

# Reducing sedentary behaviour and increasing physical activity among 10-year-old children: overview and process evaluation of the 'Switch-Play' intervention

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## SUMMARY

Overweight and obesity has doubled among children in Australia. There is an urgent need to develop primary prevention strategies to prevent current and future unhealthy weight gain. The aims of this paper are to describe a randomized controlled trial ('Switch-Play') developed to prevent unhealthy weight gain among 10-year-old children and to report the findings of the process evaluation. Children from three government primary schools were randomized by class to one of four conditions: a behavioural modification group (BM;  $n = 69$ ); a fundamental motor skills group (FMS;  $n = 73$ ); a combined BM and FMS group ( $n = 90$ ); or a control (usual classroom lessons) group ( $n = 61$ ). Children in the BM group participated in 19 sessions that encouraged them to reduce screen-based behaviours, and identified physical activity alternatives. The FMS group participated in 19 lessons that focused on mastery of six skills: run, throw, dodge, strike, vertical jump and kick. The combined group

participated in all the BM and FMS activities. The intervention specialist teacher reported that the children showed high enjoyment and engagement (88% lessons attended) in most aspects of the programme. At-home tasks were completed by 57–62% of the children, and 92% completed the in-class tasks. Two-thirds of the children in the BM group participated in the behavioural contracting to switch off the TV. Most of the children reported high enjoyment of the programmes, and only a small proportion (7–17%) reported difficulties in switching off their nominated TV shows. More than half the children reported reducing their TV viewing; however, less than half reported increasing their physical activity. It was found that most aspects of the intervention arms of the programme were successfully delivered to the majority of children participating in 'Switch-Play'; that the programmes were delivered as intended; and that the programmes were favourably evaluated by participating children and their parents.

**Key words:** fundamental motor skills; randomized controlled trial; weight maintenance

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## INTRODUCTION

Obesity in childhood is an independent risk factor for adult obesity and its associated health problems (Dietz, 1986; Must, 1996). In Australia, one in five children and adolescents are overweight or obese (Magarey *et al.*, 2001). Of even more concern is that data from the past 35 years indicate that not only is the prevalence

of obesity increasing, but that the incidence is accelerating (Booth *et al.*, 2003). Other developed countries including the United States (Freedman *et al.*, 1997) and the United Kingdom (National Audit Office, 2001) have identified similar increases in overweight and obesity among children.

While there is little disputing that obesity poses a major adult population health problem, there is less agreement as to whether the epidemic that has developed over the past few decades is a consequence of increased energy intakes and/or decreased energy expenditure (Jeffery, 2001). What is clear, however, is that there are now increased opportunities for children to be sedentary in their leisure time through greater access to 'pay' television (TV), electronic games, computers and the Internet (ACNielsen Company, 2001; ACNielsen Media International, 2001). Australian children spend considerable time playing electronic games and using the computer, and those aged 5–12 years watch an average of 2.5 h of TV per day [Australian Bureau of Statistics (ABS), 2001]. This is of concern since TV viewing has been shown to be independently positively associated with overweight and obesity, both cross-sectionally and longitudinally, among children [e.g. (Andersen *et al.*, 1998; Armstrong *et al.*, 1998)] and among adults (Ching *et al.*, 1996; Jeffery and French, 1998). Even among adults who are highly physically active, there is evidence that TV viewing is associated with an elevated risk of obesity (Salmon *et al.*, 2000; Cameron *et al.*, 2003).

While there is evidence of a positive relationship between sedentary habits and obesity among children, a recent Cochrane systematic review identified only two well designed intervention studies that have examined the effectiveness of strategies aimed at reducing sedentary behaviour and preventing obesity among children (Campbell *et al.*, 2001). Both interventions were randomized controlled trials (RCTs) conducted in the US. One focused on children in grades 6–8 (Gortmaker *et al.*, 1999); the other targeted younger children in grades 3–4 (Robinson, 1999). Both studies used school curriculum-based interventions and included behaviour change strategies such as self-monitoring and budgeting of TV use. While both of these studies were effective in reducing unhealthy weight gain and in bringing about reductions in TV viewing in the short-term, no follow-up data have been published on the longer-term effects of the interventions.

Furthermore, neither intervention was able to demonstrate an increase in physical activity. This may have been attributable to limitations in the measurement of physical activity since both studies relied on self-report rather than objective measures of physical activity. The lack of effect on physical activity may also have been due to the fact that neither of these interventions targeted

improvements in the skills necessary to participate in physical activity. Mastery of fundamental motor skills (FMS) has been found to be associated with participation in organized physical activity (Okely *et al.*, 2001), and improving children's FMS has been shown to increase physical activity enjoyment (Okely and Booth, 2000). There is also consistent evidence that enjoyment is associated with participation in activity among children (Sallis *et al.*, 2000) and among adults (Salmon *et al.*, 2003). Improving children's skills in and enjoyment of physical activity will provide them with alternatives to sedentary behaviours, such as TV viewing, playing electronic games and computer use. Mastery of FMS may also be important for physical activity participation across the lifespan.

The present study was designed to investigate the effectiveness of a school-based intervention in maintaining healthy weight among 10-year-old children through reducing the time spent in sedentary behaviours and increasing skills in, enjoyment of and participation in physical activity. The primary goal of the intervention ('Switch-Play') was to develop and test three approaches towards the achievement of healthy weight maintenance among 10-year-old children: (1) through reducing the time spent in sedentary behaviours (e.g. TV viewing, playing electronic games and recreational computer use); (2) through increasing skills and enjoyment of physical activity; or (3) through a combination of these two strategies (these three approaches are being compared with a control condition). Process evaluation, i.e. assessment of programme delivery and participant engagement (intervention dose and quality), and how the intervention was received by participants (subjective evaluation) is important to consider when evaluating whether the intervention achieved its goals. Therefore, the purpose of this paper is to describe the theoretical background and study methods used in the 'Switch-Play' intervention, and to present the findings of the process evaluation of the intervention.

## METHODS

### Procedures and subjects

'Switch-Play' is a cluster-randomized trial using a  $2 \times 2$  factorial design that targets 10-year-old children. Assessment was conducted at baseline (March 2002) and immediately post-intervention

(December 2002). To assess longer-term effects of the programme, follow-up data collection was completed at 6 and 12 months post-intervention (July and December 2003, respectively). A total of 397 children (51% boys; mean age  $10.1 \pm 0.4$  years) enrolled in grade 5 at three government primary schools across four campuses in low socio-economic status suburbs in metropolitan Melbourne, Australia, were recruited to the study.

All schools consented to the intervention components being incorporated into the school curriculum; therefore, all children who were in an intervention class received the programme. Ethics approval was granted by the Education Department of Victoria and the Deakin University Human Research Ethics Committee. It is an ethics requirement in Australia to gain active parental consent to assess each child, and signed consent was sought for each of the assessment components. Seventy-six per cent of parents consented to their child wearing an accelerometer for one week; 77% of parents consented to their child performing a series of FMS tests; 77% of parents consented to their child completing a survey. A total of 74% of children ( $n = 293$ ) had parental consent to complete all assessment components. Parents were also asked to complete a questionnaire, and 44% of parents ( $n = 176$ ) consented.

Each grade 5 class within each school was randomly allocated to one of four conditions: a behavioural modification condition (BM;  $n = 69$ ); an FMS condition ( $n = 73$ ); a combined BM/FMS ( $n = 90$ ) condition; or a control/ comparison condition (C;  $n = 61$ ). The BM and BM/FMS programmes focused on reducing the time spent in sedentary behaviours, and also focused on physical activity alternatives students could undertake in a variety of settings. The focus for children in the FMS and BM/FMS conditions was mastery of six FMS that are important for a broad range of lifestyle and organized physical activities. Children in the C condition participated in the usual school curriculum. All intervention components were delivered by one intervention specialist (a qualified Physical Education teacher) across all three schools.

#### **Theoretical background for the 'Switch-Play' interventions**

Increasing evidence suggests that theoretically informed behaviour change interventions are

more effective than atheoretical approaches (Crawford and Ball, 2002; Sorenson and Steckler, 2002). The more widely espoused theories of behaviour change posit that behaviour is shaped by the interaction of individual factors with the broader social and environmental contexts [e.g. (Sallis and Owen, 1999)]. The 'Switch-Play' intervention was based on three of these key theoretical approaches, namely social cognitive theory (Bandura, 1986), behavioural choice theory (Rachlin, 1989; Epstein, 1998) and ecological theory (Sallis and Owen, 1999). These approaches share the tenet that physical activity behaviour change may be mediated or moderated by a number of individual, social and environmental level factors, including self-efficacy; social influences, which includes parental influences/modelling, parental support, the family environment and rules; and the local community environment. These variables were considered in the development of intervention strategies and the evaluation of the intervention programme.

A number of successful intervention strategies for behaviour change have been recommended (e.g. Ory *et al.*, 2002). In the present study, the following strategies were used: education and awareness-raising (physical activity and health; own physical activity and own environment; importance of environment for health behaviours); self-monitoring (time spent in TV viewing and physical activity, pedometer use); decision-making and behavioural choices (e.g. intelligent viewing; active alternatives); role playing; goal setting and behavioural contracts (TV switch-off); social support (team-based activities at school; information for parents; support from parents to switch off the TV); and feedback and reinforcement (external and intrinsic rewards).

#### **Description of the intervention**

Components of the intervention programme were developed by the study team, while others were adapted from previous interventions; SPARK (Faucette *et al.*, 1995; Hovell *et al.*, 1999), from concepts outlined in Robinson's study (Robinson, 1999), from Planet Health (Gortmaker *et al.*, 1999) and from the Victorian Fundamental Motor Skills programme [Department of Education Victoria (DOE), 1998]. Table 1 outlines the content of the intervention conditions, with more details provided below.

**Table 1:** Lesson content for the BM and FMS conditions

Lesson	BM	FMS
1	Introduction to 'Switch-Play'	Run and throw
2	Patterns of sedentary behaviour (SB) <sup>a</sup>	Throw and dodge
3	Self-monitoring SB	Run and strike
4	Physical activity and health	Vertical jump and throw
5	Patterns of physical activity behaviour	Dodge and kick
6	The home environment	Run and strike
7	The community environment	Throw and dodge
8	Decision-making	Kick and vertical jump
9	Identifying alternative activities	Dodge and throw
10	Increasing physical activity	Throw and kick
11	Intelligent viewing and decreasing SB <sup>b</sup>	Throw and strike
12	Intelligent viewing <sup>c</sup> and TV advertising	Throw and vertical jump
13	Advocacy of decreased SB—role plays <sup>d</sup>	Run and kick
14	Perform advocacy plays <sup>e</sup>	Dodge and strike
15	Advocacy of decreased SB—posters	Vertical jump and strike
16	Complete advocacy posters	Throw and run
17	Increasing physical activity—pedometers	Kick and dodge
18	'Switch-Play' games	Vertical jump, run and kick
19	Present posters to younger grades	Dodge, run, strike and kick

<sup>a</sup>Sedentary behaviour comprises TV viewing, computer use, electronic game use.

<sup>b,c,d,e</sup>'Switch-Off challenge' from one TV programme in lesson 11 to four programmes in lesson 14.

### BM condition

The BM condition aimed to reduce the time spent on TV viewing by 20% (e.g. from 2.5 to 2 hours/day). The BM intervention comprised 19 sessions of 40–50 min duration taught across three school terms by the intervention specialist teacher. The aim of lessons 1, 2 and 4 was to increase children's awareness of time-use, including time spent watching TV, playing electronic games, using the computer and being physically active. Health benefits of physical activity were also covered. Lessons 3 and 5 involved the children self-monitoring the time they spent in sedentary behaviours (TV viewing, electronic games and computer use) and physical activity, respectively.

Lessons 6 and 7 raised children's awareness of the home and community environments in relation to their sedentary and physical activity choices and opportunities, through map drawing and photographic techniques (Orellana, 1999; Morrow, 2001; Hume *et al.*, in press). Lesson 8 involved teaching the children decision-making skills, such as weighing up the positives and negatives of choosing between being active or sedentary in a variety of different scenarios. In lessons 9 and 10, the children developed their own physical activities and games in which they could participate as an alternative to being sedentary.

Lesson 11 involved teaching children about 'intelligent viewing', where the child selects the TV programmes that he/she wants to watch and limits viewing to those programmes. This is to encourage children to engage in selective, rather than 'vegetative' viewing or channel surfing. Children were given their first 'Switch-off Challenge' that involved completing and signing a contract pledging to switch off one TV programme per week over the next 4 weeks. Children were to return the contract signed by parents each week. An intermittent reinforcement schedule was employed with children receiving a small reward (e.g. a ball, a Frisbee, a drink bottle) for the return of each of the first four contracts, and thereafter an intermittent reward for continuing to maintain the switch-off, thus, developing behavioural persistence by shifting the child's reliance from external to intrinsic rewards from participating in the programme (Martin and Pear, 1996).

In lesson 12, the focus was on increasing children's awareness of the purpose of advertisements on TV. Lessons 13 to 16 focused on advocacy, with children writing their own scripts, performing plays and designing posters about choices to be active or sedentary based on real-life situations (e.g. what happens when they get home from school). Lesson 17 reinforced the children's awareness of their physical activity through the use of pedometers. Each child wore

a pedometer for the whole lesson and walked to various destinations in the school grounds (e.g. from their classroom to the Principal's office). In lesson 18, children participated in the 'Switch-Play Games' with all the other BM classes in the school. The children participated in physical activities that they could easily perform at home on their own, or with friends or siblings using inexpensive equipment (\$5 or less) or recycled items (e.g. milk containers, old socks or sheets). At the end of the Games, all children received a participation medal and certificate. Finally, in lesson 19, the children presented their advocacy posters to children in the younger grades.

### **FMS condition**

The FMS intervention (DOE, 1998) comprised 19 sessions of 40–50 min duration taught across three school terms by the same intervention specialist teacher that delivered the BM intervention. The FMS intervention focused on six skills, including three object control skills (overhand throw, kick and strike) and three locomotor skills (run, dodge and vertical jump). The locomotor skills were selected based on evidence that children who are overweight or obese are less likely to demonstrate mastery of these skills compared with non-overweight children (Okely *et al.*, 2002). The skills were taught with an emphasis on fun through games and maximum involvement for all the children. Most lessons focused on at least two skills, and each skill was a focus lesson in at least six or more sessions.

## **EVALUATION**

### **Intervention outcomes**

As the intervention outcomes are not presented in this paper, only a brief overview will be provided here. The primary outcome measure to be evaluated is change in body mass index (BMI; kg/m<sup>2</sup>). BMI will be expressed as both a raw value and a standard deviation (SD) score based upon age- and sex-related BMI reference values (Cole *et al.*, 2000). Secondary outcomes of interest include sedentary behaviours, physical activity, FMS and enjoyment of physical activity. Sedentary behaviours to be assessed include time spent watching TV, playing electronic games (i.e. computer, video and handheld), and in recreational computer use per week. To monitor substitution of these activities with other

sedentary pursuits as a consequence of the intervention, behaviors such as doing homework, reading, listening to music, doing arts and crafts, playing a musical instrument and playing quiet games indoors, will also be assessed.

Physical activity will be assessed by a combination of objective assessment (accelerometer) and self-report (Telford *et al.*, 2004). Accelerometers are small matchbox sized devices that are worn on a belt around the waist. They can measure physical movement for up to 3 weeks, with motion outside of 'normal' human range being filtered electronically. The self-report instrument will provide important behavioural information about children's physical activity using a behavioural checklist of 30 activities (e.g. child plays basketball, tennis, walks or cycles to school). Children will self-report their enjoyment of each of these physical activities (Okely and Booth, 2000) and also of the sedentary behaviours being assessed.

Six FMS were selected to be the focus of the FMS component of the intervention: overhand throw, kick, strike, run, dodge and vertical jump. Up to eight components in each FMS will be assessed by comparing each child's videotaped performance with a checklist of skill components specific to each skill that has been modified from several existing FMS assessment tools (Booth *et al.*, 1997; Department of Education, 1998; Ulrich, 2000).

### **Mediating, moderating and confounding variables**

It is important to consider the effects of mediating, moderating and confounding variables on the cause-effect link between the intervention and change in behaviour or health outcome (Baranowski *et al.*, in press). A mediating or intervening variable lies on the pathway between intervention programme and desired outcome. To give an example, an intervention might result in increased social support, which in turn might lead to increased physical activity. Potential mediating variables, such as 'beliefs', 'self-efficacy' and 'social support' were identified from the literature (Sallis *et al.*, 2000) and will be included in the baseline and post-intervention measurement phases of the study.

An intervention might also vary in its effectiveness if there are factors that moderate the behaviour change. For example, environments conducive to physical activity, such as having lots of sports equipment at home, may moderate the

effect of the intervention, so that those with a supportive environment may have more success with the intervention compared with those with a non-supportive environment. Factors in the home environment conducive to physical activity and sedentary behaviour were identified from the literature (Sallis *et al.*, 2000) and will be included in baseline and post-intervention assessment phases. Finally, potential confounders that may be associated with the healthy weight maintenance, such as diet, will also be assessed.

### Process evaluation

Process evaluation included documentation of the intervention delivery quantity (how many children participated in the various lessons), quality (that the intervention was delivered as it was intended) and intervention evaluation by the children and by the intervention specialist teacher (subjective evaluations of the intervention components that may be useful in predicting outcomes). In each lesson, the intervention specialist teacher delivering the lessons monitored the amount of material or content to be covered and also evaluated each lesson with each class for appropriateness of the material, children's enjoyment of the lesson, and children's active participation in the lesson.

At the end of the intervention, children in the three intervention groups completed a survey that asked them to describe what they knew about 'Switch-Play', how they felt about it and why, what they enjoyed the most and the least, and for those in the BM or BM/FMS groups only, whether they were able to switch off their nominated TV programmes successfully. Parents with children in the intervention groups also completed a post-intervention survey that asked about their awareness of the programme and their participation in the switch-off component of the intervention. To determine the possibility of contamination between the intervention classes and the controls, awareness and understanding of the intervention among parents and children in the control groups was also assessed.

## RESULTS

### Intervention quantity

For the BM and FMS lessons there was an average attendance of 88% among the children.

For the activities where children had to complete a task at home (i.e. the physical activity and sedentary behaviour self-monitoring sheets) the children completed 57 and 62% of the sheets, respectively. However, 92% of tasks undertaken in class were completed. Out of the 838 'Switch-Off' contracts developed for children in the BM or BM/FMS conditions to complete over the 4-week period, 588 were returned signed by a parent (70% participation rate). There was not a substantial decline in the percentage of contracts being returned from week one (75%) to week four (69%).

### Intervention evaluation

*Intervention specialist teacher.* The intervention specialist teacher rated each lesson (scale 1–5) according to whether it was appropriate to the students' level of understanding and ability; the teacher's perception of the students' enjoyment of the lesson; and whether in the FMS lessons, the students' opportunities for physical activity were maximized. Most of the lessons were rated highly for appropriateness (BM mean rating  $4.5 \pm 0.7$ ; FMS mean rating  $4.3 \pm 0.5$ ). The intervention specialist teacher's perception of the children's enjoyment of the FMS lessons was rated  $4.5 \pm 0.5$  and  $4.4 \pm 0.6$  for the BM lessons. The FMS lessons were given an average rating of  $4.0 \pm 0.5$  by the intervention specialist teacher for maximizing the students' 'opportunity to be physically active in the lesson'.

*Parents' awareness and evaluation of 'Switch-Play'.* Between 70 and 80% of parents whose children participated in the intervention indicated that they had heard of 'Switch-Play', compared with 44% of parents with children in the control group ( $p = 0.028$ ). When asked to report qualitatively what they thought the intervention was about, most parents reported that it was about children's physical activity and wearing the accelerometers. Almost 80% of parents who had a child in the intervention reported that their child had spoken about 'Switch-Play' at home. When these parents were asked what they knew about 'Switch-Play', 17% of parents thought that it was about increasing children's physical activity, 27% thought it had something to do with physical activity or fitness, just eight parents (<1%) thought it was about watching less TV, and the remainder of the parents gave varying responses, but were not clear on the programme's content.

More than three-quarters (78%) of parents whose child was either in the BM or BM/FMS groups felt that their child enjoyed the BM programme, and just four parents reported that their child did not enjoy it. When asked whether they had noticed a change in their child's TV viewing, 45% indicated they had noticed a change, 49% indicated no change and the remainder were unsure. Thirty-four per cent of parents reported that their child now watches less TV, and 16% of parents thought that their child is now more active. More than half (51%) reported that their child was 'enthusiastic' or 'very enthusiastic' about participating in the programme and 88% of parents recalled receiving the 'Switch-Off' contract to sign, with 62% of parents reporting that they discussed the contract with their child and 17% reporting that

they did not (the remainder were not sure or could not recall having done so).

Almost half the parents (49%) of children in the BM/FMS or FMS groups reported that their child talked about the FMS programme at home, and a similar proportion reported that their child enjoyed the lessons (47%). Between 34 and 51% of parents reported noticing some improvement in their child's FMS. It is important to note here that only 44% of parents completed a questionnaire, so the proportions presented here represent less than half of the parents.

*Children's awareness and evaluation of 'Switch-Play'.* Table 2 presents the children's self-reported evaluation scores of the BM component of the 'Switch-Play' intervention. Most of the children reported high enjoyment of the BM lessons, with only a small proportion (<18%) reporting

**Table 2:** Self-reported evaluation scores of the BM component of the 'Switch-Play' intervention for boys and girls

	Boys		Girls	
	BM (n = 30)	BM/FMS (n = 45)	BM (n = 31)	BM/FMS (n = 39)
Enjoyment <sup>a</sup>	(%)	(%)	(%)	(%)
Overall	78	84	81	92
Self-monitoring	43	58	48	68
Physical activity and health	60	60	58	67
Mind maps	60	71	55	74
Decision-making	52	73	61	61
'Switch-Play' activities <sup>b</sup>	62	80	77	86
Switch-off	52	69	77	74
Ads	59	76	63	78
Play acting	72	73	68	80
Poster	57	78	77	85
Games	86	82	87	100
Changed TV viewing (Yes)	55	82	68	85
How difficult was:				
Switch-off (hard/very hard)	17	16	7	10
Doing something else (hard/very hard)	10	14	10	8
Who helped you switch off?				
No one	11	18	9	15
Mother	6	10	9	10
Father	5	6	4	9
Brother/sister	3	6	4	5
Grandparent/s	1	2	1	1
Someone else	4	4	3	5
What did you do instead?				
Played outside	37	63	43	66
Played indoors	26	7	17	5
Homework	11	12	10	16
Did 'Switch-Play' change your computer use? (Yes)	38	50	45	50
Did 'Switch-Play' change your electronic games use? (Yes)	47	81	55	78

<sup>a</sup>Really enjoy/enjoy.

<sup>b</sup>Developed by the children themselves.

difficulties in switching off the TV and finding something else to do. Playing outside was the most common activity that was reported by children when they switched off. Approximately half the children reported reducing the time they spent on computer use. Interestingly, the proportion of children who reported spending less time playing electronic games varied between BM and BM/FMS groups, with almost double the children in the latter group reporting spending less time on electronic games (78–81%) compared with those in the BM only group (47–55%). Overall, 72% of children in the BM and BM/FMS groups thought that the 'Switch-Play' lessons made a difference to how much TV they watched.

Children's self-reported evaluation scores of the FMS component of the 'Switch-Play' intervention are shown in Table 3. A high proportion of children reported enjoying the FMS intervention programme. The most commonly reported perception by the FMS only group (30% of boys and girls) was that it increased their interest in physical activity, and 29% of boys and 25% of girls in the BM/FMS group reported that it increased their physical activity levels and fitness/energy levels. When asked which components of the FMS lessons they enjoyed the most, 92% of boys and 70% of girls in the FMS-only group reported that they enjoyed the games and sports, and 76% of boys and 92% of girls in the combined BM/FMS groups reported enjoying the specific and varied physical activities. Overall, 42% of children in the BM and BM/FMS groups thought that the 'Switch-Play' lessons made a difference to their physical activity.

## DISCUSSION

The implementation of well designed RCTs to test the effectiveness of obesity prevention strategies among children has been identified as an urgent priority by the International Obesity Taskforce [World Health Organisation (WHO), 1998]. The 'Switch-Play' project was designed to test three approaches that might contribute towards the achievement of healthy weight maintenance among 10-year-old children. This is the first study of its type in Australia; it overcomes limitations of two previous RCTs by incorporating a focus on increasing mastery of FMS, and enjoyment and participation in physical activity as well as reducing time spent in sedentary behaviours. Other unique aspects of the study include the use of objective as well as self-report measures of physical activity and sedentary behaviour, and assessment of the long-term effects of the intervention (6- and 12-month follow-ups).

The process evaluation found: that the majority of the intervention was successfully delivered to most of the children participating in the RCT (intervention dose); that the programmes were delivered as intended (intervention quality); and that the programmes were favourably evaluated by participating children and their parents (subjective evaluations). A limitation of these findings is, however, that less than half the parents responded to the survey. Further, of those who did respond, most parents thought the intervention was about increasing physical activity and <1% of parents ( $n = 8$ ) reported

**Table 3:** Self-reported evaluation scores of the FMS component of the 'Switch-Play' intervention for boys and girls

Enjoyment <sup>a</sup> (%)	Boys		Girls	
	FMS ( $n = 37$ )	BM/FMS ( $n = 45$ )	FMS ( $n = 38$ )	BM/FMS ( $n = 39$ )
Overall	76	84	79	93
Warm-up activities	73	89	82	87
Kicking activities	81	98	84	92
Running activities	78	91	82	85
Dodging activities	81	89	76	90
Throwing activities	76	96	79	85
Jumping activities	62	78	76	82
Striking activities	73	93	74	80
Playing games	81	98	92	90
Make a difference to physical activity? (Yes)	41	41	47	40

<sup>a</sup>Really enjoy/enjoy.



that the intervention was about reducing TV viewing. Nevertheless, 88% of parents who responded to the survey recalled signing their child's TV 'Switch-Off' contract during the intervention programme.

The ultimate goal of the project is to make a contribution to public health approaches through the integration of the programme into primary school curricula. While the development of an effective programme is critical, the programme elements should also be practical and feasible in terms of delivery and cost. Although we have not provided a cost estimate of the intervention programme in this paper, the programme was designed to be incorporated into the school curriculum and does not require expensive equipment to implement. There are many real-world challenges in delivering a physical activity programme for healthy weight maintenance among children. For example, support from the schools, teachers and parents are all critical. In the attempt to control as many external factors as possible (e.g. in this study, one intervention specialist teacher delivered the whole programme across the four school campuses), the effectiveness or feasibility of the intervention in the 'real world' has not been tested. It was considered critical in the first instance to determine the *efficacy* or impact of the intervention programme in changing children's physical activity and sedentary behaviours and maintaining healthy weight, when delivered under 'ideal conditions'.

Escalating rates of childhood obesity worldwide have provided a stimulus for the development of high quality and well evaluated school-based research programmes [e.g. (Gortmaker *et al.*, 1999; Robinson, 1999; Sahota *et al.*, 2001; Manios *et al.*, 2002)]. In addition to school-based approaches, recent interventions to increase physical activity among children and youth have incorporated community-based strategies (Pate *et al.*, 2003) and family programmes (Beech *et al.*, 2003). However, there are relatively few studies that have assessed change in potential physical activity mediators, such as self-efficacy and enjoyment, that may be attributed to the intervention (Lewis *et al.*, 2002), as well as predicting changes in physical activity prospectively (King *et al.*, 2002). There is a need for studies to evaluate whether theory-based interventions can bring about increases in physical activity or maintenance of healthy weight by effecting changes in the proposed theoretical constructs (Lewis *et al.*, 2002). Furthermore, the effect of the community, school and

family environments as potential moderators of the intervention should also be considered. Future analyses of the 'Switch-Play' baseline and post-intervention data will shed light on this issue.

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