<td><a href="mailto:j.den.hartog35@kpnpnl.net">j.den.hartog35@kpnpnl.net</a></td>
</tr>
<tr>
<td>Den Hartog-</td>
<td>Marij</td>
<td>Fysiotherapie Waterland</td>
<td><a href="mailto:j.den.hartog35@kpnpnl.net">j.den.hartog35@kpnpnl.net</a></td>
</tr>
<tr>
<td>Desai</td>
<td>Mala</td>
<td>Royal Children’s Hospital Melbourne</td>
<td><a href="mailto:mala@ojtala.com.au">mala@ojtala.com.au</a></td>
</tr>
<tr>
<td>Dew</td>
<td>Angela</td>
<td>The University of Sydney</td>
<td><a href="mailto:a.dew@usyd.edu.au">a.dew@usyd.edu.au</a></td>
</tr>
<tr>
<td>Dewar</td>
<td>Margaret</td>
<td>The Centre for Cerebral Palsy</td>
<td><a href="mailto:helman.watts@tcp.com.au">helman.watts@tcp.com.au</a></td>
</tr>
<tr>
<td>Last Name</td>
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<td>Organisation</td>
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<tr>
<td>Dimitracopoulos</td>
<td>Stacy</td>
<td>Royal Children’s Hospital</td>
<td><a href="mailto:stacy.dimitracopoulos@rch.org.au">stacy.dimitracopoulos@rch.org.au</a></td>
</tr>
<tr>
<td>Dobson</td>
<td>Fiona</td>
<td>Murdoch Childrens Research Institute</td>
<td><a href="mailto:fdobson@unimelb.edu.au">fdobson@unimelb.edu.au</a></td>
</tr>
<tr>
<td>Donaghey</td>
<td>Samantha</td>
<td>Queensland Cerebral Palsy Health Service</td>
<td><a href="mailto:asdonaghey@gpbusnet.com.au">asdonaghey@gpbusnet.com.au</a></td>
</tr>
<tr>
<td>Donnell</td>
<td>Sue</td>
<td>Carlson School for Cerebral Palsy</td>
<td><a href="mailto:gpdonnell@family.net.nz">gpdonnell@family.net.nz</a></td>
</tr>
<tr>
<td>Drayton</td>
<td>Jennifer</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:jdrayton@tscnsw.org.au">jdrayton@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Dredge</td>
<td>Christine</td>
<td>Mec's</td>
<td><a href="mailto:dredgec@nissionaustralia.com.au">dredgec@nissionaustralia.com.au</a></td>
</tr>
<tr>
<td>Drew</td>
<td>Jennifer</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:jdrew@tscnsw.org.au">jdrew@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Driscoll</td>
<td>Mark</td>
<td>Advanced Bio-Mechanical Rehabilitation</td>
<td><a href="mailto:markdriscoll@abc.anada.com">markdriscoll@abc.anada.com</a></td>
</tr>
<tr>
<td>Drury</td>
<td>Tamara</td>
<td>Lifestart</td>
<td><a href="mailto:tamara.drury@infomax.com.au">tamara.drury@infomax.com.au</a></td>
</tr>
<tr>
<td>Dubber</td>
<td>Ellen</td>
<td>Learning Links</td>
<td><a href="mailto:ontrakophysio@aprms.com.au">ontrakophysio@aprms.com.au</a></td>
</tr>
<tr>
<td>Dunning</td>
<td>Sandy</td>
<td>Education Queensland</td>
<td><a href="mailto:sduinn@eq.edu.au">sduinn@eq.edu.au</a></td>
</tr>
<tr>
<td>Durell</td>
<td>Karen</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:kduurell@tscnsw.org.au">kduurell@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Dwan</td>
<td>Leanne</td>
<td>University of New South Wales</td>
<td><a href="mailto:ld.wan@unsw.edu.au">ld.wan@unsw.edu.au</a></td>
</tr>
<tr>
<td>Dyne</td>
<td>Maree</td>
<td>Dyonics Consulting</td>
<td>maree@<a href="mailto:macoule@yotastic.com.au">macoule@yotastic.com.au</a></td>
</tr>
<tr>
<td>Eccleston</td>
<td>Erica</td>
<td>Orange and District Early Education Program</td>
<td><a href="mailto:odeeep@nbehil.com.au">odeeep@nbehil.com.au</a></td>
</tr>
<tr>
<td>Edwardsen</td>
<td>Mark</td>
<td>Akershus University Hospital</td>
<td>marit.edwardsen.net</td>
</tr>
<tr>
<td>Edward</td>
<td>Kathryn</td>
<td>Children’s Hospital at Westmead</td>
<td><a href="mailto:kat.edward@gmail.com">kat.edward@gmail.com</a></td>
</tr>
<tr>
<td>Edward (led)</td>
<td>O’Loughlin</td>
<td>The Children’s Hospital at Westmead</td>
<td><a href="mailto:bedo@chew.edu.au">bedo@chew.edu.au</a></td>
</tr>
<tr>
<td>Edwards</td>
<td>Judy</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:jedward@tscnsw.org.au">jedward@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Edwards</td>
<td>J ulie</td>
<td>Royal Children’s Hospital</td>
<td><a href="mailto:peterandjulia.edwards@gmail.com">peterandjulia.edwards@gmail.com</a></td>
</tr>
<tr>
<td>Edwards</td>
<td>Phya</td>
<td>Royal Childrens Hospital</td>
<td><a href="mailto:phya.edwards@health.qld.gov.au">phya.edwards@health.qld.gov.au</a></td>
</tr>
<tr>
<td>Elason</td>
<td>Ann-Chriss</td>
<td>Karolinska Institutet</td>
<td><a href="mailto:ann-chriss.elason@ki.se">ann-chriss.elason@ki.se</a></td>
</tr>
<tr>
<td>Elkeier</td>
<td>Sonja</td>
<td>Rikshospitalet University Hospital</td>
<td><a href="mailto:sonja.elkeier@rikshospitalet.no">sonja.elkeier@rikshospitalet.no</a></td>
</tr>
<tr>
<td>Ellis</td>
<td>Graham</td>
<td></td>
<td></td>
</tr>
<tr>
<td>English</td>
<td>Sarah</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:sarah.english@dadhc.nsw.gov.au">sarah.english@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Enns</td>
<td>Helen</td>
<td>Helen Enns Development Physiotherapy Services</td>
<td><a href="mailto:helene.nn@gmail.com">helene.nn@gmail.com</a></td>
</tr>
<tr>
<td>Evans</td>
<td>Debra</td>
<td>Therapies for Kids</td>
<td><a href="mailto:d.evans@therapiesforkids.com.au">d.evans@therapiesforkids.com.au</a></td>
</tr>
<tr>
<td>Evans</td>
<td>Keny</td>
<td>Novita Children’s Services</td>
<td><a href="mailto:keny.evans@novita.org.au">keny.evans@novita.org.au</a></td>
</tr>
<tr>
<td>Evans</td>
<td>Ruth</td>
<td>The Children’s Hospital at Westmead</td>
<td><a href="mailto:ruthevan@iinet.net.au">ruthevan@iinet.net.au</a></td>
</tr>
<tr>
<td>Everton</td>
<td>Therese</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:teverton@tscnsw.org.au">teverton@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Evans</td>
<td>Carmen</td>
<td>Royal Darwin Hospital</td>
<td><a href="mailto:ewens.family@bigpond.com">ewens.family@bigpond.com</a></td>
</tr>
<tr>
<td>Evins</td>
<td>Janine</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:janine.evins@dadhc.nsw.gov.au">janine.evins@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Elsby</td>
<td>Christine</td>
<td>Aberdeen Clinic</td>
<td><a href="mailto:cewilby@aberdovy.com.au">cewilby@aberdovy.com.au</a></td>
</tr>
<tr>
<td>Eysen</td>
<td>Marjike</td>
<td>Catholic University Lueven Belgium</td>
<td><a href="mailto:m.eysen@telnet.be">m.eysen@telnet.be</a></td>
</tr>
<tr>
<td>Fabre</td>
<td>Deborah</td>
<td>Rocky Bay Inc</td>
<td><a href="mailto:deffabre@yahoo.com">deffabre@yahoo.com</a></td>
</tr>
<tr>
<td>Fallins</td>
<td>Zara</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:zfallins@tscnsw.org.au">zfallins@tscnsw.org.au</a></td>
</tr>
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<td>Famely</td>
<td>Chemise</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:cfamely@tscnsw.org.au">cfamely@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Ferlings</td>
<td>Darcy</td>
<td>Booroom Kids Rehab</td>
<td><a href="mailto:dferlings@booroom.ca">dferlings@booroom.ca</a></td>
</tr>
<tr>
<td>Fennell</td>
<td>Zoe</td>
<td>Cerebral Palsy League of Queensland</td>
<td><a href="mailto:pauhove@optusnet.com.au">pauhove@optusnet.com.au</a></td>
</tr>
<tr>
<td>Ferney</td>
<td>Chorene</td>
<td>Kurrajong Waranah Early Intervention</td>
<td><a href="mailto:origina.early@hotmail.com">origina.early@hotmail.com</a></td>
</tr>
<tr>
<td>Feys</td>
<td>Hilde</td>
<td>Department of Rehabilitation Sciences</td>
<td>hide.fysefaberleuenbe.com</td>
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<tr>
<td>Fielding</td>
<td>Sheila</td>
<td>The Spastic Centre New South Wales</td>
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<tr>
<td>Flicski</td>
<td>Gabriella</td>
<td>Péto and Irs Institute</td>
<td><a href="mailto:rabi@entemet.hu">rabi@entemet.hu</a></td>
</tr>
<tr>
<td>Fisher</td>
<td>Margaret</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:pegfisher@hotmail.com">pegfisher@hotmail.com</a></td>
</tr>
<tr>
<td>Feiss</td>
<td>Bobbi</td>
<td>Monash University</td>
<td><a href="mailto:bobbi.datter@med.monash.edu.au">bobbi.datter@med.monash.edu.au</a></td>
</tr>
<tr>
<td>Fleming</td>
<td>Rhonda</td>
<td>Cerebral Palsy League of Queensland</td>
<td><a href="mailto:jmcell@cpilp.org.au">jmcell@cpilp.org.au</a></td>
</tr>
<tr>
<td>Fletcher</td>
<td>Rachel</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:rfighter@tscnsw.org.au">rfighter@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Flettet</td>
<td>Peter</td>
<td>Royal Hobart Hospital</td>
<td><a href="mailto:p.flettet@calvarytas.com.au">p.flettet@calvarytas.com.au</a></td>
</tr>
<tr>
<td>Foley</td>
<td>Sarah</td>
<td>Kids Plus Foundation</td>
<td><a href="mailto:heenan@kpqnd.net.au">heenan@kpqnd.net.au</a></td>
</tr>
<tr>
<td>Ford</td>
<td>Jo</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:jford@tscnsw.org.au">jford@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Forsang</td>
<td>Adrienne</td>
<td>Royal Children’s Hospital</td>
<td><a href="mailto:adrienne.forsang@rch.org.au">adrienne.forsang@rch.org.au</a></td>
</tr>
<tr>
<td>Foy</td>
<td>Liz</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:lfoy@tscnsw.org.au">lfoy@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Francis</td>
<td>Anna</td>
<td>CCS Disability Action Christchurch</td>
<td><a href="mailto:mfrancis@ebra.co.nz">mfrancis@ebra.co.nz</a></td>
</tr>
<tr>
<td>Franklin</td>
<td>Lyndal</td>
<td>Mater Children’s Hospital</td>
<td><a href="mailto:lyndalfranklin@materr.org.au">lyndalfranklin@materr.org.au</a></td>
</tr>
<tr>
<td>Fraser</td>
<td>Rene</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:rene.fraser@dadhc.nsw.gov.au">rene.fraser@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Frauenfelder</td>
<td>Lynette</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:lyn.frauenfelder@dadhc.nsw.gov.au">lyn.frauenfelder@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>French</td>
<td>Amanda</td>
<td>Therapy Focus</td>
<td><a href="mailto:amanda.french@therapyfocus.com">amanda.french@therapyfocus.com</a></td>
</tr>
<tr>
<td>French</td>
<td>Michelle</td>
<td>Michelle french and Associates</td>
<td><a href="mailto:michelle@michellefrench.com.au">michelle@michellefrench.com.au</a></td>
</tr>
<tr>
<td>Frost</td>
<td>Alicia</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:afrost@tscnsw.org.au">afrost@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Fung</td>
<td>Jenny</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:jfung@tscnsw.org.au">jfung@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Furesad</td>
<td>Bigitta</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:bigitta.furesad@dadhc.nsw.gov.au">bigitta.furesad@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Furui</td>
<td>Masayo</td>
<td>Association for Health and Life of People with CP</td>
<td><a href="mailto:masayo@cp-research.com">masayo@cp-research.com</a></td>
</tr>
<tr>
<td>Furui</td>
<td>Toru</td>
<td>Osaka Kawasaki Rehabilitation University</td>
<td><a href="mailto:furuitoh@yahoo.com">furuitoh@yahoo.com</a></td>
</tr>
<tr>
<td>Gair</td>
<td>Rebecca</td>
<td>Department of Education, Training and the Arts</td>
<td><a href="mailto:ngair@eq.edu.au">ngair@eq.edu.au</a></td>
</tr>
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<td>Last Name</td>
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<tr>
<td>Gallard</td>
<td>Angela</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:agallard@tscnsw.org.au">agallard@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Gan</td>
<td>Neesha</td>
<td>Liverpool Hospital</td>
<td><a href="mailto:linchinpx@yahoo.com.sg">linchinpx@yahoo.com.sg</a></td>
</tr>
<tr>
<td>Gangemi</td>
<td>Rachel</td>
<td>Children’s Hospital Westmead</td>
<td><a href="mailto:rachel2@chw.edu.au">rachel2@chw.edu.au</a></td>
</tr>
<tr>
<td>Garbellini</td>
<td>Simon</td>
<td>Princess Margaret Hospital</td>
<td><a href="mailto:simon.garbellini@jha.th.wa.gov.au">simon.garbellini@jha.th.wa.gov.au</a></td>
</tr>
<tr>
<td>Garcia</td>
<td>Pam</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:pgarcia@tscnsw.org.au">pgarcia@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Gardiner</td>
<td>Margaret</td>
<td>Carlson School for Cerebral Palsy</td>
<td><a href="mailto:margie@carlson.school.nsw.edu.au">margie@carlson.school.nsw.edu.au</a></td>
</tr>
<tr>
<td>Ganner</td>
<td>Victoria</td>
<td>Cerebral Palsy Support Network</td>
<td><a href="mailto:victoria@melbourneinderscrale.org.au">victoria@melbourneinderscrale.org.au</a></td>
</tr>
<tr>
<td>Ganman</td>
<td>Peter</td>
<td>Northcott Disability Services</td>
<td>peternorthcott.com.au</td>
</tr>
<tr>
<td>Gerhardy</td>
<td>Angela</td>
<td>Novita Children’s Services</td>
<td><a href="mailto:angela.gerhardy@novita.org.au">angela.gerhardy@novita.org.au</a></td>
</tr>
<tr>
<td>Gestreau</td>
<td>Christian</td>
<td>University Paul Cezanne</td>
<td><a href="mailto:christian.gestreau@univ-cezanne.fr">christian.gestreau@univ-cezanne.fr</a></td>
</tr>
<tr>
<td>Gibson</td>
<td>Catherine</td>
<td>University of Adelaide</td>
<td><a href="mailto:catherine.s.gibson@adelaide.edu.au">catherine.s.gibson@adelaide.edu.au</a></td>
</tr>
<tr>
<td>Gibson</td>
<td>Nouria</td>
<td>Princess Margaret Hospital</td>
<td><a href="mailto:nouria.gibson@bigpond.com">nouria.gibson@bigpond.com</a></td>
</tr>
<tr>
<td>Gibson</td>
<td>Susan</td>
<td>Novita Children’s Services</td>
<td><a href="mailto:suan.gibson@novita.org.au">suan.gibson@novita.org.au</a></td>
</tr>
<tr>
<td>Giddey</td>
<td>Karl</td>
<td>Osd University Hospital</td>
<td>karl.giddey@ausno</td>
</tr>
<tr>
<td>Giuliana</td>
<td>Donna</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:dotgian@tscnsw.org.au">dotgian@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Gleeson</td>
<td>Fiona</td>
<td>Royal Institute for Deaf and Blind Children</td>
<td><a href="mailto:fiona.gleeson@rdtc.org.au">fiona.gleeson@rdtc.org.au</a></td>
</tr>
<tr>
<td>Glover</td>
<td>Mark</td>
<td>Allergan Australia Pty Ltd</td>
<td><a href="mailto:glover_mark@allergan.com">glover_mark@allergan.com</a></td>
</tr>
<tr>
<td>Goldsmith</td>
<td>Shona</td>
<td>Cerebral Palsy Institute</td>
<td><a href="mailto:sgolsmith@tscnsw.org.au">sgolsmith@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Gombinsky</td>
<td>Lisa</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:lgombinsky@tscnsw.org.au">lgombinsky@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Goodwin</td>
<td>Natalie</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:ngoodwin@tscnsw.org.au">ngoodwin@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Gorter</td>
<td>Jan Willem</td>
<td>CanChild, Centre for Childhood Disability Research</td>
<td><a href="mailto:gorter@mcmaster.ca">gorter@mcmaster.ca</a></td>
</tr>
<tr>
<td>Goss</td>
<td>Nicola</td>
<td>Vision Australia</td>
<td><a href="mailto:nicola.goss@visionaustralia.org">nicola.goss@visionaustralia.org</a></td>
</tr>
<tr>
<td>Graham</td>
<td>Kerr</td>
<td>Royal Children's Hospital</td>
<td><a href="mailto:kerrham@tnt.th.org.au">kerrham@tnt.th.org.au</a></td>
</tr>
<tr>
<td>Gray</td>
<td>Dorothy</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:dgrey@tscnsw.org.au">dgrey@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Gray</td>
<td>Lisa</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:lgray@tscnsw.org.au">lgray@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Gray</td>
<td>Peter</td>
<td>Mater Mothers’ Hospital</td>
<td><a href="mailto:peter_gray@mater.org.au">peter_gray@mater.org.au</a></td>
</tr>
<tr>
<td>Greaves</td>
<td>Sarah</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:sgreaves@tscnsw.org.au">sgreaves@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Green</td>
<td>Suzi</td>
<td>Nepean School</td>
<td><a href="mailto:suzy.green_physiotherapy@yahoo.com">suzy.green_physiotherapy@yahoo.com</a></td>
</tr>
<tr>
<td>Greenstein</td>
<td>Caroline</td>
<td>Department of Health and Families</td>
<td><a href="mailto:caroline.greenstein@nt.gov.au">caroline.greenstein@nt.gov.au</a></td>
</tr>
<tr>
<td>Greenwood-Smith</td>
<td>Joanne</td>
<td>Cerebral Palsy League of Queensland</td>
<td><a href="mailto:jmsuell@cpqld.org.au">jmsuell@cpqld.org.au</a></td>
</tr>
<tr>
<td>Gregory</td>
<td>Donalda</td>
<td>Kumong Early Intervention Service</td>
<td><a href="mailto:mattdonald@bigpond.com">mattdonald@bigpond.com</a></td>
</tr>
<tr>
<td>Gregory</td>
<td>Donalda</td>
<td>Kumong Early Intervention Service</td>
<td><a href="mailto:mattdonald@bigpond.com">mattdonald@bigpond.com</a></td>
</tr>
<tr>
<td>Gregory</td>
<td>Shalyn</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:sgray@tscnsw.org.au">sgray@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Griffin</td>
<td>Mark Philip</td>
<td>Queensland Cerebral Palsy and Rehabilitation Research Centre</td>
<td><a href="mailto:m.griffin@uq.edu.au">m.griffin@uq.edu.au</a></td>
</tr>
<tr>
<td>Griffths</td>
<td>Emma</td>
<td>The Centre for Cerebral Palsy</td>
<td><a href="mailto:emma.grifths@tscp.com.au">emma.grifths@tscp.com.au</a></td>
</tr>
<tr>
<td>Grote</td>
<td>Robyn</td>
<td>Queensland Children’s Gait Laboratory</td>
<td><a href="mailto:robyn.grote@health.qld.gov.au">robyn.grote@health.qld.gov.au</a></td>
</tr>
<tr>
<td>Grove</td>
<td>Jakob</td>
<td>University of Aarhus</td>
<td><a href="mailto:jg@sociau.dk">jg@sociau.dk</a></td>
</tr>
<tr>
<td>Grundy</td>
<td>Lorraine</td>
<td>Aedtech SRS Ltd</td>
<td><a href="mailto:lorraine@aldechnz.com">lorraine@aldechnz.com</a></td>
</tr>
<tr>
<td>Gubbay</td>
<td>Anna</td>
<td>Princess Margaret Hospital</td>
<td><a href="mailto:anna.gubbay@tscnsw.org.au">anna.gubbay@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Guerni</td>
<td>Anna Maria</td>
<td>Conductive Education Canterbury</td>
<td><a href="mailto:cecanbury@tnc.org.nz">cecanbury@tnc.org.nz</a></td>
</tr>
<tr>
<td>Hadden</td>
<td>Tracy</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:thadden@tscnsw.org.au">thadden@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Haglisas</td>
<td>Nick</td>
<td>Scope</td>
<td><a href="mailto:nhaglisas@scope.org.au">nhaglisas@scope.org.au</a></td>
</tr>
<tr>
<td>Halliday</td>
<td>Arlie</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:arhiliday@tscnsw.org.au">arhiliday@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Hamer</td>
<td>Jane</td>
<td>Waitemata DHB - CDS</td>
<td><a href="mailto:janedean@hug.co.nz">janedean@hug.co.nz</a></td>
</tr>
<tr>
<td>Handayastuti</td>
<td>Setyo</td>
<td>University of Indonesia</td>
<td><a href="mailto:handrayas@ahu.com">handrayas@ahu.com</a></td>
</tr>
<tr>
<td>Hanley</td>
<td>Lisa</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:lhanley@tscnsw.org.au">lhanley@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Hanna</td>
<td>Carle</td>
<td>Michigan State University</td>
<td><a href="mailto:hanna.mcar@msu.edu">hanna.mcar@msu.edu</a></td>
</tr>
<tr>
<td>Hardacre</td>
<td>Marco</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:marco.hardacre@dadhc.nsw.gov.au">marco.hardacre@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Harno</td>
<td>Amy</td>
<td>Royal Children’s Hospital</td>
<td><a href="mailto:amy_harno@tscnsw.org.au">amy_harno@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Harris</td>
<td>Angela</td>
<td>Novita Children’s Services</td>
<td><a href="mailto:angela.harris@novita.org.au">angela.harris@novita.org.au</a></td>
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<tr>
<td>Hart</td>
<td>Phil</td>
<td>The Spastic Centre New South Wales</td>
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<tr>
<td>Harvey</td>
<td>Adrienne</td>
<td>McMaster University</td>
<td><a href="mailto:harvey.adrienne@gmail.com">harvey.adrienne@gmail.com</a></td>
</tr>
<tr>
<td>Hasmat</td>
<td>Monika</td>
<td>Royal Children’s Hospital</td>
<td><a href="mailto:monika.ha@ausdoctors.net">monika.ha@ausdoctors.net</a></td>
</tr>
<tr>
<td>Hastings-Ison</td>
<td>Tandy</td>
<td>Royal Children’s Hospital</td>
<td><a href="mailto:tandy.hastingison@rch.org.au">tandy.hastingison@rch.org.au</a></td>
</tr>
<tr>
<td>Haylen</td>
<td>Kym</td>
<td>Westmead Hospital</td>
<td><a href="mailto:eileenm@westgate.wh.usyd.edu.au">eileenm@westgate.wh.usyd.edu.au</a></td>
</tr>
<tr>
<td>Haywood</td>
<td>Kristen</td>
<td>Sydney West Area Health Service</td>
<td><a href="mailto:kristen.bocking@swa.health.nsw.gov.au">kristen.bocking@swa.health.nsw.gov.au</a></td>
</tr>
<tr>
<td>Hazlett</td>
<td>Cherie</td>
<td>Department of Health and Human Services</td>
<td><a href="mailto:cherie.hazlett@health.nhs.gov.au">cherie.hazlett@health.nhs.gov.au</a></td>
</tr>
<tr>
<td>Healy</td>
<td>Helen</td>
<td>Brookview Kids Rehab</td>
<td><a href="mailto:hhelen@brookview.com.au">hhelen@brookview.com.au</a></td>
</tr>
<tr>
<td>Heathcote</td>
<td>Katrina</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:katrina.heathcote@dadhc.nsw.gov.au">katrina.heathcote@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Hedges</td>
<td>Kate</td>
<td>Self Employed</td>
<td><a href="mailto:khegedgi2x@xtra.co.nz">khegedgi2x@xtra.co.nz</a></td>
</tr>
<tr>
<td>Hegerty</td>
<td>Christine</td>
<td>Cerebral Palsy League of Queensland</td>
<td><a href="mailto:jmussel@cpqld.org.au">jmussel@cpqld.org.au</a></td>
</tr>
<tr>
<td>Heggie</td>
<td>Diana</td>
<td>Scope and CP Australia</td>
<td><a href="mailto:dhegge@scope.org.au">dhegge@scope.org.au</a></td>
</tr>
<tr>
<td>Heiler</td>
<td>Susan</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:susan.heiler@dadhc.nsw.gov.au">susan.heiler@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Heinen</td>
<td>Florian</td>
<td>Dr V Hauners Children’s Hospital</td>
<td><a href="mailto:florion.heinen@meduni.muenchen.de">florion.heinen@meduni.muenchen.de</a></td>
</tr>
<tr>
<td>Hempley</td>
<td>Bronwyn</td>
<td>The University of Sydney</td>
<td><a href="mailto:b.hempley@usyd.edu.au">b.hempley@usyd.edu.au</a></td>
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<td>Hemsley</td>
<td>Sonya</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:shemsley@tsc.nsw.org.au">shemsley@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Henderson</td>
<td>Kim</td>
<td>Cerebral Palsy Support Network</td>
<td><a href="mailto:km.henderson@cpsn.info">km.henderson@cpsn.info</a></td>
</tr>
<tr>
<td>Hensey</td>
<td>Owen</td>
<td>Central Remedial Clinic</td>
<td><a href="mailto:ohensey@crc.ie">ohensey@crc.ie</a></td>
</tr>
<tr>
<td>Hertz-Pänner</td>
<td>Lucie</td>
<td>La Fondation Mobits</td>
<td><a href="mailto:lucie.hertz-panner@cea.fr">lucie.hertz-panner@cea.fr</a></td>
</tr>
<tr>
<td>Hilary</td>
<td>John</td>
<td>Communication Resource Centre - Scope</td>
<td><a href="mailto:hjohnson.rc@scopevic.org.au">hjohnson.rc@scopevic.org.au</a></td>
</tr>
<tr>
<td>Hilby</td>
<td>Catherine</td>
<td>Therapy ACT</td>
<td><a href="mailto:catherine.hilby@act.gov.au">catherine.hilby@act.gov.au</a></td>
</tr>
<tr>
<td>Himmelmann</td>
<td>Kate</td>
<td>The Regional Rehabilitation Center for Children and Adolescents</td>
<td><a href="mailto:kate.himmelmann@nreregion.se">kate.himmelmann@nreregion.se</a></td>
</tr>
<tr>
<td>Hing</td>
<td>Cherie</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:ching@tsc.nsw.org.au">ching@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Hipgrave</td>
<td>Donna</td>
<td>QCPHS</td>
<td><a href="mailto:donna@hipgrave.com.au">donna@hipgrave.com.au</a></td>
</tr>
<tr>
<td>Högbom</td>
<td>Carly</td>
<td>Children’s Community Therapy Service</td>
<td><a href="mailto:carly.hogbom@yahoocom.au">carly.hogbom@yahoocom.au</a></td>
</tr>
<tr>
<td>Ho</td>
<td>Eric</td>
<td>John Hunter Children’s Hospital</td>
<td><a href="mailto:eric.ho@nthealth.nsw.gov.au">eric.ho@nthealth.nsw.gov.au</a></td>
</tr>
<tr>
<td>Hoare</td>
<td>Brian</td>
<td>Victorian Paediatric Rehabilitation Service - Southern Health</td>
<td><a href="mailto:brian.hoare@southernhealth.org.au">brian.hoare@southernhealth.org.au</a></td>
</tr>
<tr>
<td>Hobbins</td>
<td>David</td>
<td>Novita Children’s Services</td>
<td><a href="mailto:david.hobbins@novita.org.au">david.hobbins@novita.org.au</a></td>
</tr>
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<td>Hodgkinson</td>
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<td>The Spastic Centre New South Wales</td>
<td></td>
</tr>
<tr>
<td>Holmefur</td>
<td>Marie</td>
<td>Karolinska Institutet</td>
<td><a href="mailto:marie.holmefur@ki.se">marie.holmefur@ki.se</a></td>
</tr>
<tr>
<td>Holmstrom</td>
<td>Linda</td>
<td>Karolinska Institutet</td>
<td><a href="mailto:lind.a.holmstrom@ki.se">lind.a.holmstrom@ki.se</a></td>
</tr>
<tr>
<td>Holt</td>
<td>Judith</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:jholt@tsc.nsw.org.au">jholt@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Hooper</td>
<td>Elizabeth</td>
<td>Catholic Care</td>
<td><a href="mailto:liz.hooper@catholic.org">liz.hooper@catholic.org</a></td>
</tr>
<tr>
<td>Horsley</td>
<td>Peter</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:phorsley@tsc.nsw.org.au">phorsley@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Horvat</td>
<td>Kelly</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:kelly.horvat@dadhc.nsw.gov.au">kelly.horvat@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Hough</td>
<td>Janet</td>
<td>Southern Health</td>
<td><a href="mailto:mtmartha.hough@bigpond.com">mtmartha.hough@bigpond.com</a></td>
</tr>
<tr>
<td>Hughes</td>
<td>Marty</td>
<td>Nepean School</td>
<td><a href="mailto:marty.hug@hotmail.com">marty.hug@hotmail.com</a></td>
</tr>
<tr>
<td>Hughes</td>
<td>Meredith</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:meredith.hughes@dadhc.nsw.gov.au">meredith.hughes@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Humes</td>
<td>Sarah</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:shumes@tsc.nsw.org.au">shumes@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Hutton</td>
<td>Lisa</td>
<td>Monash University</td>
<td><a href="mailto:lisa.hutton@med.monash.edu.au">lisa.hutton@med.monash.edu.au</a></td>
</tr>
<tr>
<td>Hudgell</td>
<td>Graham</td>
<td>CP Foundation</td>
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</tr>
<tr>
<td>Hvington</td>
<td>Dorte</td>
<td>University of Aarhus</td>
<td><a href="mailto:dh@soc.au.dk">dh@soc.au.dk</a></td>
</tr>
<tr>
<td>Ignatievsky</td>
<td>Natalia</td>
<td>Macarthur Early Childhood Intervention Service</td>
<td><a href="mailto:ignatievsky@missionaustralia.com.au">ignatievsky@missionaustralia.com.au</a></td>
</tr>
<tr>
<td>Im</td>
<td>Sun</td>
<td>Catholic University of Korea</td>
<td><a href="mailto:lafola@catholic.ac.kr">lafola@catholic.ac.kr</a></td>
</tr>
<tr>
<td>Imms</td>
<td>Christine</td>
<td>La Trobe University</td>
<td><a href="mailto:c.imms@latrobe.edu.au">c.imms@latrobe.edu.au</a></td>
</tr>
<tr>
<td>Isbister</td>
<td>Saul</td>
<td>University of Sydney</td>
<td><a href="mailto:jbr4956@mail.usyd.edu.au">jbr4956@mail.usyd.edu.au</a></td>
</tr>
<tr>
<td>Ison</td>
<td>Nicole</td>
<td>University of Western Sydney</td>
<td><a href="mailto:n.ison@uws.edu.au">n.ison@uws.edu.au</a></td>
</tr>
<tr>
<td>Jack</td>
<td>Leanne</td>
<td>QCPPRC</td>
<td><a href="mailto:leanne.jack@health.qld.gov.au">leanne.jack@health.qld.gov.au</a></td>
</tr>
<tr>
<td>Jackson</td>
<td>Kathleen</td>
<td>Catholic Care</td>
<td><a href="mailto:kate.jackson@catholic.org">kate.jackson@catholic.org</a></td>
</tr>
<tr>
<td>Jackson</td>
<td>Sandra</td>
<td>Cerebral Palsy League of Queensland</td>
<td><a href="mailto:jsunsel@cpl.qld.org.au">jsunsel@cpl.qld.org.au</a></td>
</tr>
<tr>
<td>Jaeger</td>
<td>Nile-Use</td>
<td>Oslo University Hospital</td>
<td><a href="mailto:big@bus.no">big@bus.no</a></td>
</tr>
<tr>
<td>Johannsen</td>
<td>Reidun</td>
<td>Rikshospitalet University Hospital</td>
<td><a href="mailto:reidun.johannsen@rikshospitalet.no">reidun.johannsen@rikshospitalet.no</a></td>
</tr>
<tr>
<td>Jakowitz</td>
<td>Kathleen</td>
<td>Hillmorton High School</td>
<td>kjakowitz@yahoocom</td>
</tr>
<tr>
<td>James</td>
<td>Meredith</td>
<td>Sydney Children’s Hospital</td>
<td><a href="mailto:meredith.james@health.nsw.gov.au">meredith.james@health.nsw.gov.au</a></td>
</tr>
<tr>
<td>James</td>
<td>Scott</td>
<td>Cerebral Palsy League of Queensland</td>
<td><a href="mailto:jnusell@cpl.qld.org.au">jnusell@cpl.qld.org.au</a></td>
</tr>
<tr>
<td>Jamott</td>
<td>Allya</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:ajamott@tsc.nsw.org.au">ajamott@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Jegelsony</td>
<td>Ira</td>
<td>Arcada, University of applied Sciences</td>
<td><a href="mailto:ira.jegelsony@arcada.fi">ira.jegelsony@arcada.fi</a></td>
</tr>
<tr>
<td>Jenning</td>
<td>Slee</td>
<td>Genetic Services of Western Australia</td>
<td><a href="mailto:jennie.slee@health.wa.gov.au">jennie.slee@health.wa.gov.au</a></td>
</tr>
<tr>
<td>Jiang</td>
<td>Benian</td>
<td>The Royal Children’s Hospital</td>
<td><a href="mailto:brian@yhotmail.com">brian@yhotmail.com</a></td>
</tr>
<tr>
<td>Johnson</td>
<td>Dace</td>
<td>Cerebral Palsy League of Queensland</td>
<td><a href="mailto:danjoh@au.daneit.com.au">danjoh@au.daneit.com.au</a></td>
</tr>
<tr>
<td>Johnston</td>
<td>Leanne</td>
<td>Cerebral Palsy League of Queensland</td>
<td><a href="mailto:ljjohnston@cpl.qld.org.au">ljjohnston@cpl.qld.org.au</a></td>
</tr>
<tr>
<td>Jones</td>
<td>Cheryl</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:cjones@tsc.nsw.org.au">cjones@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Jones</td>
<td>Fiona</td>
<td>University of Queensland</td>
<td><a href="mailto:f.jones@uq.queensland.edu.au">f.jones@uq.queensland.edu.au</a></td>
</tr>
<tr>
<td>Jonischkeit</td>
<td>Anette</td>
<td>Sunshine Coast Children’s Therapy Centre</td>
<td><a href="mailto:paediatric.physio@yahoo.com.au">paediatric.physio@yahoo.com.au</a></td>
</tr>
<tr>
<td>Jonson</td>
<td>Gerd</td>
<td>Dandenong University Hospital</td>
<td><a href="mailto:gerd.jonson@ds.se">gerd.jonson@ds.se</a></td>
</tr>
<tr>
<td>Jordan</td>
<td>Rachel</td>
<td>Education Queensland</td>
<td><a href="mailto:rjord15@eq.edu.au">rjord15@eq.edu.au</a></td>
</tr>
<tr>
<td>Joseph</td>
<td>Kaylene</td>
<td>Coths Harbour Health Campus</td>
<td><a href="mailto:kayvince@bigpond.com">kayvince@bigpond.com</a></td>
</tr>
<tr>
<td>Ju</td>
<td>Yun-Huel</td>
<td>Karolinska Medical University</td>
<td><a href="mailto:yunhuel@hkm.edu.tw">yunhuel@hkm.edu.tw</a></td>
</tr>
<tr>
<td>Junenend</td>
<td>Anna</td>
<td>Dandenong University Hospital</td>
<td><a href="mailto:ajunenend@gmail.com">ajunenend@gmail.com</a></td>
</tr>
<tr>
<td>Justins</td>
<td>Emma</td>
<td>Mater Children’s Hospital</td>
<td><a href="mailto:emma.justins@materegan.org">emma.justins@materegan.org</a></td>
</tr>
<tr>
<td>Kalanji</td>
<td>Vida</td>
<td>The University of Queensland</td>
<td><a href="mailto:vkalani@uq.edu.au">vkalani@uq.edu.au</a></td>
</tr>
<tr>
<td>Karamat</td>
<td>Mashe Bhatti</td>
<td>Pakistan Community Peace Foundation</td>
<td><a href="mailto:info@pcpf.org">info@pcpf.org</a></td>
</tr>
<tr>
<td>Kardamis</td>
<td>Angela</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:angela.kardamis@dadhc.nsw.gov.au">angela.kardamis@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Karlsson</td>
<td>Peta</td>
<td>University of Western Sydney</td>
<td><a href="mailto:p.karlsson@uws.edu.au">p.karlsson@uws.edu.au</a></td>
</tr>
<tr>
<td>Karstensen</td>
<td>Anne</td>
<td>University Hospital of Akenhus</td>
<td><a href="mailto:anne.karstensen@ahus.no">anne.karstensen@ahus.no</a></td>
</tr>
<tr>
<td>Katchbhan</td>
<td>Lesley</td>
<td>Great Ormond Street Hospital for Children</td>
<td><a href="mailto:katchbhan@go.nhs.uk">katchbhan@go.nhs.uk</a></td>
</tr>
<tr>
<td>Katherine</td>
<td>Gambell</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:katherine.gambell@dadhc.nsw.gov.au">katherine.gambell@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Kavanagh</td>
<td>Sue</td>
<td>Cerebral Palsy League of Queensland</td>
<td><a href="mailto:skavanagh@cpl.qld.org.au">skavanagh@cpl.qld.org.au</a></td>
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<td>CP Foundation</td>
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<tr>
<td>Kennedy</td>
<td>Robyn</td>
<td>Cerebral Palsy Education Centre</td>
<td><a href="mailto:robyn_kennedy@primus.com.au">robyn_kennedy@primus.com.au</a></td>
</tr>
<tr>
<td>Kennett</td>
<td>Kate</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:kennett@tscnsw.org.au">kennett@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Kent</td>
<td>Mish</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:mishkent@bigpond.com">mishkent@bigpond.com</a></td>
</tr>
<tr>
<td>Keogh</td>
<td>Helen</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:helen.keogh@dadhc.nsw.gov.au">helen.keogh@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Kerslake</td>
<td>Lyn</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:kerslake@tscnsw.org.au">kerslake@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Ketelaar</td>
<td>Marjolijn</td>
<td>Rehabilitation Centre De Hoogstraat</td>
<td><a href="mailto:m.ketelaar@dehoogstraat.nl">m.ketelaar@dehoogstraat.nl</a></td>
</tr>
<tr>
<td>Khan</td>
<td>Nerita</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:nikan@tscnsw.org.au">nikan@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Khammwan</td>
<td>Samerduen</td>
<td>Department of Rehabilitation</td>
<td><a href="mailto:sam_medru@kuku.ac.th">sam_medru@kuku.ac.th</a></td>
</tr>
<tr>
<td>Khattab</td>
<td>Azhar</td>
<td>Hamad Medical Corporation</td>
<td><a href="mailto:drazha@hotmail.com">drazha@hotmail.com</a></td>
</tr>
<tr>
<td>Khot</td>
<td>Abhay</td>
<td>Royal Children’s Hospital</td>
<td><a href="mailto:abhaykhot@gmail.com">abhaykhot@gmail.com</a></td>
</tr>
<tr>
<td>Kidd</td>
<td>Jenny</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:jkidd@tscnsw.org.au">jkidd@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Keffer</td>
<td>Gerhard N.</td>
<td>Alberta Children's Hospital</td>
<td><a href="mailto:gkeffer@ucalgary.ca">gkeffer@ucalgary.ca</a></td>
</tr>
<tr>
<td>Kigour</td>
<td>Gaela</td>
<td>Christchurch District Health Board</td>
<td><a href="mailto:cgaela@gmail.com">cgaela@gmail.com</a></td>
</tr>
<tr>
<td>Kim</td>
<td>Heakyung</td>
<td>University of Pennsylvania</td>
<td><a href="mailto:kmhc@email.chop.edu">kmhc@email.chop.edu</a></td>
</tr>
<tr>
<td>Kim</td>
<td>Seongwoo</td>
<td>National Health Insurance Corporation Ilan Hospital</td>
<td><a href="mailto:kw42754@hanmail.net">kw42754@hanmail.net</a></td>
</tr>
<tr>
<td>King</td>
<td>Carol</td>
<td>BC Children's Hospital</td>
<td><a href="mailto:carolkingbc@shaw.ca">carolkingbc@shaw.ca</a></td>
</tr>
<tr>
<td>King</td>
<td>Joanne</td>
<td>Wilton Centre Waitemata DHB</td>
<td><a href="mailto:joanne.king@waitematadhb.govt.nz">joanne.king@waitematadhb.govt.nz</a></td>
</tr>
<tr>
<td>Kleiven</td>
<td>Mette</td>
<td>Hjelpemiddelspesialisten a/S</td>
<td><a href="mailto:mklei@broadpark.no">mklei@broadpark.no</a></td>
</tr>
<tr>
<td>King</td>
<td>Jannett</td>
<td>Department of Rehabilitation Sciences</td>
<td><a href="mailto:jannett@tafberkelvenuleu.be">jannett@tafberkelvenuleu.be</a></td>
</tr>
<tr>
<td>Koclas</td>
<td>Louise</td>
<td>Montreal Children's Hospital</td>
<td><a href="mailto:louisekoclas@mac.com">louisekoclas@mac.com</a></td>
</tr>
<tr>
<td>Kohlenberg</td>
<td>Cathy</td>
<td>Northcott Early Childhood Support Services</td>
<td><a href="mailto:cathyk@bigpond.net.au">cathyk@bigpond.net.au</a></td>
</tr>
<tr>
<td>Korsch</td>
<td>Annessa</td>
<td>Therapy ACT</td>
<td><a href="mailto:annessa.korsch@act.gov.au">annessa.korsch@act.gov.au</a></td>
</tr>
<tr>
<td>Kostoglou</td>
<td>Vivienne</td>
<td>Yoon</td>
<td><a href="mailto:peferkos@bigpond.net">peferkos@bigpond.net</a></td>
</tr>
<tr>
<td>Krageloh-Mann</td>
<td>Ingeborg</td>
<td>University Children's Hospital</td>
<td><a href="mailto:ingelborg.krageloh-mann@meduni-tuebingen.de">ingelborg.krageloh-mann@meduni-tuebingen.de</a></td>
</tr>
<tr>
<td>Kreiliger</td>
<td>Verena</td>
<td>Canterbury District Health Board</td>
<td><a href="mailto:verena.kreiliger@cdhb.govt.nz">verena.kreiliger@cdhb.govt.nz</a></td>
</tr>
<tr>
<td>Kreiner</td>
<td>Kevin</td>
<td>Cerebral Palsy Tasmania</td>
<td><a href="mailto:kkreiner@cpts.org.au">kkreiner@cpts.org.au</a></td>
</tr>
<tr>
<td>Kuek</td>
<td>Jess</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:jessica.kuek@dadhc.nsw.gov.au">jessica.kuek@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Kwak</td>
<td>Yoon Hae</td>
<td>Severance Children's Hospital</td>
<td><a href="mailto:drkwak76@yuhs.ac">drkwak76@yuhs.ac</a></td>
</tr>
<tr>
<td>Kwok</td>
<td>Elaine</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:ekwok@tscnsw.org.au">ekwok@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Labhard</td>
<td>Susan</td>
<td>Shriners Hospital for Children</td>
<td><a href="mailto:slabhard@shrinethospital.org">slabhard@shrinethospital.org</a></td>
</tr>
<tr>
<td>Lambeck</td>
<td>Gerda</td>
<td>Therapy ACT</td>
<td><a href="mailto:geralda.lambeck@act.govt.au">geralda.lambeck@act.govt.au</a></td>
</tr>
<tr>
<td>Lamont</td>
<td>Andrea</td>
<td>Booroo View Kids Rehab</td>
<td><a href="mailto:aamont@booroview.ca">aamont@booroview.ca</a></td>
</tr>
<tr>
<td>Lancaster</td>
<td>Ann</td>
<td>Sydney Childrens Hospital</td>
<td><a href="mailto:thelancaster@bigpond.com">thelancaster@bigpond.com</a></td>
</tr>
<tr>
<td>Langdon</td>
<td>Katherine</td>
<td>Princess Margaret Hospital</td>
<td><a href="mailto:katherine.langdon@health.wa.gov.au">katherine.langdon@health.wa.gov.au</a></td>
</tr>
<tr>
<td>Langerak</td>
<td>Nelleke</td>
<td>University of Cape Town</td>
<td><a href="mailto:nelleke.langerak@uct.ac.za">nelleke.langerak@uct.ac.za</a></td>
</tr>
<tr>
<td>Lanigan</td>
<td>Anna</td>
<td>Murdoch Childrens Research Institute</td>
<td><a href="mailto:anna.lanigan@mcri.edu.au">anna.lanigan@mcri.edu.au</a></td>
</tr>
<tr>
<td>Larmi</td>
<td>Natasha</td>
<td>Rehabilitation Studies Unit</td>
<td><a href="mailto:nlarmi@health.gov.au">nlarmi@health.gov.au</a></td>
</tr>
<tr>
<td>Laughner</td>
<td>Christine</td>
<td>Greater Southern Area Health Service</td>
<td><a href="mailto:christine.laughner@health.nsw.gov.au">christine.laughner@health.nsw.gov.au</a></td>
</tr>
<tr>
<td>Laundy</td>
<td>Jane</td>
<td>Toorak Society of Victoria</td>
<td><a href="mailto:jane.laundy@toorak.org">jane.laundy@toorak.org</a></td>
</tr>
<tr>
<td>Leaver</td>
<td>Simone</td>
<td>Allergan Australia Pty Ltd</td>
<td><a href="mailto:leete_nicole@allergan.com">leete_nicole@allergan.com</a></td>
</tr>
<tr>
<td>Lebrun</td>
<td>Francoise</td>
<td>Hospital Cochín St Vincent de Paul</td>
<td><a href="mailto:francoise.lebrun@chrch-ph.fr">francoise.lebrun@chrch-ph.fr</a></td>
</tr>
<tr>
<td>Lee</td>
<td>Elaine</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:ellee@tscnsw.org.au">ellee@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Lee</td>
<td>Sarah</td>
<td>aBR Asia Pte Ltd</td>
<td><a href="mailto:sarah_.guat@hotmail.com">sarah_.guat@hotmail.com</a></td>
</tr>
<tr>
<td>Lee</td>
<td>Zee-hn</td>
<td>Catholic University of Daegu</td>
<td><a href="mailto:zilee@hanmail.net">zilee@hanmail.net</a></td>
</tr>
<tr>
<td>Leete</td>
<td>Nicole</td>
<td>Allergan Australia Pty Ltd</td>
<td><a href="mailto:leete_nicole@allergan.com">leete_nicole@allergan.com</a></td>
</tr>
<tr>
<td>Legg</td>
<td>Megan</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:megan.legg@dadhc.nsw.gov.au">megan.legg@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Lehmann-Monck</td>
<td>Val</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:val.lehmann-monck@dadhc.nsw.gov.au">val.lehmann-monck@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Lemcke</td>
<td>Michele</td>
<td>Mater Children's Hospital</td>
<td><a href="mailto:michele.lmcke@mater.org.au">michele.lmcke@mater.org.au</a></td>
</tr>
<tr>
<td>Leong</td>
<td>Ruth</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:rleong@tscnsw.org.au">rleong@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Lemaara</td>
<td>Sergio</td>
<td>Nino Jesús Pediatric University Hospital</td>
<td><a href="mailto:demelara@yahoo.es">demelara@yahoo.es</a></td>
</tr>
<tr>
<td>Lester</td>
<td>Rochelle</td>
<td>Royal Children's Melbourne</td>
<td><a href="mailto:richelle.lester@rch.org.au">richelle.lester@rch.org.au</a></td>
</tr>
<tr>
<td>Levensen</td>
<td>Tsen-aie</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:tsen-aie.levens@dadhc.nsw.gov.au">tsen-aie.levens@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Lewis</td>
<td>Jenny</td>
<td>The Children’s Hospital at Westmead</td>
<td><a href="mailto:jennifis@chw.edu.au">jennifis@chw.edu.au</a></td>
</tr>
<tr>
<td>Lewis</td>
<td>Melinda</td>
<td>Queensland Cerebral Palsy Health Service</td>
<td><a href="mailto:melinda_lewis@health.qld.gov.au">melinda_lewis@health.qld.gov.au</a></td>
</tr>
<tr>
<td>Liu</td>
<td>Xiaoje</td>
<td>Jiamusi University</td>
<td><a href="mailto:xiaojiming@163.com">xiaojiming@163.com</a></td>
</tr>
<tr>
<td>Lui</td>
<td>Michelle</td>
<td>Allergan Australia Pty Ltd</td>
<td><a href="mailto:leete_nicole@allergan.com">leete_nicole@allergan.com</a></td>
</tr>
<tr>
<td>Uip</td>
<td>Michelle</td>
<td>Griffith University</td>
<td><a href="mailto:gchiwhi@grif.ee">gchiwhi@grif.ee</a></td>
</tr>
<tr>
<td>Uddstrom</td>
<td>Asa</td>
<td>Folk Bernadotte Regional Habitation Centre</td>
<td><a href="mailto:asa.ksdrom@jakademiak.se">asa.ksdrom@jakademiak.se</a></td>
</tr>
<tr>
<td>Ullemark</td>
<td>Karin</td>
<td>Department of Rehabilitation Medicine Stockholm</td>
<td><a href="mailto:karin.ullemark@ss.se">karin.ullemark@ss.se</a></td>
</tr>
<tr>
<td>Ullmark</td>
<td>Rebecca</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:rullmark@tscnsw.org.au">rullmark@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Um</td>
<td>Eewei</td>
<td>The Children’s Hospital at Westmead</td>
<td><a href="mailto:eewei@chw.edu.au">eewei@chw.edu.au</a></td>
</tr>
<tr>
<td>Un</td>
<td>Li</td>
<td>Guangzhou Rehabilitation Experimental School</td>
<td><a href="mailto:duweihua_2007@yahoo.com.cn">duweihua_2007@yahoo.com.cn</a></td>
</tr>
<tr>
<td>Last Name</td>
<td>First Name</td>
<td>Organisation</td>
<td>Email Address</td>
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</tr>
<tr>
<td>Lin</td>
<td>Yu-Ching</td>
<td>E-Da Hospital and I-Shou University</td>
<td><a href="mailto:yuchinglin2003@yahoo.com.tw">yuchinglin2003@yahoo.com.tw</a></td>
</tr>
<tr>
<td>Lind</td>
<td>Stefan</td>
<td>Orthopaedic Department</td>
<td><a href="mailto:stefan.lind@je.se">stefan.lind@je.se</a></td>
</tr>
<tr>
<td>Loane</td>
<td>Sally</td>
<td>CP Foundation</td>
<td></td>
</tr>
<tr>
<td>Lock</td>
<td>Suzy</td>
<td>South Eastern Sydney and Waverley Health</td>
<td><a href="mailto:madlock@ias.org.au">madlock@ias.org.au</a></td>
</tr>
<tr>
<td>Lockwood</td>
<td>Joanne</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:joanne.lockwood@tasnsw.org.au">joanne.lockwood@tasnsw.org.au</a></td>
</tr>
<tr>
<td>Longva</td>
<td>Jonrun</td>
<td>Aarhus University Hospital</td>
<td><a href="mailto:jonrun.longva@hus.no">jonrun.longva@hus.no</a></td>
</tr>
<tr>
<td>Lord</td>
<td>Nicole</td>
<td>Cerebral Palsy League of Queensland</td>
<td><a href="mailto:mrusell@cppql.org.au">mrusell@cppql.org.au</a></td>
</tr>
<tr>
<td>Lotze</td>
<td>Tim</td>
<td>Baylor College of Medicine</td>
<td><a href="mailto:tlotze@bcm.edu">tlotze@bcm.edu</a></td>
</tr>
<tr>
<td>Louca</td>
<td>Christilla</td>
<td>Cerebral Palsy League of Queensland</td>
<td><a href="mailto:clouca@cplqld.org.au">clouca@cplqld.org.au</a></td>
</tr>
<tr>
<td>Louise</td>
<td>Farrel</td>
<td>Sydney Children's Hospital</td>
<td><a href="mailto:louise_osullivan@hotmail.com">louise_osullivan@hotmail.com</a></td>
</tr>
<tr>
<td>Love</td>
<td>Sarah</td>
<td>Princess Margaret Hospital</td>
<td><a href="mailto:sarah.love@health.wa.gov.au">sarah.love@health.wa.gov.au</a></td>
</tr>
<tr>
<td>Low</td>
<td>Jemimah</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:jemimah.low@dadhc.nsw.gov.au">jemimah.low@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Lowe</td>
<td>Kevin</td>
<td>Sydney Children's Hospital</td>
<td><a href="mailto:kevlowe@bigpond.net.au">kevlowe@bigpond.net.au</a></td>
</tr>
<tr>
<td>Luck</td>
<td>Paula</td>
<td>Queensland Cerebral Palsy Health Service</td>
<td><a href="mailto:paula_luck@health.qld.gov.au">paula_luck@health.qld.gov.au</a></td>
</tr>
<tr>
<td>Luff</td>
<td>Rosemary</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:ruff@tscnsw.org.au">ruff@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Luhrs</td>
<td>Kim</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:kuhrs@tscnsw.org.au">kuhrs@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Lwig</td>
<td>Melissa</td>
<td>Westmead Hospital</td>
<td>melisweddgethat.wu.edu.au</td>
</tr>
<tr>
<td>Luke</td>
<td>Teigan</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:tiluke@tscnsw.org.au">tiluke@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Lundberg</td>
<td>Larsen</td>
<td>Sunnaas Rehabilitation Hospital</td>
<td><a href="mailto:lundberg.larsen@sunnaas.no">lundberg.larsen@sunnaas.no</a></td>
</tr>
<tr>
<td>Lundkvist</td>
<td>Jostenby</td>
<td>Children's Hospital</td>
<td><a href="mailto:annika.lundkvist@med.lu.se">annika.lundkvist@med.lu.se</a></td>
</tr>
<tr>
<td>Lwin</td>
<td>Elizabeth</td>
<td>Early Intervention, Central Coast</td>
<td><a href="mailto:elwin@mcc.ahs.health.nsw.gov.au">elwin@mcc.ahs.health.nsw.gov.au</a></td>
</tr>
<tr>
<td>Lyons</td>
<td>Julie</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:jlyons@tscnsw.org.au">jlyons@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Maanum</td>
<td>Grethe</td>
<td>Sunnaas Rehabilitation Hospital</td>
<td><a href="mailto:grethe.manum@sunnaas.no">grethe.manum@sunnaas.no</a></td>
</tr>
<tr>
<td>Maathus</td>
<td>Karel</td>
<td>University Medical Center Groningen</td>
<td><a href="mailto:kgrmaathus@home.nl">kgrmaathus@home.nl</a></td>
</tr>
<tr>
<td>Macbeth</td>
<td>Sharon</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:shamorgan@dadhc.nsw.gov.au">shamorgan@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>MacDonald</td>
<td>Julie Anne</td>
<td>University of Queensland</td>
<td><a href="mailto:jmcdonald@uq.edu.au">jmcdonald@uq.edu.au</a></td>
</tr>
<tr>
<td>Mackay</td>
<td>Anne</td>
<td>Scope</td>
<td><a href="mailto:amackay@scopevic.org.au">amackay@scopevic.org.au</a></td>
</tr>
<tr>
<td>Mackenzie</td>
<td>Elizabeth</td>
<td>Victorian Paediatric Rehabilitation Service</td>
<td><a href="mailto:elizabeth.mackenzie@southernhealth.org.au">elizabeth.mackenzie@southernhealth.org.au</a></td>
</tr>
<tr>
<td>Mackey</td>
<td>Anna</td>
<td>University of Auckland</td>
<td><a href="mailto:a.mackey@ucl.ac.nz">a.mackey@ucl.ac.nz</a></td>
</tr>
<tr>
<td>Maclean</td>
<td>Liza</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:lmaclean@tscnsw.org.au">lmaclean@tscnsw.org.au</a></td>
</tr>
<tr>
<td>MacLennan</td>
<td>Alastair</td>
<td>University of Adelaide</td>
<td><a href="mailto:alastair.macleann@adelaide.edu.au">alastair.macleann@adelaide.edu.au</a></td>
</tr>
<tr>
<td>Macneeney</td>
<td>Edmund</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:emacneeney@bcnsw.org.au">emacneeney@bcnsw.org.au</a></td>
</tr>
<tr>
<td>Maenner</td>
<td>Matt</td>
<td>University of Wisconsin-Madison</td>
<td><a href="mailto:mmaenner@wisc.edu">mmaenner@wisc.edu</a></td>
</tr>
<tr>
<td>Maenpää</td>
<td>Helena</td>
<td>Helsinki University for Children and Adolescents</td>
<td><a href="mailto:helena.maenpaa@hus.fi">helena.maenpaa@hus.fi</a></td>
</tr>
<tr>
<td>Magee</td>
<td>Julie</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:julymagee@dadhc.nsw.gov.au">julymagee@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Magee</td>
<td>Julie</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:julymagee@dadhc.nsw.gov.au">julymagee@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Magill-Evans</td>
<td>Joyce</td>
<td>University of Alberta</td>
<td>joyce@<a href="mailto:magill-evans@ualberta.ca">magill-evans@ualberta.ca</a></td>
</tr>
<tr>
<td>Malignity</td>
<td>Jill</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:jmalignty@tscnsw.org.au">jmalignty@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Maher</td>
<td>Janice</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:jmaher@tscnsw.org.au">jmaher@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Maier</td>
<td>Atja</td>
<td>Therapy ACT</td>
<td><a href="mailto:atja.maier@act.gov.au">atja.maier@act.gov.au</a></td>
</tr>
<tr>
<td>Malikun</td>
<td>Francine</td>
<td>Laval University</td>
<td><a href="mailto:francine.malikun@lab.idlal.ca">francine.malikun@lab.idlal.ca</a></td>
</tr>
<tr>
<td>Mantell</td>
<td>Elizabeth</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:emantell@tscnsw.org.au">emantell@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Mamo</td>
<td>Meg</td>
<td>St Vincent's Health Melbourne</td>
<td><a href="mailto:meg.mamo@shmh.org.au">meg.mamo@shmh.org.au</a></td>
</tr>
<tr>
<td>Martin</td>
<td>Liz</td>
<td>Yoolah</td>
<td><a href="mailto:liz.martin@yoolah.com.au">liz.martin@yoolah.com.au</a></td>
</tr>
<tr>
<td>Martyn</td>
<td>Sue</td>
<td>Early Childhood Intervention Program</td>
<td><a href="mailto:smarty.physio@bigpond.com">smarty.physio@bigpond.com</a></td>
</tr>
<tr>
<td>McD</td>
<td>Paul</td>
<td>CP Foundation</td>
<td></td>
</tr>
<tr>
<td>Matussek</td>
<td>Jan Robert Heinrich</td>
<td>Regensburg Medical School</td>
<td><a href="mailto:j.matussek@adepio.com">j.matussek@adepio.com</a></td>
</tr>
<tr>
<td>Maxwell</td>
<td>Joanne</td>
<td>Boorview Kid's Rehab</td>
<td><a href="mailto:jma.well@boorview.ca">jma.well@boorview.ca</a></td>
</tr>
<tr>
<td>Maya</td>
<td>Irene</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:irene.maya@dadhc.nsw.gov.au">irene.maya@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Mazucchetli</td>
<td>Sivor</td>
<td>Triple P International</td>
<td>trevorm-www.net.au</td>
</tr>
<tr>
<td>McArthur</td>
<td>Peppa</td>
<td>North West Regional Hospital</td>
<td><a href="mailto:philipa.mcarthur@nwrhs.tas.gov.au">philipa.mcarthur@nwrhs.tas.gov.au</a></td>
</tr>
<tr>
<td>McComb</td>
<td>Louise</td>
<td>The Spastic Centre New South Wales</td>
<td></td>
</tr>
<tr>
<td>McDonald</td>
<td>Rachel</td>
<td>Manon University</td>
<td><a href="mailto:rachael.mcdonald@med.manonahu.ca">rachael.mcdonald@med.manonahu.ca</a></td>
</tr>
<tr>
<td>McEwan</td>
<td>Irene</td>
<td>University of Oklahoma Health Sciences Center</td>
<td><a href="mailto:irene-mcewan@ouhsc.edu">irene-mcewan@ouhsc.edu</a></td>
</tr>
<tr>
<td>McGinley</td>
<td>Jenny</td>
<td>Gait CCRE, Murdoch Children's Research Institute</td>
<td><a href="mailto:jennifer.mcginley@murdoch.edu">jennifer.mcginley@murdoch.edu</a></td>
</tr>
<tr>
<td>McGrath</td>
<td>Michelle</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:mcm.grath@tscnsw.org.au">mcm.grath@tscnsw.org.au</a></td>
</tr>
<tr>
<td>McGregor</td>
<td>Rachel</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:rachael.mcgregor@dadhc.nsw.gov.au">rachael.mcgregor@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>McGrells</td>
<td>Wendy</td>
<td>Scope</td>
<td><a href="mailto:wmcgrells@scopevic.org.au">wmcgrells@scopevic.org.au</a></td>
</tr>
<tr>
<td>McGuire</td>
<td>Nichola</td>
<td>Conductive Education Canterbury</td>
<td><a href="mailto:cecanterbury@jda.co.nz">cecanterbury@jda.co.nz</a></td>
</tr>
<tr>
<td>McIntosh</td>
<td>Judith</td>
<td>North Sydney Central Coast Area Health Service</td>
<td><a href="mailto:judithandstewart@bigpond.com">judithandstewart@bigpond.com</a></td>
</tr>
<tr>
<td>McIntyre</td>
<td>Sarah</td>
<td>Cerebral Palsy Institute</td>
<td><a href="mailto:smcintyre@tscnsw.org.au">smcintyre@tscnsw.org.au</a></td>
</tr>
<tr>
<td>McClure</td>
<td>Kathryn</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:kathryn.westland@dadhc.nsw.gov.au">kathryn.westland@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>McKay</td>
<td>Alison</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:amckay@tscnsw.org.au">amckay@tscnsw.org.au</a></td>
</tr>
<tr>
<td>McLaren</td>
<td>Helen</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:heleni.mclaren@dadhc.nsw.gov.au">heleni.mclaren@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>McLennan</td>
<td>Kim</td>
<td>Royal Children's Hospital Brisbane</td>
<td><a href="mailto:kim_mclennan@health.qld.gov.au">kim_mclennan@health.qld.gov.au</a></td>
</tr>
<tr>
<td>McMahon</td>
<td>Madelyn</td>
<td>Barwon Valley School</td>
<td><a href="mailto:mcmaison.madelyn@edumail.vic.gov.au">mcmaison.madelyn@edumail.vic.gov.au</a></td>
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<td>Last Name</td>
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<tr>
<td>McMahon</td>
<td>Margherita</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:margherita.mcmahon@dhs.vic.gov.au">margherita.mcmahon@dhs.vic.gov.au</a></td>
</tr>
<tr>
<td>McMichael</td>
<td>Gai</td>
<td>University of Adelaide</td>
<td><a href="mailto:gaimcmichael@adelaide.edu.au">gaimcmichael@adelaide.edu.au</a></td>
</tr>
<tr>
<td>McPherson</td>
<td>Kyeong</td>
<td>Cerebral Palsy League of Queensland</td>
<td><a href="mailto:jmu@clpl.org.au">jmu@clpl.org.au</a></td>
</tr>
<tr>
<td>Mendez</td>
<td>George</td>
<td>The University of Notre Dame</td>
<td><a href="mailto:gmendez@ind.edu.au">gmendez@ind.edu.au</a></td>
</tr>
<tr>
<td>Mendes</td>
<td>Doug</td>
<td>The Spastic Centre New South Wales</td>
<td></td>
</tr>
<tr>
<td>Mercer</td>
<td>Louise</td>
<td>Cerebral Palsy League of Queensland</td>
<td><a href="mailto:lmercer@clpl.org.au">lmercer@clpl.org.au</a></td>
</tr>
<tr>
<td>Mesterman</td>
<td>Ronit</td>
<td>McMaster Children's Hospital</td>
<td><a href="mailto:ronit.mcm@mcmaster.ca">ronit.mcm@mcmaster.ca</a></td>
</tr>
<tr>
<td>Mewett</td>
<td>Peter</td>
<td>Cerebral Palsy League of Queensland</td>
<td><a href="mailto:pmewett@clpl.org.au">pmewett@clpl.org.au</a></td>
</tr>
<tr>
<td>Michelmore</td>
<td>Alex</td>
<td>Novita Children's Services</td>
<td><a href="mailto:alex.michelmore@novita.org.au">alex.michelmore@novita.org.au</a></td>
</tr>
<tr>
<td>Midgley</td>
<td>Ann</td>
<td>School Therapy Team St George Hospital</td>
<td><a href="mailto:wagnermid@primusonline.com.au">wagnermid@primusonline.com.au</a></td>
</tr>
<tr>
<td>Mifsud</td>
<td>Renee</td>
<td>The Spastic Centre New South Wales</td>
<td></td>
</tr>
<tr>
<td>Miles</td>
<td>Cindy</td>
<td>Cindy Miles and associates</td>
<td><a href="mailto:bike4ever@verizon.net">bike4ever@verizon.net</a></td>
</tr>
<tr>
<td>Miller</td>
<td>Bob</td>
<td>The Spastic Centre New South Wales</td>
<td></td>
</tr>
<tr>
<td>Miller</td>
<td>Kate</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:kmiller@tscnsw.org.au">kmiller@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Miller</td>
<td>Stephanie</td>
<td>The University of Queensland</td>
<td><a href="mailto:s.odriscoll@uq.edu.au">s.odriscoll@uq.edu.au</a></td>
</tr>
<tr>
<td>Miller</td>
<td>Suzanne</td>
<td>Monash University</td>
<td><a href="mailto:suze.miller@med.monash.edu.au">suze.miller@med.monash.edu.au</a></td>
</tr>
<tr>
<td>Mills</td>
<td>Lauren</td>
<td>Lifestart</td>
<td><a href="mailto:laurenmills@lifestart.org.au">laurenmills@lifestart.org.au</a></td>
</tr>
<tr>
<td>Mitchell</td>
<td>Kesty</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:knesty.mitchell@dadhc.nsw.gov.au">knesty.mitchell@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Monno</td>
<td>Alison</td>
<td>Sydney Children's Hospital</td>
<td><a href="mailto:alison.mono@sesahs.health.nsw.gov.au">alison.mono@sesahs.health.nsw.gov.au</a></td>
</tr>
<tr>
<td>Monats</td>
<td>Nick</td>
<td>CP Foundation</td>
<td></td>
</tr>
<tr>
<td>Morgan</td>
<td>Cathy</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:c.morgan@tscnsw.org.au">c.morgan@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Morgan</td>
<td>Don</td>
<td>Center for Physical activity and Health in Youth</td>
<td><a href="mailto:dmorgan@mhts.edu">dmorgan@mhts.edu</a></td>
</tr>
<tr>
<td>Morgan</td>
<td>John</td>
<td>The Spastic Centre New South Wales</td>
<td></td>
</tr>
<tr>
<td>Mori</td>
<td>Rosalie</td>
<td>King Edward Memorial Hospital</td>
<td><a href="mailto:rosalie.m@health.wa.gov.au">rosalie.m@health.wa.gov.au</a></td>
</tr>
<tr>
<td>Mulle</td>
<td>Joanne</td>
<td>New South Wales Health - Illawarra</td>
<td><a href="mailto:gmmiddle@yahoo.com">gmmiddle@yahoo.com</a></td>
</tr>
<tr>
<td>Moris</td>
<td>Jessa</td>
<td>The Centre for Cerebral Palsy</td>
<td><a href="mailto:jessa.morris@tccp.com.au">jessa.morris@tccp.com.au</a></td>
</tr>
<tr>
<td>Morris</td>
<td>Shereen</td>
<td>Cerebral Palsy Education Centre</td>
<td><a href="mailto:shereen.morris@tccp.com.au">shereen.morris@tccp.com.au</a></td>
</tr>
<tr>
<td>Morrow</td>
<td>Angie</td>
<td>The Children's Hospital at Westmead</td>
<td><a href="mailto:angiem@chw.edu.au">angiem@chw.edu.au</a></td>
</tr>
<tr>
<td>Morton</td>
<td>Natalie</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:nmorton@tscnsw.org.au">nmorton@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Moyle</td>
<td>Julie</td>
<td>University of Canberra</td>
<td><a href="mailto:julie.moyle@canberra.edu.au">julie.moyle@canberra.edu.au</a></td>
</tr>
<tr>
<td>Mintz</td>
<td>Michael</td>
<td>The University of Chicago</td>
<td><a href="mailto:mmintz@bsd.uic.edu">mmintz@bsd.uic.edu</a></td>
</tr>
<tr>
<td>Mudford</td>
<td>Natalie</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:natalia.mudford@dadhc.nsw.gov.au">natalia.mudford@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Mudge</td>
<td>Anita</td>
<td>Sydney Childrens Hospital</td>
<td><a href="mailto:anita.mudge@sesahs.health.nsw.gov.au">anita.mudge@sesahs.health.nsw.gov.au</a></td>
</tr>
<tr>
<td>Muller</td>
<td>Angela</td>
<td>Education Queensland</td>
<td><a href="mailto:angela.muller@hotmail.com">angela.muller@hotmail.com</a></td>
</tr>
<tr>
<td>Mulpuesk</td>
<td>Pomchay</td>
<td>Ramathibodee Hospital</td>
<td><a href="mailto:drpcm@yaho.com">drpcm@yaho.com</a></td>
</tr>
<tr>
<td>Mulready</td>
<td>Katrina</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:kmulready@tscnsw.org.au">kmulready@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Munro</td>
<td>Rebecca</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:rebecca.munro@dadhc.nsw.gov.au">rebecca.munro@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Murchland</td>
<td>Sonya</td>
<td>Novita Children's Services</td>
<td><a href="mailto:sonia.murchland@novita.org.au">sonia.murchland@novita.org.au</a></td>
</tr>
<tr>
<td>Murillo</td>
<td>Josephine</td>
<td>King Fahad Specialist Hospital Rehabilitation</td>
<td><a href="mailto:penmurillo@yahoo.com">penmurillo@yahoo.com</a></td>
</tr>
<tr>
<td>Murr</td>
<td>Sue</td>
<td>Gillette Children's Specialty Healthcare</td>
<td><a href="mailto:smurr@Gillettechildrens.com">smurr@Gillettechildrens.com</a></td>
</tr>
<tr>
<td>Myers</td>
<td>Kellie</td>
<td>Princess Margaret Hospital</td>
<td><a href="mailto:kellie.myers@health.wa.gov.au">kellie.myers@health.wa.gov.au</a></td>
</tr>
<tr>
<td>Muysken</td>
<td>Nette Une</td>
<td>Princess Margaret Hospital</td>
<td><a href="mailto:nnete.myers@health.wa.gov.au">nnete.myers@health.wa.gov.au</a></td>
</tr>
<tr>
<td>Myklebust</td>
<td>Gerd</td>
<td>Riddihospitalet University Hospital</td>
<td><a href="mailto:gerd.myklebust@rihospitalet.no">gerd.myklebust@rihospitalet.no</a></td>
</tr>
<tr>
<td>Nade</td>
<td>Elizabeth</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:enade@tsc.nsw.gov.au">enade@tsc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Narayanan</td>
<td>Unni</td>
<td>University of Toronto</td>
<td><a href="mailto:unninarayanan@seckids.ca">unninarayanan@seckids.ca</a></td>
</tr>
<tr>
<td>Nayak</td>
<td>Jagriti</td>
<td>Royal Children's Hospital</td>
<td><a href="mailto:nayakjagriti@hotmail.com">nayakjagriti@hotmail.com</a></td>
</tr>
<tr>
<td>Nelson</td>
<td>Karin</td>
<td>NIH/NINDS, Children's National Med Center</td>
<td><a href="mailto:nelsonk@ninds.nih.gov">nelsonk@ninds.nih.gov</a></td>
</tr>
<tr>
<td>Nelson</td>
<td>Maureen</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:maureen.nelson@dadhc.nsw.gov.au">maureen.nelson@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Nelson</td>
<td>Rosemary</td>
<td>Novita Children's Services</td>
<td><a href="mailto:rosemary.nelson@novita.org.au">rosemary.nelson@novita.org.au</a></td>
</tr>
<tr>
<td>Newell</td>
<td>Grace</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:cinewell@tscnsw.org.au">cinewell@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Newton</td>
<td>Kathryn</td>
<td>Private Practice and RCH Melbourne</td>
<td><a href="mailto:kathy.newton.ot@rcom.com.au">kathy.newton.ot@rcom.com.au</a></td>
</tr>
<tr>
<td>Newton</td>
<td>Vikki</td>
<td>Cerebral Palsy Education Centre</td>
<td><a href="mailto:vik.newton@gmail.com">vik.newton@gmail.com</a></td>
</tr>
<tr>
<td>Nichols</td>
<td>Lisa</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:lisa.nichols@dadhc.nsw.gov.au">lisa.nichols@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Nicola-Richmond</td>
<td>Kelli</td>
<td>Scope</td>
<td><a href="mailto:knicola@scopevic.org.au">knicola@scopevic.org.au</a></td>
</tr>
<tr>
<td>Nielsen</td>
<td>Lone</td>
<td>Hvidovre University Hospital</td>
<td><a href="mailto:lone.margit.nielsen@hvi.regionh.dk">lone.margit.nielsen@hvi.regionh.dk</a></td>
</tr>
<tr>
<td>Niethol</td>
<td>Coral</td>
<td>Cerebral Palsy League of Queensland</td>
<td><a href="mailto:jmussell@clpl.org.au">jmussell@clpl.org.au</a></td>
</tr>
<tr>
<td>Nissen</td>
<td>Chantelle</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:cnissen@tsc.nsw.org.au">cnissen@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Nix</td>
<td>Pruie</td>
<td>Therapies for Kids</td>
<td><a href="mailto:p.nix@therapiestforkids.com.au">p.nix@therapiestforkids.com.au</a></td>
</tr>
<tr>
<td>Noble</td>
<td>Yolande</td>
<td>Physiotherapy Department</td>
<td><a href="mailto:yolande.noble@health.qld.gov.au">yolande.noble@health.qld.gov.au</a></td>
</tr>
<tr>
<td>Nordmark</td>
<td>Eva</td>
<td>Lund University</td>
<td><a href="mailto:eva.nordmark@med.lu.se">eva.nordmark@med.lu.se</a></td>
</tr>
<tr>
<td>Nossal</td>
<td>Victor</td>
<td>The Spastic Centre New South Wales</td>
<td>CP Foundation</td>
</tr>
<tr>
<td>Nottage</td>
<td>Lyn</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:lottage@tsc.nsw.org.au">lottage@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Novak</td>
<td>Iona</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:novak@tsc.nsw.org.au">novak@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Oates</td>
<td>Diane</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:doates@tscnsw.org.au">doates@tscnsw.org.au</a></td>
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<tr>
<td>Oates</td>
<td>Joanne</td>
<td>Evaluate</td>
<td><a href="mailto:joanne@evaluate.com.au">joanne@evaluate.com.au</a></td>
</tr>
<tr>
<td>O’Callaghan</td>
<td>Michael</td>
<td>University of Adelaide</td>
<td><a href="mailto:michael.oacallaghan@student.adelaide.edu.au">michael.oacallaghan@student.adelaide.edu.au</a></td>
</tr>
<tr>
<td>O’Connor</td>
<td>Bridget</td>
<td>Charles Sturt University</td>
<td><a href="mailto:bocconnor@cj.ac.edu.au">bocconnor@cj.ac.edu.au</a></td>
</tr>
<tr>
<td>O’Connor</td>
<td>Catherine</td>
<td>Starship Children’s Health</td>
<td><a href="mailto:catherineo@dhb.gov.nzt">catherineo@dhb.gov.nzt</a></td>
</tr>
<tr>
<td>O’Connor</td>
<td>Cathy</td>
<td>CP Foundation</td>
<td></td>
</tr>
<tr>
<td>O’Donnell</td>
<td>Maureen</td>
<td>Sunny Hill Health Centre for Children</td>
<td><a href="mailto:modonell@cw.bc.ca">modonell@cw.bc.ca</a></td>
</tr>
<tr>
<td>O’Farley</td>
<td>Fahyse</td>
<td>Guha¶ane Military Medical Academy</td>
<td><a href="mailto:forb@yahoo.com">forb@yahoo.com</a></td>
</tr>
<tr>
<td>Ohnwall</td>
<td>Ann-Marie</td>
<td>Karolinska Institutet</td>
<td><a href="mailto:ann-marie.ohnwall@kas.se">ann-marie.ohnwall@kas.se</a></td>
</tr>
<tr>
<td>Oliver</td>
<td>Debbie</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:doliver@bc.nsw.org.au">doliver@bc.nsw.org.au</a></td>
</tr>
<tr>
<td>Olsen</td>
<td>Barbara</td>
<td>Cerebral Palsy Tasmania</td>
<td><a href="mailto:b.olsen@cpts.org.au">b.olsen@cpts.org.au</a></td>
</tr>
<tr>
<td>Ong</td>
<td>Han Tat</td>
<td>University Children’s Medical Institute</td>
<td><a href="mailto:paev5@nus.edu.sg">paev5@nus.edu.sg</a></td>
</tr>
<tr>
<td>Ong</td>
<td>Lai Choo</td>
<td>UKM Medical Centre</td>
<td><a href="mailto:ongle@mail.hukm.ukm.my">ongle@mail.hukm.ukm.my</a></td>
</tr>
<tr>
<td>Ong</td>
<td>Stephanie</td>
<td>Sydney Children’s Hospital</td>
<td><a href="mailto:stephanie.org@sesa.health.nsw.gov.au">stephanie.org@sesa.health.nsw.gov.au</a></td>
</tr>
<tr>
<td>Oo</td>
<td>Kathleen</td>
<td>St Vincent’s Hospital Melbourne</td>
<td><a href="mailto:ttkoo@dpbsnet.com.au">ttkoo@dpbsnet.com.au</a></td>
</tr>
<tr>
<td>Opheim</td>
<td>Arne</td>
<td>Sunnaas Rehabilitation Hospital</td>
<td><a href="mailto:arne.opheim@sunnaas.no">arne.opheim@sunnaas.no</a></td>
</tr>
<tr>
<td>Oppenheim</td>
<td>William</td>
<td>David Geffen School of Medicine at UCLA</td>
<td><a href="mailto:woppenhe@ucla.edu">woppenhe@ucla.edu</a></td>
</tr>
<tr>
<td>Oromd</td>
<td>Anna</td>
<td>Novita Children’s Services</td>
<td><a href="mailto:anna.ormod@novita.org.au">anna.ormod@novita.org.au</a></td>
</tr>
<tr>
<td>Orton</td>
<td>Jane</td>
<td>Royal Women’s Hospital</td>
<td><a href="mailto:jane.orton@thewomens.org.au">jane.orton@thewomens.org.au</a></td>
</tr>
<tr>
<td>Osbaldston</td>
<td>Nicola</td>
<td>Bormfield Special School</td>
<td><a href="mailto:nic.osbaldston@bormfield.school.nz">nic.osbaldston@bormfield.school.nz</a></td>
</tr>
<tr>
<td>O’Shannessy</td>
<td>Veronica jayne</td>
<td>Daretton Community Health Centre</td>
<td><a href="mailto:drifterhouseboathols@hotmail.com">drifterhouseboathols@hotmail.com</a></td>
</tr>
<tr>
<td>O’Shea</td>
<td>Roberta</td>
<td>Governors State University</td>
<td><a href="mailto:roshea@govst.edu">roshea@govst.edu</a></td>
</tr>
<tr>
<td>Ou</td>
<td>Jin</td>
<td>Princess Margaret Hospital</td>
<td><a href="mailto:jinhung.ou@health.wa.gov.au">jinhung.ou@health.wa.gov.au</a></td>
</tr>
<tr>
<td>Page</td>
<td>Louise</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:louise.page@dadhc.nsw.gov.au">louise.page@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Peiris</td>
<td>Bronwen</td>
<td>University of Adelaide</td>
<td><a href="mailto:bronwen.peiris@adelaide.edu.au">bronwen.peiris@adelaide.edu.au</a></td>
</tr>
<tr>
<td>Paliano</td>
<td>Robert</td>
<td>Drew University</td>
<td><a href="mailto:gp33@drew.edu">gp33@drew.edu</a></td>
</tr>
<tr>
<td>Park</td>
<td>Eun Sook</td>
<td>Yonsei University College of Medicine</td>
<td><a href="mailto:pes1234@yumc.yonsei.ac.kr">pes1234@yumc.yonsei.ac.kr</a></td>
</tr>
<tr>
<td>Park</td>
<td>Moon Seok</td>
<td>Seoul National University Bundang Hospital</td>
<td><a href="mailto:pmmed@hanafos.com">pmmed@hanafos.com</a></td>
</tr>
<tr>
<td>Parkyn</td>
<td>Helen</td>
<td>Novita Children’s Services</td>
<td><a href="mailto:helen.parkyn@novita.org.au">helen.parkyn@novita.org.au</a></td>
</tr>
<tr>
<td>Payne</td>
<td>Nicole</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:nicole.payne@dadhc.nsw.gov.au">nicole.payne@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Pearse</td>
<td>Janice</td>
<td>Newcastle University</td>
<td><a href="mailto:janice.peare@nc.uk">janice.peare@nc.uk</a></td>
</tr>
<tr>
<td>Pearson</td>
<td>Gillian</td>
<td>Warwick Medical School</td>
<td><a href="mailto:maxwellpearson@bigpond.com">maxwellpearson@bigpond.com</a></td>
</tr>
<tr>
<td>Peet</td>
<td>Janna</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:joanna_peet@yahoo.co.uk">joanna_peet@yahoo.co.uk</a></td>
</tr>
<tr>
<td>Penfold</td>
<td>Rebecca</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:rebecca.penfold@dadhc.nsw.gov.au">rebecca.penfold@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Pennington</td>
<td>Lindsay</td>
<td>Newcastle University</td>
<td><a href="mailto:lindsay.pennington@nc.uk">lindsay.pennington@nc.uk</a></td>
</tr>
<tr>
<td>Peregrine</td>
<td>Laura</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:lperegrine@tsc.nsw.org.au">lperegrine@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Perera</td>
<td>Lesley</td>
<td>Princess Margaret Hospital</td>
<td><a href="mailto:lesey.perera@health.wa.gov.au">lesey.perera@health.wa.gov.au</a></td>
</tr>
<tr>
<td>Peters</td>
<td>Susan</td>
<td>Waitemata DHB</td>
<td><a href="mailto:susan.peters@waitemata.dhb.govt.nz">susan.peters@waitemata.dhb.govt.nz</a></td>
</tr>
<tr>
<td>Phillips</td>
<td>Teresa</td>
<td>Queensland Health</td>
<td><a href="mailto:teresa_phillips@health.qld.gov.au">teresa_phillips@health.qld.gov.au</a></td>
</tr>
<tr>
<td>Piccinini</td>
<td>Luigi</td>
<td>IRCCS E Medea - a. La Nostra Famiglia</td>
<td><a href="mailto:medea@issbp.it">medea@issbp.it</a></td>
</tr>
<tr>
<td>Pigeon</td>
<td>Nicole</td>
<td>CP Clinic CHU95</td>
<td><a href="mailto:npigeonpep@hotmail.com">npigeonpep@hotmail.com</a></td>
</tr>
<tr>
<td>Pilkington</td>
<td>Clare</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:claire.pilkington@dadhc.nsw.gov.au">claire.pilkington@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Picard</td>
<td>Mary Jane</td>
<td>The University of Liverpool</td>
<td><a href="mailto:mjpicard@unliverpool.ac.uk">mjpicard@unliverpool.ac.uk</a></td>
</tr>
<tr>
<td>Polivoda</td>
<td>Andrea</td>
<td>Polyicnic for Physical Medicine and Rehabilitation</td>
<td><a href="mailto:saan@lp.hr">saan@lp.hr</a></td>
</tr>
<tr>
<td>Polivoda</td>
<td>Svetlana</td>
<td>Polyicnic for Physical Medicine and Rehabilitation</td>
<td><a href="mailto:tanja.svetlana@zg.t-com.hr">tanja.svetlana@zg.t-com.hr</a></td>
</tr>
<tr>
<td>Pope</td>
<td>Michelle</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:michelle.pope@dadhc.nsw.gov.au">michelle.pope@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Popov</td>
<td>Robert</td>
<td>Families Supporting Families Inc</td>
<td><a href="mailto:live3@optusnet.com.au">live3@optusnet.com.au</a></td>
</tr>
<tr>
<td>Porter</td>
<td>Gayle</td>
<td>Cerebral Palsy Education Centre</td>
<td><a href="mailto:gayleporter@cpec.com.au">gayleporter@cpec.com.au</a></td>
</tr>
<tr>
<td>Poulos</td>
<td>Katherine</td>
<td>Royal Institute for Deaf and Blind Children</td>
<td><a href="mailto:kathy.poulos@kdbc.org.au">kathy.poulos@kdbc.org.au</a></td>
</tr>
<tr>
<td>Powell</td>
<td>Rebecca</td>
<td>Kumjong Early Intervention Service</td>
<td><a href="mailto:bce.powell@hotmail.com">bce.powell@hotmail.com</a></td>
</tr>
<tr>
<td>Previletra</td>
<td>Nicola</td>
<td>Royal Children Hospital Queensland</td>
<td><a href="mailto:nicola.previletra@health.qld.gov.au">nicola.previletra@health.qld.gov.au</a></td>
</tr>
<tr>
<td>Price</td>
<td>Katie</td>
<td>Great Ormond Street Hospital for Children</td>
<td><a href="mailto:pricek@gos.nhs.uk">pricek@gos.nhs.uk</a></td>
</tr>
<tr>
<td>Prosser</td>
<td>Tracey</td>
<td>The Geelong Hospital</td>
<td><a href="mailto:tracey@bawonhealth.org.au">tracey@bawonhealth.org.au</a></td>
</tr>
<tr>
<td>Proudfoot</td>
<td>Kath</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:kproproudfoot@tsc.nsw.org.au">kproproudfoot@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Provian</td>
<td>Kenny</td>
<td>QCP + RRC</td>
<td><a href="mailto:kerry_provian@health.qld.gov.au">kerry_provian@health.qld.gov.au</a></td>
</tr>
<tr>
<td>Puig</td>
<td>Jose</td>
<td>IMC2</td>
<td><a href="mailto:jpuig@egealem2.org">jpuig@egealem2.org</a></td>
</tr>
<tr>
<td>Quadrus</td>
<td>Nigel</td>
<td>Rehabilitation Medicine</td>
<td><a href="mailto:nigel.quadrus@nwahs.sa.gov.au">nigel.quadrus@nwahs.sa.gov.au</a></td>
</tr>
<tr>
<td>Quaglio</td>
<td>Tania</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:tania.quaglodi@dadhc.nsw.gov.au">tania.quaglodi@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Quinn</td>
<td>Patricia</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:patricia.quinn@dadhc.nsw.gov.au">patricia.quinn@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Rae</td>
<td>Nicole</td>
<td>Cerebral Palsy League of Queensland</td>
<td><a href="mailto:jmrseil@pcp.org.au">jmrseil@pcp.org.au</a></td>
</tr>
<tr>
<td>Rahavendra</td>
<td>Parmarn</td>
<td>Novita Children’s Services</td>
<td><a href="mailto:parma.parhavendra@novita.org.au">parma.parhavendra@novita.org.au</a></td>
</tr>
<tr>
<td>Rahman</td>
<td>Neza</td>
<td>Child Development Centre</td>
<td><a href="mailto:nezarehman@hotmail.com">nezarehman@hotmail.com</a></td>
</tr>
<tr>
<td>Ramkeizers</td>
<td>Eugene</td>
<td>SRL / Franciscusord</td>
<td><a href="mailto:eaa.ramkeizers@hetnet.nl">eaa.ramkeizers@hetnet.nl</a></td>
</tr>
<tr>
<td>Ramsted</td>
<td>Eric</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:eramsten@tsc.nsw.org.au">eramsten@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Randall</td>
<td>Melinda</td>
<td>Victorian Paediatric Rehabilitation Service</td>
<td><a href="mailto:melinda.randall@arch.org">melinda.randall@arch.org</a></td>
</tr>
<tr>
<td>Rappensberg</td>
<td>Glenn</td>
<td>Novita Children’s Services</td>
<td><a href="mailto:melissa.michaels@novita.org.au">melissa.michaels@novita.org.au</a></td>
</tr>
<tr>
<td>Last Name</td>
<td>First Name</td>
<td>Organisation</td>
<td>Email Address</td>
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</tr>
<tr>
<td>Rasmussen</td>
<td>Helle</td>
<td>Hvidovre University Hospital</td>
<td><a href="mailto:helle.rasmussen@vh.regionh.dk">helle.rasmussen@vh.regionh.dk</a></td>
</tr>
<tr>
<td>Rasafiani</td>
<td>Mehdi</td>
<td>University of Social Welfare and Rehabilitation Sciences</td>
<td><a href="mailto:mrasafiani@yahoo.com">mrasafiani@yahoo.com</a></td>
</tr>
<tr>
<td>Ravenscroft</td>
<td>John</td>
<td>RIDBC Renwick Centre University of Newcastle</td>
<td><a href="mailto:john.ravenscroft@ridbc.org.au">john.ravenscroft@ridbc.org.au</a></td>
</tr>
<tr>
<td>Rawsthorne</td>
<td>Julie</td>
<td>Novita Children’s Services</td>
<td><a href="mailto:julie.rawsthorne@neurorehab.co.nz">julie.rawsthorne@neurorehab.co.nz</a></td>
</tr>
<tr>
<td>Rebecca</td>
<td>Gilles</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:rebecca.gilles@dadhc.nsw.gov.au">rebecca.gilles@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Reddington</td>
<td>Anne</td>
<td>Neuropediatric Results</td>
<td><a href="mailto:anne@neurorehab.co.nz">anne@neurorehab.co.nz</a></td>
</tr>
<tr>
<td>Reddough</td>
<td>Dinah</td>
<td>Royal Children’s Hospital</td>
<td><a href="mailto:dinah.reddough@rch.org.au">dinah.reddough@rch.org.au</a></td>
</tr>
<tr>
<td>Redman</td>
<td>Jan</td>
<td>Northern Beaches Health New South Wales</td>
<td><a href="mailto:janred13@hotmail.com">janred13@hotmail.com</a></td>
</tr>
<tr>
<td>Reeder</td>
<td>Jim</td>
<td>Therapy ACT</td>
<td><a href="mailto:jim.reeder@act.gov.au">jim.reeder@act.gov.au</a></td>
</tr>
<tr>
<td>Reeves</td>
<td>Sandra</td>
<td>University of Melbourne</td>
<td><a href="mailto:s.rees@unimelb.edu">s.rees@unimelb.edu</a></td>
</tr>
<tr>
<td>Rees</td>
<td>Kate</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:kate.rees@dadhc.nsw.gov.au">kate.rees@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Reid</td>
<td>Andrea</td>
<td>CCS Disability Action Christchurch</td>
<td><a href="mailto:haired@actbrc.co.nz">haired@actbrc.co.nz</a></td>
</tr>
<tr>
<td>Reid</td>
<td>Denise</td>
<td>University of Toronto</td>
<td><a href="mailto:d.reid@utoronto.ca">d.reid@utoronto.ca</a></td>
</tr>
<tr>
<td>Reid</td>
<td>Sobhan</td>
<td>University of Western Australia</td>
<td><a href="mailto:sobhan.reid@uwa.edu">sobhan.reid@uwa.edu</a></td>
</tr>
<tr>
<td>Rees</td>
<td>Julie</td>
<td>Monash Medical Centre</td>
<td><a href="mailto:melba.81@hotmail.com">melba.81@hotmail.com</a></td>
</tr>
<tr>
<td>Robinson</td>
<td>Kate</td>
<td>Education Queensland - Southport Special School</td>
<td><a href="mailto:kobl13@eq.edu.au">kobl13@eq.edu.au</a></td>
</tr>
<tr>
<td>Robinson</td>
<td>Susan</td>
<td>Cerebral Palsy League of Queensland</td>
<td><a href="mailto:jmsell@qld.lq.org.au">jmsell@qld.lq.org.au</a></td>
</tr>
<tr>
<td>Rode</td>
<td>Jillian</td>
<td>Hugh Williamson Gait Laboratory</td>
<td><a href="mailto:jill.rode@ohnh.org">jill.rode@ohnh.org</a></td>
</tr>
<tr>
<td>Rogers</td>
<td>Melinda</td>
<td>Hastings Early Intervention Program</td>
<td><a href="mailto:melinda.grogan@yahoo.com">melinda.grogan@yahoo.com</a></td>
</tr>
<tr>
<td>Rogers</td>
<td>Melissa</td>
<td>Novita Children’s Services</td>
<td><a href="mailto:melissa.michaelis@novita.orgau">melissa.michaelis@novita.orgau</a></td>
</tr>
<tr>
<td>Roland</td>
<td>Natalie</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:nroland@tsc.nsw.org.au">nroland@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Roman</td>
<td>Kingsley</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:kromani@tsc.nsw.org.au">kromani@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Rosenbaum</td>
<td>Peter</td>
<td>CanChild Centre for Childhood Disability Research</td>
<td><a href="mailto:rosenbaum@canchild.ca">rosenbaum@canchild.ca</a></td>
</tr>
<tr>
<td>Ross</td>
<td>Amy</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:aro@tsc.nsw.org.au">aro@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Rotbery</td>
<td>Sophie</td>
<td>Sunny Hill Health Centre for Children</td>
<td>sunnyhillforchildren.org.au</td>
</tr>
<tr>
<td>Rowe</td>
<td>Vanessa</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:vanessa.rowe@dadhc.nsw.gov.au">vanessa.rowe@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Roxburgh</td>
<td>Lori</td>
<td>Sunny Hill Health Centre for Children</td>
<td>sunnyhillhealthcentre.org.au</td>
</tr>
<tr>
<td>Rueda</td>
<td>Anna</td>
<td>School Therapy Team for Students with a Physical Disability</td>
<td><a href="mailto:anna.rueda@seskahs.health.gov.au">anna.rueda@seskahs.health.gov.au</a></td>
</tr>
<tr>
<td>Russell</td>
<td>Dionne</td>
<td>CanChild Centre for Childhood Disability Research</td>
<td><a href="mailto:dionne@canchild.ca">dionne@canchild.ca</a></td>
</tr>
<tr>
<td>Russell</td>
<td>Jessica</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:jessica.russell@dadhc.nsw.gov.au">jessica.russell@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Russo</td>
<td>Remo</td>
<td>Women’s and Children’s Hospital</td>
<td><a href="mailto:russo.0169@finders.ac">russo.0169@finders.ac</a></td>
</tr>
<tr>
<td>Ryan</td>
<td>Kyle</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:kyle.ryan@dadhc.nsw.gov.au">kyle.ryan@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Saglam</td>
<td>Burcu</td>
<td>Monash University</td>
<td><a href="mailto:burcu.saglam@med.monash.edu.au">burcu.saglam@med.monash.edu.au</a></td>
</tr>
<tr>
<td>Sakkowski</td>
<td>Leanne</td>
<td>University of Queensland</td>
<td><a href="mailto:leanne.sakkowski@student.uq.edu.au">leanne.sakkowski@student.uq.edu.au</a></td>
</tr>
<tr>
<td>Salokorpi</td>
<td>Hannu</td>
<td>University of Rio de Janeiro</td>
<td><a href="mailto:hannu.salokorpi@ufrj.fi">hannu.salokorpi@ufrj.fi</a></td>
</tr>
<tr>
<td>Salokorpi</td>
<td>Teija</td>
<td>Rinnekoti-Saatio, Rehab Home for Children</td>
<td><a href="mailto:teija.salokorpi@rinnekoti.fi">teija.salokorpi@rinnekoti.fi</a></td>
</tr>
<tr>
<td>Sampson</td>
<td>Fiona</td>
<td>Westmead Childrens Hospital</td>
<td><a href="mailto:fiona.2@chw.edu.au">fiona.2@chw.edu.au</a></td>
</tr>
<tr>
<td>Sandelance</td>
<td>Myriam</td>
<td>Novita Children’s Services</td>
<td><a href="mailto:myriam.sandelance@novita.org.au">myriam.sandelance@novita.org.au</a></td>
</tr>
<tr>
<td>Sander</td>
<td>Anna</td>
<td>Tonsberg Rehabilitation Center</td>
<td>anna.sander@svno</td>
</tr>
<tr>
<td>Sanders</td>
<td>Matthew</td>
<td>The University of Queensland</td>
<td><a href="mailto:m.sanders@uq.edu.au">m.sanders@uq.edu.au</a></td>
</tr>
<tr>
<td>Sandstrom</td>
<td>Karin</td>
<td>Linköping University</td>
<td><a href="mailto:karin.sandstrom@lsu.se">karin.sandstrom@lsu.se</a></td>
</tr>
<tr>
<td>Sandstrom</td>
<td>Marie</td>
<td>Folke Bernadotte Regional Rehabilitation Centre</td>
<td><a href="mailto:marie.sandstrom@akademiska.se">marie.sandstrom@akademiska.se</a></td>
</tr>
<tr>
<td>Santos</td>
<td>Cory</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:cory.santos@dadhc.nsw.gov.au">cory.santos@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Saraswat</td>
<td>Kanti</td>
<td>Early Childhood Intervention Program Cooffs Harbour</td>
<td><a href="mailto:kanti.saraswat@gmail.com">kanti.saraswat@gmail.com</a></td>
</tr>
<tr>
<td>Sato</td>
<td>Haruhiko</td>
<td>Kitasato University School of Allied Health Sciences</td>
<td><a href="mailto:haruhiko@kitasato-u.ac.jp">haruhiko@kitasato-u.ac.jp</a></td>
</tr>
<tr>
<td>Saunders</td>
<td>Marina</td>
<td>Cerebral Palsy League of Queensland</td>
<td><a href="mailto:jmsell@cpld.org.au">jmsell@cpld.org.au</a></td>
</tr>
<tr>
<td>Sawyer</td>
<td>Johanna</td>
<td>Children’s Development Team</td>
<td><a href="mailto:johanna.sawyer@nt.gov.au">johanna.sawyer@nt.gov.au</a></td>
</tr>
<tr>
<td>Schenking</td>
<td>Adam</td>
<td>The Children’s Hospital at Westmead</td>
<td><a href="mailto:adams2@chw.edu.au">adams2@chw.edu.au</a></td>
</tr>
<tr>
<td>Schofer</td>
<td>Vanessa</td>
<td>VU University Medical Centre</td>
<td><a href="mailto:vanessa.schofer@vumc.nl">vanessa.schofer@vumc.nl</a></td>
</tr>
<tr>
<td>Schwabe</td>
<td>Alyson</td>
<td>Baylor College of Medicine</td>
<td><a href="mailto:alyson.schwabe@texaschildrens.org">alyson.schwabe@texaschildrens.org</a></td>
</tr>
<tr>
<td>Scicca</td>
<td>Lynne</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:lynne.scicca@dadhc.nsw.gov.au">lynne.scicca@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Scinni</td>
<td>Aline</td>
<td>University of Sydney</td>
<td><a href="mailto:acsinni@uts.edu.au">acsinni@uts.edu.au</a></td>
</tr>
<tr>
<td>Scott</td>
<td>Heath</td>
<td>Women’s and Children’s Hospital</td>
<td><a href="mailto:heather.scott@jwss.sa.gov.au">heather.scott@jwss.sa.gov.au</a></td>
</tr>
<tr>
<td>Scott</td>
<td>Tim</td>
<td>Royal North Shore Hospital</td>
<td><a href="mailto:tscott@med.usyd.edu.au">tscott@med.usyd.edu.au</a></td>
</tr>
<tr>
<td>Sedmak</td>
<td>Frank</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:f.sedmak@spasticcentre.nsw.gov.au">f.sedmak@spasticcentre.nsw.gov.au</a></td>
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<tr>
<td>Last Name</td>
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</tr>
<tr>
<td>Sellars</td>
<td>Hilary</td>
<td>Department of Education and Early Childhood Development</td>
<td><a href="mailto:hilary.sellars@dhs.vic.gov.au">hilary.sellars@dhs.vic.gov.au</a></td>
</tr>
<tr>
<td>Semple</td>
<td>Fiona</td>
<td>Cerebral Palsy League of Queensland</td>
<td><a href="mailto:f_semple@yahoo.com">f_semple@yahoo.com</a></td>
</tr>
<tr>
<td>Seppala</td>
<td>Eeva</td>
<td>Vajaalikkesiemen Kunto ry</td>
<td>eeva@<a href="mailto:seppala@elissanet.fl">seppala@elissanet.fl</a></td>
</tr>
<tr>
<td>Serrj</td>
<td>Pat</td>
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<td>Sever</td>
<td>Jane</td>
<td>Nepean School</td>
<td><a href="mailto:sever.jane@edumail.vic.gov.au">sever.jane@edumail.vic.gov.au</a></td>
</tr>
<tr>
<td>Shanran</td>
<td>Deepak</td>
<td>Recoup</td>
<td><a href="mailto:deepak.shar@recoup.in">deepak.shar@recoup.in</a></td>
</tr>
<tr>
<td>Sheldon</td>
<td>Coralee</td>
<td>Novita Children’s Services</td>
<td><a href="mailto:melissa.michaels@novita.org.au">melissa.michaels@novita.org.au</a></td>
</tr>
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<td>Shelton</td>
<td>Jill</td>
<td>Novita Children’s Services</td>
<td><a href="mailto:jillian.shelton@novita.org.au">jillian.shelton@novita.org.au</a></td>
</tr>
<tr>
<td>Shepherd</td>
<td>Roberta</td>
<td>The University of Sydney</td>
<td><a href="mailto:rshepherd@usyd.edu.au">rshepherd@usyd.edu.au</a></td>
</tr>
<tr>
<td>Sheppard</td>
<td>Robyn</td>
<td>Calvary Healthcare Tasmania</td>
<td><a href="mailto:rsheppard1@vtown.com.au">rsheppard1@vtown.com.au</a></td>
</tr>
<tr>
<td>Shields</td>
<td>Kirty</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:kshield@stc.nsw.org.au">kshield@stc.nsw.org.au</a></td>
</tr>
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<td>Shiosaki</td>
<td>Prue</td>
<td>Novita Children’s Services</td>
<td><a href="mailto:prue.shiosaki@novita.org.au">prue.shiosaki@novita.org.au</a></td>
</tr>
<tr>
<td>Shores</td>
<td>Ben</td>
<td>Royal Children’s Hospital</td>
<td><a href="mailto:benlenshore@gmail.com">benlenshore@gmail.com</a></td>
</tr>
<tr>
<td>Senkievicz</td>
<td>Christine</td>
<td>Orana Early Childhood Intervention and Education</td>
<td><a href="mailto:chris.senkievicz@oeci.org.au">chris.senkievicz@oeci.org.au</a></td>
</tr>
<tr>
<td>Signorini</td>
<td>Doug</td>
<td>The Spastic Centre New South Wales</td>
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<tr>
<td>Silberston</td>
<td>Lesley</td>
<td>The Centre for Cerebral Palsy</td>
<td><a href="mailto:helen.watts@tct.cp.com.au">helen.watts@tct.cp.com.au</a></td>
</tr>
<tr>
<td>Sinclair</td>
<td>Shelley</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:shelley.sclint@dadhc.nsw.gov.au">shelley.sclint@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Singer</td>
<td>Barbara</td>
<td>University of Western Australia</td>
<td><a href="mailto:bj@cms.uwa.edu.au">bj@cms.uwa.edu.au</a></td>
</tr>
<tr>
<td>Skrillas</td>
<td>John</td>
<td>CP Foundation</td>
<td></td>
</tr>
<tr>
<td>Sparit</td>
<td>Salla Maria</td>
<td>Helsinki Metropolitan University of Applied Sciences</td>
<td><a href="mailto:sspari@yahoo.com">sspari@yahoo.com</a></td>
</tr>
<tr>
<td>Skinner</td>
<td>Kay</td>
<td>Mercy Care Centre</td>
<td><a href="mailto:kskinner@mercy.com.au">kskinner@mercy.com.au</a></td>
</tr>
<tr>
<td>Skjold</td>
<td>Imelin</td>
<td>Vestfold Hospital</td>
<td><a href="mailto:imelin.skjold@sv.no">imelin.skjold@sv.no</a></td>
</tr>
<tr>
<td>Skanes</td>
<td>Jon</td>
<td>Norwegian University of Science and Technology</td>
<td><a href="mailto:jonskanes@ntnu.no">jonskanes@ntnu.no</a></td>
</tr>
<tr>
<td>Slater</td>
<td>Anne</td>
<td>Allowah Childrens Hospital</td>
<td><a href="mailto:anne.dater@gmail.com">anne.dater@gmail.com</a></td>
</tr>
<tr>
<td>Smith</td>
<td>Ann</td>
<td>Wilson Centre Wailemata DHB</td>
<td><a href="mailto:ann.smith@wailemata.dhb.govt.nz">ann.smith@wailemata.dhb.govt.nz</a></td>
</tr>
<tr>
<td>Smith</td>
<td>Glenda</td>
<td>Therapy ACT</td>
<td><a href="mailto:glenda.smith@act.gov.au">glenda.smith@act.gov.au</a></td>
</tr>
<tr>
<td>Smolick</td>
<td>Merick</td>
<td>Korthotsyf/ly</td>
<td><a href="mailto:korthotsyf@ly.com">korthotsyf@ly.com</a></td>
</tr>
<tr>
<td>Smthers/sheedy</td>
<td>Hayley</td>
<td>The Centre for Cerebral Palsy</td>
<td>smthers/sheedy@stc.nsw.org.au</td>
</tr>
<tr>
<td>Smits</td>
<td>Dirk-Wouter</td>
<td>Rehabilitation Center De Hoogstraat</td>
<td><a href="mailto:d.smits@dehoogstraat.nl">d.smits@dehoogstraat.nl</a></td>
</tr>
<tr>
<td>Sofonoff</td>
<td>Kate</td>
<td>The University of Queensland</td>
<td><a href="mailto:kate@psy.uq.edu.au">kate@psy.uq.edu.au</a></td>
</tr>
<tr>
<td>Somerville</td>
<td>Helen</td>
<td>Children’s Hospital Westmead</td>
<td><a href="mailto:helens@chw.edu.au">helens@chw.edu.au</a></td>
</tr>
<tr>
<td>Southcombe</td>
<td>Tess</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:tess.southcombe@dadhc.nsw.gov.au">tess.southcombe@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Speth</td>
<td>Lucianne</td>
<td>SRL / Franciscaoud</td>
<td>l.speth@srlnl</td>
</tr>
<tr>
<td>Spellman</td>
<td>Claire</td>
<td>Queensland Health</td>
<td><a href="mailto:claire_spellman@thea.heal.qld.gov.au">claire_spellman@thea.heal.qld.gov.au</a></td>
</tr>
<tr>
<td>Spizzo</td>
<td>Marianne</td>
<td>Children, Youth and Women’s Health Service</td>
<td><a href="mailto:marianne.spizzo@cywhs.sa.gov.au">marianne.spizzo@cywhs.sa.gov.au</a></td>
</tr>
<tr>
<td>Stack</td>
<td>Jacqueline</td>
<td>Sydney South West area Health Service</td>
<td><a href="mailto:jacqueline.stack@swahs.nsw.gov.au">jacqueline.stack@swahs.nsw.gov.au</a></td>
</tr>
<tr>
<td>Sambell</td>
<td>Andrea</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:asambell@stc.nsw.org.au">asambell@stc.nsw.org.au</a></td>
</tr>
<tr>
<td>Stanley</td>
<td>Antonette</td>
<td>North Sydney Central Coast area Health Service</td>
<td><a href="mailto:antonette@nstc.nsw.org.au">antonette@nstc.nsw.org.au</a></td>
</tr>
<tr>
<td>Stanley</td>
<td>Fiona</td>
<td>Telephone Institute for Child Health Research</td>
<td><a href="mailto:Fiona@chruwa.edu.au">Fiona@chruwa.edu.au</a></td>
</tr>
<tr>
<td>Stannard</td>
<td>Barbara</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:barbara.stannard@dadhc.nsw.gov.au">barbara.stannard@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Stapleton</td>
<td>Sara</td>
<td>The Centre for Cerebral Palsy Western Australia</td>
<td><a href="mailto:sara.stapleton@cccp.com.au">sara.stapleton@cccp.com.au</a></td>
</tr>
<tr>
<td>Stapper</td>
<td>Marlene</td>
<td>Southem Health</td>
<td><a href="mailto:marlene.stapper@southemhealth.org.au">marlene.stapper@southemhealth.org.au</a></td>
</tr>
<tr>
<td>Steele-Mills</td>
<td>Joan</td>
<td>Rehab on The Move</td>
<td><a href="mailto:info@caswellhealthcare.com.au">info@caswellhealthcare.com.au</a></td>
</tr>
<tr>
<td>Steer</td>
<td>Kari</td>
<td>Royal Children’s Hospital</td>
<td><a href="mailto:kari.steer@rch.org.au">kari.steer@rch.org.au</a></td>
</tr>
<tr>
<td>Skening</td>
<td>Michael</td>
<td>Sydney Children’s Hospital</td>
<td><a href="mailto:mskening@qtpnial.com.au">mskening@qtpnial.com.au</a></td>
</tr>
<tr>
<td>Stephens</td>
<td>Rosemary</td>
<td>Children’s Development Team</td>
<td><a href="mailto:rosemary.stephens@nt.gov.au">rosemary.stephens@nt.gov.au</a></td>
</tr>
<tr>
<td>Stevens</td>
<td>Clare</td>
<td>Department of Education and Training Queensland</td>
<td><a href="mailto:c.stev@105.org.au">c.stev@105.org.au</a></td>
</tr>
<tr>
<td>Stevenson</td>
<td>Kim</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:kim.stevenson@dadhc.nsw.gov.au">kim.stevenson@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Stilton</td>
<td>Sarah</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:stilton@stc.nsw.org.au">stilton@stc.nsw.org.au</a></td>
</tr>
<tr>
<td>Stonehouse</td>
<td>Mary</td>
<td>Turawiti District Health Board</td>
<td><a href="mailto:mary@4.tdh.org.nz">mary@4.tdh.org.nz</a></td>
</tr>
<tr>
<td>Stott</td>
<td>Susan</td>
<td>Starship Children’s Hospital</td>
<td><a href="mailto:s.stott@auclairland.ac.nz">s.stott@auclairland.ac.nz</a></td>
</tr>
<tr>
<td>Strömberg</td>
<td>Aimo</td>
<td>International Cerebral Palsy Society</td>
<td><a href="mailto:aimo.stromberg@c-p-llito.fi">aimo.stromberg@c-p-llito.fi</a></td>
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<tr>
<td>Stubbs</td>
<td>Erin</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:erin.stubbs@dadhc.nsw.gov.au">erin.stubbs@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Sudman</td>
<td>Lisa</td>
<td>Triple P International</td>
<td><a href="mailto:lisa@triplep.com">lisa@triplep.com</a></td>
</tr>
<tr>
<td>Suttor</td>
<td>Sean</td>
<td>Westmead Children’s Hospital</td>
<td><a href="mailto:sean.suttor@otbolan.com">sean.suttor@otbolan.com</a></td>
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<td>Suva-Neville</td>
<td>Rodheilla</td>
<td>Cerebral Palsy League of Queensland</td>
<td><a href="mailto:jrussel@cp.net.org.au">jrussel@cp.net.org.au</a></td>
</tr>
<tr>
<td>Sværke</td>
<td>Claus</td>
<td>Aarhus University</td>
<td><a href="mailto:cs@oc.claude.dk">cs@oc.claude.dk</a></td>
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<td>Swanwick</td>
<td>Debbie</td>
<td>Cerebral Palsy League of Queensland</td>
<td><a href="mailto:jrunell@cp.net.org.au">jrunell@cp.net.org.au</a></td>
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<td>Swei</td>
<td>Carle</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:csw@stc.nsw.org.au">csw@stc.nsw.org.au</a></td>
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<tr>
<td>Swinburn</td>
<td>Katherine</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:jswinburn@bigpond.com">jswinburn@bigpond.com</a></td>
</tr>
<tr>
<td>Symonds</td>
<td>Marie</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:marie.symonds@dadhc.nsw.gov.au">marie.symonds@dadhc.nsw.gov.au</a></td>
</tr>
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<td>Sidorous</td>
<td>Hadya</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:haidouros@stc.nsw.org.au">haidouros@stc.nsw.org.au</a></td>
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<tr>
<td>Takahashi</td>
<td>Hitodoshi</td>
<td>National Center for Child Health and Development</td>
<td><a href="mailto:takahashi1959@hfc.com">takahashi1959@hfc.com</a></td>
</tr>
<tr>
<td>Takahio</td>
<td>Junichi</td>
<td>Bwakogakuen Medical and Welfare Center, Kusatsu</td>
<td><a href="mailto:j.takahio@bwakogakuen.org">j.takahio@bwakogakuen.org</a></td>
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<td>Tann</td>
<td>Beverley</td>
<td>Rehabilitation Institute of Chicago</td>
<td><a href="mailto:btann@ric.org">btann@ric.org</a></td>
</tr>
<tr>
<td>Tarr</td>
<td>Jessica</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:jta@tsc.nsw.org.au">jta@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Taudorf</td>
<td>Karen</td>
<td>Cerebral Palsy Education Centre</td>
<td><a href="mailto:karen.taudorf@dadinet.dk">karen.taudorf@dadinet.dk</a></td>
</tr>
<tr>
<td>Taylor</td>
<td>Emma</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:e.taylor@tsc.nsw.org.au">e.taylor@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Tedroff</td>
<td>Kristina</td>
<td>Neurupediatric Unit Department Women and Child Health Karolinska Institute</td>
<td><a href="mailto:kristina.tedroff@ki.se">kristina.tedroff@ki.se</a></td>
</tr>
<tr>
<td>Thambayah</td>
<td>Malinee</td>
<td>Panati Medical Centre</td>
<td><a href="mailto:dmalinee@pantai.com.my">dmalinee@pantai.com.my</a></td>
</tr>
<tr>
<td>Thomas</td>
<td>Bronwyn</td>
<td>The Children's Hospital at Westmead</td>
<td><a href="mailto:bronwynt@chw.edu.au">bronwynt@chw.edu.au</a></td>
</tr>
<tr>
<td>Thomas</td>
<td>Rachel</td>
<td>Queensland Cerebral Palsy Health Service</td>
<td><a href="mailto:rachel.thomas@health.qld.gov.au">rachel.thomas@health.qld.gov.au</a></td>
</tr>
<tr>
<td>Thomson</td>
<td>Pam</td>
<td>Hugh Williamson Gait Laboratory</td>
<td><a href="mailto:pam.thomson@jch.org.au">pam.thomson@jch.org.au</a></td>
</tr>
<tr>
<td>Thompson</td>
<td>Edwina</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:etompson@tsc.nsw.org.au">etompson@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Thompson</td>
<td>Hayley</td>
<td>Queensland Health - CP Health RCH</td>
<td><a href="mailto:hayley.m.thompson@health.qld.gov.au">hayley.m.thompson@health.qld.gov.au</a></td>
</tr>
<tr>
<td>Thompson</td>
<td>Nicole</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:n.thompson@tsc.nsw.org.au">n.thompson@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Thomson</td>
<td>Jiae</td>
<td>Northcott Disability Services</td>
<td><a href="mailto:jiae.thomson@northcott.com.au">jiae.thomson@northcott.com.au</a></td>
</tr>
<tr>
<td>Thomson</td>
<td>Joanna</td>
<td>The Centre for Cerebral Palsy</td>
<td><a href="mailto:jojotomo@hotmail.com">jojotomo@hotmail.com</a></td>
</tr>
<tr>
<td>Thorne</td>
<td>Deborah</td>
<td>The University of North Carolina at Chapel Hill</td>
<td><a href="mailto:dthorne@med.unc.edu">dthorne@med.unc.edu</a></td>
</tr>
<tr>
<td>Thurlow</td>
<td>Pam</td>
<td>Cerebral Palsy League of Queensland</td>
<td><a href="mailto:jnmusel@cpql.org.au">jnmusel@cpql.org.au</a></td>
</tr>
<tr>
<td>Timmans</td>
<td>Angela</td>
<td>Cerebral Palsy League of Queensland</td>
<td><a href="mailto:atilmann@cpql.org.au">atilmann@cpql.org.au</a></td>
</tr>
<tr>
<td>Trick</td>
<td>Greine</td>
<td>Murdoch Children's Research Institute</td>
<td><a href="mailto:g.reine@med.usyd.edu.au">g.reine@med.usyd.edu.au</a></td>
</tr>
<tr>
<td>Toh</td>
<td>Teck-Hock</td>
<td>Sibu Hospital</td>
<td><a href="mailto:thtoh@ya.hoo.com">thtoh@ya.hoo.com</a></td>
</tr>
<tr>
<td>Tores</td>
<td>Sofia</td>
<td>Centro De Rehabilitacion Infantil Teleton</td>
<td>sofatos@<a href="mailto:92@hotmail.com">92@hotmail.com</a></td>
</tr>
<tr>
<td>Tohill</td>
<td>Jillian</td>
<td>Disability South Australia</td>
<td><a href="mailto:ntandj@bigpond.net.au">ntandj@bigpond.net.au</a></td>
</tr>
<tr>
<td>Trembath</td>
<td>David</td>
<td>The University of Sydney</td>
<td><a href="mailto:dtrebath@usyd.edu.au">dtrebath@usyd.edu.au</a></td>
</tr>
<tr>
<td>Tsgt</td>
<td>Badamseren</td>
<td>CP Center</td>
<td><a href="mailto:badama27@yahoo.com">badama27@yahoo.com</a></td>
</tr>
<tr>
<td>Tulogi</td>
<td>HajiNalla</td>
<td>Disability Enterprises Leura</td>
<td><a href="mailto:haji@westnet.com.au">haji@westnet.com.au</a></td>
</tr>
<tr>
<td>Tumer</td>
<td>Melanie</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:m.tumer@tsc.nsw.org.au">m.tumer@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Udosen</td>
<td>Moses-Augustine</td>
<td>Moscow Communication</td>
<td><a href="mailto:akgandyo@gmail.com">akgandyo@gmail.com</a></td>
</tr>
<tr>
<td>Ungles</td>
<td>Dorothy</td>
<td>Cerebral Palsy League of Queensland</td>
<td><a href="mailto:jnmusel@cpql.org.au">jnmusel@cpql.org.au</a></td>
</tr>
<tr>
<td>Vainionpää</td>
<td>Leena</td>
<td>Oulu University Hospital</td>
<td><a href="mailto:leena.vainionpaa@ppshp.fi">leena.vainionpaa@ppshp.fi</a></td>
</tr>
<tr>
<td>Valentine</td>
<td>Jane</td>
<td>Princess Margaret Hospital</td>
<td><a href="mailto:jane.valentine@health.wa.gov.au">jane.valentine@health.wa.gov.au</a></td>
</tr>
<tr>
<td>Van De Winkel</td>
<td>Ann</td>
<td>Faculty of Kinesiology and Rehabilitation Sciences, IU Leuven</td>
<td><a href="mailto:ann.vandewinkel@fa.ber.kuleuven.be">ann.vandewinkel@fa.ber.kuleuven.be</a></td>
</tr>
<tr>
<td>Van Der Bot</td>
<td>Wilma</td>
<td>Rijndam Rehabilitation Centre</td>
<td><a href="mailto:w.vanderbot@rijndam.nl">w.vanderbot@rijndam.nl</a></td>
</tr>
<tr>
<td>Van Der Wilken</td>
<td>Gelbe</td>
<td>RC Het Roessingh</td>
<td><a href="mailto:g.y.wilkening@nh.nl">g.y.wilkening@nh.nl</a></td>
</tr>
<tr>
<td>Van Drenth</td>
<td>Annette</td>
<td>Mossos Augustin</td>
<td><a href="mailto:nber5765@maulay.edu.au">nber5765@maulay.edu.au</a></td>
</tr>
<tr>
<td>Van Santen</td>
<td>Hilde</td>
<td>Carlson School for Cerebral Palsy</td>
<td><a href="mailto:hildevansanten@stra.co.nz">hildevansanten@stra.co.nz</a></td>
</tr>
<tr>
<td>Van Schie</td>
<td>Petra</td>
<td>VU University Medical Center</td>
<td><a href="mailto:p.m.vanschie@vumc.nl">p.m.vanschie@vumc.nl</a></td>
</tr>
<tr>
<td>Vanessa</td>
<td>Gobsell</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:vanessa.gobsell@adhc.nsw.gov.au">vanessa.gobsell@adhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Vasconcelos Estes</td>
<td>Ana Maria De Oliveira</td>
<td>Grunenthal S.A.</td>
<td><a href="mailto:sofia.martins@grunenthal.com">sofia.martins@grunenthal.com</a></td>
</tr>
<tr>
<td>Veerabangsa</td>
<td>Sudhi</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:sveerabangsa@tsc.nsw.org.au">sveerabangsa@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Velickovic Peat</td>
<td>Milloj</td>
<td>University Medical Centre</td>
<td><a href="mailto:milloj@medisinum.unizslii.slo">milloj@medisinum.unizslii.slo</a></td>
</tr>
<tr>
<td>Vermeulen</td>
<td>R.J. eten</td>
<td>VU Medical Center</td>
<td><a href="mailto:r.j.vermeulen@vumc.nl">r.j.vermeulen@vumc.nl</a></td>
</tr>
<tr>
<td>Verschuren</td>
<td>Olaf</td>
<td>Rehabilitation Centre De Hoogstraat</td>
<td><a href="mailto:o.verschuren@dehoogstraat.nl">o.verschuren@dehoogstraat.nl</a></td>
</tr>
<tr>
<td>Vickers</td>
<td>Deborah</td>
<td>University of New South Wales</td>
<td><a href="mailto:d.vickers@unsw.edu.au">d.vickers@unsw.edu.au</a></td>
</tr>
<tr>
<td>Vickery</td>
<td>Joanne</td>
<td>Bendigo Health</td>
<td><a href="mailto:jvickery@bendigoheath.org.au">jvickery@bendigoheath.org.au</a></td>
</tr>
<tr>
<td>Vik</td>
<td>Torstein</td>
<td>Norwegian University of Science and Technology</td>
<td><a href="mailto:torstein.vik@ntnu.no">torstein.vik@ntnu.no</a></td>
</tr>
<tr>
<td>VVIPAKORN</td>
<td>KITMAN</td>
<td>Khon Kaen University</td>
<td><a href="mailto:ktbv@kku.ac.th">ktbv@kku.ac.th</a></td>
</tr>
<tr>
<td>Vilany</td>
<td>Cheryn</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:cvilany@tsc.nsw.org.au">cvilany@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Vies</td>
<td>Georges</td>
<td>University Hospital Maaidicht</td>
<td><a href="mailto:g.vies@student.unimaas.nl">g.vies@student.unimaas.nl</a></td>
</tr>
<tr>
<td>Vies</td>
<td>Jhan</td>
<td>University Hospital Maaidicht</td>
<td><a href="mailto:jhan.vies@mumc.nl">jhan.vies@mumc.nl</a></td>
</tr>
<tr>
<td>Volmer</td>
<td>Brigitte</td>
<td>Karolinska Institutet</td>
<td><a href="mailto:brigitte.volmer@ki.se">brigitte.volmer@ki.se</a></td>
</tr>
<tr>
<td>Van Heijne</td>
<td>Monica</td>
<td>University Clinic for Rehabilitation Medicine</td>
<td><a href="mailto:monica.vanheijne@dss.nl">monica.vanheijne@dss.nl</a></td>
</tr>
<tr>
<td>Waddell</td>
<td>Brett</td>
<td>Cerebral Palsy Education Centre</td>
<td><a href="mailto:earlysteps@optusnet.com.au">earlysteps@optusnet.com.au</a></td>
</tr>
<tr>
<td>Wake-Dyster</td>
<td>Wendy</td>
<td>Novita Children's Services</td>
<td><a href="mailto:wendy.wake-dyster@novita.org.au">wendy.wake-dyster@novita.org.au</a></td>
</tr>
<tr>
<td>Walker</td>
<td>David</td>
<td>Monash University</td>
<td><a href="mailto:david.walker@med.monash.edu.au">david.walker@med.monash.edu.au</a></td>
</tr>
<tr>
<td>Wallen</td>
<td>Margaret</td>
<td>The Children's Hospital at Westmead</td>
<td><a href="mailto:margarew@chw.edu.au">margarew@chw.edu.au</a></td>
</tr>
<tr>
<td>Wallman</td>
<td>Paul</td>
<td>Princess Margaret Hospital</td>
<td><a href="mailto:paul.wallman@health.wa.gov.au">paul.wallman@health.wa.gov.au</a></td>
</tr>
<tr>
<td>Wang</td>
<td>Upping</td>
<td>Medicine of Jamius University</td>
<td>wangliuping@<a href="mailto:9542000@yahaoho.com.cn">9542000@yahaoho.com.cn</a></td>
</tr>
<tr>
<td>Ward</td>
<td>Anna</td>
<td>The Children's Hospital at Westmead</td>
<td>anna.thewards.id.au</td>
</tr>
<tr>
<td>Watkins</td>
<td>Neil</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:n.watkins@dadhc.nsw.gov.au">n.watkins@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Watson</td>
<td>Linda</td>
<td>Telethon Institute for Child Health Research</td>
<td><a href="mailto:linda@chkuwa.edu.au">linda@chkuwa.edu.au</a></td>
</tr>
<tr>
<td>Watson</td>
<td>Nikki</td>
<td>Waitemata District Health Board</td>
<td><a href="mailto:nikki.watson@waitematadhb.govt.nz">nikki.watson@waitematadhb.govt.nz</a></td>
</tr>
<tr>
<td>Watson</td>
<td>Sue</td>
<td>Northcott Disability Services</td>
<td><a href="mailto:sue.watson@northcott.com.au">sue.watson@northcott.com.au</a></td>
</tr>
<tr>
<td>Last Name</td>
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<tr>
<td>Watterson</td>
<td>Margaret</td>
<td>Department of Education and Early Childhood Development</td>
<td><a href="mailto:memwatt@bigpond.com.au">memwatt@bigpond.com.au</a></td>
</tr>
<tr>
<td>Waugh</td>
<td>Mary-Clare</td>
<td>The Children's Hospital at Westmead</td>
<td><a href="mailto:maryw@chw.edu.au">maryw@chw.edu.au</a></td>
</tr>
<tr>
<td>Way</td>
<td>Robyn</td>
<td>The Spastic Centre New South Wales</td>
<td></td>
</tr>
<tr>
<td>Webb</td>
<td>Leanda</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:leanda.webb@dadhc.nsw.gov.au">leanda.webb@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Weir</td>
<td>Suzanne</td>
<td>Manning and Great Lakes Early Intervention</td>
<td><a href="mailto:suzannew@apt.net.au">suzannew@apt.net.au</a></td>
</tr>
<tr>
<td>Welsh</td>
<td>Patty</td>
<td>Newcastle Temporary Care</td>
<td><a href="mailto:pattystee@hotmail.com">pattystee@hotmail.com</a></td>
</tr>
<tr>
<td>Welsh</td>
<td>Rachel</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:rwelsh@tscnsw.org.au">rwelsh@tscnsw.org.au</a></td>
</tr>
<tr>
<td>Westbon</td>
<td>Lena</td>
<td>Children's Hospital</td>
<td><a href="mailto:lenawestbon@med.us">lenawestbon@med.us</a></td>
</tr>
<tr>
<td>Wharldall</td>
<td>Denice</td>
<td>Leveda Incorporated</td>
<td><a href="mailto:leveda@leveda.org.au">leveda@leveda.org.au</a></td>
</tr>
<tr>
<td>White</td>
<td>Diana</td>
<td>Therapy ACT</td>
<td><a href="mailto:diana.white@act.gov.au">diana.white@act.gov.au</a></td>
</tr>
<tr>
<td>White</td>
<td>Robert</td>
<td>The Spastic Centre New South Wales</td>
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<td>Whitefield</td>
<td>Peter</td>
<td>The Spastic Centre New South Wales</td>
<td></td>
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<tr>
<td>Whiltam</td>
<td>Genevieve</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:gwiltam@tsc.nsw.org.au">gwiltam@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Whittingham</td>
<td>Koa</td>
<td>University of Queensland</td>
<td><a href="mailto:koawhittingham@psy.uq.edu.au">koawhittingham@psy.uq.edu.au</a></td>
</tr>
<tr>
<td>Wiart</td>
<td>Lesley</td>
<td>Alberta Centre for Child, Family and Community Research</td>
<td><a href="mailto:lesley.wiart@ualberta.ca">lesley.wiart@ualberta.ca</a></td>
</tr>
<tr>
<td>Wichers</td>
<td>Marc</td>
<td>Sophia Rehabilitation</td>
<td><a href="mailto:mjwicher@gmail.com">mjwicher@gmail.com</a></td>
</tr>
<tr>
<td>Wilkinson</td>
<td>Fiona</td>
<td>Southern Health</td>
<td>fiona.wilkinson@ southernhealth.org.au</td>
</tr>
<tr>
<td>Williams</td>
<td>Andrea</td>
<td>The Centre for Cerebral Palsy</td>
<td><a href="mailto:helen.wata@cpc.com.au">helen.wata@cpc.com.au</a></td>
</tr>
<tr>
<td>Williams</td>
<td>Brett</td>
<td>Novita Children's Services</td>
<td><a href="mailto:brett.williams@novita.org.au">brett.williams@novita.org.au</a></td>
</tr>
<tr>
<td>Williams</td>
<td>Jacqueline</td>
<td>Murdoch Children's Research Institute</td>
<td><a href="mailto:jacqueline.williams@mcri.edu.au">jacqueline.williams@mcri.edu.au</a></td>
</tr>
<tr>
<td>Williams</td>
<td>Jane</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:jane.williams@dadhc.nsw.gov.au">jane.williams@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Williams</td>
<td>Nadine</td>
<td>Princess Margaret Hospital</td>
<td><a href="mailto:nadine.williams@health.wa.gov.au">nadine.williams@health.wa.gov.au</a></td>
</tr>
<tr>
<td>Williams</td>
<td>Naomi</td>
<td>Barwon Valley School</td>
<td><a href="mailto:williams.naomi@edumail.vic.gov.au">williams.naomi@edumail.vic.gov.au</a></td>
</tr>
<tr>
<td>Williamson</td>
<td>Brian</td>
<td>The Spastic Centre New South Wales</td>
<td></td>
</tr>
<tr>
<td>Williamson</td>
<td>Judy</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:jwilliamson@tsc.nsw.org.au">jwilliamson@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Willis</td>
<td>Elizabeth</td>
<td>Kurnoong Early Intervention Service</td>
<td><a href="mailto:ewills@kurnoongwaratath.org.au">ewills@kurnoongwaratath.org.au</a></td>
</tr>
<tr>
<td>Willmot</td>
<td>Cathy</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:cathylwillmot@dadhc.nsw.gov.au">cathylwillmot@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Willoughby</td>
<td>Kate</td>
<td>Yoolala</td>
<td><a href="mailto:kate.willoughby@yoolala.com.au">kate.willoughby@yoolala.com.au</a></td>
</tr>
<tr>
<td>Wilson</td>
<td>Erin</td>
<td>Scope and Deakin University</td>
<td><a href="mailto:erin.wilson@deakin.edu.au">erin.wilson@deakin.edu.au</a></td>
</tr>
<tr>
<td>Wilson</td>
<td>Françoise</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:fwilson@tsc.nsw.org.au">fwilson@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Wilson</td>
<td>Kylie</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:kyleann.wilson@dadhc.nsw.gov.au">kyleann.wilson@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Wilton</td>
<td>Judith</td>
<td>The Cerebral Palsy Centre Western Australia</td>
<td><a href="mailto:judithwilson@yahoo.com.au">judithwilson@yahoo.com.au</a></td>
</tr>
<tr>
<td>Woolin</td>
<td>Leslie</td>
<td>Sydney Children's Hospital</td>
<td><a href="mailto:leslewolfin@sesiahs.health.nsw.gov.au">leslewolfin@sesiahs.health.nsw.gov.au</a></td>
</tr>
<tr>
<td>Wolski</td>
<td>Robyn</td>
<td>North Sydney Central Coast area Health Service</td>
<td><a href="mailto:riven13@tpg.com.au">riven13@tpg.com.au</a></td>
</tr>
<tr>
<td>Wong</td>
<td>Peter</td>
<td>Royal Children's Hospital Melbourne</td>
<td><a href="mailto:peterwong@optusnet.com.au">peterwong@optusnet.com.au</a></td>
</tr>
<tr>
<td>Wong</td>
<td>Queeny</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:qwong@tsc.nsw.org.au">qwong@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Wong</td>
<td>Tez Yuen Janice</td>
<td>KK Women's and Children's Hospital</td>
<td>janicewong.bykkh.com.sg</td>
</tr>
<tr>
<td>Woodford</td>
<td>Deb</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:dwoodford@tsc.org.au">dwoodford@tsc.org.au</a></td>
</tr>
<tr>
<td>Woods</td>
<td>Mary</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:marywoods@dadhc.nsw.gov.au">marywoods@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Woods</td>
<td>Robert</td>
<td>The Spastic Centre New South Wales</td>
<td></td>
</tr>
<tr>
<td>Woollton</td>
<td>Elizabeth</td>
<td>Child Development Centre</td>
<td><a href="mailto:lizwoollton@dtas.co.nz">lizwoollton@dtas.co.nz</a></td>
</tr>
<tr>
<td>Woottton</td>
<td>Rachel</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:nwootton@tsc.nsw.org.au">nwootton@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Wome</td>
<td>Brendan</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:brendan.wome@dadhc.nsw.gov.au">brendan.wome@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Wonad</td>
<td>Anne</td>
<td>Orange and District Early Education Program</td>
<td><a href="mailto:odeep@nswet.net.au">odeep@nswet.net.au</a></td>
</tr>
<tr>
<td>Wornell</td>
<td>Liz</td>
<td>Specialist Children's Services</td>
<td><a href="mailto:elizabeth.wornell@dadhc.nsw.gov.au">elizabeth.wornell@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Wright</td>
<td>Brion</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:twright@tsc.nsw.org.au">twright@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Wright</td>
<td>Virginia</td>
<td>Brookview Research Institute</td>
<td><a href="mailto:wwright@brookview.ca">wwright@brookview.ca</a></td>
</tr>
<tr>
<td>Wu</td>
<td>Albin</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:awu@tsc.nsw.org.au">awu@tsc.nsw.org.au</a></td>
</tr>
<tr>
<td>Wu</td>
<td>Shun Ping</td>
<td>Queen Elizabeth Hospital</td>
<td><a href="mailto:wusp@sha.org.hk">wusp@sha.org.hk</a></td>
</tr>
<tr>
<td>Wynter</td>
<td>Meredith</td>
<td>Cerebral Palsy Health Service</td>
<td><a href="mailto:meredith.wynter@health.qld.gov.au">meredith.wynter@health.qld.gov.au</a></td>
</tr>
<tr>
<td>Yates</td>
<td>Matthew</td>
<td>Cerebral Palsy Education Centre</td>
<td><a href="mailto:mattyates@hotmail.com">mattyates@hotmail.com</a></td>
</tr>
<tr>
<td>Yeo</td>
<td>Laura</td>
<td>The Rehab Practice</td>
<td><a href="mailto:yoeotp@signet.com.sg">yoeotp@signet.com.sg</a></td>
</tr>
<tr>
<td>Yeo</td>
<td>Peng Ha</td>
<td>Women's and Children's Hospital</td>
<td><a href="mailto:penghaye@yahoo.com.au">penghaye@yahoo.com.au</a></td>
</tr>
<tr>
<td>Young</td>
<td>Judith</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:judith.young@dadhc.nsw.gov.au">judith.young@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Xu</td>
<td>Xavier</td>
<td>Royal Children's Hospital</td>
<td><a href="mailto:xavier_yu@hotmail.com">xavier_yu@hotmail.com</a></td>
</tr>
<tr>
<td>Zdros</td>
<td>Briony</td>
<td>The Spastic Centre New South Wales</td>
<td><a href="mailto:zdrobrony@tsc.org.au">zdrobrony@tsc.org.au</a></td>
</tr>
<tr>
<td>Zarrmit</td>
<td>Hayley</td>
<td>Department of Ageing Disability and Home Care</td>
<td><a href="mailto:hayley.zarrmit@dadhc.nsw.gov.au">hayley.zarrmit@dadhc.nsw.gov.au</a></td>
</tr>
<tr>
<td>Zrinkalam</td>
<td>Rosa</td>
<td>Adelaide Women's and Children's Hospital</td>
<td><a href="mailto:roza.zrinkalam@cchw.sa.gov.au">roza.zrinkalam@cchw.sa.gov.au</a></td>
</tr>
<tr>
<td>Zvny</td>
<td>Boris</td>
<td>International Cerebral Palsy Clinic</td>
<td><a href="mailto:zvny@meurocentrum.cz">zvny@meurocentrum.cz</a></td>
</tr>
</tbody>
</table>

We are delighted to welcome 113 consumers from NSW who are recipients of the Department of Families, Housing, Community Services and Indigenous Affairs (FaHCSIA) grant to support attendance. We respect their privacy and confidentiality and have not publicised their personal details.
BOTOX® (botulinum toxin type A) purified neurotoxin complex is a prescription medicine containing 100 units (U) of botulinum toxin type A for injection.

**Indications:** Strabismus; blepharospasm associated with dystonia, including benign blepharospasm & VIIth nerve disorders (hemifacial spasm) in patients 12 years & over; cervical dystonia (spasmotic torticollis); *focal* spasticity of the upper & lower limbs, including dynamic equinus foot deformity due to spasticity in juvenile cerebral palsy patients 2 years & older; severe primary hyperhidrosis of the axillae; focal spasticity in adults; spasmodic dysphonia; upper facial rhytides (glabellar lines, crow's feet and forehead lines) in adults. **Contraindications:** Hypersensitivity to ingredients; myasthenia gravis or Eaton Lambert Syndrome; infection at injection site(s). **Precautions:** Use with aminoglycosides or drugs that interfere with neuromuscular transmission; peripheral motor neuropathic diseases or neuromuscular junctional disorders; inflammation at injection sites; excessive weakness in target muscle; pregnancy and lactation. Generalised weakness & myalgia may be related to systemic absorption. Different botulinum preparations are not therapeutically equivalent. Exercise extreme caution should substitution with another botulinum preparation be necessary. Blepharospasm: Reduced blinking following injection of the orbicularis muscle can lead to corneal pathology. Caution with patients at risk of angle closure glaucoma, including anatomically narrow angles. Strabismus: Inducing paralysis in extracocular muscles may produce spatial disorientation, double vision or past pointing. Use in chronic paralytic strabismus only in conjunction with surgical repair to reduce antagonist contracture. Spasticity: Not likely to be effective at a joint affected by a known fixed contracture. Cervical Dystonia (spasmotic torticollis): Possibility of dysphagia or dysphonia. May be decreased by limiting dose injected into the sternocleidomastoid muscle to <100U. Primary Hyperhidrosis of the Axillae: Consider causes of secondary hyperhidrosis to avoid symptomatic treatment. Spasmodic Dysphonia: Laryngoscopy in diagnostic evaluation is mandatory. Avoid treatment in patients due to have elective surgery requiring general anaesthesia. Paediatric Use: Safety & effectiveness below 12 years not established for blepharospasm, hemifacial spasm, cervical dystonia, hyperhidrosis, spasmodic dysphonia or upper facial rhytides. *Safety & effectiveness below 2 years not established for focal spasticity. Caution should be exercised when treating patients with significant disability & co-morbidities.**

**Adverse Reactions:** Usually transient & occur within first week of injection. ≥1% Localised pain, tenderness, bruising, infection, local & general weakness, erythema, oedema, ptosis, irritation/tearing, diplopia, headaches, 

**Dose/Administration:**
- Strabismus; blepharospasm & VIIth nerve disorders: 1.25U to 2.5U injected into the procerus muscle for 20U total dose. Crow's Feet: 2-6U/injection site, 3 sites bilaterally in lateral orbicularis oculi. Forehead Lines: 2-6U/injection site, 4 sites bilaterally.
- Dystonia (spasmodic torticollis): Dosing as for unilateral blepharospasm. Inject other facial muscles as needed. *Focal Spasticity in Children 2 Years & Older: 0.5-2.0U/kg body weight for upper limb & 2.0-4.0U/kg body weight for lower limb. 4U/kg or 200U (the lesser amount) for equinus foot deformity. Other muscles range 3.0-8.0U/kg body weight & do not exceed 300U divided among muscles at any treatment session. Spasmodic Dysphonia: Bilateral injections. Individualise dosing. Glabellar Lines: 2-4U in each corrugator muscle & 4U in the procerus muscle for 20U total dose. Crow's Feet: 2-6U/injection site, 3 sites bilaterally in lateral orbicularis oculi. Forehead Lines: 2-6U/injection site, 4 sites bilaterally.

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