The Prevalence and Impact of

Hearing Impairment in Acute Care

by

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B.A., Dip. Aud., M.A. (Hons)

Submitted in fulfilment of the requirements for the degree of

Doctor of Philosophy

Deakin University
4th January 2017
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## Abbreviations

<table>
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<th>Term</th>
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<tr>
<td>AB wordlist</td>
<td>AB Isophonemic Monosyllabic Word list</td>
</tr>
<tr>
<td>ACSQHC</td>
<td>Australian Commission on Safety and Quality in Health Care</td>
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<tr>
<td>ASHA</td>
<td>American Speech-Language-Hearing Association</td>
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<tr>
<td>AUC</td>
<td>Area under the curve</td>
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<tr>
<td>Auslan</td>
<td>Australian Sign Language</td>
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<tr>
<td>BMHS</td>
<td>Blue Mountains Hearing Study</td>
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<tr>
<td>CALD</td>
<td>Culturally and Linguistically Diverse</td>
</tr>
<tr>
<td>CHASE</td>
<td>Communication &amp; Hearing Access Screening Evaluation</td>
</tr>
<tr>
<td>CI</td>
<td>Confidence interval</td>
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<tr>
<td>CHMS</td>
<td>Canadian Health Measures Survey</td>
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<tr>
<td>CVD</td>
<td>Cardiovascular Disease</td>
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<td>dB</td>
<td>Decibels</td>
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<tr>
<td>dBA</td>
<td>A-weighted decibels</td>
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<tr>
<td>dBHL</td>
<td>Decibels Hearing Level</td>
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<tr>
<td>DMR</td>
<td>Digital Medical Record</td>
</tr>
<tr>
<td>GP</td>
<td>General Practitioner</td>
</tr>
<tr>
<td>HHIE-S</td>
<td>Hearing Handicap Inventory for the Elderly-screening version</td>
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<tr>
<td>HI</td>
<td>Hearing impairment</td>
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<td>HL</td>
<td>Hearing Level</td>
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<tr>
<td>Hz</td>
<td>Hertz</td>
</tr>
<tr>
<td>ICF</td>
<td>International Classification of Functioning, Disability and Health</td>
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<tr>
<td>i.PM</td>
<td>Patient management system</td>
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<tr>
<td>Term</td>
<td>Definition</td>
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<td>---------------------------------------------------------------------------</td>
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<tr>
<td>kHz</td>
<td>Kilohertz</td>
</tr>
<tr>
<td>NAATI</td>
<td>National Accreditation authority for Translators and Interpreters Ltd</td>
</tr>
<tr>
<td>NS</td>
<td>Not significant</td>
</tr>
<tr>
<td>NSQHS</td>
<td>National Safety and Quality Health Service Standards</td>
</tr>
<tr>
<td>OR</td>
<td>Odds ratios</td>
</tr>
<tr>
<td>PICF</td>
<td>Participant Information and Consent Form</td>
</tr>
<tr>
<td>PTA</td>
<td>Pure Tone Audiometry</td>
</tr>
<tr>
<td>SAHOS</td>
<td>South Australian Health Omnibus Study</td>
</tr>
<tr>
<td>SD</td>
<td>Standard Deviation</td>
</tr>
<tr>
<td>UK</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>UR</td>
<td>Unit record</td>
</tr>
<tr>
<td>HHIE-S</td>
<td>Hearing handicap inventory for the elderly-screening version</td>
</tr>
<tr>
<td>ICF</td>
<td>International Classification of Functioning, Disability and Health</td>
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<tr>
<td>WHO</td>
<td>World Health Organisation</td>
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<tr>
<td>YLD</td>
<td>Years lost to disability</td>
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<tr>
<td>4FA</td>
<td>“Four-frequency average” The average of hearing thresholds at .5, 1, 2, and 4kHz</td>
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<tr>
<td>4FABE</td>
<td>Four-frequency average in better ear</td>
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<tr>
<td>4FAWE</td>
<td>Four-frequency average in worse ear</td>
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Abstract

**Background:** Hearing impairment (HI) is the most common cause of disability globally, and a leading cause of “Years Lost to Disability” (YLD) (World Health Organisation, 2008). The net effect of HI is difficulty communicating, which in turn reduces opportunities for equitable participation in virtually every aspect of life (Access Economics, 2006).

The current thesis reports a study about HI in hospitalised adults, the results of which are analysed and reported in three parts. The first part provides prevalence estimates of HI and describes hearing sensitivity in a random sample of medically stable hospitalised adults aged over 50 years. Hearing aid use and the documentation about hearing loss in the medical record are also discussed. The second part assesses the sensitivity and specificity of a hearing-screening tool against the gold standard: pure tone audiometry. The third part considers the impact of HI in acute care through the ‘Patient Story’. The findings are considered within the International Classification of Functioning, Disability and Health (ICF) framework (World Health Organisation, 2001) in relation to patient experience, patient centred care and the safety and quality of care.

**Part 1**

**Aims:** The aims of part 1 of the study were to estimate the prevalence and severity of HI in the study population and compare the findings with Australian population studies of HI prevalence; to determine the prevalence of significant HI in the study population, to determine the proportion of adults
with significant HI in the study population who have and use hearing aids, and 
to determine the proportion of adults in the study population who have and 
use hearing aids for whom HI was documented in the medical record on 
admission to hospital.

**Method:** A random sample (n = 186) of medically stable hospitalised adults 
aged over 50 years were recruited from the inpatient population of an acute 
‘Principal Referral Hospital’ in Victoria, Australia. Prevalence and severity of 
HI were measured using pure tone audiometry. Participants were interviewed 
about hearing aid ownership and use, and the medical records were reviewed 
for evidence of documentation about HI.

**Findings:** The results showed increasing prevalence and severity of HI with 
age. Half of all hospitalised adults aged over 50 years had a bilateral HI of a 
degree likely to adversely affect communication. The prevalence of significant 

bilateral HI doubled each decade after age 50 and reached 85% for 
hospitalised adults aged over 81 years. In general, the prevalence and severity 
of HI were significantly higher than previously established values for age 
matched adults in the Australian population, and the trend was very 

noteworthy in the youngest cohort. Hearing aid use among participants with 
significant bilateral HI was modest, but consistent with previous reports in the 
literature. Documentation in the medical record about HI or hearing aids was 
frequently absent or incorrect.
Part 2

Aims: The aim of part 2 of the study was to assess the sensitivity and specificity of a modified version of the AB words as a hearing-screening test and determine appropriate cut points for screening.

Method: The AB words test was presented ‘live voice’ at 60dBA on a convenience subset (n = 118) of the randomly selected prevalence study participants. Responses were scored phonemically as a percentage and evaluated against the four-frequency average hearing levels in the better ear, as measured by pure tone audiometry. The screening tool was assessed using signal detection theory and sensitivity and specificity were calculated for three clinically significant screening conditions.

Findings: The Area Under the Curve (AUC), sensitivity and specificity support the use of the modified AB words screening test at three levels of bilateral HI: HI ≥ 25dB: AUC = 0.876 (sensitivity = 87%, specificity = 58%); HI ≥ 35dB: AUC = 0.900 (sensitivity = 88%, specificity = 78%); and HI ≥ 45dB: AUC = 0.931 (sensitivity = 94%, specificity = 77%).

Part 3

Aims: The aims of part 3 were to explore the patient experience of acute care mediated by HI and Deafness and to explore the impact of HI and Deafness on the quality and safety of acute care.

Method: The patient experience of HI in the health setting was explored through the Patient Story. Two additional participants who raised concerns related to HI through the hospital complaints and feedback processes were
purposively sampled. One extended Patient Story highlights a series of incidents during an episode of inpatient care. The details of the second complaint and other experiences and observations of participants from part one were presented to highlight common concerns. The Patient Story was contextualised with the ICF framework and further discussed in relation to health care standards and person-centred care.

**Findings:** The Patient Story highlights systemic quality and safety risks for people with HI in acute care. The ICF provides a framework for addressing risks and improving person-centred care.

**Conclusions:** Considered together, the Patient Story and the quantitative findings provide new and compelling perspectives to identify and improve the management of HI. The research findings have significant implications for public health policy and highlight the importance of identifying HI in hospitalised adults in order to improve the quality and safety of acute care, and the patient experience.
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Chapter 1 overview

The current thesis explores questions about Hearing Impairment (HI) in an acute hospital population: how commonly it occurs, who is likely to be affected, how to identify it, and how it impacts on the quality, safety, experience and outcomes of care. Chapter 1 introduces the current research and provides an overview of the thesis. It includes the background to formulating the research questions, and describes the research rationale, as well as the purpose and aims of the study and the thesis structure.
Background to the research

My background

I stumbled across the study of Linguistics by accident, when I was in my second year of an Arts degree at the University of Melbourne. I owe the beginnings of my interest in language and communication to the lecturers in that program in the late 1980s, and perhaps even more so, to a remarkable and vibrant cohort of students with whom I shared tutorials and many engaging hours in the little ‘linguistics library’ on the ground floor of the Babel building. These students embodied diversity and valued language and communication in a way I had not previously experienced—and it was exhilarating.

During the summer break after completing my undergraduate degree, I marked time as a junior clerk in a hospital while I contemplated the handful of graduate courses for which I had applied. One day, an older man and his wife, both Deaf, came to enquire about their pathology account; an uncomplicated, common activity of daily life. They spoke Auslan (Australian Sign Language). I was both mesmerised and appalled by the encounter that ensued, where privacy, respect, and effective communication were utterly absent. It was clearly a frustrating, ineffective ordeal for all concerned.

The factors that made the exchange between the Deaf couple and the health service so profoundly inadequate were complex, and it was many years before I began to understand the concept of ‘communication access’ in our community and, in particular, in the health care setting. Many years later I learned that the man I encountered that day is a successful advocate for the Deaf, a skilled educator, and generous contributor to the Deaf community through active
service at community, board, and government levels. Yet, for him, paying an account at the local hospital was an unreasonably challenging, unpleasant, and difficult task. At the time, I lacked the insight to consider how communication barriers might have affected the quality of the care he received, but it was clear that a simple administrative task became an almost insurmountable problem.

Later the same day, I received a phone call offering me a place in the graduate Audiology program at the University of Melbourne, one of the handful of audiology training programs in Australia. The decision to accept was easy and a new phase of learning began.

**My experience of people with Hearing Impairment in a hearing aid clinic**

I spent the first five years of my audiology career working in the public hearing aid sector, which catered mainly for children, aged pensioners and war veterans. The typical new patient was an older person, often accompanied by a frustrated family member—ostensibly present as a support person—but with a strong and almost palpable desire to make sure the truth was exposed! The patient might concede that their hearing was not as good as it used to be, but frequently denied they had any significant hearing problems, other than the fact that other people—especially younger people and children—mumble or talk too quickly. In contrast, the family member would report that their loved one mishears what is said, cannot hear the phone ring, and has the TV turned up so loud it is unbearable for anyone else.

Once in the privacy of the soundproof booth, the patient might divulge to me that they can *hear* but increasingly not *understand* what people say. They might
confess that in difficult or noisy environments they either guess or simply pretend to understand out of sheer desperation. Some people describe avoiding difficult situations altogether, by withdrawing from the activities they previously enjoyed. Some withdraw from activities without necessarily attributing their decision to problems with their hearing. Acknowledging and seeking help for HI was difficult for many people, and outright gruelling for others.

Through the experiences of many patients who courageously shared their fears with me, I learned that the stigma associated with HI and the distrust associated with its most obvious marker – the hearing aid – are often more influential in decision making about managing HI than the frustration and isolation of HI itself. Negative experiences with hearing aids—for example, memories of a relative who unsuccessfully used a hearing aid—were often a powerful barrier to trying hearing aids: ‘why bother advertising my HI by wearing hearing aids if they don't work anyway?’

Other people were very pragmatic about their HI and how to manage it: ‘if a hearing aid could help me then it’s worth a try’. The process of identifying one’s own HI, learning self-management and communication skills, seeking professional help, or deciding to use amplification, is not linear and there is no one-size-fits-all approach. As an observer, the consequences of not identifying and managing HI seemed to be deteriorating relationships, increasing stress and distress because of the effort required to compensate for the loss of hearing, and a loss of enjoyment of life.
My experience of people with Hearing Impairment in the health setting

During my sixth year of clinical practice, I accepted a senior Audiology position in a large regional hospital. The focus of my clinical work shifted from hearing aids and rehabilitation to diagnosis and early intervention. I saw familiar faces and heard familiar stories from patients and their loved ones. However, I heard new stories, and identified new challenges. My focus on hearing in a broader health environment provided a different lens through which to view the issues.

HI was still a closely guarded secret; HI was still a barrier to communication and relationships. HI was sometimes acknowledged, but immediately relegated to ‘the least of my worries’. However, HI was also a barrier to patients understanding what was wrong with them, what would happen to them, and what their choices were. The consequences of not identifying and managing HI now included new elements of risk to health, and health outcomes.

One man in his late seventies remains in my memory. When we met, he had suffered a stroke and spent nearly eight weeks in hospital: three weeks in the acute setting and a further five weeks in inpatient rehabilitation. He was not progressing as expected and consequently the goal of ‘discharge home’ was under scrutiny by the treating medical team. On a hunch and as a last resort, the speech pathologist referred him to Audiology.

An inexpensive, painless hearing assessment performed at the bedside revealed the patient had a severe bilateral HI, which he subsequently acknowledged had been a ‘bit of a problem’ for him for more than ten years, although it had never been formally diagnosed. In the course of his care, clinicians had raised
concerns about the gentleman’s receptive language, cognition, and memory, but never his hearing. His hearing was not scrutinised throughout almost eight weeks of comprehensive inpatient medical care.

While the consequences of navigating a serious illness and the medical system mediated through impaired hearing were very significant, the nexus between his ‘performance’ in terms of recovery from stroke and his ‘invisible’ HI remained very difficult for him and his health professionals to identify. With a loaned hearing aid and aural rehabilitation, his situation changed. He could accurately hear the physiotherapist in the gym, understand his new medication regimen and participate more fully in decisions about his care. He reported feeling less anxious about what was going to happen to him, and he ultimately achieved his important goal: to go home.

My Dad

My father is a World War II Veteran who, with some support, still lives independently and enjoys relatively good physical health despite his advancing age and declining cognition. He has relatively good hearing in the low frequencies but has a severe HI in the high frequencies, which is a typical HI pattern associated with significant noise exposure such as Dad’s wartime service in the Royal Australian Air Force. High frequency HI renders the high frequency and low intensity components of speech—for example “th”, “sh” “k” inaudible, while the low frequency components of speech may be heard normally. High frequency HI results in speech sounding mumbled or indistinct, but not necessarily lacking in volume. Dad was a reluctant, occasional hearing
aid user who did not readily attribute any benefit to wearing hearing aids, although his family noticed and appreciated the difference.

In his 86th year, he experienced a mild stroke that required a short hospital admission and the usual assortment of diagnostic assessments. I arrived at Dad's room shortly after his admission, where a nursing assessment was underway, and quietly took a seat. I immediately saw that there were 'little' miscommunications occurring, unbeknown to either participant. I carefully chose the moment and politely interrupted to ask Dad whether he wanted his hearing aids. Dad assured me that his hearing was just fine and his hearing aids were not required.

The nurse did not appear concerned about my comments or Dad's hearing, in fact the nurse did not acknowledge my comments or engage with me at all, and instead continued with the assessment, head down over her paperwork. But in the minutes that followed, further miscommunications occurred: Dad sat bolt upright with a very quizzical expression on his face and said to the nurse: “Sailing? I haven’t been sailing for years” when he was asked about having a bath or a shower; and shortly after gave the banking sector stock market report from the midday news when the nurse joked about the enormous hole in his left sock (not stocks).

Both errors were quite funny, but they might not have been. At the time I was confident Dad was not suffering any significant stroke-related cognitive or language problems, but I wondered how easily his inappropriate responses might have been interpreted as ‘confusion’, or how well he might have performed on a formal, language-based cognitive assessment. I wondered how
much he understood about his treatment when he could not relate to me the recommended changes to his medication other than “something about the liver”. At least I could advocate on his behalf, albeit with resistance from both Dad and his clinicians. I felt some pressure to ensure I was present to do so at any important discussions.

Because it was my Dad, or perhaps in spite of that fact, observing Dad’s admission assessments helped emphasise the complex inter-relationship between several counterintuitive yet common responses to HI. People often actively deny and conceal their HI, even from their health professionals, even when the HI is significant, and even when the stakes are high. Health professionals routinely neglect to ask about and screen for HI in their patients, and often demonstrate a very limited repertoire of skills required to enhance communication with their hearing-impaired patients. Neither the patients nor their health professionals recognise the effect of HI on the ability to understand spoken language accurately. The professional knows they have asked all the right questions and explained every aspect of the care expertly. The patient only knows what they heard or guessed; not what they did not hear or guessed incorrectly, and never the twain shall meet.

**Rationale for the study**

Unbeknown to him, the man from inpatient rehabilitation was responsible for a small revolution in referral patterns. The Audiology department received more referrals from inpatient rehabilitation for people like him, and they all had HI. Subsequently two small-scale hearing loss audits in the stroke unit at University Hospital Geelong found HI was common, and commonly poorly managed, a
finding consistent with the limited literature about HI in hospital wards and stroke units (Poltl & Hickson, 1990; Lim & Yap, 2000; O'Halloran, Worrall, & Hickson, 2009).

A comprehensive body of literature describes the prevalence of HI and the monotonic relationship between age and HI prevalence (Davis, 1989; Davis, Stephens, Rayment, & Thomas, 1992; Taylor, Wilson, & Read, 1993; Cruickshanks et al., 1998; Wilson et al., 1999; Cruickshanks et al., 2003; Agrawal, Platz, & Niparko, 2008; Lin, Thorpe, Gordon-Salant, & Ferrucci, 2011; Nash et al., 2011). A growing research literature describes the poorer health outcomes of people with HI, which occur over and above the effects of ageing. Hogan, O'Loughlin, Miller, and Kendig (2009) examined hearing disability in older adults using the 2003 Australian Survey of Disability, Ageing and Carers. They found hearing disability was associated with poorer mental and physical health especially for severe hearing disability. Hearing disability was rated by participants as the third most problematic condition they had, after chronic pain and restricted physical activity. Even patients who reported hearing disability but denied communication limitations had lower physical and mental health status. Lin et al. (2013) studied cognitive function and HI in older adults as part of the Health ABC (Health, Aging, and Body Composition) study of community dwelling older adults in the United States. They found HI was independently associated with accelerated cognitive decline and incident cognitive impairment, and that increasing severity of HI resulted in greater cognitive decline.
Another growing area of interest is the link between HI and cardiovascular disease and diabetes. Both are risk factors for HI (Bainbridge, Hoffman, & Cowie, 2008; Bainbridge, Cheng, & Cowie, 2010) and are associated with increased rates of hospitalisation. Therefore, the age distribution of hospital inpatients, common indications for hospital treatment, and the extensive evidence about the increasing prevalence of HI with age and other chronic health problems, suggest that HI prevalence may be higher in the inpatient population than the general population of age-matched adults.

Lin and Albert (2014) describe HI as the ‘least studied’ risk factor in the older adult and an ‘afterthought’ in clinical care: only addressed when the patient insists, and most patients do not insist. An extensive literature describes HI in adults as under diagnosed and inadequately managed (Bogardus, Yueh, & Shekelle, 2003; Yueh, Shapiro, MacLean, & Shekelle, 2003). The use of hearing aids falls well below the prevalence of HI expected to benefit from amplification (Davis, 2003; Gopinath et al., 2011). There is a paucity of research about HI and hearing aid use in an acute hospital population, and the extent to which hospitalised adults have, prior to their admission, sought and successfully implemented HI management strategies is not known.

HI can restrict opportunities to be a well-informed, active health consumer. Identifying and supporting patients to manage HI is an important prerequisite to providing person-centred care (The Joint Commission, 2010). There is a very scant literature about the documentation of HI in medical records. However, a retrospective review of physician case notes of patients with known significant
HI showed that hearing loss was frequently incorrectly documented (Halpin, Iezzoni, & Rauch, 2009).

Australia’s Health Service Standards (NSQHS) (ACSQHC, 2011) and the Australian Charter of Healthcare Rights (ACSQHC, 2008) mandate a person-centred model of care, predicated on purposeful and effective communication between health practitioners and patients. The patient experience of health care provides new insights into the safety and quality of care. A few studies suggest people with HI face barriers to purposeful and effective communication about their health care and have identified broad quality dimensions of concern (Iezzoni, O’Day, Killeen, & Harker, 2004). In spite of this, the precise nexus between patient experience and health care standards in relation to HI is less clear. However, it is known that people with communication impairment are more likely to suffer preventable harms (Bartlett, Blais, Tamblyn, Clermont, & MacGibbon, 2008).

Screening for Hearing Impairment

There are a variety of screening methods deemed suitable for hearing screening in adults (U.S. Preventive Services Task Force, 2012). However, depending on the aims of the screening, some methods are not sufficiently precise (Wilson, 1997). Self-report of HI is effective for identifying hearing disability but a prerequisite to self-reporting hearing disability is being aware of and acknowledging the HI.

Like other admission-to-hospital screening strategies, such as falls risk assessments, the aim of hearing screening is to identify people who need risk reduction strategies to reduce risk during the hospital admission, and to
identify appropriate longer term follow up. Screening processes that provide reliable and sensitive qualitative and quantitative information about the patients’ functioning are particularly relevant. To this end, the research hospital: University Hospital Geelong, used a modified version of a speech discrimination test for which psychometric performance characteristics were well known (Boothroyd, 1968). The performance characteristics of the modified test were logically inferred from the original test, but no formal assessment of sensitivity or specificity as a screening tool were available (Osborne, 2015).

Overall there are significant gaps in the literature about hearing loss and how best to identify and manage acquired HI in adults, and the impact of HI in acute care is largely inferred from more generalised studies. Evidence from observational studies about HI prevalence and patient needs could significantly improve the safety and quality of care, and the patient experience of care.

**Aims**

The purpose of the current research was to advance the current knowledge about HI in a cohort of hospitalised adults, and the extent to which HI might impact on the quality, safety and experience of care. Specifically, the researcher sought to estimate the prevalence and severity of HI, and hearing aid use, in a cohort of hospitalised adults aged over 50 years, to determine whether the prevalence and severity of HI in the study population was higher than that of the general population. Next the researcher sought to identify how well people with HI are identified in the acute health context, and to assess the specificity and sensitivity of a hearing-screening tool. Finally, the researcher sought to
describe the lived experience of HI in the context of acute health care, through the ‘Patient Story’, which is discussed in relation to the National Safety and Quality Health Service Standards (NSQHS) (ACSQHC, 2011) and the Australian Charter of Healthcare Rights (ACSQHC, 2008).

The study aims fall within five broad themes: prevalence of HI, severity of HI, management of significant HI, the health service response to HI and the patient experience of HI in acute care. The study population was defined as hospitalised adults older than 50 years of age who stayed longer than 24 hours.

There are five primary data types in the current study: audiology, patient history questions, medical records review, screening test score and Patient Story. Further details about the data types are described in Chapter 3. Figure 1 (page 15) shows the different data types and their relationship to the study aims.
The study aims listed by theme

1. Prevalence of HI
   a) Estimate the prevalence of HI in the study population
   b) Compare the prevalence of HI in the study population (1a) with Australian population studies of HI prevalence

2. Severity of HI
   a) Describe the severity of HI in the study population
   b) Compare the severity of HI in the study population (2a) with the literature

3. Management of significant HI
   a) Determine the prevalence of significant HI in the study population
   b) Determine the proportion of adults with significant HI in the study population (3a) who have and use hearing aids

4. The health service response to HI
   a) Determine the proportion of adults in the study population who have and use hearing aids for whom HI was documented in the medical record on admission to hospital
   b) Assess the sensitivity and specificity of a modified AB words speech test and determine appropriate cut points to identify significant HI in the better ear

5. Patient experience of HI in acute care
   a) Explore the patient experience of acute care mediated by HI and Deafness
   b) Explore the impact of HI and Deafness on the quality and safety of acute care.
Figure 1: Schematic showing the study population, and data types and their relationship to the current study aims.
Overview of the thesis

The thesis has seven chapters. Chapter one introduces the current research and provides an overview of the thesis including the background, rationale, context, purpose and aims of the research and the overview of the thesis.

Chapter two provides a review of literature relevant to the thesis. The International Classification of Functioning, Disability and Health (World Health Organisation, 2001) is described.

The literature describes the prevalence of HI and the relationship between HI and chronic health conditions. The literature highlights the importance of person-centred care to achieving positive health outcomes, and the evidence that HI is associated with poorer access to person-centred care and poorer health outcomes, all of which lead people with HI to be regular users of health services. The literature review considers different methods for detecting and assessing HI and identified gaps in knowledge that are addressed in the current research aims.

Chapter 3 describes the research questions, research design, and the research method. Chapter 3 also includes details about ethics approval, study setting, and participant recruitment processes.

Chapter 4 reports the prevalence of HI and includes the description of average hearing sensitivity for each decade of age. Hearing aid use and documentation about HI in the medical record are described. Chapter 5 reports the sensitivity and specificity of a hearing-screening tool.
Chapter 6 explores the patient experience of acute care mediated by HI and Deafness, told primarily through an extended Patient Story of a Deaf man, and experiences of other study participants to highlight common concerns. The patient experience is considered in relation to the Australian Charter of Healthcare Rights (ACSQHC, 2008) and the National Safety and Quality Health Service Standards (NSQHS) (ACSQHC, 2011) as a means to explore the impact of HI and Deafness on the quality and safety of acute care. The ICF provides a framework for ameliorating risks and improving patient experience.

Chapter 7 brings the different findings together to consider the implications of HI on the safety and quality of acute care. The findings are considered in the broader public health context for improving the identification and management of HI, prevention, and secondary prevention. The implications for Audiology clinical practice in acute care and person-centred health care service design and delivery are considered, as are the strengths and limitations of the current research and opportunities for further research.
Chapter 2: A Review of the Literature

Chapter 2 overview

The purpose of chapter 2 is to review and synthesise a diverse range of literature relevant to the current research. The chapter begins with a discussion about the role of communication in health care, and considers communication barriers and enablers in health care for people with HI, and the implications of these communication barriers for health care safety. The International Classification of Functioning, Disability and Health (World Health Organisation, 2001) and specifically its 'Personal Factors' and 'Environmental Factors' and their application to HI are discussed as a framework for understanding and improving communication and health care safety.

The following section includes a discussion about HI type, severity, onset, and impact on speech discrimination, and issues about the function and use of hearing aids are considered. Key information about the cultural aspects of deafness is presented and compared with the experience of adults with acquired HI. The prevalence of HI and the prevalence of HI in hospital are reviewed and the challenges of identifying HI are discussed. Adverse events in health care are defined, and the consequences and common methods of identifying adverse events are discussed.

The issue of the impact of communication barriers on the risk of experiencing an adverse event is introduced, and parallels between communication barriers that result from cultural and linguistic diversity and those related to deafness and HI are highlighted. Evidence describing the risk of an adverse event
associated with HI is presented. Person-centred care and patient safety and their relationship with HI are considered. The review of the literature identified gaps in the current knowledge and methodological issues relevant to the current research.
Communication in health care

Debra Roter and Judith Hall wrote extensively about the positive benefit of good medical communication, from the tangible, immediate benefits during the consultation through to an enduring impact on a range of positive patient outcomes (Roter & Hall, 1992). They use strong language to describe the impact of communication in the medical setting, recounting communication as the most fundamental and powerful vehicle of health care and the means by which relationships develop and therapeutic outcomes are delivered (Roter & Hall, 1997). Likewise, Schyve (2007) referred to medical care as complex ‘information management’ and that as such, the communication between medical professionals and patients is a core component of health care, not merely an adjunct or facilitator of care.

High quality medical care is contingent on providers actively listening and responding to patient concerns, and patients understanding diagnostic information and therapeutic advice they receive (Lavizzo-Mourey, 2007). Communication barriers result in misdiagnosis, poor therapeutic choices and reduced treatment compliance. In short, when health professionals and patients cannot talk with each other effectively “the result is bad medical care” (Lavizzo-Mourey, 2007, p. 279). Addressing poor communication means that ‘bad medical care’, and the poor outcomes that accompany it, are avoidable.

Effective medical communication is an exchange of ideas in which there is acknowledgement of the expertise of the medical professional and the patient. The medical professional is expert in their ‘specialty’, but the patient is the expert in ‘the patient’. Patients are expert in their own history and prior
experience of illness, personality, lifestyle, values, and expectations (Roter, Frankel, Hall, & Sluyter, 2006). What a patient says to a health professional, both in their answers and their questions ‘sculpts’ the professional’s thinking (Groopman, 2007); therefore, the successful collaboration between these experts is more likely to achieve appropriate, safe outcomes.

Effective communication between professionals and patients is always a challenging and active process; however, people who are hearing-impaired or deaf face significant additional barriers to effective communication with their medical professionals (Ubido, Huntington, & Warburton, 2002; Iezzoni et al., 2004; Lowrie, 2014).

**Communication barriers in health care associated with deafness or Hearing Impairment**

Several qualitative studies have explored the experiences of deaf and HI people in the health care setting (Ubido et al., 2002; Iezzoni et al., 2004; Lowrie, 2014). The studies identified communication as a primary concern of the participants and highlight communication issues that put health care quality and safety at risk (Ubido et al., 2002; Iezzoni et al., 2004).

Iezzoni et al. (2004) conducted four semi structured group interviews, two conducted in American Sign Language, and two using real time captioning, with 26 deaf men and women. The results highlighted communication problems that could compromise health care quality, safety, effectiveness, efficiency, timeliness, equity and patient-centeredness. For example, participants reported they were frequently required to use inadequate modes of communication such as reading lips, writing notes, or using family members to interpret, which they
believed meant they received incomplete information. Consequently they reported not understanding therapeutic regimens, medication dosages, or side effects (Iezzoni et al., 2004). They reported health professionals typically do not understand deafness, do not know how to communicate with people who are deaf or hearing-impaired; and rarely use supportive strategies and technologies, findings also reported by Lowrie (2014). Davies and Channon (2004) investigated communication with deaf and hearing-impaired patients in a medical imaging department and found that procedures requiring the patient to follow verbal instructions caused communication problems for both patients and radiographers. Davies and Channon (2004) also questioned the reliability of informed consent elicited prior to procedures.

A small British study investigated the inequalities in health care access for women who were deaf or hard of hearing using questionnaires, interviews and focus groups (Ubido et al., 2002). Ubido et al. (2002) found that fewer than 10% of deaf women attending an appointment unaccompanied said they usually fully understand what the doctor says to them during the appointment. Consequently, they described significant problems in medical care. For example, one woman attended what she believed was a routine antenatal appointment, only to find that her labour was being induced. Another woman attended for a check-up but instead underwent bowel surgery.

The lived experience of deafness and HI in the health care context reflects the HI, but also the accessibility of the health setting for the individual. The experiences Iezzoni et al. (2004) and Ubido et al. (2002) highlighted reflect barriers to communication and participation that are a function of the health
care environment. The study participants proposed a number of solutions; solutions that are a good fit with the model of disability described in the International Classification of Functioning, Disability and Health (ICF) (World Health Organisation, 2001).

**The International Classification of Functioning, Disability and Health**

The ICF is a *biopsychosocial* conceptual framework of functioning, disability and health where disability and functioning are viewed as the outcome of a health condition, within a dynamic context of ‘Environmental Factors’ and ‘Personal Factors’. The ICF definition of disability has evolved from one where disability was synonymous with functioning, to one where disability is the outcome of the interaction between impairment, functioning and the environment (Hurst, 2003).

The ICF replaced the International Classification of Impairments, Disabilities and Handicaps (ICIDH) (1980) and redirects the focus onto *health* rather than *disability*. In doing so, the ICF provided a standardised language and framework for describing *functioning*, referring to body functions, activities and participation, and *disability*, referring to impairments, Activity Limitations and Participation Restrictions (WHO, 2001). Figure 2 on page 24 shows the ICF model of disability. In highlighting the range of factors that influence outcomes, the ICF provides a blueprint for acknowledging, reducing and removing barriers to activities and participation.
The ICF is intended to be a flexible framework that has relevance at the individual level and at institutional, societal, and policy levels as well as economic and research applications (WHO, 2001). The ICF successfully combined medical and social models of health through an international and interdisciplinary health language to facilitate the integration of research from different perspectives (O'Halloran, Hickson, & Worrall, 2008). Additionally, the ICF enabled comparison across disparate health conditions by focusing on outcomes rather than causes (WHO, 2001).

Figure 2: A representation of the model of disability that is the basis of the ICF (WHO, 2001, p. 18)
The limitations of the ICF are well known and described (Jette, 2009): it is onerous, complicated and confusing (Kagan et al., 2008) and there is no specific provision to record or capture health risks that occur as a consequence of impairment in the ICF (Möller, 2003). Despite the limitations, the ICF is a robust framework through which to consider communication disorders because of its utility in exposing multifactorial and dynamic interactions inherent in the communication process, and capturing the individuality of the experience of impairment, in ‘real life’.

A primary goal of clinical Audiology and Speech pathology is to ensure that functional improvements in communication transfer to ‘real life’. Consequently, the ICF is used extensively in the consideration of communication disorders across clinical and research settings (Threats, 2007; Geyh et al., 2011), including communication in the health care setting (O’Halloran et al., 2008; O’Halloran et al., 2009; O’Halloran, Worrall, & Hickson, 2010; O’Halloran, Grohn, & Worrall, 2012; O’Halloran, Worrall, & Hickson, 2012). In the health care context, ICF Activities and Participation such as the ability to communicate one’s needs and participate fully in health care discussions and decisions are shaped by the nature and degree of any impairments and the interaction with the communication environment and the personal characteristics of the individual. The ICF framework captures these influences in the Body Functions and Structures component, Environmental Factors component and Personal Factors components respectively (O’Halloran et al., 2010).
Contextual factors

An important aspect of the ICF is the explicit acknowledgement of contextual factors, namely 'Environmental Factors' and 'Personal Factors' and their interaction with all other health dimensions. The ICF contextual factors are intended to represent a comprehensive background of an individual’s life (World Health Organisation, 2001), recognising the influence of Environmental and Personal Factors on functioning (Howe, 2008).

Environmental Factors

Environmental Factors are the physical, social and attitudinal environment in which we live (World Health Organisation, 2001). This includes high-level physical factors like climate and terrain, but also includes social attitudes, institutions, and laws (Ustun, Chatterji, Bickenbach, Kostanjsek, & Schneider, 2003). Environmental Factors are categorised into two levels in the ICF: individual referring to the immediate environment of the individual, and societal, referring to the social structures and systems in the community that affect the individual. Furthermore, the Environmental Factor classification identifies Environmental Factors as positive or negative, that is, facilitators or barriers/hindrances of performance in any setting (World Health Organisation, 2001; Ustun et al., 2003; Scherer, Craddock, & Mackeogh, 2011).

The ICF makes explicit the impact of the health care environment on the ability of people to participate in their care (Ustun et al., 2003). Environmental Factors in health care include the built environment, policies, processes, and procedures. (O'Halloran et al., 2008) also discuss the importance of the knowledge, skills and attitudes of health care professionals as Environmental
Factors, as described in the ‘Support and relationships’ and ‘Attitudes’ sections of the ICF (World Health Organisation, 2001). Similarly, Howe (2008) also considers communication partners as Environmental Factors. Within the ICF framework, the disability a person with communication impairment ultimately experiences reflects the interactive result of the impairment, functioning, and the health care environment.

An important aspect of Environmental Factors is that they can be modified. When Environmental Factors are identified, the Environmental Factors that facilitate participation can be promoted and supported, and specific barriers or hindrances can be addressed, modifying the experience of disability and improving participation. Societal level Environmental Factors such as policy or organisation changes occur independently of the individual. Importantly, changes to individual level Environmental Factors can also occur independently of the health condition or other Personal Factors.

Personal Factors

The ICF characterises Personal Factors as the ‘background’ of an individual’s life. Some are relatively easily defined factors such as gender, race, or age, but some are more nuanced and complex factors such as habits, coping styles, social background, past and current experience, individual psychological assets and other characteristics (World Health Organisation, 2001).

Personal Factors are depicted in the ICF model of disability shown in figure 2 on page 24, as core to the ICF: reflecting the impact of Personal Factors on outcomes and the influence on the individual experience of disability. Personal factors are shown as equivalent to Environmental Factors; however, there are
key differences in the way Personal Factors are identified and managed within the ICF.

The ICF does not include a classification taxonomy for Personal Factors, although the WHO (2001) acknowledge that the development of a taxonomy for Personal Factors would improve the ICF. The U.S. National Academies' Institute of Medicine (2007) recommends further development of the ICF in relation to Personal Factors. A systematic review of ICF Personal Factors identified 28 papers describing Personal Factors not reflected in the ICF and five independent attempts to classify Personal Factors, suggesting interest in an expanded but systematic approach to the application of Personal Factors (Geyh et al., 2011).

The ICF categorises Environmental Factors as positive (facilitators) or negative (barriers/hindrances), but explicitly does not categorise Personal Factors in the same way, and instead “Their assessment is left to the user, if needed” (World Health Organisation, 2001, p. 19). However, Geyh et al. (2011) note the need to better understand the role of Personal Factors as determinants, predictors, mediators or moderator variables. Scherer et al. (2011), in their study relating to the use of assistive technology, including hearing aids, contend that Personal Factors can be barriers or facilitators. They suggested that detailed knowledge about Personal Factors offered new insights into person-centred approaches to improving outcomes.

Scherer et al. (2011) also highlighted the different applications of the positive or negative aspects of Personal Factors compared with Environmental Factors. Environmental barriers or hindrances are identified and classified so that barriers can be removed or other facilitators can be introduced. Identifying
Personal Factors allows identification of individual strengths, and a better understanding of ‘unchangeable’ Personal Factors such as gender, ethnic background, or a strongly held view. Knowledge of Personal Factors enables clinicians to better understand their patients’ needs and to individualise services to meet those needs (Threats, 2007). Indeed, detailed knowledge about ICF Personal Factors—barriers and facilitators—is essential to the provision of individualised, person-centred care (Cott, 2004).

Scherer et al. (2011) also discussed how Personal Factors change over time in response to new information or experiences; whereby the consequences of one behaviour become the antecedents for future behaviours, a premise also consistent with the Health Belief Model (HBM) of health behaviour change (Champion & Skinner, 2008). Thus, while some Personal Factors are appropriately characterised as ‘unchangeable’, or ‘difficult to change’ (Howe, 2008), others may be better described as ‘not changeable yet’. Consequently, health care (and hearing care) should be individualised in response to the Personal Factors as they are currently manifested, but with an eye to the information, experience or decisions likely to contribute to positive changes to Personal Factors over time. This is a particularly important concept in HI given the long latency between onset to awareness, and the further latency from awareness to action.

**ICF Contextual factors and HI**

People with HI typically find their participation is limited in activities involving the spoken word, especially in poor acoustic environments. For example, background noise or a poor quality public address system are barriers to
participation because they distort the sound, making it harder to understand. However, they are Environmental Factors, and can be modified.

Consider a public lecture where the following strategies are used: the presenter uses:

- a reliable microphone and amplification system;
- a sign language interpreter translates the spoken word to Auslan (Australian sign language);
- a real time captioning system transcribes the written word, displays it on a screen, and transmits it to personal devices;
- an audio loop transmits sound directly to hearing aids or loaned headsets;
- a written handout provides a summary of the presentation.

Each of these strategies is a facilitating Environmental Factor that can enable participation to such an extent that the person with HI can participate in the public lecture, and access the same information as their hearing peers. Importantly, the environmental factors can have an impact on participation regardless of the type or severity of impairment or personal factors. The individual with HI might be aware of their HI or not, use hearing aids or not, speak Auslan or not. The broad range of strategies (‘facilitating Environmental Factors’) used to make the lecture communicatively accessible, positively reduced the degree of Activity Limitation or Participation Restrictions related to HI, by enabling the individual to choose and use strategies appropriate to their needs and regardless of Personal Factors. The same approach can be applied in the health setting.
Hearing Impairment and deafness

Assessing Hearing Impairment

The gold standard for assessing hearing and quantifying HI is pure tone audiometry. Pure tone audiometry measures the sensitivity of hearing to calibrated pure tones at octave frequencies, usually between 250Hz and 8000Hz (approximately from Middle C to the C five octaves above Middle C). Each ear is tested separately, and the results are plotted on an audiogram: a graph of the threshold value (in dBHL) for each ear at each frequency.

The audiogram, in conjunction with a suite of audiological tests, provides information about the hearing of the individual in relation to the normal range of hearing, and the broad location in the auditory pathway where any deficits occur. In ICF parlance, audiometry describes the ICF ‘impairment’ of a ‘body structure or function’. From the audiogram, it is possible to make broad inferences about the frequency and intensity of sounds likely to be audible to the individual. For example, speech detection thresholds for words, sentences and discourse are approximately equivalent and consistent with the audiogram (Silverman & Hirsh, 1955; American Speech-Language-Hearing Association, 1988).

However, despite a positive relationship between the overall level of HI and the ability to understand speech, the accuracy with which the level of HI predicts the ability to understand speech or the Activity Limitations or Participation Restrictions described in the ICF is poorer (Granberg et al., 2014).
A direct measure of speech discrimination is routinely included in the audiometric test battery for three main reasons: to confirm audiometric results, to yield diagnostic and prognostic information not provided by the audiogram, and to provide a valid estimate of ‘socially adequate hearing’ (Silverman & Hirsh, 1955, p. 2). Speech tests assess different aspects of ICF ‘functioning’: Body Structures and Functions and Activity (Saunders, Chisolm, & Abrams, 2005). Speech discrimination tests provide insights, over and above the audiogram or self-report, into Activity Limitations associated with HI (Timmer, Hickson, & Launer, 2015).

**Describing Hearing Impairment**

The results of audiological assessment identify the type and severity of HI. HI is typically described by type, severity, and onset, which, along with speech discrimination ability, are significant determinants of the functional impact of HI on communication outcomes for people with HI.

**Type of HI**

The type of HI reflects the location of the impairment in the auditory pathway and is typically categorised as conductive, sensorineural, mixed, or central. Conductive HI is the result of abnormality or dysfunction of the outer or middle ear that reduce the intensity of sound reaching the inner ear. Sensorineural HI is the result of damage or malformation of the cochlea or auditory nerve, while mixed HI is a combination of conductive and sensorineural HI. Central auditory dysfunction reflects dysfunction from the auditory nerve, auditory brainstem or cerebral cortex (Smith, Shearer, Hildebrand, & Van Camp, 2014).
Severity of HI

The severity of HI can be described numerically, for example as an average level of HI, or categorised, somewhat arbitrarily as mild, moderate, severe or profound. However, there is wide variation in the terminology and definitions used, and the limitations of descriptions of hearing loss severity are well documented (Clark, 1981) and do not necessarily predict the difficulty or disability (Activity Limitation and Participation Restriction) experienced by the individual. The experience of severity is often mediated by several factors described in the following pages.

Onset of HI

The onset of HI is described in several ways. Firstly, the HI is described as congenital (present at birth) or acquired. Conductive hearing loss can be congenital, for example, an atresia or absence of the pinna or ear canal, or acquired because of otitis media. Conductive HI often responds well to medical or surgical treatment and amplification. Congenital causes of sensorineural HI include mutations (Smith et al., 2014) or intrauterine infection, for example rubella or cytomegalovirus (Grosse, Ross, & Dollard, 2008). Sensorineural HI can also be acquired at any time across the lifespan due to age, genetic predisposition, noise exposure or other toxin, or a combination of all three. There is no effective medical or surgical treatment for sensorineural HI.

The onset of HI is also characterised as sudden or gradual. Physical trauma causing a perforated tympanic membrane can result in a sudden conductive HI. A physical trauma such as a fractured temporal bone, or physiological trauma due to meningitis can cause sudden sensorineural loss; however, most cases of
sudden sensorineural loss are idiopathic, with possible causes including viral infection, intracochlear membrane rupture, or autoimmune disease (Leong, Fairley, & Padgham, 2007).

Noise-induced HI and age-related HI or ‘presbyacusis’ are the most common causes of acquired sensorineural HI, and their onset is typically gradual and insidious. Gates and Mills (2005) describe three classic types of presbyacusis: sensory, neural and strial, which can occur alone or in combination. Sensory presbyacusis refers to a loss of hair cell function, neural presbyacusis to deterioration in the conductive properties of the VIIIth cranial (auditory) nerve through to the auditory cortex, and strial presbyacusis to a loss of metabolic function (that powers the active process of the cochlea) in the stria vascularis.

Finally, sensorineural HI is further described as ‘pre-or-post-lingual’, meaning the onset of HI occurred before or after the development of language, respectively. People with post-lingual HI have auditory and neural pathways developed and fine-tuned in response to consistent exposure to language during a period in which the brain was primed for language acquisition (Thomas & Johnson, 2008). The developed brain structure and function means that people who acquire HI as competent language users are usually able to continue to use oral language with appropriate assistive technology such as hearing aids or cochlear implants, although a proportion will also choose to learn sign language (Sloss Luey, Glass, & Elliott, 1995; Aguayo & Coady, 2001; Access Economics, 2006).

Pre-lingual HI affects all aspects of language acquisition and development because it prevents or limits exposure to the oral language necessary for
auditory, language and brain development (Pimperton & Kennedy, 2012). The age at onset of bilateral HI can have a significant effect on language development and communication, and ultimately economic and social participation (Barnett & Franks, 2002).

The introduction of newborn hearing screening has significantly improved outcomes for children born with pre-lingual HI by facilitating very early identification of HI, access to amplification, and early intervention to support the development of speech and language (Olusanya, 2011). However, newborn hearing screening is a relatively new phenomenon, for example, the Victorian Infant Hearing Screening Program achieved state-wide coverage in 2012 (Victorian Infant Hearing Screening Program (VIHSP), 2016). Therefore, today’s adults with congenital HI were typically diagnosed only after their language development was demonstrably delayed.

**The impact of HI on speech discrimination**

Sensorineural HI reduces one’s ability to hear alarms, music and environmental sounds, but it has its’ particular impact on the ability to accurately perceive speech: it is often possible to hear speech, but not with sufficient detail or clarity to understand it.

Despite a positive relationship between the overall severity of HI and the ability to understand speech, the accuracy with which the level of HI predicts the ability of an individual to understand speech is poorer. Significant differences in speech discrimination performance are observed despite similar levels of audiometric hearing loss: some people with HI can understand speech well if the speech is loud enough, while others will demonstrate improved
understanding with increased loudness to a point, but do not show improvement above a certain loudness or show a deterioration in performance (Silverman & Hirsh, 1955; Ching, Dillon, & Byrne, 1998).

In addition to the reduction in sound intensity for people with HI, other critical changes in frequency resolution and rapid temporal processing distort the speech signal (Jerger, 2006). In most cases of sensorineural HI, frequency selectivity is reduced, and temporal resolution is impaired. Therefore, in sensorineural HI both the absolute range of frequencies that remain audible and the precision with which the auditory system can analyse frequency information is impaired. The loss of frequency and temporal resolution causes the difficulties associated with understanding speech in noisy situations (Moore, 1985; Moore, Glasberg, & Hopkins, 2006). The primary strategy for improving speech perception is to amplify speech so that it is audible, using a hearing aid.

**Hearing aids**

Modern hearing aids are designed to precisely and selectively amplify and manipulate sound according to an individual prescription designed to maximise speech discrimination. Cochlear implants use electrical stimulation of the auditory nerve instead of amplified sound and are an effective surgical option for people with severe and profound hearing HI. Even the most effective amplification will not restore normal hearing and speech perception; however, there is good evidence that hearing aids improve communication and ameliorate risk against the secondary effects of HI on participation and quality of life.
Findings of the ‘ABCD’ study of hearing aid benefit in Great Britain demonstrated that appropriate hearing aid fittings resulted in significant improvements in speech recognition for people with acquired HI (Davis et al., 1992). Other studies have also demonstrated hearing aids lead to improvement to speech perception and secondary benefits to participation, quality of life and health outcomes (Kochkin & Rogin, 2000; Davis, Smith, Ferguson, Stephens, & Gianopoulos, 2007; Ivory, Hendricks, Van Vliet, Beyer, & Abrams, 2009; Roup & Noe, 2009; Smith, Noe, & Alexander, 2009).

Unfortunately, only a small proportion of those who would benefit from hearing aids use them. Davis (1989) reported hearing aid use of only 25% among those who would benefit from a hearing aid. Gopinath et al. (2011) reported 23.4% aid usage. A large Australian epidemiological study (Wilson et al., 1999) found that 6.9% of the South Australian population had a HI in the better ear at or exceeding the level at which hearing aid use is beneficial (Davis et al., 1992), but at best only 38% of this group were regular hearing aid users. A decade ago, Kochkin (2000) reported that one in six hearing aids are kept ‘in the drawer’ instead of ‘in the ear’. Fortunately, the expanding use of digital technology in hearing aids is associated with significantly higher ratings of satisfaction and benefit (Kochkin, 2005), and there is some evidence of an increase in the proportion of those who would benefit from hearing aids actually using hearing aids (Kochkin, 2009).

The experience of Deafness and Hearing Impairment

The degree and cause of HI, the age of onset of HI and the period between onset and intervention significantly affect performance, opportunities, and outcomes
for the individual. The availability and quality of hearing aids and technology, exposure to language and literacy models in the home and the dominant educational and habilitation theories of the time also have significant impact on the development of language and communication skills. Consequently, the lived experience of today’s adults who were born deaf, and those who acquired deafness after they have acquired language is vastly different.

Many pre-lingually deaf people use hearing aids, cochlear implants, and other technology to support their communication, while others reject the ‘medical model’ of deafness, and consider deafness a cultural and language difference rather than a disability (Lane, 2002). Consequently, deafness and HI are often viewed from quite different perspectives, and they are often examined separately in the literature. However, what is shared is the impact that being deaf or HI has on a person’s ‘life chances’ through the reduced opportunity to equitably participate in an ordinary life (Access Economics, 2006) in a world where oral language and communication is the norm. In fact Iezzoni et al. (2004) observed that participants who were deaf or hard of hearing actually reported very similar concerns (Activity Limitations and Participation Restrictions) when discussing health care experiences, although the specific details (Personal Factors and Environmental Factors) differed.

Terms such as ‘Deaf’ or ‘deaf’ or ‘hearing impaired’ or ‘hard of hearing’, although used in different contexts and sometimes interchangeably, are not strictly equivalent terms. ‘Hard of hearing’ is often used to describe individuals with a severe or profound degree of HI who communicate using oral language rather than signed language. Colloquially, ‘deaf’ or ‘a bit deaf’ can mean almost any
degree of HI. Sensorineural HI is sometimes described as ‘nerve deafness’. The terms ‘hearing impaired’ or ‘HI’ describe the physiological condition: the ICF impairment. The term ‘Deaf’ with a capital D is typically used to reflect cultural identity and language preference, while the term ‘deaf’ refers to the physiological condition (Slegers, 2010).

Slegers (2010) describes the significance of the ‘capital D’ distinction but also acknowledges the challenges applying it practically. The preferences for, and use of particular terms is dynamic, as is the point at which ‘deafness’ begins and ‘HI’ ends (Baynton, 1996; Carty, 2006). The Victorian Deaf Society (Vicdeaf) use the term ‘Deaf’ when referring specifically to the cultural aspects of Deafness, but in relation to the services and support they provide, define their clients as ‘deaf’ (lowercase d) inclusively to describe people who are hard of hearing or deaf (Vicdeaf, 2009). Therefore, where appropriate, throughout the current study the use of the term ‘deaf’ will follow the Vicdeaf convention. Additionally, in line with other Australian studies about hearing, the terms ‘hearing impaired’ or ‘hearing impairment’ will apply (Hogan et al., 2001; Flores & Ngui, 2006; Hogan, O’Loughlin, Davis, & Kendig, 2009; Hogan, O’Loughlin, Miller, et al., 2009).

**The Deaf Community and Auslan**

The Deaf community is a cultural and linguistic minority within the Australian community and their signed language, Auslan, is a defining feature of that community. Auslan is the primary or preferred language of some deaf people who have been severely or profoundly deaf from early childhood, and the native language of many hearing children of deaf parents (Johnston & Schembri, 2007).
Auslan is not related to English and is thought to have developed from the signed language brought to Australia by deaf immigrants and deaf educators from the early nineteenth century and is related to British and New Zealand sign language (Carty, 2004).

Auslan is a young language with relatively few speakers. The first published descriptions of Auslan appeared in the late 1980s; the first curriculum guide in 1987 (Johnston, 1987), the first dictionary (Johnston, 1989) and PhD dissertation in 1989 (Johnston, 1989). The Australian Government recognises the Deaf community as a language group and Auslan as their language (Dawkins, 1991). Signed languages have the same potential for expressing subtle technical and complex meanings as spoken languages; however, the vocabulary of Auslan is smaller than the vocabulary of English; the vocabulary of health and medicine in Auslan is extremely limited, although any word can be introduced into Auslan from English by finger-spelling (Johnston & Schembri, 1999).

**Prevalence of Hearing Impairment**

The term ‘prevalence’ refers to the frequency of cases in a defined population who have the condition at a given time, compared with the total population (Bonita, Beaglehole, & Kjellström, 2006). Congenital HI is a low prevalence condition occurring in approximately one in every one thousand births, while acquired HI accounts for an increase in the overall HI prevalence to around 3% in childhood and adolescence (Mehra, Eavey, & Keamy Jr, 2009).
The first of two primary studies of HI in the Australian population are the South Australian Hearing Studies conducted in conjunction with the South Australian Health Omnibus Study (SAHOS) during the 1990s (Wilson, Xibin, Read, Walsh, & Esterman, 1992; Taylor et al., 1993; Wilson, 1997; Wilson et al., 1999). The second is the Blue Mountains Hearing Study (BMHS), a study exploring sensory loss and health outcomes in participants aged 50 years and over in a representative community in Western Sydney, with data collected in 1992–1994 and 1997–2000 (Sindhusake et al., 2001; Chia et al., 2007; Gopinath et al., 2009; Karpa et al., 2010).

The data reported by Wilson et al. (1999) were the first in Australia to assess the prevalence of HI from a representative population sample and use audiometric testing methods. Wilson et al. (1999) employed the epidemiological model described by Davis (1997) for the investigation of hearing disorders in populations. The overall prevalence of HI reported by Wilson et al. : 16.6% in the better ear and 22.2% in the worse ear, was consistent with that of the British population reported by Davis (1997), and confirmed HI as the most commonly occurring disability.

The direct comparison of studies of HI prevalence can be problematic because of inconsistencies in the methodology of population selection and in the definition and measurement of HI. However, once those differences are accounted for, there are generally consistent findings internationally.

Data from The National Health and Nutrition Examination Survey, 1999–2004 in the United States of America found an overall prevalence of HI of 16.1%, and 7.3% for people aged 20–69 (Agrawal et al., 2008). The 1991 South Australian
Health Omnibus Survey found overall HI prevalence for those aged 15 and over was 15.2%, compared with 14.6% for the 1990 survey, and 16% of the adult population (17–80 years) in Great Britain (Davis, 1989). Studies of HI prevalence consistently report that HI increases with age, and is higher for males. These data confirmed acquired HI as a high prevalence disorder and a major public health problem (Taylor et al., 1993).

The prevalence of HI increases steadily throughout adulthood then rises steeply after the age of 50 (Davis, 1989; Davis et al., 1992; Taylor et al., 1993; Cruickshanks et al., 1998; Wilson et al., 1999; Cruickshanks et al., 2003; Agrawal et al., 2008; Lin et al., 2011; Nash et al., 2011). The relationship between ageing and increasing HI is monotonic and significant: prevalence of HI exceeded 77% in the Australian population aged over 70 years (Wilson et al., 1999).

The large two-stage sample survey in Great Britain (Davis, 1989) found that 8% of participants in the age range 51–60 years had bilateral impairment in the mild range (35–45 dBHL), and a further 5% had hearing levels above that range. Wilson (1997) reported moderate and severe bilateral loss at 2.8% and 0.5% respectively. Together these findings show that although hearing loss is highly prevalent, it is typically categorised as ‘mild’.

**Prevalence of Hearing Impairment in hospital**

Over two decades ago, Poltl and Hickson (1990) lamented the limited research data on the hearing status of older people admitted to hospital, and regrettably this is still the case. However, the available data suggests that when compared with the estimated prevalence in the general population, samples of hospital inpatient populations have higher than expected prevalence of HI and increased
severity of HI for age (Poltl & Hickson, 1990; Lim & Yap, 2000; O’Halloran et al., 2009).

Poltl and Hickson (1990) investigated HI and self-reported ‘hearing handicap’ using audiometry and the “Hearing Handicap Inventory for the Elderly-screening version” (HHIE-S) (Ventry & Weinstein, 1983), in a population of elderly hospital inpatients with an average age of 77.2 years. They reported a prevalence of HI defined as an average of ≥ 25dBHL in the better ear of 80%; and 49% of hospital inpatients aged over 50 years had at least a moderate HI in the better ear.

More recently, in their study of communication impairment in the stroke inpatient population, O’Halloran, Worrall and Hickson (2009) found 79% of patients had mild or greater HI. Similarly, as part of a small study to determine nursing competence with respect to assessment and care of HI older patients, Heron and Wharrad (2000) conducted a point prevalence survey of hearing measured by audiometry on three ‘Health care of the elderly’ wards in Nottinghamshire, United Kingdom. They found a prevalence of over 90% for HI defined as ≥ 25dBHL in the better ear. They found that nursing hearing assessments used extensively on admission were ineffective in detecting HI (more than 60% incorrect), that nursing staff were “largely unaware” (p. 838) of their patients’ hearing ability, and that HI among hospitalised adults was poorly identified, documented and supported (Heron & Wharrad, 2000).

Hines (2000) investigated the hospital experiences of people with HI in the United Kingdom through a questionnaire. Participants were recruited through a network of lip-reading classes, which suggests some bias towards participants
who are well informed and active in managing their HI. The sample was also skewed towards more severe impairment, and more hearing aid users. The study reported inadequate awareness of HI and communication skills among health care workers, consistent with Heron and Wharrad (2000) and others. Interestingly, and despite the sample bias, Hines (2000) found that one of the most common causes of communication problems in the hospital setting was that the patients themselves actively concealing their HI. These findings highlight the need for more effective strategies to identify HI.

**Identifying acquired Hearing Impairment in older adults**

A sudden loss of hearing is obvious to the individual and to those around them. However, the onset of acquired sensorineural HI is typically slow and insidious and consequently individuals frequently do not realise they have acquired a HI (Yueh et al., 2003). Taylor et al. (1993) found that people gradually become aware of the condition but that HI is typically present for 10 years before appropriate diagnosis is sought.

Taylor (1993) et al. also found that 46% of those reporting a HI had not had it diagnosed, and 33% of those who had not had the loss diagnosed reported that it had affected their quality of life. This suggests that a significant proportion of people with acquired HI acknowledge an adverse effect of HI on quality of life without seeking appropriate diagnosis and intervention.

For many people who are aware of their HI, concern about the stigma associated with HI is so pervasive that they actively work to deny or disguise their impairment (Backenroth & Ahlner, 2000; Yorgason, Piercy, & Piercy, 2007; Wallhagen, 2009), even when the HI is longstanding. Others, including health
care professionals, may recognise the onset of symptoms but passively accept the effects of HI because HI is viewed as an inevitable part of ageing. HI is consistently overlooked as a condition that requires assessment and intervention (Heron & Wharrad, 2000).

Data from the Blue Mountains Hearing Study suggest that older people are more likely to seek help when a HI is moderate to severe, and most likely to seek this help from their General Practitioner (GP), who responds with a referral in around 50% of cases (Schneider et al., 2010). Opportunistic identification of HI in the study population aged over 50 was relatively infrequent, identifying the relatively low levels of identification and management of HI by GPs in Australia (Schneider et al., 2010).

It is widely reported that rates of detection, diagnosis and management of HI fall well short of the prevalence of significant HI (Davis, 1989; Access Economics, 2006) and international data suggest that hearing screening occurs infrequently (Bogardus et al., 2003; Wallhagen & Pettengill, 2008). The growing literature describing the impact of HI on general health and quality of life suggests there is a pressing need to improve the identification and management of HI (Strawbridge, Wallhagen, Shema, & Kaplan, 2000; Hogan, O’Loughlin, Miller, et al., 2009). Hearing screening for older adults is a key strategy for identifying HI.

**Hearing Screening**

The purpose of screening for any condition is to identify people who would benefit from further testing or intervention, to reduce the risk of future problems (morbidity or mortality), or to provide information to enable patient awareness and choice. Screening tests help identify a given condition in an
individual who is asymptomatic (Herman, 2006) or has not recognised the symptoms (Raffle & Gray, 2007). An ideal screening test is sensitive: it correctly identifies a high proportion of true positives; and specific: it correctly identifies a high proportion of true negatives. An ideal screening test is further characterised by a low proportion of false positives (1-specificity) and false negatives (1-sensitivity) (Raffle & Gray, 2007), and addresses the aims of the screening.

A range of techniques are considered appropriate for hearing screening, including single questions, whispered voice tests, detailed questionnaires, clinical measures such as otoacoustic emissions, screening or handheld automated audiometry (U.S. Preventive Services Task Force, 2012).

Historically, self-report of HI was favoured even in epidemiological studies of HI because direct measurement of HI was considered too expensive or logistically too complex. Self-reported measures are attractive because of relatively low cost and ease of use; however, they do not provide an accurate assessment of HI (Sindhusake et al., 2001; Agrawal et al., 2008; Ikeda, Murray, & Salomon, 2009). However, the key requirement of any screening tool is that the performance of the screening tool must reflect the target condition. For example, in a study to estimate the prevalence of HI, where the screening target condition is 'HI'—impairment of the Body Structure or Function—the screening test must be sensitive to a minor deterioration in the hearing thresholds of either ear.

**Using self-report to screen for HI**

Several studies have compared audiometric thresholds and self-report of hearing loss. The study by Davis (1989) was the first large population based
study to demonstrate that HI estimates based upon self-report were likely to be underestimated. Agrawal et al. (2008) also compared the accuracy of self-report as a measure of HI compared with audiometry in a population based study and found that the sensitivity of self-reported HI was 41% for high frequency loss, 46% for unilateral loss, and 65% for bilateral loss. They concluded that that estimates of HI based on self-report would likely underestimate the true prevalence of the disorder. Agrawal et al. (2008) further assert that given HI often begins in the high frequencies, audiometric screening is essential to capture early stages of hearing loss in young adults because individuals are significantly less likely to report high frequency loss.

Wilson et al. (1999) described self-report of HI as imprecise and associated with high probability of both false positives and false negatives when compared with audiometry. Remarkably, these differences can remain obscured when comparing overall prevalence only (Davis, 1989; Chia et al., 2007; Agrawal et al., 2008). Hickson et al. (1999) reviewed hearing and vision loss through objective and self-report methods and reported a similar overall prevalence through both methods but a significant mismatch associated with false positives and negatives. Both Wilson et al. (1999) and Hickson et al. (1999) concluded that self-assessment is insufficient to detect HI. In a large population study in Great Britain, Davis et al. (2007) described self-reported HI as a poor indicator of measured hearing loss at the population and individual level, reporting that in at least a quarter of the sample, when a person reported that their hearing is “not that bad”, a hearing test would find this “is probably not the case” (Davis et al., 2007, p. 30). Furthermore, Wilson et al. (1999) also cautioned against the
use of self-report data alone for policy development, suggesting that the inaccuracy in descriptions of the target groups would yield flawed conclusions. Over many decades, using self-report alone consistently underestimated the prevalence of HI, particularly in ageing populations. Because a significant aspect of the current study includes estimating the prevalence of HI, the limitations associated with using self-report to identify HI was an important methodological consideration.

Questionnaires such as the “Hearing Handicap Inventory for the Elderly-screening version” (HHIE-S) (Ventry & Weinstein, 1983) demonstrate good sensitivity to hearing disability but relatively poor sensitivity for HI (Poltl & Hickson, 1990; Demers & Putnam, 2013). Questionnaires are effective measures of perceived Activity Limitations and Participation Restrictions. Self-reported hearing disability is valuable information in the context of person-centred acute care and aural rehabilitation, in the assessment process, goal-setting or tailoring interventions to the person’s characteristics (Geyh et al., 2011) However, self-report will only identify Activity Limitations and Participation Restrictions in individuals who are aware of and acknowledge the impact of HI on activities and participation; that is, where the Personal Factors include awareness and acknowledgement of HI. Therefore, self-assessment alone is insufficient alone for assessing risk of communication problems in an acute health setting.

‘Functional’ hearing screening

While audiometry provides a good estimate of HI, and self-report measures describe the Activity Limitations and Participation Restrictions perceived and
acknowledged by the individual, the ongoing challenge is to understand the potential Activity Limitations and Participation Restrictions in the health care setting, even if the individual does not recognise or acknowledge them. Activity Limitations and Participation Restrictions in the acute health setting mean there is an increased risk of not understanding important health information and treatment plans, and may affect the ability to provide informed consent.

The acute health setting

As we age, we are also likely to use hospital services more often and for longer periods. People aged 65 and over accounted for 39% of hospital ‘separations’—patient transfer, discharge or death—and 48% of patient days in 2011–2012 (Australian Institute of Health and Welfare, 2013). People with diabetes, cardiovascular disease and smokers are also frequent users of hospital services; furthermore, smoking and cardiovascular disease are associated with an increased risk of HI (Agrawal et al., 2008), as is diabetes (Bainbridge et al., 2008; Bainbridge et al., 2010).

Health care quality and safety: adverse events

Adverse events occur often in health care and constitute a serious, costly problem (Brennan et al., 1991; Ehsani, Jackson, & Duckett, 2006). An adverse event is an unintended injury or complication occurring because of clinical care rather than underlying disease. Adverse events can result in prolonged hospitalisation, temporary or permanent disability or death (Brennan et al., 1991; Wilson et al., 1995; Baker et al., 2004; de Vries, Ramrattan, Smorenburg, Gouma, & Boermeester, 2008). Szekendi et al. (2006) assert that inadequate
information about, and understanding of, the factors that increase the risk of adverse events is an obstacle to improving patient safety. Given that the consequences of adverse events are significant, the phenomenon of adverse events appropriately attracts significant research investment.

**Consequences of adverse events**

Adverse events are associated with higher health-sector costs of the order of 15% of the total in-hospital cost, or almost $7000 in additional costs per admission episode (Ehsani et al., 2006) largely because they commonly lead to a significant increase in the mean length of hospital stay (Sari, Sheldon, Cracknell, Turnbull, et al., 2007). A review of the incidence and cost of adverse events in Victoria during 2003 and 2004 revealed that patients who suffered an adverse event stayed on average 10 days longer and had over seven times the risk of in-hospital death than those who did not suffer an adverse event. Patients who died in hospital were significantly more likely to have had an adverse event than those discharged alive (Ehsani et al., 2006).

Other researchers report readmission to hospital as being among the most common sequelae of a hospital adverse event (Bartlett et al., 2008). These financial costs and statistical outcomes are significant for the health system and they also result in very real personal costs to those who suffer an adverse event and frequently change the relationship between the patient and provider, and the health system (Massó Guijarro, Aranaz Andrés, Mira, Perdiguero, & Aibar, 2010).

The rate of adverse events is frequently used as a health care quality and safety indicator when monitoring the quality of health care, because adverse events
represent harm to patients, clinicians and health services (Baker et al., 2004). A systematic review of eight studies from the USA, Canada, the UK, Australia and New Zealand showed the median overall incidence of adverse events was 9.2%, and almost half were regarded as preventable (de Vries et al., 2008). The term ‘preventable’ implies there is some prospect of identifying people and situations at risk of an adverse event and modifying risks and actions to avert similar events in the future.

**Identifying and assessing adverse events**

The analysis and study of adverse events requires that they are identified (Szekendi et al., 2006). Fortunately, most errors do not result in patient harm, but when identified, ‘near misses’ (Leape, 1994) also provide an opportunity for learning and further prevention. Once the adverse event or near miss is identified, systematically coding and recording the adverse events enables trends to be identified and analysed, and prevention strategies to be implemented and benchmarked against other similar health organisations.

**Which patients are at risk of suffering an adverse event?**

Although every consumer is at risk of suffering an adverse event during a hospital admission, it appears that specific groups are more vulnerable to adverse events. “The quality in Australian health care” study scrutinised over 14,000 admissions to 28 hospitals in New South Wales and South Australia and found an increased risk of suffering an adverse event with increasing age (Wilson et al., 1995). Additionally, serious disability and death because of an adverse event increased markedly with age. The increased risk associated with increasing age could reflect the greater complexity of illness, fragility and the
requisite interventions needed to manage complex illnesses. However, the evidence that risk increases with age suggests that more attention towards supporting the safety of older people in hospital is needed (Brennan et al., 1991). Identifying other patient groups who might be at increased risk of adverse events in the hospital setting could also direct new strategies to enhance safety and reduce unintended harm.

**Communication barriers and adverse events**

The communication barriers that occur in the absence of a shared language are almost palpable to the observer: agitation and frustration manifest as raised voices and exaggerated facial expressions. With a phrase book and a willing partner, it is often possible to order dinner or secure a hotel booking in an unfamiliar language, but crafted questions and precise answers are simply not possible. In the health setting, the conversations between practitioner and patient are rarely trivial, and the potential for misunderstanding and confusion is more likely when communication barriers occur. Misunderstanding and confusion preclude people from understanding the details of their care and limits their right to participate fully in decisions about that care.

Johnstone and Kanitsaki (2006) argued that patient safety systems and processes should explicitly address the vulnerabilities of patients from minority cultural and language backgrounds. Interestingly, the risks in health care associated with cultural and linguistic diversity have not been widely studied (Divi, Koss, Schmaltz, & Loeb, 2007; Suurmond, Ulters, De Bruljne, Stronks, & Essink-Bot, 2010). However, studies reviewing quality of care and health outcomes demonstrate significant disparities associated with language and
culture (Flores & Ngui, 2006; Divi et al., 2007). Carmona (2007) asserted that culturally and linguistically diverse groups experience poorer access to care, quality of care, health status and outcomes.

Recognition of the impact of language and culture on health care outcomes led to initiatives such as the Victorian Government requirements for health services to operate within “The Cultural Responsiveness Framework”. The framework includes standards and requirements for reporting cultural diversity initiatives within health services, and mandated sentinel events reporting that includes data fields relating to 'preferred language spoken' and 'interpreter required' (Department of Health, 2009). While they are disparate groups in terms of the cause of the specific language barriers they face, patients with a HI share a common need for additional appropriate support to communicate effectively within the health setting. Despite the obvious parallels, language barriers caused by deafness and HI, or indeed other forms of communication impairment such as aphasia or cerebral palsy, are not identified, managed or evaluated with the same attention to detail as cultural and linguistic barriers, if at all.

However, as the health care risks associated with cultural and linguistic diversity are emerging in the research literature, likewise, risks associated with communication impairment are also beginning to emerge. Language barriers due to communication impairment and those resulting from the absence of a common language are associated with reduced quality of health care, and, understandably, lower levels of satisfaction with the care provided. The concerns patients express are similar among linguistically diverse communities.
and among patients with communication impairments such as aphasia, cerebral palsy and deafness (Dalton et al., 2003; Iezzoni, Davis, Soukup, & O’Day, 2003; Iezzoni et al., 2004), which demonstrates that the human need for effective communication, rather than the aetiology of the language barrier, is the underlying unmet need.

**Hearing Impairment, deafness, and adverse events**

There is a paucity of literature directly examining the in-hospital health care risks associated with deafness and HI; however, the available evidence indicates poorer outcomes for deaf and hearing-impaired patients. For example, Landsberger and Diaz (2010) reported on a range of demographic and diagnostic comparisons in a small retrospective case review of deaf (n = 30) and hearing (n = 60) psychiatric inpatients. The research design using small samples of archival data limits the strength of the findings; nevertheless, the mean length of stay for deaf inpatients was seven days longer than the admissions of hearing patients. Landsberger and Diaz (2010) suggested clinical staff need to be aware of the cultural and linguistic differences and the effect of these differences on diagnosis and treatment.

Diaz and Landsberger (2010) also reported the findings of a preliminary study into using seclusion and restraint among an inpatient psychiatric population, that compared randomly sampled adults with normal hearing (n = 51), randomly sampled adults with intellectual disability (n = 30) and archival data for deaf (n = 30 ) groups. Only 12% of the hearing group experienced seclusion or restraint, while 43% of the deaf group experienced seclusion or restraint during hospitalisation. The authors concluded there was a strong possibility
that cultural misunderstanding and miscommunication could have contributed to the high rates of seclusion and restraint observed in the deaf group in their study.

A recent Canadian study used a systematic two stage case review to explore whether the presence of communication impairment predicted preventable adverse events. More than 2000 patient records were selected at random from almost 150,000 admissions to 20 randomly selected hospitals (Bartlett et al., 2008). Bartlett et al. (2008) identified a three-fold increased risk of preventable adverse events in the acute health care setting for people with some form of communication impairment. Multiple preventable adverse events also occurred more frequently in people with communication impairment. One-third of the patients who experienced a preventable adverse event required readmission to hospital, and almost half of the adverse events resulted in some level of disability. Half of the communication impairments were due to deafness and most of the preventable adverse events were drug related or caused by poor clinical management. Bartlett et al. (2008) suggested that the types of errors they found relate to the concerns raised by deaf patients in Iezzoni et al. (2004) about inadequate communication.

Bartlett et al. (2008) compared population estimates of communication impairment of approximately 10% in the general population (Hoffman et al., 2005) and 15% of hospital admissions (Ebert & Heckerling, 1998) with their much lower prevalence of communication impairment as identified by record review of 3%, and inferred that impairment details may not have been systematically documented in the medical record. Bartlett et al.’s conclusion
was supported by a recent review of the documentation of HI in medical records. A retrospective review of physician case notes of 100 patients with known significant binaural HI showed that HI was either not documented (36%) or incorrectly documented as normal (36%): it was correctly documented in only 28% of case notes (Halpin et al., 2009). Incorrect or absent documentation about HI in the medical record means that information about HI cannot be identified through retrospective case review, and will not be accounted for in ICD-10-AM coding.

Although Bartlett et al. (2008) conducted the first study of its kind to explicitly explore the relationship between acute health care outcomes and communication impairment; the findings mirror the longstanding concerns of patients with communication impairment about their safety and opportunities for satisfying communication with medical professionals. The importance of effective communication to reducing health care risk is also supported by the findings of a recent literature review of the patient’s perspectives of adverse events: “Physician-patient communication stands out as the key to prevent and manage adverse events” (Massó Guijarro et al., 2010, p. 146).

Person-centred care and safety

According to Stevens (2010), the “Crossing the quality chasm” Report (Institute of Medicine, 2001) has strongly influenced health care safety theory and research, and emphasises patient-centredness as an important dimension of a better health system. For, example, the ‘Australian National Health and Hospitals Reform Commission’ has identified and adopted people-centred care
as a key design feature of the Australian health system of the future (NHHRC, 2008).

A person-centred health system is one where the views, experiences and rights of the patient influence the way health care is delivered (Jorm, Dunbar, Sudano, & Travaglia, 2009). Patient safety research has consistently demonstrated the link between poor communication between health care organisations and patients and their families or other carers (Hindel, Braithwaite, Travaglia, & Iedema, 2006). Poor, incomplete, or inadequate communication prevents person-centred care.

Although the ICF is successfully applied to the discussion of communication impairment throughout the literature, it does not appear to have transferred to the quality and safety literature, where instead person-centred care is recognised as being integral to supporting better patient safety strategies. However, in addressing barriers to support participation, the ICF framework does much to illuminate the process of addressing risk to support safer, person-centred care. According to the World Health Organisation report ‘People at the centre of health care’, people-centred care targets outcomes in four key policy and action domains: Informed and empowered individuals, families and communities; competent and responsive health practitioners; efficient and benevolent health care organisations; and supportive and humanitarian health care systems (World Health Organisation, 2007). These key policy and action domains relate to the ICF (World Health Organisation, 2001) Environmental Factors as described by Hurst (2003) and O’Halloran et al. (2008).
Despite their different origins, in practice, the ICF framework (World Health Organisation, 2001) and the person-centred framework (World Health Organisation, 2007) are complementary rather than mutually exclusive. Where person-centred care is achieved in all four domains of the WHO’s (2007) ‘People at the centre of health care’ guideline, then Environmental Factors in the ICF are likely to be enablers of participation, rather than barriers (World Health Organisation, 2001).

In the area of safety and quality of health care, focus has shifted in recent years towards the ‘systems’ approach that assumes people make mistakes, and that the system that surrounds them should provide a safety net for these mistakes (de Vries et al., 2008). Health systems designed on the assumption that errors are inevitable—such as the much referenced aviation industry—include buffers and redundancy afforded by double checks to help ‘absorb’ the errors when they do occur, and standardised procedures to support consistent practice (Leape, 1994). The safety literature often views health care consumers as victims of adverse events. However, in a person-centred model of care, the patient is an active agent who makes decisions, choices and consents to treatment, chooses one treatment over another, gives consent and contributes to preventing adverse events (Massó Guijarro et al., 2010). Therefore, patients have an important role in their own safety (Leape et al., 2009).

The concept of person-centred care is not new, but it is now enshrined in the regulatory framework for health care delivery; in Australia the National Safety and Quality Health Standards (NSQHS) (ACSQHC, 2011) and the Australian Charter of Health care Rights (the Charter) (ACSQHC, 2008) form part of the
regulation. The focus on person-centred care highlights the role of communication in safe and high quality care. The patient experience of health care provides new insights into the safety and quality of care. The implementation of the NSQHS standards is relatively recent and has occurred at the same time as a rapid growth in the patient safety literature. It is currently unclear how the NSQHS standards person-centred model of care will positively influence the practice of person-centred care: where health providers are incentivised to deliver person-centred care because the standards against which they are measured require them to do so. The connections between person-centred care, patient experience and health care standards need to be better understood to exploit the potential improvements for patients who are HI.

Chapter summary

Chapter 2 reviews a diverse literature to connect a literature describing HI incidence, prevalence and impact with the acute care patient safety literature in order to identify mechanisms for improving health care quality and safety for patients with HI. The chapter commenced with a discussion of the role of health care communication as a key to patient safety, and the concerns of deaf and HI patients about health care communication were explored. The use of the International Classification of Functioning, Disability and Health (World Health Organisation, 2001) and specifically its Environmental Factors and Personal Factors in providing a framework to enhance health communication was advanced.

An overview of the assessment and description of HI was provided, with consideration of the different experiences and outcomes for people who are
deaf or HI. Estimates of the prevalence of HI were presented and the different methodologies used to determine prevalence were discussed. The prevalence of HI in hospital was discussed and while all available evidence suggests very high prevalence of HI, cross sectional studies of hearing loss prevalence in hospitalised adults are lacking.

The link between communication barriers and the risk of suffering an adverse event was compared with communication barriers and risks associated with cultural and linguistic diversity. Person-centred care was considered in terms of its role as a vehicle for patient safety for people who are deaf or HI. The literature describing low rates of screening and identification of acquired HI, and modest rates of hearing aid use were discussed. Research exploring ways to identify patients with HI and to support communication and hearing aid use in an acute hospital population is needed.
Chapter 3: Method

Chapter 3 overview

Chapter 3 describes the research design and methodology used in the current study. Study participants were hospital inpatients recruited during their hospital stay. The research context including details about the research hospital and the broader context of hearing services for adults is discussed. An overview of the research and methodological issues is provided and the ethical issues associated with the data collection are outlined. The eligibility criteria and recruitment process are described, along with the approach used to identify the sample population, the sampling strategy and the data sources. The ethical considerations and consent process are discussed. Data collection and hearing assessment processes are described, as well as the electronic data extraction strategy. The methodological considerations for the ‘Patient Story’ are discussed, and finally, the data analysis methods are described.
Research Design

The current study design references the work of Davis (1997) and the two primary sources of hearing loss prevalence data for the Australian population. The South Australian Hearing Studies (Wilson et al., 1992; Taylor et al., 1993; Wilson, 1997; Wilson et al., 1999) were significant randomised cross-sectional hearing loss prevalence studies conducted alongside the South Australian Health Omnibus Study (SAHOS) during the early 1990s. The Blue Mountains Hearing Study (BMHS) is a population-based study exploring sensory loss and health outcomes in participants aged 50 years and over in a representative community in Western Sydney, with data collected in 1992–1994 and 1997–2000 (Sindhusake et al., 2001; Chia et al., 2007; Gopinath et al., 2009; Karpa et al., 2010).

Both the SAHOS and BMHS were cross-sectional studies with complex random sampling strategies. Davis (1997) described the cross-sectional random sample survey as an appropriate means of establishing reliable hearing loss prevalence estimates and confidence intervals at relatively low cost while excluding crude forms of bias. While the current smaller prevalence study was conducted in a single acute hospital site, the cross-sectional design principles and random sampling described by Davis (1997) were used. Study participants were randomly selected and recruited from the inpatient census of a large regional acute hospital. Consistent with the SAHOS and BMHS, the research protocol included a reliable measure of hearing thresholds: Pure tone audiometry.
Research Context

Hearing services

A range of public and privately funded hearing services are available across Australia. Public funding is provided primarily through the Commonwealth Hearing Services Program. The Hearing Services Program comprises a ‘voucher’ component and a ‘Community Service Obligation’ component. Eligibility for the Hearing Services Program is set out in the Hearing Services Administration Act 1997. Australian citizens or permanent residents aged 26 years and older who meet one of the following criteria are eligible to access the voucher component of the Hearing Services Program:

- a Pensioner Concession Card holder
- a Department of Veterans’ Affairs Gold Card holder
- a Department of Veterans’ Affairs White Card holder issued for specific conditions that include hearing loss
- receiving Sickness Allowance from Centrelink
- a dependent of a person in one of the above categories
- a member of the Australian Defence Force
- referred by the Disability Employment Services (Disability Management Services) Program or
- a National Disability Insurance Scheme (NDIS) participant with hearing needs, referred by a planner from the National Disability Insurance Agency.

Services funded through the voucher program are delivered by Hearing Services Program contracted service providers nationally, and include hearing assessments, provision of a range of fully subsidised hearing aids, maintenance of hearing devices, and communication and hearing aid education. Individuals
can choose to ‘top up’ to a different hearing device by paying extra (The Office of Hearing Services, 2015).

The ‘Community Service Obligation’ program funds ‘Australian Hearing’ to provide hearing services for Children and young adults up to the age of 26 who are Australian citizens or permanent residents. Australian Hearing are also funded to provide hearing services to:

- All Aboriginal and Torres Strait Islander peoples aged over 50.
- Aboriginal and Torres Strait Islander peoples participating in the Remote Jobs and Communities Program.
- An adult client who meets the Voucher program eligibility criteria and has a profound hearing loss or hearing loss and severe communication impairment.
- A person who meets the Voucher program eligibility criteria, and lives in a remote area of Australia (Australian Hearing, 2013).

Diagnostic hearing assessment is available through some public hospital and community health services, and private Audiology and Ear, Nose and Throat practices. Audiologists and Audiometrists also perform assessments, prescribe, and fit hearing aids through private and franchised hearing clinics in metropolitan and many regional areas including Geelong. Remote and very remote communities may have limited access to hearing services. Community organisations such as Better Hearing Australia provide access to some screening and low cost hearing aid services in metropolitan and many regional areas.

**The research hospital**

The current research was conducted at University Hospital Geelong, an acute hospital facility of Barwon Health. University Hospital Geelong was known as
‘The Geelong Hospital’ at the time of the research and until July 2014. Barwon Health is the largest regional health provider in Victoria, Australia, delivering sub-acute, acute, community health, rehabilitation, mental health, drug and alcohol and residential aged care services across 21 locations. University Hospital Geelong provides maternity care, cancer services and most surgical specialties. During the 2010–2011 financial year, University Hospital Geelong provided services for 39,233 same day admissions and 28,319 overnight admissions with an average length of stay of 4.7 days (National Health Performance Authority, 2013).

The Australian Institute of Health and Welfare (2015) describes University Hospital Geelong as a ‘Principal Referral Hospital’. Principal referral hospitals are defined as public acute facilities providing a very broad range of services, with a large range of highly specialised service units and very large patient volumes. ‘Principal Referral Hospital’ is one of 36 hospital peer subgroups used to enable useful comparison between hospitals within the same groups and subgroups. Hospital peer groups and subgroups share similar characteristics and are widely used in Australia and internationally for analysing and interpreting hospital statistics and performance information (AIHW, 2015).

University Hospital Geelong has an Audiology department that provides predominantly paediatric outpatient services. It also has a small clinical resource providing specialist support to inpatients with hearing loss. The Audiology Department may be a point of difference between University Hospital Geelong and some ‘Principal Referral Hospitals’ because not every hospital has
an Audiology service, although most hospitals with an Ear Nose and Throat surgical unit provide some Audiology services.

Barwon Health supported the current research by enabling the researcher to access facilities, audiometric equipment, clinical information systems and recruit potential participants. The author collected the individual patient data for the prevalence and screening studies during fieldwork from September 11 2011 to December 11 2011.

**Sample selection**

**Population and sample data sources**

Barwon Health used the ‘i.Patient Manager’ or ‘i.PM’ patient management system for all patient registrations at University Hospital Geelong. Through i.PM, all patients are allocated a unique identifier, referred to as a ‘UR’ or ‘unit record’ number. While i.PM does not contain the electronic medical record per se, it communicates with the ’Patient Master Index’ and each of the other integrated clinical systems to manage and record details, including patient identification, demographics, emergency presentations and outpatient appointments. Details about an individual, their admission, treating doctor and location within the hospital can be viewed through i.PM, which can also provide a ward-by-ward hospital census.

Clinical information was scanned into or captured directly by the ‘BOSSnet’ Digital Medical Records (DMR) system. Clinical information about an individual was accessed via the unique identifier through BOSSnet. A paper-based history was maintained on the ward for hospital inpatients and scanned into BOSSnet
when they were discharged. Therefore, information pertaining to the current admission was recorded on paper such as notes from Medical, Nursing or Allied Health staff, and electronically, for example Pathology or Medical Imaging results, or specific electronic screening results. Information about all previous admissions was stored electronically because all paper-based records are scanned into BOSSnet after the patient is discharged from hospital.

A ‘Data Warehouse’ enables data reporting and data analysis. It was a central repository of data from several disparate sources, including clinical systems and i.PM. Data warehouse reporting software was used to extract data from i.PM using purpose-written reports, which were automated but could also be compiled on demand. The current study required multiple reports throughout the planning, data collection and data analysis stages. Barwon Health’s Health Information Services coded the data reports used in the conduct of the current study to specifications detailing the required fields and data types provided by the researcher.

**Eligibility criteria**

Patients were eligible to participate in the study if they were an inpatient of the research hospital for more than 24 hours during the study period, aged 51 or older on the date they were admitted to hospital, medically stable, and able to complete the audiometry tasks. A report that identified all patients meeting the admission, length of stay and age criteria was extracted from the Data Warehouse. Details about the criteria and how the selection and randomisation occurred are provided in the following section. Additional criteria, for example,
decisions about whether the patient was ‘medically stable’ were assessed individually and are also discussed in the following section.

**Admission to the research hospital during the study period**

The study was undertaken to investigate the prevalence of HI in acute care and the extent to which HI might impact on patient-related quality and safety in the acute hospital setting. Therefore, only those individuals admitted to the research hospital during the study period were eligible to participate.

**Minimum 24-hour length of stay**

The minimum 24-hour length of stay was chosen to actively exclude same day admissions of any kind (e.g. day surgery, renal dialysis, chemotherapy, and aphaeresis, and so on). Day-stay patients typically have a full program of essential health interventions and are discharged as soon as practicable after these treatments are completed; therefore, getting access to day-stay patients would be difficult. Reliably recruiting and completing data collection within the short time frames was unlikely, given the limited resources available for the study.

**Minimum age of 51 years**

The study required an adequate sample of participants with hearing loss. People under the age of 51 were excluded because they are significantly less likely to have hearing loss. The prevalence of hearing loss in the general population in Australians aged between 15 and 50 years is 5.2% for all degrees of loss and 0.4% for hearing loss in the severe range, which would require a minimum of 250 participants to be screened for each case of severe hearing loss identified. The prevalence of hearing loss increases with age, to 28.3% for all
degrees of loss and 5.2% for hearing loss in the severe range in Australians aged over 51 years, up to 73.5% for all degrees of hearing loss and 12.1% for hearing loss in the severe range for Australians aged over 71 years (Wilson et al., 1999). Davis (1989) also described a large increase in prevalence after age 51. Therefore, selecting participants aged over 50 years would significantly improve the number of cases of hearing loss detected and make the best use of limited resources.

As people age, they are also likely to use hospital services more often and for longer periods of time. People aged 65 and over accounted for 39% of hospital ‘separations’—patient transfer, discharge or death—and 48% of patient days in 2011-2012 in Australia (Australian Institute of Health and Welfare, 2013).

**Medically stable**

Any patient aged 51 years or older occupying a bed in University Hospital Geelong for more than 24 hours was included in the randomising algorithm for the study; therefore, even gravely ill patients could be identified as a potential participant. Patients in areas such as the Intensive Care Unit were not invited to participate unless and until their condition improved.

The nurse in charge of the shift in each ward, and occasionally the treating doctor, was consulted about the patient’s condition and any relevant issues, and potential participants were ‘cleared’ to be invited to participate, before the researcher approached potential participants. Patients who were not considered well enough to be invited to participate by the nurse in charge were excluded from the study on that basis, or the decision was deferred pending a further review, if possible, on the following day. Family members, where
appropriate, were also included in the decision-making about whether the patient should be invited to participate. Once ‘cleared’ by the senior nurse, an appropriate timetable was negotiated with the patient and their treating team.

**Capacity to participate**

It is possible to assess the hearing and auditory function of any person at any age, regardless of their cognitive function or conscious state. However, the ‘gold standard’ hearing assessment technique and preferred assessment method for the current study was audiometry. Audiometry can only be reliably performed with the active participation of a person who, with appropriate support, can comprehend and follow instructions at the level of a developmentally normal five-year-old child. Because the hearing-screening test requires conscious effort and co-operation, some participants with cognitive impairment or mental illness may not be able to complete all the required tasks, but they were invited to participate to the extent of their ability. Where appropriate, informed consent to participate was sought from the next of kin or carers, and those with legal authority such as a guardian or power of attorney.

**Other eligibility considerations**

The research sample was randomly selected from University Hospital Geelong inpatient population, which includes people from Culturally and Linguistically Diverse (CALD) backgrounds including Aboriginal and/or Torres Strait Islander peoples, those with a primary language other than English, people with a cognitive impairment, other sensory loss, an intellectual disability or a mental illness.
Primary language, cultural background or disability did not affect eligibility for the current study, and if otherwise eligible, people were free to elect to participate or not. Communication support to enable participation, for example, interpreters or information provided in large print, was provided. The researcher has extensive clinical experience working with hearing-impaired people from culturally diverse backgrounds and those with mental health or cognitive impairments, and could competently provide or arrange appropriate support for such participants as required.

Where information in i.PM correctly recorded primary or preferred language and the need for an interpreter, the information was automatically recorded and flagged in the reports used to identify potential participants. Flagging enabled an interpreter to be pre-arranged. Where applicable, the consent process, assessment, and interview were conducted with interpreter support and the interpreter's details and signature were recorded on the consent form. Most patient records had the default preferred language: English. Likewise, cognitive impairment can also be recorded in i.PM through a ‘cognitive identifier’ although very few potential participants were flagged in this way. While the potential to electronically flag a range of important information is possible, several people with visual or cognitive impairment or a preferred language other than English were identified by the researcher at the first face-to-face encounter, not through electronic flagging, reviewing the medical record or consulting with the nursing staff.
**Identifying eligible participants**

When planning the study, Data Warehouse reports were used to establish the average number of patients meeting the age eligibility criterion admitted to University Hospital Geelong each day. Because these reports were run retrospectively, they reported actual admissions and known discharge details.

A significant challenge for the study was to establish a reliable method to prospectively identify patients who had been in hospital for 24 hours (but not much longer) or were likely to stay in hospital more than 24 hours. Importantly, the identification process needed to occur while potential participants were still in hospital, but as early as possible during the admission to allow sufficient time to invite them to participate, then recruit and complete the hearing assessment, preferably before they were discharged. Length of stay is actively managed to be as short as possible. Discharge from hospital can occur at relatively short notice, which was often the case during periods of high demand and bed shortage.

It is possible to record an “estimated date of discharge” in i.PM for each admission or planned admission. However, the field was not reliable, nor reliably completed, particularly for medical admissions. Consequently, there was no single reliable predictor of length of stay; therefore, the researcher developed a systematic approximation method to enable the prospective identification of potential participants for the study.

A daily automated Data Warehouse report was used to provide a systematic estimate of daily eligible admissions. Potential participants were identified via a report automatically generated by Data Warehouse at 7.47 am each day. The
report identified patients admitted the previous day who were aged 51 years and older on the date of admission, and were still an admitted patient as at 7.47 am the day after admission. For example, on September 12, 2011, an ‘eligible daily admission’ was any patient:

1. aged 51 years or over and
2. admitted to hospital on September 11, 2011, and
3. still an inpatient at 7:47 am on September 12, 2011.

This method identified all eligible patients with a relatively low rate of approximately 15% ‘false alarms’; that is, around 15% of those patients identified as eligible in the report were ultimately excluded because the length of stay did not meet eligibility requirements.

**Sampling strategy**

A representative sample was randomly selected from the eligible daily admissions. There was a significant variation in the number of eligible age patients admitted to the research hospital each day. Weekend admission rates are typically much lower than weekday admission rates and other events such as public or school holidays affect the number of admissions, largely due to changes in the number of scheduled procedures or ‘elective’ surgery.

A constant sampling fraction, the proportion of the population sampled, was selected to manage the daily variability in the size of the eligible population and ensure every eligible patient had an equal and known probability of being selected. Therefore, while the number of eligible admissions varied each day, the proportion randomly selected from the population was kept constant. That
is, the probability of being selected was proportional to the size of the eligible population each day.

It was important to identify an adequate number of eligible daily admissions to manage the limited shared access to the audiometry equipment required for data collection resources and to achieve adequate population coverage by recruiting a sufficient proportion of eligible participants. Therefore, admissions data were examined to determine a suitable sampling fraction. Both retrospective admissions reports, and prospective daily admissions reports for the 10 days prior to the commencement of data collection were considered. The choice of sampling fraction also took into account the extremely limited resources available to collect data, and was based on several assumptions about the logistics of data collection, namely, of the eligible daily admissions:

- up to 15% would be excluded because they were discharged within 24 hours
- up to 10% would be excluded due to health status (not medically stable)
- around half of those eligible and invited to participate would subsequently decline.

Additionally, up to 30% would remain in hospital for more than 24 hours but less than 48 hours, increasing the likelihood that they would be discharged before they could be recruited and assessed. Therefore, recognising the need to ‘over-select’ by an appropriate number throughout the primary data collection period to ensure an adequate sample size, a fixed proportion of 25% of the eligible daily admissions was randomly selected.

A randomisation process was applied to all the records identified in the ‘eligible daily admission’ report for a given admission date. An SQL Server algorithm:
“checksum(newid())” assigned a random number between negative 2.1 billion and positive 2.1 billion to each record. The records were then sorted from lowest to highest and the top 25% of records rounded up to the next whole number were flagged for inclusion in the study, while the remainder were excluded.

The ‘eligible daily admission’ report was run automatically via the Data Warehouse each morning during data collection and emailed as a Microsoft Excel spread sheet to the researcher. Alternative access to the report was possible ‘on demand’ via the Data Warehouse if there was a problem with the automated process or email. The data fields included in the ‘eligible daily admission’ report for example patient details and location, and other information to support planning for the study recruitment or assessment process such as interpreter requirements were included to support the recruitment process. The data fields included in the ‘eligible daily admission’ are shown in table 1.

Table 1: Data fields included in the ‘eligible daily admissions’ report

<table>
<thead>
<tr>
<th>Location (Ward, bed)</th>
<th>Expected date of discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>UR</td>
<td>Needs interpreter Yes / No</td>
</tr>
<tr>
<td>Name</td>
<td>Spoken language</td>
</tr>
<tr>
<td>Age at admission</td>
<td>Indigenous status? Yes / No</td>
</tr>
<tr>
<td>Admitting doctor</td>
<td>Cognitive identifier? Yes / No</td>
</tr>
<tr>
<td>Admission date</td>
<td>Admitting specialty</td>
</tr>
</tbody>
</table>

UR = ‘Unit Record’: unique patient identifier
Sample size

Sample sizes were calculated using ‘Epitools’ epidemiological calculators (Sergeant, 2015). Calculations assumed a significance of 95% (α = 0.05) and a power of 80% (β = 0.20). The required sample size for the prevalence study (n = 229) was based on estimates of a worse ear HI prevalence of 33% for a population aged from 50 years (Gopinath et al., 2009). The required sample size for the screening tool evaluation (n = 57) was based on an area under the curve (AUC) of 0.725 and a negative to positive ratio of 2:1.

Using the ‘eligible daily admission’ report

Each morning during the data collection period the researcher reviewed the contents of the ‘eligible daily admission’ report. Although data collection commenced within an hour of receiving the ‘eligible daily admission’ report, significant changes had often occurred in the admission status during the intervening period. A proportion of patients were discharged or transferred between wards, or i.PM was updated to reflect an earlier discharge or transfer. Ward clerks were not rostered to work overnight, so these changes were likely the consequence of a backlog of information that was not updated until the morning shift of ward clerks commences.

Within the first week of data collection, ward census reports were included in the morning process to supplement the ‘eligible daily admission’ report to help confirm the location of patients and identify any patients who had died or been discharged. Where required for clarity, i.PM was also used to review individual records. The current day’s list of eligible admissions was combined with admissions not yet completed from previous days. The eligible patient data was
sorted using Microsoft Excel so that date of admission, expected date of discharge (where known) and the number of patients within each ward could be used to develop a priority list for that day.

**Data anomalies**

There were occasional minor anomalies and errors in the data reports that were later corrected in i.PM. Where errors occurred, the corrected i.PM data was used in any subsequent analysis.

**Ethical issues**

The proposal for the current research was formally reviewed and approved by both the Barwon Health Human Research Ethics Committee (project 11/72); and the Deakin University Human Research Ethics Committee (project 2011-194).

Ethics approval also included approval for the researcher to establish and maintain an electronic hearing loss database for potential future longitudinal research following the same cohort recruited for the current study. Evidence of formal ethics approval from Barwon Health and Deakin University is attached in Appendices A and B respectively.

**Participant recruitment and consent**

During their hospital stay, potential participants were approached by the researcher and invited to participate in the study. At the initial meeting, the researcher explained the study and provided a copy of the Patient Information and Consent Form (PICF). Potential participants were encouraged to ask
questions and were given as much time as they needed to make their decision. Potential participants were also given information to enable them to access Audiology services at a later date, if they so desired. The consent process and the hearing screening were conducted at a mutually convenient time.

Informed consent was documented on the Patient Information and Consent Form (PICF) for all participants. If a potential participant was unable to consent, consent was sought from their medical power-of-attorney, guardian or next-of-kin. The admitting medical team and the medical power-of-attorney or next-of-kin was consulted whenever there was any ambiguity regarding the individual's capacity to provide informed consent.

Informed consent was sometimes provided verbally if appropriate. For example, a participant with an injured dominant arm provided verbal consent and the details and reasons for verbal consent recorded by the researcher on the PICF. A next of kin or person with legal authority, who had read and understood the PICF could provide acknowledgement on behalf of a potential participant during a phone conversation with the researcher. When consent was provided by phone, the researcher recorded the date and time of the call, the contact details of the person providing the acknowledgement, the reason for phone acknowledgement and any other relevant comments on the PICF.

**Participant recruitment**

Figure 3 on page 80 provides an overview of the participant recruitment process.
Data Collection

There were three primary data sources for the research: clinical data, medical history and information about the lived experience of hearing loss were collected directly from participants, their family and carers. The medical record pertaining to the current admission, both paper based and digital, was audited to identify any documentation about hearing loss and other communication support needs. Finally electronic data primarily describing the current admission as well as indicators relating to previous and subsequent admissions was sourced through the Data Warehouse.

Data collected directly from participants

Most hearing assessment interviews were conducted at the participant’s bedside in the ward and completed within a single session lasting up to an hour. The duration of testing increased with the degree of hearing loss and other factors such as age or other sensory or cognitive loss. Where testing was prolonged, participants were given the opportunity to take a break or defer or decline further tests. Likewise, the data collectors could terminate or limit the test battery at any time if they were concerned about the patient’s condition or fatigue or at the patient’s request. Audiometric data and history were recorded on the standard Audiology record forms. The results were explained to the participant immediately after the testing was completed, and participants were offered a copy of the results and referred for follow-up if indicated.

Data collection for the current study occurred concurrently with the clinical work of the Audiology department at University Hospital Geelong, Barwon
Figure 3: Overview of participant recruitment
A total of six Audiologists from Barwon Health and two Masters of Audiology students (University of Melbourne, and Flinders University) helped assess some participants. All testing completed by Audiology students was supervised by qualified clinicians. Each clinician involved in testing study participants completed a one-to-one briefing session with the researcher. Each briefing session included an overview of the study protocols including:

- equipment calibration
- correct use of insert earphones
- monitoring and management of background noise
- the preferred sequence to perform the Audiological test battery
- recording results
- appropriate referral of patients with significant morbidity.

The research test battery did not differ significantly from the usual clinical practice at Barwon Health. The researcher cross-checked each participant’s details with the medical record and the eligible daily admissions report, and confirmed documented informed consent before each assessment.

The primary audiometric data required for the study were the hearing threshold levels for both ears tested separately for the octave frequencies between 500Hz and 4000Hz. These thresholds were required to calculate the ‘4 frequency average hearing levels’ for the ‘better and worse ear’. Audiometry is rarely used alone in clinical practice, because the aetiology of any impairment cannot be accurately described by audiometry alone. Whenever possible, additional information including tympanometry, acoustic reflexes and otoacoustic emissions were also recorded when clinically indicated to enable
the aetiology of hearing loss to be documented and discussed with the participant.

**History**

The participant interview included an Audiological history and brief medical history including existing medical conditions and surgical procedures. The Audiological history included the patient’s subjective view of their hearing, the presence of any tinnitus, any history of ear pain, discharge, infection or surgery, family history of hearing loss, occupational or recreational noise exposure, vertigo or balance disturbance, and use of medications, particularly those known to be ototoxic such as aminoglycosides, diuretics and platinum based chemotherapeutics.

The patient history questions included questions from the “Communication & Hearing Access Screening Evaluation” (CHASE). CHASE is an ‘in house’ tool developed by the research hospital to assist with clinical prioritisation.

Questions included:

- Do you feel you have any problems with your hearing?
- Do you have any problems hearing in background noise?
- Does anyone complain that you are not hearing them properly?
- Do you ever rely on someone else to ask or answer questions on your behalf?

And specific questions about vision loss, including:

- Do you have any vision problem that isn’t helped by wearing glasses?
- With your glasses on (if necessary) can you see well enough to:
  - drive?
  - distinguish faces?
  - read a newspaper?
Participants were asked whether they owned or had ever owned a hearing aid, and how much they usually used the hearing aid. Hearing aid use in the hospital was also discussed and recorded, including reason for not using the hearing aid in the hospital, where appropriate. Use of other assistive listening devices such as volume control phones, audio loops and so on was also discussed and recorded.

With the consent of the participant, any family member present for the assessment was also asked to provide their view of the patient's hearing, using the following prompt questions:

- Do you think they have any hearing problems?
- Do you need to raise your voice or repeat yourself to be understood?
- Do you need to write things down to be understood?
- Do they have the television louder than you would like?
- Do they have trouble hearing the phone ring or hearing your voice over the phone?

The history and CHASE questions prompted other comments and questions and these were followed up naturalistically using probing and clarifying questions. Most participants provided a typical, relatively brief history, while some participants provided additional detail about their lived experience of hearing loss and their communication experiences in the health care setting.

Hearing assessment

Test environment and preparation

Sound levels were measured using either a Lutron Sound Level Meter model SL-4012 or the 'Digital Sound Level Meter' application on an iPhone 4 (Giudicelli,
A routine equipment calibration check was completed prior to testing each day. The Madsen Sound Level Meter was professionally calibrated and both Sound Level Meters were checked in the sound proof booth against a calibrated sound each morning before data collection.

Assessment was conducted 'on the ward', with every effort made to reduce background noise in the vicinity of testing. Background noise levels were continuously monitored with a sound level meter during testing. Testing was suspended or moved to quieter surroundings if necessary to ensure maximum background noise levels at the patient’s ear of 50-55 dBA. Audiology testing was moved to sound treated conditions in the Audiology Department for seven participants to ensure reliable results. The ear canals were otoscopically examined and any occluding cerumen was removed if necessary by a qualified Audiologist, and a hearing history was taken prior to testing.

**Audiometry**

The gold standard for assessing hearing is pure tone audiometry (PTA). PTA was performed using a Madsen AZ222 audiometer that had been professionally calibrated to the relevant ISO standards, with EARTONE 3A® insert earphones. Insert earphones were preferred because they provide 30dBA attenuation of ambient noise across the test frequency range (Etymotic Research Inc, 1997). EARTONE 3A® insert earphones were inserted deeply in the ear canal in line with standard clinical practice, and as described by Etymotic Research Inc (1997). Where the use of insert earphones was precluded due to the size or shape of the ear canal, wax occlusion of the ear canal that could not be addressed, or for any other reason, 'Madsen’ TDH39P standard audiometric
headphones in ‘Amplivox’ noise-excluding enclosures were substituted. A ‘Radio’ model B-71 bone conductor was used where clinically indicated to measure bone conduction hearing thresholds. The transducer type used during testing was recorded with the audiometric results.

Each ear was tested separately, using a standard manual audiometry ‘Ascending Technique’. An ascending technique begins with an inaudible signal and intensity is increased until a response is obtained. The intensity is then decreased by 10db and increased in 5dB steps until a response is obtained. The hearing threshold was defined as the lowest sound intensity level (in dB) or “softest” sound at which responses occur in at least two out of three ascending trials (ASHA, 2005). Thresholds were measured at octave frequencies between 500Hz and 4000kHz in each ear. Additional high frequencies and intermediate frequencies were assessed when time permitted and as clinically indicated. The recommended testing order was 1kHz, 2kHz, 4kHz and 500Hz, with a re-test at 1kHz as a measure of reliability. A 5dB test-retest reliability is usually assumed in pure tone audiometry; therefore, any test-retest differences larger than 5dB were checked by a second clinician from the research hospital. Masking was performed whenever clinically indicated to validate hearing thresholds.

**Tympanometry (middle ear function)**

Middle ear function was assessed using the AZ222 standard automated 226Hz (‘low frequency’) probe tone protocol. The results were categorised as Type A, As, B (high), B (low), or C using the Jerger Classification System (Jerger, 1970; Harris, Hutchinson, & Moravec, 2005).
Speech screening test

The research hospital’s inpatient Audiology service uses a hearing screening strategy which includes a ‘live voice’ version of the “AB words” speech discrimination test (Boothroyd, 1968). The screening strategy, first recommended by Osborne and Heine (2002), has been in use at Barwon Health’s acute and subacute inpatient facilities since 2003. One of the aims of the current research is to evaluate the sensitivity and specificity of AB words when used as a screening tool, with stimuli presented ‘live voice’ and at a fixed presentation level of 60dBA, and to determine appropriate cut points for hearing screening.

The “AB Isophonemic Monosyllabic Word test” is a speech perception test consisting of 15, 10-word lists. Each of the 15 lists uses the same 10 vowels and 20 consonants in a series of ten ‘phonemically balanced’ consonant-vowel-consonant words (e.g. fan, rug, ship) (Boothroyd, 1968).

The AB wordlists are familiar to Australian and British Audiologists for whom a recorded version typically forms part of a standard audiology test battery. The words are spoken in isolation, with no further linguistic context provided. The patient is asked to repeat the word they hear and are given one point for each of the three constituent phonemes in the word they repeat correctly. For example, if a patient repeats the word 'bug' in response to 'rug', they score two out of a possible three points. Each three points equates to ten per cent, which can be made up of three lots of one point or one point plus two points. The scoring convention is to add up each three, two or one point, into groups of ten per cent.
Any single leftover points are equal to three per cent and two points are equal to seven per cent (Boothroyd, 1968).

The scores are plotted as a performance versus intensity (PI) function: the percentage correct phoneme score is plotted at each presentation level sound intensity. According to Boothroyd (2008), the PI function describes the relationship between speech recognition probability and average speech amplitude. The use of phonemic scoring instead of whole word scoring effectively increases the number of test items—30 phonemes compared with 10 words—while maintaining good test-retest reliability (Boothroyd, 1968, 2008). Furthermore, phoneme recognition can be used to estimate performance on ‘whole word’ recognition and word recognition in sentences (Boothroyd, 2008), providing an objective estimate of functional hearing impairment.

The screening test evaluated in the current study uses the original AB word lists and is scored ‘phonemically’ in the same manner as the formal AB words test, however the test items are spoken aloud at a fixed intensity (volume) rather than using recorded stimuli at variable intensity. In the current study, the researcher read aloud the AB words at a 60dBA sound level at the patient’s ear. A sound level meter placed near the participant’s ear throughout testing enabled the researcher to monitor and manage their voice level and background noise.

The researcher explained the process before the screening began, as follows:

“I am going to read aloud a list of 10 short words like ‘house’ or ‘car’. I want you to repeat those words back to me. So if I say, ‘house’, you say ‘house’. My voice will be quite soft, so if you’re not sure what the word is, have a guess, or just tell me
any part of the word you did hear. Do you understand? ...Ok, when you’re ready to start, close your eyes and listen carefully.”

The researcher obscured the view of their mouth while speaking the stimulus words to prevent participants using lip-reading cues.

Where access to, or time with, the participant was limited, the study protocol prioritised the history and audiometry data collection above data collection for the hearing screening evaluation and the screening task was not completed. Audiometry was prioritised because the prevalence study required the largest sample size. A total of n = 118 data pairs were recorded, more than twice the required sample size.

**Data sourced from the medical record**

The paper-based current admission medical record was audited to identify any information documenting a medical power-of-attorney, guardian or next-of-kin. Admission information including risk assessments, care plans or pathways and notes about care were reviewed, paying particular attention to any information about hearing loss and hearing aids, cognitive impairment, vision loss and vision aids and any information describing falls, incidents and complaints. The absence of information about hearing loss, vision loss, or cognitive impairment was recorded. Any relevant notes were transcribed and or photocopied.

**Data sourced from Data Warehouse reports**

A series of Data Warehouse reports were used to extract hospital performance data relating to each person within the sample cohort pertaining to the “reference admission”, that is, the admission for which they were randomly
selected to participate in the study. Each individual was only eligible to be
included for one admission; therefore, participants randomly selected for a
second or subsequent admission were excluded from the study.

**Identification, alerts, admission and discharge details**

The following data was included for the reference admission:

- Name
- Date of Birth and age on date of admission
- Unit Record number
- All electronically recorded clinical alerts including Cognitive identifier, NESB/interpreter requirements.
- Date of admission
- Admitting Doctor, Unit, Ward, bed number
- Expected and actual date of discharge

**Data Analysis**

The data collected for the study produced a range of data types that warranted different statistical routines. The researcher sought expert advice about the statistical methods best suited to the aims of the study and the data (Mohebbi, 2014). Hearing loss prevalence, hearing aid usage and so on was expressed as proportions (%) with confidence intervals, consistent with the primary sources of Australian hearing loss population data (Wilson et al., 1992; Wilson, 1997; Wilson et al., 1999). Differences between proportions were tested using two-tailed z-tests. Differences between means were tested using two-tailed t-tests (independent samples). Potential associations between outcomes and exposure
were assessed with odds ratios. The Pearson product-moment correlation coefficient was computed to assess the relationship between the better ear hearing loss and speech screening score. The diagnostic accuracy of the AB words as a predictor of HI was assessed using signal detection theory.

**Calculating prevalence of Hearing Impairment**

Individual hearing test results consist of hearing threshold values at a range of frequencies usually recorded on a graph or audiogram, whereas HI prevalence in a group of individuals is described as a percentage of individuals who meet a HI criterion, which is based on a single average figure. In the current study, the single-figure four-frequency average (4FA) hearing threshold was calculated from the hearing threshold levels at 0.5, 1, 2, and 4kHz for each ear of each participant. Ears were categorised as ‘better ear’ or ‘worse ear’ by comparing the four-frequency average for each ear: the four-frequency average hearing in the better ear (4FABE) is the ear with the lower 4FA, and the four-frequency average hearing in the worse ear (4FAWE) is the ear with the higher four frequency average.

To enable comparison with other studies, better and worse ear prevalence was calculated for HI defined at several different severity levels: 4FA ≥ 21, 25, 35, 45, 65, and > 25dBHL. In clinical practice, hearing thresholds ≥ 21dBHL are considered to be outside the normal range (Australian Hearing, 2013), and 25, 45, and 65 approximate the categorical labels mild, moderate, and severe, respectively. The ≥ 35dBHL 4FABE HI is the recommended target condition for screening for HI in adults, and refers to the degree of HI at which one is likely to benefit from a hearing aid (Davis et al., 2007).
The ‘worse ear’ prevalence refers to the population prevalence of a given severity in either or both ears, including unilateral (single sided) HI. For example, a person with a 4FA of 30dB in one ear and 10dB in the other ear has a worse ear of 30dB and a better ear of 10dB. The individual would be counted as a positive case if the prevalence criterion was ≥ 21 or ≥ 25dBHL 4FAWE, but not if the criterion was ≥ 35dBHL 4FAWE. The worse ear criterion is used when the aim is to determine the presence of any hearing loss of a given severity. Better ear prevalence is used when the aim is to identify bilateral hearing loss, or the functional impairment prevalence at a defined threshold. Prevalence studies commonly report better ear prevalence. Prevalence at each level of severity is discussed in chapter 4.

**Describing severity of Hearing Impairment**

In combination with the prevalence estimates, descriptive statistics of HI shape and severity provide further insight into hearing loss in each of the age cohorts in the study population. The mean and median measures of central tendency of hearing thresholds were calculated, along with minimum and maximum threshold at each octave frequency between 500Hz and 4000Hz to highlight the typical range of severity of HI in the study population. The minimum and maximum thresholds depict the lowest and highest threshold recorded at a given frequency in each age range, rather than the best thresholds of any individual or ear.

Clark (1981) describes wide variation in the terminology used to describe hearing sensitivity. The Australian Hearing (2013) severity descriptions are used throughout the current study:
• Normal: -10 to 20 dBHL
• Mild: 21 to 45 dBHL
• Moderate: 46 to 64 dBHL
• Severe: 66 to 90 dBHL
• Profound: ≥ 91 dBHL.

Where high frequency thresholds are higher (worse) than the low frequency thresholds, the HI is often described as ‘sloping’, meaning that the audiogram slopes downwards. HI slope can be further differentiated as ‘gently sloping’: where there is a small change in thresholds with increasing frequency or ‘steeply sloping’ where there is a large change in thresholds over one or two frequencies. A ‘rising audiogram’ has worse thresholds in the lower frequencies and a flat audiogram has no appreciable change in gradient across the frequency range. The audiogram shape describes the way sounds of a particular frequency were heard in relation to other frequencies, and is a diagnostic feature that provides insight into the individual’s ability to hear speech sounds. Demeester et al. (2009) indicated the most common audiogram configurations in age-related HI are flat, gently sloping high frequency and steeply sloping high frequency.

**Measuring use of hearing aids**

Participants were asked about past and current hearing aid ownership, hearing aid use, and hearing aid use in hospital, during the patient interviews. Current hearing aid ownership, previous hearing aid ownership, and hearing aid use was discussed and documented, then tallied using the following categories:

• I don’t have hearing aids
  o I’ve never had hearing aids
I had some once but not any more

- I have hearing aids
  - I don’t use my hearing aids
  - I use my hearing aids
    - I use hearing aids sometimes
    - I use hearing aids most of the time
    - I use hearing aids all of the time

From the tallies, proportions and confidence intervals were calculated for the study population (n = 186) and the subset with HI ≥35dB 4FABE (n = 92) to enable comparison with the literature.

Assessing documentation about hearing loss in the medical record

Each participant’s admission, assessment and care documentation was reviewed in the medical record. Any entry relating to hearing aids or hearing impairment, or an absence thereof, was recorded and compared with the measured hearing impairment and the hearing aid ownership and use information collected for the current study, and proportions and confidence intervals were calculated.

Evaluating the screening tool

A convenience subset (n = 118) of participants randomly selected and recruited for the study (n = 186), provided both audiograms and speech screening scores to test the sensitivity and specificity of the screening test. The Standards for Reporting of Diagnostic Accuracy (STARD) (Bossuyt et al., 2003) recruitment flow charts are provided in figure 4–6 (pages 94-95).
Figure 4: STARD (Bossuyt et al., 2003) recruitment flow chart showing results for identifying ≥25dB target condition

Figure 5: STARD (Bossuyt et al., 2003) recruitment flow chart showing results for identifying ≥35dB target condition
The target condition for screening

The sensitivity of any screening tool is evaluated in relation to a target condition. Three HI cut point values or ‘criterion of positivity’ were evaluated. The first was ≥25dB 4FA to detect mild HI: ≥25dB 4FA effectively determines the presence of HI, and may be an appropriate measure to estimate HI prevalence and identify individuals for later follow up. The second: ≥35dB, was selected because it is the recommended screening target value of the Health Technology Assessment report into screening for HI in older adults (Davis et al., 2007). A further value of ≥45dB 4FA reflects moderate or greater HI (Australian Hearing, 2013) that might warrant intervention during the hospital admission.

Figure 6: STARD (Bossuyt et al., 2003) recruitment flow chart showing results for identifying ≥45dB target condition
Data analysis

The left ear audiometric thresholds at 500Hz, 1000Hz, 2000Hz and 4000Hz were added together and the total divided by four to give the left ear four-frequency average HI. The process was repeated for the right ear. The better ear was identified as the ear with the lower four-frequency average HI.

The four-frequency average HI in the better ear (4FABE) was compared with the ≥25dB target condition. The result was coded as “1” when the target condition was present, and “0” when the target condition was not present. This process was repeated for the ≥35dB and ≥45dB target conditions, resulting in three sets of data pairs consisting of the hearing screening score (%) and the coded condition flag (1 or 0).

A Pearson product-moment correlation coefficient was computed to assess the relationship between the 4FABE and speech screening score. The diagnostic accuracy of the AB words as a predictor of HI was assessed using signal detection theory. Using the data pairs consisting of the hearing screening score (%) and the coded condition flag, ‘Receiver Operator Characteristic’ functions (ROC) were calculated by the non-parametric method using SPSS Version 22 for three clinically relevant levels of four-frequency average HI: ≥25, ≥35, ≥45 4FABE.

In addition to ROC analysis, each participant’s score was coded by categorising the score in relation to a cut point as a true positive (TP), false positive (FP), true negative (TN) or false negative (FN). Then sensitivity and specificity were
calculated using the following formulae:

\[
\text{Sensitivity} = \frac{TP}{TP + FP} \\
\text{Specificity} = \frac{TN}{FP + TN}
\]

**Methodological considerations for the ‘patient story’**.

Data to address aim 5a was collected as part of the patient history as described on page 83. Additional participants with HI with knowledge and experience of quality and safety incidents in acute care were purposively sampled to elicit additional data to address aim 5b: “Explore the impact of HI and Deafness on the quality and safety of acute care”.

Purposive sampling is the deliberate choice of an informant based on qualities the informant possesses (Tongco, 2007). Purposive sampling deliberately includes ‘outliers’ to enable the ‘deviant’ case to demonstrate, by juxtaposition with the routine, “the exception to prove the rule” (Barbour, 2001, p. 1117). Despite its inherent bias, purposive sampling can provide reliable and robust data, and the strength of the method lies in its intentional bias (Bernard, 2011). Purposive sampling is widely used in pilot studies, intensive case studies, critical case studies, and studies of hard-to-find populations (Bernard, 2011) and is increasingly employed in the quality and safety literature reporting of case studies and patient stories.

Complaints provide unique insights into quality and safety issues (Mulcahy & Titter, 1998). Health care complaints can act as an early warning system and reveal problems in patient care that are not otherwise captured through other safety and quality monitoring systems, because patients have privileged access
to information about some aspects of care including communication and person-centred care (Gillespie & Reader, 2016). Making a complaint is an atypical response to dissatisfaction: patients and their families only complain when a threshold of dissatisfaction has been crossed (Mulcahy & Tritter, 1998). Complaints from patients with HI and their families could provide additional insights into the impact of HI on quality and safety in health care.

Purposive sampling was used to recruit Deaf or HI adults (over 18 years of age) who lodged a formal complaint (or whose family lodged a complaint) to the research hospital in relation to their impairment during an episode of acute inpatient care from July 1 2012 to June 30 2013. Complaints relating to the damage or loss of hearing aids but no other communication issue were excluded. Three complainants meeting the criteria were identified and invited to participate; one declined and two were recruited to the study: Mrs L and Mr G.

Mrs L’s daughter: Mrs T, complained on behalf of her mother and was the informant for the complaint and the study. The hospital Consumer Liaison Officer contacted Mrs T initially to acknowledge and process the complaint. The researcher received the formal complaint in her professional role with the research hospital. Mrs T was subsequently interviewed by phone and provided detailed information about the communication problems and incidents during Mrs L’s episode of care. The researcher documented Mrs T’s concerns, thanked her for raising the issues for discussion, and then acknowledged and apologised for the experiences. Mrs L was invited to participate in the current research and Mrs T consented on her mother’s behalf. Mrs T was motivated to make the
complaint and participate in the study to contribute to staff education about the different types of HI and how to communicate with a deaf person. Mrs T declined invitations to provide a more detailed background story about her mother or to be recorded or filmed.

Mr G initially discussed his concerns about his hospital experience with a podiatrist—helped by an Auslan interpreter—during an appointment at a Community Health Centre that is part of the research hospital’s service. Mr G wanted to complain about what had happened to him in hospital and the podiatrist lodged an incident in the hospital complaint system on Mr G’s behalf. The researcher received the formal complaint in her professional role with the research hospital. The hospital Consumer Liaison Officer contacted Mr G through an interpreter and invited him to an appointment to follow up on the complaint. The researcher and Consumer Liaison Officer met with Mr G to discuss his concerns with the assistance of an Auslan interpreter.

The researcher documented Mr G’s concerns, thanked him for raising the issues for discussion, and then acknowledged and apologised for his experiences. When asked what Mr G wanted to achieve by complaining, he said he thought that health professionals should know about deafness, sign language, and how to communicate with deaf people. He explained that he wanted to try to prevent something like that happening again to him or anyone else.

Mr G was invited and subsequently agreed to participate in the current research. He also agreed to record his story for use in educating health professionals. Auslan is a visual language and does not have an aural or written form. In Auslan, hand movements convey meaning through a three-dimensional
space. The whole body and facial expressions contribute to that meaning in the way intonation, inflexions, and pauses contribute to meaning in oral language. Mr G used his whole body to communicate, and moved around as he spoke. These essential aspects of his communication style would not have been adequately captured using audio recording or written words alone; therefore, the researcher proposed filming rather than audio recording the second interview.

The researcher, Mr G, and an accredited Auslan interpreter were present for the second interview, which was filmed with an iPad. The researcher set up an interview space in a meeting room in the Community Health Centre Mr G normally attends. Three seats were arranged to ensure good lighting for Mr G and the interpreter; however, Mr G could not sit still, so the chairs were removed and we all stood. Consequently, Mr G occasionally, briefly and unintentionally moved in and out of camera range during the interview, especially when he was describing the difficult and distressing parts of his story; however, the audio recording of the interpreter’s voice was not interrupted.

To ensure Mr G was well informed before he decided to participate, the researcher and Mr G discussed and completed the consent process through the interpreter at both interviews. He understood the video image was for educational and research purposes, and that his image could not be de-identified. He understood that following up on his complaint was not conditional on him participating in the research or any other activity.
He was delighted that his complaint could lead to such a positive outcome, in which his story would help inform and educate health professionals about Deafness, Auslan, and communication. He said emphatically:

>I want to explain my story. It (the interviews and video) is proof of my story. It will make things better in the future. People will be interested to see someone signing. It’s great for the nurses to have this training and make them aware of deaf people and different circumstances…and using Auslan to describe it is great. People will see the signs and maybe want to learn some.

The researcher transcribed the English translation of Mr G’s story, as spoken by the interpreter. There is no one-to-one correspondence between the Auslan signs and the spoken word, therefore the transcription is not a verbatim representation of Mr G’s words, but reflects a careful translation. Mr G’s patient story recorded in chapter 6 incorporates data from the video interview, written interview notes made by the interviewer at the first interview, the medical record and complaint record. The documented patient story attempts to maintain the chronology of the story as told by the participant, therefore the thematic analysis is presented as a narrative.

The researcher extracted themes in the data by identifying and coding repeated patterns of meaning relevant to the research questions, including the prevalence, emphasis, or importance placed on the issue by the participant within the narrative, along with concordance with themes in the existing literature that highlight communication problems impacting health care quality. The concerns raised by the participant are considered in the context of the applicable policy, legislative and regulatory frameworks, with particular
reference to the National Safety and Quality Health Standards (NSQHS) (ACSQHC, 2011) and the Australian Charter of Healthcare Rights (the Charter) (ACSQHC, 2008)

**Chapter Summary**

Chapter 3 provided an overview of the methodological approach of the current study. The complexity of identifying and randomly sampling from the study population was detailed, and the consent process described. The current study drew from different data sources; the different data collection and hearing assessment processes were described, along with a description of the electronic data extraction strategy. The data analysis methods relevant to each aspect of the study were discussed. Finally, the methodological considerations and processes relating to the elicitation of the patient stories was described.
Chapter 4 overview

Chapter four presents the findings addressing aims 1 to 4a regarding the prevalence and severity of HI, management of significant HI and the health service response to HI. The chapter begins with a description of the participant profile and then presents the prevalence estimates for HI in the study population of acute hospital inpatients older than 50 years. The HI prevalence estimates and 95% confidence intervals identified in the study population were summarised using different HI severity and age group criteria so the findings could be directly compared with other significant HI prevalence studies. Where published studies provided sufficient details, a statistical test of difference was also reported. Additionally, average hearing sensitivity of the study cohorts are described in relation to better or worse ear, gender, and age group. Self-reported hearing aid ownership and usage patterns are described, along with documentation in the medical record of HI and hearing aid use.
Introduction

The findings presented in chapter 4 address the study aims regarding the evaluation of the prevalence and severity of HI in a sample population of hospital inpatients, the management of HI and health service response to HI in the study population. Specifically, chapter 4 addresses study aims 1-4a, namely:

1a) Estimate the prevalence of HI in the study population

1b) Compare the prevalence of HI in the study population (1a) with Australian population studies of HI prevalence

2a) Describe the severity of HI in the study population

2b) Compare the severity of HI in the study population (2a) with the literature

3a) Determine the prevalence of significant HI in the study population

3b) Determine the proportion of adults with significant HI in the study population (3a) who have and use hearing aids

4a) Determine the proportion of adults in the study population who have and use hearing aids for whom HI was documented in the medical record on admission to hospital.
Participant profile

There were 186 participants recruited to the prevalence and severity studies: 101 were male and 85 were female. The average age was 74.61 years ± 10.63 range 51-100.

Table 2 (page 106) compares the age and gender distribution of the study population with the age and gender distribution reported in the Australian Hospital Statistics 2011-2012 data for overnight acute separations. The proportion of males to females within each age range is consistent with the AIHW data (Australian Institute of Health and Welfare, 2013). As a proportion of the total, the study population has fewer males in the 50-54 age range, more males in the 80-84 age range, and more females in the 85+ age range than the average AIHW data. According to the Australian Bureau of Statistics (2016), the median age in Geelong is higher than the Australian population.

Language background as recorded in i.PM for participants and patients eligible to participate is compared in table 3 on page 107. Most participants (96%; CI 93.4% -99.0%) were classified as English speakers. Fewer study participants spoke languages other than English (3.8%; CI 1.0% -6.6%) than the non-recruited inpatient population (7.1%, CI -0.87 - 7.4%), however, the difference was not statistically significant (Z = 1.6, p < 0.05). A total of 8.6% of Geelong residents reported speaking a language other than English in the home in the 2011 census (Australian Bureau of Statistics, 2016).
Table 2: Proportion (%) of males, females and total in the current study (n = 186) by age group compared with the AIHW 2011-2012 data (n = 1010007) (Australian Institute of Health and Welfare, 2013).

<table>
<thead>
<tr>
<th>Age group</th>
<th>Males</th>
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<th></th>
<th>Females</th>
<th></th>
<th></th>
<th></th>
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<td>AIHW</td>
<td>Current study</td>
<td>Significance</td>
<td></td>
<td>AIHW</td>
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<td>AIHW</td>
<td>Current study</td>
<td>Significance</td>
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<td>3.8%</td>
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<td>10.5%</td>
<td>5.9%</td>
<td>1.38</td>
<td>NS</td>
<td>10.9%</td>
<td>8.1%</td>
<td>1.24</td>
</tr>
<tr>
<td>60-64</td>
<td>13.7%</td>
<td>7.9%</td>
<td>1.69</td>
<td>NS</td>
<td>11.7%</td>
<td>5.9%</td>
<td>1.68</td>
<td>NS</td>
<td>12.7%</td>
<td>7.0%</td>
<td>2.35</td>
</tr>
<tr>
<td>65-69</td>
<td>14.2%</td>
<td>14.9%</td>
<td>-0.18</td>
<td>NS</td>
<td>11.8%</td>
<td>7.1%</td>
<td>1.35</td>
<td>NS</td>
<td>13.0%</td>
<td>11.3%</td>
<td>0.70</td>
</tr>
<tr>
<td>70-74</td>
<td>13.6%</td>
<td>16.8%</td>
<td>-0.94</td>
<td>NS</td>
<td>11.9%</td>
<td>12.9%</td>
<td>-0.31</td>
<td>NS</td>
<td>12.8%</td>
<td>15.1%</td>
<td>-0.94</td>
</tr>
<tr>
<td>75-79</td>
<td>12.8%</td>
<td>16.8%</td>
<td>-1.21</td>
<td>NS</td>
<td>12.1%</td>
<td>16.5%</td>
<td>-1.24</td>
<td>NS</td>
<td>12.5%</td>
<td>16.7%</td>
<td>-1.74</td>
</tr>
<tr>
<td>80-84</td>
<td>12.2%</td>
<td>18.8%</td>
<td>-2.05</td>
<td>p&lt;0.05</td>
<td>13.5%</td>
<td>17.6%</td>
<td>-1.17</td>
<td>NS</td>
<td>12.8%</td>
<td>18.3%</td>
<td>-2.23</td>
</tr>
<tr>
<td>85+</td>
<td>12.1%</td>
<td>11.9%</td>
<td>0.07</td>
<td>NS</td>
<td>18.3%</td>
<td>29.4%</td>
<td>-2.65</td>
<td>p&lt;0.01</td>
<td>15.2%</td>
<td>19.9%</td>
<td>-1.80</td>
</tr>
<tr>
<td>Total</td>
<td>100.0%</td>
<td>100.0%</td>
<td></td>
<td></td>
<td>100.0%</td>
<td>100.0%</td>
<td></td>
<td></td>
<td>100.0%</td>
<td>100.0%</td>
<td></td>
</tr>
</tbody>
</table>
Table 3: Languages background of study participants compared with eligible inpatients not recruited (missed, declined or excluded).

<table>
<thead>
<tr>
<th>Preferred Language recorded in i.PM</th>
<th>Eligible Not recruited</th>
<th>Eligible Recruited</th>
</tr>
</thead>
<tbody>
<tr>
<td>Croatian</td>
<td>13 (2.7%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>English</td>
<td>447 (92.9%)</td>
<td>179 (96.2%)</td>
</tr>
<tr>
<td>German</td>
<td>2 (0.4%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Greek</td>
<td>2 (0.4%)</td>
<td>1 (0.5%)</td>
</tr>
<tr>
<td>Italian</td>
<td>11 (2.3%)</td>
<td>3 (1.6%)</td>
</tr>
<tr>
<td>Mandarin</td>
<td>1 (0.2%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Not stated</td>
<td>1 (0.2%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Polish</td>
<td>1 (0.2%)</td>
<td>1 (0.5%)</td>
</tr>
<tr>
<td>Portuguese</td>
<td>1 (0.2%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Russian</td>
<td>1 (0.2%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Serbian</td>
<td>0 (0.0%)</td>
<td>2 (1.1%)</td>
</tr>
<tr>
<td>Tongan</td>
<td>1 (0.2%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>481 (100.0%)</strong></td>
<td><strong>186 (100.0%)</strong></td>
</tr>
</tbody>
</table>

To facilitate comparison with Davis (1989) and (Wilson, 1997) the distribution of age and gender is also provided using alternate age groups in table 4 (page 108).
Table 4: Number of study participants by decade of age and gender

<table>
<thead>
<tr>
<th>Age</th>
<th>Male</th>
<th>Female</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>51–60 years</td>
<td>17</td>
<td>10</td>
<td>27</td>
</tr>
<tr>
<td>61–70 years</td>
<td>21</td>
<td>14</td>
<td>35</td>
</tr>
<tr>
<td>71–80 years</td>
<td>37</td>
<td>26</td>
<td>63</td>
</tr>
<tr>
<td>≥ 81 years</td>
<td>26</td>
<td>35</td>
<td>61</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>101</td>
<td>85</td>
<td>186</td>
</tr>
</tbody>
</table>

DRG Major Diagnostic Category as coded post-discharge and recorded in i.PM for participants and patients eligible to participate is compared in table 5 on page 109. The study sample included relatively more participants with respiratory and musculoskeletal problems, and relatively fewer participants with circulatory and digestive problems but otherwise the study sample reflects the range and relative proportions of DRG’s seen in the broader eligible patient group.
<table>
<thead>
<tr>
<th>DRG Major Diagnostic Category</th>
<th>Not recruited</th>
<th></th>
<th>Recruited</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
<td>%</td>
</tr>
<tr>
<td>801A</td>
<td>2</td>
<td>0.4%</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Principal diagnosis may be associated with any MDC</td>
<td>6</td>
<td>1.2%</td>
<td>1</td>
<td>0.5%</td>
</tr>
<tr>
<td>D/D of nervous system</td>
<td>36</td>
<td>7.5%</td>
<td>20</td>
<td>10.8%</td>
</tr>
<tr>
<td>D/D of the eye</td>
<td>2</td>
<td>0.4%</td>
<td>2</td>
<td>1.1%</td>
</tr>
<tr>
<td>D/D of ear/nose, mouth and throat</td>
<td>7</td>
<td>1.5%</td>
<td>3</td>
<td>1.6%</td>
</tr>
<tr>
<td>D/D of respiratory system</td>
<td>76</td>
<td>15.8%</td>
<td>42</td>
<td>22.6%</td>
</tr>
<tr>
<td>D/D of circulatory system</td>
<td>106</td>
<td>22.0%</td>
<td>26</td>
<td>14.0%</td>
</tr>
<tr>
<td>D/D of digestive system</td>
<td>63</td>
<td>13.1%</td>
<td>12</td>
<td>6.5%</td>
</tr>
<tr>
<td>D/D of hepatobiliary system/pancreas</td>
<td>21</td>
<td>4.4%</td>
<td>3</td>
<td>1.6%</td>
</tr>
<tr>
<td>D/D of musculoskeletal system and connective tissue</td>
<td>46</td>
<td>9.6%</td>
<td>40</td>
<td>21.5%</td>
</tr>
<tr>
<td>D/D of skin/subcutaneous tissue/breast</td>
<td>16</td>
<td>3.3%</td>
<td>8</td>
<td>4.3%</td>
</tr>
<tr>
<td>Endocrine, nutritional and metabolic D/D</td>
<td>7</td>
<td>1.5%</td>
<td>3</td>
<td>1.6%</td>
</tr>
<tr>
<td>D/D of the kidney and urinary tract</td>
<td>37</td>
<td>7.7%</td>
<td>10</td>
<td>5.4%</td>
</tr>
<tr>
<td>D/D of the male reproductive system</td>
<td>2</td>
<td>0.4%</td>
<td>2</td>
<td>1.1%</td>
</tr>
<tr>
<td>D/D of the female reproductive system</td>
<td>4</td>
<td>0.8%</td>
<td>1</td>
<td>0.5%</td>
</tr>
<tr>
<td>D/D of blood/blood forming organs/immunological disorders</td>
<td>11</td>
<td>2.3%</td>
<td>2</td>
<td>1.1%</td>
</tr>
<tr>
<td>Neoplastic disorders</td>
<td>10</td>
<td>2.1%</td>
<td>2</td>
<td>1.1%</td>
</tr>
<tr>
<td>Infectious and parasitic diseases</td>
<td>7</td>
<td>1.5%</td>
<td>5</td>
<td>2.7%</td>
</tr>
<tr>
<td>Alcohol/drug use &amp; alcohol/drug induced organic mental disorders</td>
<td>1</td>
<td>0.2%</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Injuries/poisoning/toxic effects of drugs</td>
<td>12</td>
<td>2.5%</td>
<td>3</td>
<td>1.6%</td>
</tr>
<tr>
<td>Factors influencing health status &amp; other contacts with health services</td>
<td>9</td>
<td>1.9%</td>
<td>1</td>
<td>0.5%</td>
</tr>
<tr>
<td>Total</td>
<td>481</td>
<td>100.0%</td>
<td>186</td>
<td>100.0%</td>
</tr>
</tbody>
</table>
Prevalence of Hearing Impairment

Prevalence of HI in a sample population is described as the percentage of individuals who meet a given HI criterion. The current study recorded the four-frequency average (4FA) hearing threshold calculated from the hearing threshold levels at 0.5, 1, 2, and 4kHz for each ear of each participant. Ears were categorised as ‘better ear’ or ‘worse ear’ by comparing the four-frequency average: the better ear (4FABE) is the ear with the lower four frequency average HI.

The prevalence results at different severity levels, namely: 4FA ≥ 21, 25, 35, 45, 65, and >25 for the better and the worse ear are discussed on the following pages. The worse ear criterion is used to reflect the presence of any hearing loss of a given severity. Better ear prevalence is commonly reported in studies of HI prevalence and identifies bilateral hearing loss at a defined threshold.

The series of graphs in figure 7 (page 112) show the increasing prevalence and increasing severity of HI for each decade of increasing age, and the changing gender differences in prevalence. The slope of the graphs illustrates the rate of change in prevalence for each decade increase in age.

Prevalence of four frequency average HI ≥ 21dBHL

In clinical practice, hearing thresholds ≥ 21dBHL are considered to be outside the normal range (Australian Hearing, 2013). Table 6 (page 113) shows the prevalence of HI defined as ≥ 21dBHL 4FA. The results for the 51–60, 61–70 and ≥ 71 age groups in table 6 can be compared directly with the corresponding age entries in table 5.2 in Wilson (1997, p. 90).
The overall prevalence of worse ear HI ≥ 21dBHL 4FA in the study population was 89.8%. The prevalence of HI increased with age for both males and females. A higher prevalence of ≥ 21dBHL 4FA HI was noted for males compared to females across each of the age ranges, however the gender difference in prevalence decreased with age, as shown in figure 7 (page 112). While the prevalence of HI ≥ 21dBHL 4FA in men in the current study was markedly higher than the population estimates reported by Wilson (1997), even greater differences were observed for women, especially in the 51–60 age range where prevalence was almost equal to that of men at 70%. There was almost 12% difference in prevalence of worse ear HI ≥ 21dBHL 4FA between men and women aged 61–70 years, decreasing to a 3% difference ≥ 81 years.

A similar pattern was evident for better ear HI ≥ 21dBHL 4FA. The prevalence of better ear HI ≥ 21dBHL 4FA for women aged between 51–60 years was more than four times that reported by Wilson (1997). As shown in figure 7 (page 112) a larger gender difference of 21.4% was noted between 61–70 years, decreasing to 5.7% ≥ 81 years. However, none of the measured gender differences at ≥ 21dBHL 4FA in the better or worse ear were statistically significant. Wilson (1997) also noted large and consistent gender differences that were not statistically significant.
Figure 7: Prevalence of HI ≥ 21, 25, 35, 45 and 65 dBHL 4FA in the worse and better ear for females, males and total in each decade of age, showing the prevalence increase with increasing age across all hearing loss criteria and the impact of gender on prevalence
Table 6: Prevalence (% and 95% CI) of HI ≥ 21dBHL 4FA in the WORSE and BETTER ear for the study population, by age group and gender (n = 186); the top three rows (shaded) can be directly compared with table 5.1 in Wilson (1997, p. 90)

<table>
<thead>
<tr>
<th>Age group</th>
<th>Worse ear ≥ 21dBHL</th>
<th>Better ear ≥ 21dBHL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Persons</td>
<td>Males</td>
</tr>
<tr>
<td>51–60 years</td>
<td>70.4%</td>
<td>70.6%</td>
</tr>
<tr>
<td></td>
<td>53.2%–87.6%</td>
<td>48.9%–92.2%</td>
</tr>
<tr>
<td>61–70 years</td>
<td>85.7%</td>
<td>90.5%</td>
</tr>
<tr>
<td></td>
<td>74.1%–97.3%</td>
<td>77.9%–103.0%</td>
</tr>
<tr>
<td>≥ 71 years</td>
<td>95.2%</td>
<td>96.8%</td>
</tr>
<tr>
<td></td>
<td>91.4%–98.9%</td>
<td>92.5%–101.2%</td>
</tr>
<tr>
<td>71–80 years</td>
<td>92.1%</td>
<td>94.6%</td>
</tr>
<tr>
<td></td>
<td>85.4%–98.7%</td>
<td>87.3%–101.9%</td>
</tr>
<tr>
<td>≥ 81 years</td>
<td>98.4%</td>
<td>100.0%</td>
</tr>
<tr>
<td></td>
<td>95.2%–101.5%</td>
<td>100.0%–100.0%</td>
</tr>
<tr>
<td>Overall</td>
<td>89.8%</td>
<td>91.1%</td>
</tr>
<tr>
<td></td>
<td>85.4%–94.1%</td>
<td>85.6%–96.6%</td>
</tr>
</tbody>
</table>
Overall prevalence in the current study increased by over 30% over the three decades from age 51–60 years to near universal prevalence. Table 7 (page 115) presents a comparison of the prevalence of HI ≥ 21dBHL 4FA in the worse and better ear for the current study with the data provided by Wilson (1997), for the 51–60, 61–70 and ≥ 71 age groups. The prevalence of HI was significantly higher in the current study in the worse and better ear.

**Prevalence of four frequency average HI ≥ 25dBHL**

Table 8 (page 116) shows the prevalence of HI defined as ≥ 25dBHL 4FA. The results for the 51–60, 61–70 and ≥ 71 age groups in table 8 can be compared directly with the corresponding age groups in table 5.1 in Wilson (1997, p. 90) and enable the current findings to be compared to previous large population-based prevalence studies in the United Kingdom and United States (Davis, 1989; Agrawal et al., 2008).
Table 7: Prevalence (% and 95% CI) of HI ≥ 21dBHL in the WORSE and BETTER ear for the study population and Wilson (1997), by age group

<table>
<thead>
<tr>
<th>Age group</th>
<th>Worse ear ≥ 21 dBHL</th>
<th>Better ear ≥ 21 dBHL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Current study</td>
<td>Wilson</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>51-60 years</td>
<td>70.4% 53.2%–87.6%</td>
<td>31.3% 16.2%–46.4%</td>
</tr>
<tr>
<td>61-70 years</td>
<td>85.7% 74.1%–97.3%</td>
<td>64.7% 46.2%–83.3%</td>
</tr>
<tr>
<td>≥ 71 years</td>
<td>95.2% 91.4%–98.9%</td>
<td>87.5% 61.7%–100.0%</td>
</tr>
</tbody>
</table>
Table 8: Prevalence (% and 95% CI) of HI ≥ 25dBHL 4FA in the WORSE and BETTER ear for the study population, by age group and gender (n = 186); the top three rows (shaded) can be directly compared with table 5.1 in Wilson (1997, p. 90)

<table>
<thead>
<tr>
<th>Age group</th>
<th>Worse ear ≥ 25dBHL</th>
<th>Better ear ≥ 25dBHL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Persons</td>
<td>Males</td>
</tr>
<tr>
<td>51–60 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>59.3%</td>
<td>70.6%</td>
</tr>
<tr>
<td></td>
<td>40.7%–77.8%</td>
<td>48.9%–92.2%</td>
</tr>
<tr>
<td>61–70 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>85.7%</td>
<td>85.7%</td>
</tr>
<tr>
<td></td>
<td>74.1%–97.3%</td>
<td>70.7%–100.7%</td>
</tr>
<tr>
<td>≥ 71 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>93.5%</td>
<td>96.8%</td>
</tr>
<tr>
<td></td>
<td>89.2%–97.9%</td>
<td>92.5%–101.2%</td>
</tr>
<tr>
<td>71–80 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>90.5%</td>
<td>94.6%</td>
</tr>
<tr>
<td></td>
<td>83.2%–97.7%</td>
<td>87.3%–101.9%</td>
</tr>
<tr>
<td>≥ 81 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>96.7%</td>
<td>100.0%</td>
</tr>
<tr>
<td></td>
<td>92.2%–101.2%</td>
<td>100.0%–100.0%</td>
</tr>
<tr>
<td>Overall</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>85.5%</td>
<td>90.1%</td>
</tr>
<tr>
<td></td>
<td>80.4%–90.5%</td>
<td>84.3%–95.9%</td>
</tr>
</tbody>
</table>
The overall prevalence of ≥ 25dBL 4FA worse ear HI in the current study population was 85.5%. The prevalence of HI increased with age for both males and females. Overall prevalence increased by more than 30% over three decades to near universal prevalence from the age of 81 years. The overall better ear prevalence of HI ≥ 25dBHL was 76.3%, indicating that more than three-quarters of study participants aged over 50 years, over 80% of men and 70% of women, had at least a mild bilateral HI.

Prevalence of HI ≥ 25dBHL 4FA in the better ear increased with age by approximately 20% per decade from age 51. Prevalence of HI ≥ 25dBHL 4FA in the worse ear also increased with age, but the rate of increase per decade after age 51 was lower because HI was already present in almost 60% of participants aged between 51 and 60 years. For the decade from 51–60 to 61–70, the worse ear prevalence increased in a manner similar to the better ear (26.7% Vs. 25.9%) but the prevalence increase over the next two decades was lower at 4.8% and 3.2%, respectively. Table 9 (page 119) compares the prevalence of HI ≥ 25dBHL 4FA in the worse and better ear for the current study and with Wilson (1997). The worse ear and better ear prevalence was significantly higher in the current study than the prevalence reported by Wilson (1997) in each age range except 61–70 years in the better ear.

Gender differences and changes in prevalence of ≥ 25dBHL 4FA with increasing age are illustrated in figure 7 (page 112). The prevalence of ≥ 25dBHL 4FA HI in the better ear was approximately 10% lower for women aged 51–60 than men in the same age range; 33% lower in the 61–70 age group, and 20% lower in the 71–80 age range. The difference narrowed to just over 5% for
participants aged over 81 years, which represents an overall gender difference in prevalence of around 10%. While the gender difference was consistent, it was not statistically significant for any age group except the 61–70 age cohort ($Z = 1.99, p<0.05$).

**Prevalence of four frequency average HI ≥ 35dBHL**

The $\geq 35$dBHL 4FABE HI is the recommended target condition for screening for HI in adults, and refers to the degree of HI at which one is likely to benefit from a hearing aid (Davis et al., 2007). Table 10 on page 120 shows the prevalence of HI defined as $\geq 35$dBHL 4FA for the current study population.

Approximately half of the study population aged over 50 years had a bilateral HI of a degree sufficient to warrant the use of a hearing aid and predicted to have a significant impact on communication. Of note, 22% of 51–60 year olds had HI $\geq 35$dBHL 4FAWE, and 11% had HI $\geq 35$dBHL 4FABE. As shown in figure 7 (page 112), the prevalence of $\geq 35$dBHL 4FABE HI increased with age to 46% in the 71–80 age group and 85% for patients aged over 81 years, roughly doubling every decade from 51–60 years onwards.

Only small gender differences in prevalence of HI $\geq 35$dBHL 4FA were observed across most of the age cohorts except in the 71–80 age bracket where the gender difference for better ear prevalence was statistically significant ($Z = 2.1, p < 0.05$). The ≥ 81 age group also yielded the unusual finding of higher prevalence in the worse ear for females, but the difference was not significant. All other prevalence values were higher for men than women, but the differences were generally small.
Table 9: Prevalence (% and 95% CI) of HI ≥ 25dBHL in the WORSE and BETTER ear for the study population and Wilson (1997), by age group

<table>
<thead>
<tr>
<th>Age group</th>
<th>Worse ear ≥ 25dBHL</th>
<th></th>
<th></th>
<th>Better ear ≥ 25dBHL</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Current study</td>
<td>Wilson</td>
<td>Significance</td>
<td>Current study</td>
<td>Wilson</td>
<td>Significance</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Z</td>
<td>P</td>
<td></td>
<td></td>
</tr>
<tr>
<td>51-60 years</td>
<td>59.3%</td>
<td>28.3%</td>
<td>3.02</td>
<td>0.0025</td>
<td>37.0%</td>
<td>16.3%</td>
</tr>
<tr>
<td></td>
<td>40.7%–77.8%</td>
<td>13.4%–43.2%</td>
<td></td>
<td></td>
<td>18.8%–55.2%</td>
<td>3.5%–29.0%</td>
</tr>
<tr>
<td>61-70 years</td>
<td>85.7%</td>
<td>58.7%</td>
<td>3.82</td>
<td>&lt; 0.0001</td>
<td>62.9%</td>
<td>48.3%</td>
</tr>
<tr>
<td></td>
<td>74.1%–97.3%</td>
<td>40.5%–77.0%</td>
<td></td>
<td></td>
<td>46.9%–78.9%</td>
<td>29.1%–67.4%</td>
</tr>
<tr>
<td>≥ 71 years</td>
<td>93.5%</td>
<td>73.5%</td>
<td>4.81</td>
<td>&lt; 0.0001</td>
<td>88.7%</td>
<td>62.8%</td>
</tr>
<tr>
<td></td>
<td>89.2%–97.9%</td>
<td>45.7%–100.0%</td>
<td></td>
<td></td>
<td>83.1%–94.3%</td>
<td>35.0%–90.5%</td>
</tr>
</tbody>
</table>
Table 10: Prevalence (% and 95% CI) of HI ≥ 35dBHL 4FA in the WORSE and BETTER ear for the study population, by age group and gender (n = 186)

<table>
<thead>
<tr>
<th>Age group</th>
<th>Worse ear ≥ 35dBHL</th>
<th>Better ear ≥ 35dBHL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Persons Males Females</td>
<td>Persons Males Females</td>
</tr>
<tr>
<td>51–60 years</td>
<td>22.2% 23.5% 20.0%</td>
<td>11.1% 11.8% 10.0%</td>
</tr>
<tr>
<td></td>
<td>6.5%–37.9% 3.4%–43.7% -4.8%–44.8%</td>
<td>-0.7%–23.0% -3.6%–27.1% -8.6%–28.6%</td>
</tr>
<tr>
<td>61–70 years</td>
<td>31.4% 33.3% 28.6%</td>
<td>22.9% 23.8% 21.4%</td>
</tr>
<tr>
<td></td>
<td>16.0%–46.8% 13.2%–53.5% 4.9%–52.2%</td>
<td>8.9%–36.8% 5.6%–42.0% -0.1%–42.9%</td>
</tr>
<tr>
<td>71–80 years</td>
<td>60.3% 70.3% 46.2%</td>
<td>46.0% 56.8% 30.8%</td>
</tr>
<tr>
<td></td>
<td>48.0%–72.6% 55.6%–85.0% 27.0%–65.3%</td>
<td>33.5%–58.5% 40.8%–72.7% 13.0%–48.5%</td>
</tr>
<tr>
<td>≥ 81 years</td>
<td>90.2% 88.5% 91.4%</td>
<td>85.2% 88.5% 82.9%</td>
</tr>
<tr>
<td></td>
<td>82.7%–97.6% 76.2%–100.7% 82.1%–100.7%</td>
<td>76.3%–94.2% 76.2%–100.7% 70.4%–95.3%</td>
</tr>
<tr>
<td>Overall</td>
<td>59.1% 59.4% 58.8%</td>
<td>49.5% 50.5% 48.2%</td>
</tr>
<tr>
<td></td>
<td>52.1%–66.2% 49.8%–69.0% 48.4%–69.3%</td>
<td>42.3%–56.7% 40.7%–60.2% 37.6%–58.9%</td>
</tr>
</tbody>
</table>
Prevalence of HI ≥ 25dBHL, ≥ 35dBHL, ≥ 45dBHL and ≥ 65dBHL

Table 11 (page 122) compares the prevalence of four severity levels of hearing impairment by gender for the worse and better ears. As the severity of HI increases, the prevalence at each level of severity decreases, and the difference in prevalence between the genders decreases. For example, the prevalence of HI ≥ 25dBHL 4FA in the worse ear was approximately 10% lower for women than men. However, for severity of HI ≥ 35dBHL 4FA in the worse ear, the difference in prevalence between men and women was small: 59.4% vs. 58.8 at ≥ 35dBHL, 44.6% vs. 41.2% at ≥ 45dBHL, and 14.9% vs. 15.3% at ≥ 65dBHL 4FA, for men and women respectively, and none of these differences were statistically significantly different.

The pattern of differences in prevalence for men and women was also apparent in the better ear prevalence values except for the ≥ 65dBHL 4FA severity level where the prevalence for men was only 5%, compared with 29.6% for women, and the difference was significantly different (Z = 4.52, p < 0.01). This finding is noteworthy because it is one of the few significant differences in prevalence between the genders and because the higher prevalence occurred for females. Higher prevalence for females than males was also evident in the worse ear data for ≥ 65dBHL 4FA HI. Although these differences were small and not statistically significant, they are unusual.
Severity of Hearing Impairment

Descriptive statistics of HI shape and severity provide additional insights into HI in each of the age cohorts in the study population. In the following pages, the mean and median measures of central tendency of hearing thresholds are presented in the context of minimum and maximum threshold recorded at a given frequency in each age range to highlight the typical range of severity of HI.

Table 11: Prevalence (% and 95% CI) of 4FA HI in the WORSE and BETTER ear for the study population, by gender and four levels of severity (n = 186)

<table>
<thead>
<tr>
<th>Gender</th>
<th>Worse ear (dBHL 4FA)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>≥ 25</td>
<td>≥ 35</td>
<td>≥ 45</td>
<td>≥ 65</td>
</tr>
<tr>
<td>Male</td>
<td>90.1%</td>
<td>59.4%</td>
<td>44.6%</td>
<td>14.9%</td>
</tr>
<tr>
<td></td>
<td>84.3%–95.9%</td>
<td>49.8%–69.0%</td>
<td>34.9%–54.2%</td>
<td>7.9%–21.8%</td>
</tr>
<tr>
<td>Female</td>
<td>80.0%</td>
<td>58.8%</td>
<td>41.2%</td>
<td>15.3%</td>
</tr>
<tr>
<td></td>
<td>71.5%–88.5%</td>
<td>48.4%–69.3%</td>
<td>30.7%–51.6%</td>
<td>7.6%–22.9%</td>
</tr>
<tr>
<td>Overall</td>
<td>85.5%</td>
<td>59.1%</td>
<td>43.0%</td>
<td>15.1%</td>
</tr>
<tr>
<td></td>
<td>80.4%–90.5%</td>
<td>52.1%–66.2%</td>
<td>35.9%–50.1%</td>
<td>9.9%–20.2%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gender</th>
<th>Better ear (dBHL 4FA)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>≥ 25</td>
<td>≥ 35</td>
<td>≥ 45</td>
<td>≥ 65</td>
</tr>
<tr>
<td>Male</td>
<td>81.2%</td>
<td>50.5%</td>
<td>28.71%</td>
<td>5.0%</td>
</tr>
<tr>
<td></td>
<td>73.6%–88.8%</td>
<td>40.7%–60.2%</td>
<td>19.9%–37.5%</td>
<td>0.7%–9.2%</td>
</tr>
<tr>
<td>Female</td>
<td>70.6%</td>
<td>48.2%</td>
<td>30.6%</td>
<td>29.6%</td>
</tr>
<tr>
<td></td>
<td>60.9%–80.3%</td>
<td>37.6%–58.9%</td>
<td>20.8%–40.4%</td>
<td>23.0%–36.1%</td>
</tr>
<tr>
<td>Overall</td>
<td>76.3%</td>
<td>49.5%</td>
<td>29.6%</td>
<td>7.5%</td>
</tr>
<tr>
<td></td>
<td>70.2%–82.5%</td>
<td>42.3%–56.7%</td>
<td>23.0%–36.1%</td>
<td>3.7%–11.3%</td>
</tr>
</tbody>
</table>
The mean, median, maximum and minimum thresholds for each age cohort are depicted in Figures 8 to 11 on pages 124 to 131. Figure 13 (page 133) depicts the average better ear HI per decade of age; Figure 12 (page 132) shows the difference between the Left and Right ear, and Better and Worse ear average loss per decade of age.

**Average hearing sensitivity in the 51–60 years age group**

Hearing sensitivity in the 51–60 age group is described in Figure 8 (page 124). The overall mean and median thresholds were at or just outside the normal range for the mid to low frequencies, with a mild loss above 2000Hz sloping at approximately 10dBHL per octave. When comparing better and worse ears, a difference of less than 4 and 5 dBHL was observed at 2000Hz and 4000Hz, respectively.

Average and median HI for 51–60-year-old males was at or just outside the normal range for the mid to low frequencies, with a mild loss above 2000Hz sloping at approximately 15 and 20dBHL per octave in the better and worse ears, respectively. For males, the worse ear thresholds were 2 to 3 dBHL worse in the low to mid frequencies and 6dBHL worse at 4kHz, than the better ear.

Average hearing levels in the better ear for 51–60-year-old females fell into the mild HI range in a gently rising configuration. Median thresholds were at or just outside the normal range and were marginally worse in the low frequencies. When comparing better and worse ears, average thresholds were consistent in the low to mid frequencies, with a difference of 3 and 6 dBHL observed at 2000Hz and 4000Hz, respectively, resulting in a 3dBHL difference between the better and worse ears.
Figure 8: Hearing sensitivity 51–60 years
HI among the females aged 51–60 in the study population was more prevalent and more severe than expected. The small sample size (n= 10) for females aged 51–60 possibly accounts for these differences. However, it was interesting to note that only one of the females aged 51–60 had hearing thresholds entirely in the normal range from 500Hz to 4000Hz in both ears. Seven of the ten women in the 51–60 age group had HI ≥ 21dBHL 4FABE, four had HI ≥ 25dBHL 4FABE, and two had HI of ≥ 35dBHL 4FABE. Therefore, the effect may not be fully explained by one or two outliers with unusually severe HI.

Average thresholds for females were worse than those for males from 500Hz to 2000Hz. The difference decreased with frequency to 2000Hz, and then at 4000Hz the average threshold for males decreased below that for females, but the difference in 4FABE between males and females in the 51–60 age groups was not significant (T = 0.99, p < .05 2 tailed).

**Average hearing sensitivity in the 61–70 years age group**

Hearing sensitivity in participants aged 61–70 is depicted in Figure 9 on page 126. The overall mean thresholds were just outside the normal range in the lower frequencies, with a mild loss above 1kHz sloping at 15dBHL from 2kHz to 4kHz. There was no more than 2dB difference between the average thresholds in the left and right ears. The worse ear average thresholds were 3–6dB higher than the better ear, increasing with frequency.
Figure 9: Hearing sensitivity 61–70 years
Average and median better ear HI for 61 to 70-year-old males was at or just outside the normal range in the mid to low frequencies, with a mild to moderate loss above 2000Hz sloping at approximately 25dB per octave in the better ear. The worse ear thresholds for males were 3 to 5dB worse in the low to mid frequencies and 6 to 8dB worse in the high frequencies than the better ear, and the 4FA average was 6dB worse than the better ear.

Average hearing levels in the better ear for 61 to 70-year-old females were at or just outside the normal range for the low to mid frequencies, with a gently sloping mild high frequency HI. The average worse ear HI followed the same gently sloping shape 4-7dB lower. Average thresholds for males were 18dB worse than females at 4kHz.

Average hearing sensitivity in the 71–80 years age group

Figure 10 (page 129) shows the hearing sensitivity in the 71–80 age group. The overall mean thresholds were in the mild range for the lower frequencies, with a sloping loss to moderate-severe levels in the high frequencies. The average threshold declined by 8dB between 1 and 2kHz then by 19dB from 2 to 4kHz. The average left ear thresholds were 5dB worse than the right ear from 500Hz to 1kHz but only 1dB at 2kHz and above. The worse ear average thresholds were 7–8dB higher than the better ear.

Average and median HI for 71 to 80-year-old males was in the mild range for the low to mid frequencies, sloping approximately 30dB between 2 and 4kHz in the better and worse ears to the upper limits of the moderate range. The worse ear thresholds in males were between 6 and 9dB (average 7dB) worse than the better ear. Average hearing levels in the better ear for 71 to 80-year-old
females were in the mild range across the frequency range. Average thresholds for males and females were similar at 500Hz but a 15-dB difference between males and females was noted at 4kHz.

**Average hearing sensitivity in the 81 and older age group**

Hearing sensitivity in the 81 and older age group is shown in figure 11 on page 131. The overall mean thresholds were in the mild to moderate range for the lower frequencies with a sloping loss to severe levels in the high frequencies. There was no significant difference between the ears. The worse ear average thresholds were between 7 and 11 dB worse than the better ear, with the difference decreasing with frequency.

Average and median HI for 81 and older males was in the mild range for the low frequencies and moderate range for the mid frequencies, sloping 30dB overall to the severe range at 4000Hz. The worse ear thresholds for males were between 8 and 14dB worse than the better ear, decreasing with frequency, with the 4FA 11dB worse than the better ear.

Average hearing levels in the better ear for 81 and older females were in the mild range for the low to mid frequencies, sloping to a moderate level in the 4000Hz frequency range. Average thresholds for females were equivalent to those for males from 500Hz to 1000Hz. The average thresholds for males were higher than those for females above 1000kHz and the difference increased with frequency up to 11dB at 4kHz.
Figure 10: Hearing sensitivity 71–80 years
Average audiograms and ear differences overall

Differences between ears are illustrated in figure 12 (page 132). The right and left ear 4FA were essentially equivalent (R = 40.3; L = 39.9). Right ear average thresholds were higher between 500Hz and 1000Hz, and left ear average thresholds were higher between 2000 Hz and 4000Hz. The differences were not significantly statistically or clinically different. The average threshold difference between the better and worse ear increased at each frequency and overall each decade, as did the range of HI.

Figure 13 (page 133) depicts the average better ear HI per decade of age for males and females. The severity of average HI increased across the frequency range each decade. The average 4FABE threshold for 51–60 year olds was 25dBHL and increased by approximately 5dB per decade for the next two decades, then by 13dB per decade.

The average HI for females fell between the average HI for males for the same and previous decade. In a sense, the female ears were ‘younger’ than those of the males, but by less than a decade. For males, the slope of HI between 500Hz and 4000Hz increased each decade up to the 71–80 decade to a maximum of 29dB, an average of 10dB per octave, and remained at similar levels for males ≥ 81 years. For females, the slope of HI between 500Hz and 4000Hz increased each decade to a maximum of 19dB, an average of 6dB per octave.
Figure 11: Hearing sensitivity ≥ 81 years
Figure 12: Left vs. Right and Better vs. Worse ear average loss per decade
Figure 13: Average better ear hearing loss per decade of age for males and females
The biggest increase in average severity occurred in the 71–80 age group and those older than 81. The slope of HI between 2 and 4 kHz was consistently steeper for males than females. The average HI of the youngest group of females was a flat / gently rising shape while all other average HI results were worse in the high frequencies.

Most HI in the current study was mild: within the range of 21 to 45dBHL based on the Australian Hearing definitions (Australian Hearing). The results in figure 14 (page 135) are categorised according to the single figure 4FABE. Normal hearing is relatively uncommon across all age groups, and this is more marked with increasing age. Moderate loss occurred as frequently as mild loss for the group of participants ≥ 81 years however, mild HI is the most common severity of HI in the other age groups. Overall mild and moderate loss occurred significantly more frequently than normal hearing.

**Use of hearing aids**

Participants were asked about hearing aid ownership, hearing aid use, and hearing aid use in hospital, during the patient interviews. Table 12 (page 136) shows overall hearing aid ownership and usage patterns. Just under half (49.5%) of participants had HI ≥ 35dBHL in the better ear and 44.6% of these reported using a hearing aid. Of participants who reported having and using hearing aids, 59% were using their hearing aids in hospital. Some participants were admitted to hospital because of an emergent medical condition and
Figure 14: Severity of 4FABE hearing in descriptive categories (Australian Hearing, 2013) showing mild hearing loss is the most common HI severity category

inadvertently left their hearing aids behind; others reported deliberately leaving their hearing aids at home: some felt they would not need them, but others were concerned about losing their hearing aids.
Table 12: Self-reported hearing aid ownership and use (n = 186)

<table>
<thead>
<tr>
<th>Current hearing aid ownership (n = 186)</th>
<th>n</th>
<th>%</th>
<th>CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>I don't have hearing aids</td>
<td>129</td>
<td>69.4%</td>
<td>62.4%–75.5%</td>
</tr>
<tr>
<td>I have hearing aids</td>
<td>57</td>
<td>30.7%</td>
<td>24.5%–37.6%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Previous hearing aid ownership (n = 129)</th>
<th>n</th>
<th>%</th>
<th>CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>I've never had hearing aids</td>
<td>124</td>
<td>96.1%</td>
<td>91.2%–98.3%</td>
</tr>
<tr>
<td>I had some once but not any more</td>
<td>5</td>
<td>3.9%</td>
<td>1.7%–9.3%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hearing aid use (n = 186)</th>
<th>n</th>
<th>%</th>
<th>CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>I don't use hearing aids</td>
<td>142</td>
<td>76.3%</td>
<td>69.7%–81.9%</td>
</tr>
<tr>
<td>I use hearing aids</td>
<td>44</td>
<td>23.7%</td>
<td>18.1%–30.3%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hearing aid use by participants who have hearing aids (n = 57)</th>
<th>n</th>
<th>%</th>
<th>CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>I don't use my hearing aids</td>
<td>13</td>
<td>22.8%</td>
<td>13.8%–35.2%</td>
</tr>
<tr>
<td>I use my hearing aids</td>
<td>44</td>
<td>77.2%</td>
<td>64.8%–86.2%</td>
</tr>
<tr>
<td>I use hearing aids sometimes</td>
<td>17</td>
<td>38.6%</td>
<td>25.7%–53.4%</td>
</tr>
<tr>
<td>I use hearing aids most of the time</td>
<td>14</td>
<td>31.8%</td>
<td>20.0%–46.6%</td>
</tr>
<tr>
<td>I use hearing aids all of the time</td>
<td>13</td>
<td>29.6%</td>
<td>18.2%–44.2%</td>
</tr>
</tbody>
</table>

Table 13 (page 137) shows the hearing aid ownership and usage patterns for participants with HI ≥ 35dBL 4FABE. Ninety-three per cent of participants who reported using hearing aids had HI ≥ 35dBL 4FABE and the remaining 7% had asymmetrical losses. Participants with HI ≥ 35dBL 4FABE were more
Table 13: Self-reported hearing aid ownership and use for HI ≥35dBHL 4FABE (n = 92)

<table>
<thead>
<tr>
<th>Current hearing aid ownership (n = 92)</th>
<th>n</th>
<th>%</th>
<th>CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>I don’t have hearing aids</td>
<td>40</td>
<td>43.5</td>
<td>33.8%–53.7%</td>
</tr>
<tr>
<td>I have hearing aids</td>
<td>52</td>
<td>56.5</td>
<td>46.3%–66.2%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Previous hearing aid ownership (n = 40)</th>
<th>n</th>
<th>%</th>
<th>CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>I’ve never had hearing aids</td>
<td>37</td>
<td>92.5</td>
<td>80.1%–97.4%</td>
</tr>
<tr>
<td>I had some once but not any more</td>
<td>3</td>
<td>7.5</td>
<td>2.6%–19.9%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hearing aid use (n = 92)</th>
<th>n</th>
<th>%</th>
<th>CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>I don’t use hearing aids</td>
<td>51</td>
<td>55.4</td>
<td>45.3%–65.2%</td>
</tr>
<tr>
<td>I use hearing aids</td>
<td>41</td>
<td>44.6</td>
<td>34.8%–54.7%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hearing aid use by participants who have hearing aids (n = 52)</th>
<th>n</th>
<th>%</th>
<th>CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>I don't use my hearing aids</td>
<td>11</td>
<td>21.2</td>
<td>12.2%–34.0%</td>
</tr>
<tr>
<td>I use my hearing aids</td>
<td>41</td>
<td>78.9</td>
<td>66.0%–87.8%</td>
</tr>
<tr>
<td>I use hearing aids sometimes</td>
<td>15</td>
<td>36.6</td>
<td>23.6%–51.9%</td>
</tr>
<tr>
<td>I use hearing aids most of the time</td>
<td>13</td>
<td>31.7</td>
<td>19.6%–47.0%</td>
</tr>
<tr>
<td>I use hearing aids all of the time</td>
<td>13</td>
<td>31.7</td>
<td>19.6%–47.0%</td>
</tr>
</tbody>
</table>

likely to use hearing aids than participants with better hearing (OR 24.3856, CI 7.1894–82.71, p< 0.0001), however, 35% of hearing aid non-users had HI ≥ 35dBHL 4FABE.

The low rate of hearing aid use in the current study was consistent with previous reports. For example, there was no significant difference between the proportion of the current study participants with HI >40dBHL 4FABE who use a hearing aid (54.4%, CI: 42.6-65.7), and the 48.4% reported by Gopinath et al. (2011) (Z = 0.6864 p <0.01). Similarly, 28.4% (CI: 21.8-35.9) of current study participants...
participants with HI >25dBHL 4FA in either ear reported using hearing aids, compared with 23.4% reported by Gopinath et al. (2011) (Z = 1.205 p < 0.01).

**Referral for follow up of hearing loss**

A significant proportion of study participants (n = 64) were offered a referral for outpatient follow-up about hearing aids, and 70.3% accepted (CI: 58.2%–80.0%). Of these, 31.3% (CI: 21.2%–43.39%) already had hearing aids, including 9.4% of participants who had hearing aids but were not currently using them, and 21.9% to review hearing aids being used where the hearing aids appeared very old or the researcher suspected after a listening check that they were no longer adequate for the given HI. The remaining 39.0% (CI: 28.0%-51.3%) were new referrals for participants who did not already have hearing aids.

**Documentation about hearing loss in the medical record**

Each participant’s admission and care documentation was reviewed. Documentation about hearing aids was ‘correct’ for 39% (CI: 25.72 - 53.38%) of participants who reported having and using hearing aids. ‘Correct’ referred to some mention that the participant had hearing aids in the medical record. However, no documentation about hearing aids was identified for 45% of participants (CI: 31.7-59.93%). Documentation was often incorrect (16%): for example, recording ‘no hearing aids’ when the participant did have hearing aids (CI 7.93-29.37%). Documentation about HI or hearing aids was frequently absent or incorrect. The researcher observed that each clinical area had a preferred approach to admission processes and documentation. The documentation requirements differed depending on the admission ward and
sometimes also on the admission reason. Some admission and care planning documents included an entry such as “HI Yes / No”; others had a similar entry for hearing aids, and fewer still had both. In many cases the only information about hearing was recorded in a section marked ‘valuables’ where hearing aids were listed as property. Some entries were found in the ‘continuation notes’ section of the record where daily care is recorded.

**Discussion of prevalence and severity results**

**Prevalence of HI**

Comparison of prevalence findings with other published data is often difficult primarily because of the lack of agreement in HI definition along with differences in populations, test protocols and other factors. To the extent it was reasonable to do so, the current study calculated prevalence using different HI criteria and age boundaries to allow comparison with other published data, and where possible, tested differences statistically. This enabled a detailed comparison with previous prevalence estimates and demonstrated large and consistent differences between general population estimates for HI and those measured in the current study.

The large population based hearing studies originating from the South Australian Health Omnibus Survey (SAHOS) generated a series of papers with detailed results (Wilson et al., 1992; Taylor et al., 1993; Wilson, 1997; Wilson et al., 1999). The detail available in the reports of Wilsons’ studies made it possible to perform statistical tests of differences for a range of HI criterion and
age groups (Wilson et al., 1992; Taylor et al., 1993; Wilson, 1997; Wilson et al., 1999).

The HI prevalence was significantly higher in the current study population for each age group compared to Wilson’s (1997) age-matched general population data. Of particular note was the overall worse ear prevalence of HI ≥ 21dBHL 4FA for the people aged 51 to 60 years in the current study, which, at 70.4% was more than double the 31.3% Wilson reported (1997). Similarly, the better ear prevalence for HI ≥ 21dBHL was 63%, also more than double the 23% Wilson reported (1997). The extent to which the findings can be generalised may be limited by the small sample (n = 27) in the age cohort. The current study results suggest that differences between ears were common but on average the differences were very small, consistent with findings reported by Demeester et al. (2009).

At the HI ≥ 21dBHL 4FA criterion, almost 90% of study participants had hearing outside the normal range in at least one ear and almost 86% had hearing outside the normal range in both ears. The overall HI prevalence decreased as the HI criterion was increased. Using the ≥ 25dBHL 4FA criterion, HI prevalence in the worse ear was approximately 86%, and 76% of study participants—over 80% of men and 70% of females—had at least a mild bilateral HI. The prevalence of ≥ 25dBHL 4FABE in the 61–70 age cohort in the current study was consistent with that reported by Wilson (1997), while every other prevalence estimate was significantly higher.

Overall prevalence in the current study was also significantly higher than the Blue Mountains Hearing Study (BMHS); a population based study exploring
sensory loss and health outcomes in participants aged 50 years and over in a representative community in Western Sydney, with data collected in 1992–1994 and 1997–2000 (Sindhusake et al., 2001; Chia et al., 2007; Gopinath et al., 2009; Karpa et al., 2010). The BMHS reported a > 25dBHL HI prevalence of 33% in ‘any ear’ (the worse ear) (Gopinath et al., 2009). Prevalence for HI > 25dBHL was calculated from the current study data to enable a comparison with the BMHS. Noting that participants in the current study were aged from 51 years, compared with 50 years in the BMHS, the prevalence of 83.3% was more than twice the Blue Mountains cohort (Z= 13.872, p <0.0001). Similarly, bilateral > 25dBHL HI in the current cohort aged 60–69 was 69.6% and 45.5% for males and females respectively, compared with 28.7% and 17.0% for males and females respectively as reported by Gopinath et al. (2009).

The HI ≥ 35dBHL 4FABE criterion is of particular interest because it is the degree of HI at which one is likely to experience adverse impacts of HI on communication, and benefit from a hearing aid (Davis et al., 2007). Significant HI was common in the current sample of hospitalised adults. The prevalence of HI ≥ 35dBHL 4FA increased with age, doubling every decade of age. Overall 59.1% of participants had HI ≥ 35dBHL 4FA in the worse ear, while 49.5% had HI ≥ 35dBHL 4FA in the better ear.

Wilson et al. (1999) reported a 12% prevalence of ≥ 35dBHL 4FA in the worse ear and 6.9% in the better ear. In addition to participants aged from 51 years, Wilson et al. (1999) included participants aged from 15 to 50 years and is therefore not directly comparable to the results in table 7 in the current study. However, taking into account the likely prevalence difference due to the larger
age range in Wilson’s sample, a large difference was noted between Wilson et al. (1999) and the current study in the prevalence of HI ≥ 35dBHL 4FA in the better and worse ear.

While the prevalence of HI in hospitalised men was markedly higher than the population estimates Wilson (1997) reported, even greater differences were observed for females, especially in the 51–60 age range. The prevalence of better ear HI ≥ 21dBHL for females at 51–60 years was more than four times that reported by Wilson (1997). The prevalence and the severity of HI in this group were noteworthy. In contrast to the ‘typical’ mild high frequency loss in the men of the 51–60 years group, the average better ear HI of the 51–60 years old females was a flat / rising loss.

**Severity of HI and audiogram shape**

The best thresholds in the 51–60 age group were within normal range across the frequency range. In the 61–70 age group, the pattern of depressed thresholds at 4Hz is starting to emerge. By the 70–80 group the sloping loss at 4kHz is present even in the best thresholds. Average HI increased by a similar amount for each decade increase in age with a much larger increase noted between 71–80 and ≥ 81 years across the frequency range. In this age range, moderate loss occurred as frequently as mild loss.

The average audiograms show clear trends in average HI severity and shape except for females aged 51–60. The average HI shape for males and females in all but the group of females aged 51–60 was a sloping high frequency loss but a steeper gradient was noted for frequencies higher than 1000Hz for males than females. In general, the higher frequencies were affected first, and as HI
progressed lower frequencies were increasingly involved. Average audiograms were largely consistent with previous reports, e.g. Demeester et al. (2009). Overall average audiograms were worse in the current study for males and females, particularly the low frequencies. Allen and Eddins (2010) comment that the apparent orderly progression of HI with age belie the significant heterogeneity of HI shape and severity within each subgroup and overall, and this is well illustrated by the average audiogram figures (figures 8 to 11 on pages 124-131).

Allen and Eddins (2010) assessed presbyacusis phenotypes and prevalence and reported average audiograms for adults for each decade of age from 20 to 90. The average audiograms for males in the current study are a similar shape to those reported by Allen and Eddins (2010) but are more severe and show more low frequency loss and consequently have a less steep gradient in the high frequencies. Similarly, the average audiograms for females from the current study generally show more low frequency loss, a lower gradient in the high frequencies and are more severe overall. However, the average audiogram for females in the 51-60 age groups does not fit the trend.

Several researchers have discussed audiometric shape in age-related HI or presbyacusis. Demeester et al. (2009) assessed audiogram shape in a large sample of males and females within a relatively narrow age range of 55–65 years. Demeester et al. (2009) defined flat audiograms as having less than 15dB difference between the average of the low and the average of the high frequency thresholds and reported that audiometric shape in females was most commonly flat (50%), with 36% gently sloping high frequency and 14% steeply sloping.
and noted that females with HI in a flat configuration also tended to have more severe levels of HI compared with males. These descriptions are consistent with the current results for 51–60-year-old females. However, the overall average audiogram for females in the Demeester et al. (2009) study was still gently sloping and showed better average hearing than the females in the current study.

Hannula, Bloigu, Majamaa, Sorri, and Mäki-Torkko (2011) reported that flat losses were more common in females than males, and Ciletti and Flamme (2008) noted gently sloping losses were most common in females and steeply sloping losses in males, with more variability in audiogram shape among men.

Jerger, Chmiel, Stach, and Spretnjak (1993) re-examined reports of HI prevalence studies over 50 years and noted a consistent ‘gender reversal phenomenon’ whereby adult females demonstrate better pure-tone thresholds above the 1000- to 2000-Hz range which are paradoxically accompanied by poorer thresholds at lower frequencies. This difference persists after controlling for noise exposure. Jerger et al. (1993) raise the possibility that different factors may have a role in age related HI in males and females.

Allen and Eddins (2010) used factor analysis to revisit presbyacusis categories and identified that the distribution of HI was continuous and heterogeneous rather than discrete or categorical, and concluded that ‘mixed origins’ or aetiologies are likely to cause HI. Therefore, the audiogram shape might reflect a flat shape, the characteristic shape of strial loss and may have a high frequency loss due to the ototoxic effects of chemotherapy. The combined effects of both causes of HI results in an audiogram shape that is ambiguous.
Together the evidence suggests that flat loss in females is relatively common, and may result from several underlying causes, which are likely to be linked to other disease processes. Therefore, it is not unusual that a significant proportion of females in the 51–60 age group of the current study had flat audiograms. It is unusual that the average audiogram in the current study was also flat, as the literature consistently reports average audiograms showing a high frequency loss even when the sample contains a high proportion of flat audiograms, however, this is likely an artefact of the small sample size.

**Chapter Summary**

Chapter four presented the prevalence estimates of HI and average hearing levels in the current study population of 186 hospitalised adults. There was strong evidence of increasing HI prevalence and increasing HI severity with increasing age. In general, the prevalence and severity were significantly higher than previously established values for aged matched adults in the Australian population. Hearing aid use among participants with significant bilateral hearing impairment was modest, but consistent with previous reports in the literature. Documentation in the medical record about HI or hearing aids was frequently absent or incorrect.
Chapter 5: Screening test evaluation results

Chapter overview

Chapter 5 describes the evaluation of specificity and sensitivity of the AB words (Boothroyd, 1968) as a screening test and relates specifically to the current study aim 4b: “assess the sensitivity and specificity of a modified AB words speech test and determine appropriate cut points to identify significant HI in the better ear”. The results are presented along with a discussion of the clinical applicability of the screening tool.
Hearing Screening

Osborne (Osborne & Heine, 2002) suggested that a screening test based on the AB wordlists (Boothroyd, 1968), a clinical test to assess discrimination of calibrated recorded speech at various sound levels, could be a suitable screening method for screening older adults for HI. Screening methods based on speech discrimination can exploit the relationship, albeit imperfect, between hearing levels and speech discrimination. They also provide a ‘real life’ measure of the ability to understand speech and an estimate of HI. The AB words screening tool has been used extensively at the research hospital. The psychometric properties of AB words as a diagnostic measure of speech discrimination are well known. The performance of a modified version of AB words for screening was inferred from the diagnostic test (Osborne, 2015), but has not previously been evaluated.

The current study evaluated the performance of the AB words screening tool against the gold standard of hearing assessment: pure tine audiometry. The average of the audiometric thresholds at 500Hz, 1000Hz, 2000Hz and 4000Hz for each ear were compared and the ear with the lower four-frequency average was identified as the ‘better ear’. The four-frequency average HI in the better ear (4FABE) was compared with each of the three target conditions for screening, namely ≥ 25dB, ≥ 35dB and ≥ 45dB and coded to reflect whether the target condition was present, resulting in three sets of data pairs for each participant. Of the 186 participants randomly selected for the prevalence study, a convenience subset of 118 participants: 75 males and 43 females with an
average age of 71.88 years ± 10.01 range 51-96) also completed the speech screening test.

A Pearson product-moment correlation coefficient was computed using SPSS Version 22 to assess the relationship between the 4FABE and speech screening score. There was a strong negative correlation between 4FABE and speech screening score, \( r = -0.789, p = 0.01 \). Increases in 4FABE (decreased hearing) were correlated with decreases in speech screening score. A scatterplot summarizes the results (figure 15, page 149). Four outliers were noted. Two outliers reflect poorer than expected speech test performance given the hearing levels, and two reflect better than expected speech test performance given the hearing levels. Pearson product-moment correlation coefficient was computed with outliers excluded: \( r = -0.832, p = 0.01 \). The outliers were included in the remaining analysis.

![Figure 15: Scatterplot of Speech Screening Score Vs. 4FABE hearing level showing decreasing speech screening scores with increasing hearing thresholds](image)
Receiver-Operator Characteristics (ROC) Curves are presented in figure 16 (page 150). The 'Area Under the Curve' (AUC) results for each of the 4FABE hearing levels was significant ($p < 0.001$). Detailed results are provided in Table 14 (page 151). AUC increased with increasing severity of the target condition. The AUC was 0.87 for a target 4FABE HI of $\geq 25 \text{dB} \ 4\text{FABE}$, and this increased to an AUC of 0.932 for a target 4FABE HI of $\geq 45 \text{dB} \ 4\text{FABE}$.

Optimal cut points were determined for each of the hearing levels by analysing the ROC curve co-ordinates. In each condition, the choice of cut point was determined with respect to the trade-off between sensitivity and specificity as follows. First, co-ordinates with sensitivity around 0.80 or better were reviewed and those with lowest levels of ‘1-specificity’ were identified.

Two other factors concerning the clinical utility of the screening test were considered when establishing cut points. First, the scoring convention whereby AB words scores are always whole numbers ending in zero, three or seven was taken into account. Therefore, the screening score cut off chosen is the score providing the best match relative to the co-ordinate with appropriate sensitivity and specificity. In several instances this value fell between the values of adjacent co-ordinates.

Second, because the screening method is intended for fast and easy use in the clinical setting and the cut off scores naturally cluster around easy to remember values of 90, 80, and 70 per cent, it was possible to select consistent cut off criteria without compromising test sensitivity or specificity. Recommended
Figure 16: ROC Curves for Screening Tool with Target Condition of ≥25dB, ≥35dB, and ≥45dB 4FABE
Table 14: Area Under the Curve Results for Speech Screening Tool

<table>
<thead>
<tr>
<th>Screening target condition (4FABE)</th>
<th>Positive cases</th>
<th>Negative cases</th>
<th>Area under curve</th>
<th>Std. Errora</th>
<th>Asymptotic Sig.b</th>
<th>Asymptotic 95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td>≥ 25dB</td>
<td>82</td>
<td>36</td>
<td>0.876</td>
<td>0.031</td>
<td>.001</td>
<td>0.816</td>
</tr>
<tr>
<td>≥ 35dB</td>
<td>41</td>
<td>77</td>
<td>0.900</td>
<td>0.030</td>
<td>.001</td>
<td>0.841</td>
</tr>
<tr>
<td>≥ 45dB</td>
<td>16</td>
<td>102</td>
<td>0.931</td>
<td>0.025</td>
<td>.001</td>
<td>0.882</td>
</tr>
</tbody>
</table>

a. Under the nonparametric assumption; b. Null hypothesis: true area = 0.5

screening cut points for each target HI and the resultant positive and negative likelihood ratios are presented in table 15 (page 152). Sensitivity and specificity were calculated from the true positive (TP), false positive (FP), true negative (TN) or false negative (FN) rates for each of the proposed cut points and are also included in table 15.

**Discussion of screening test evaluation**

The study demonstrates very good overall sensitivity and specificity of the AB words screening test in identifying 4FABE HI of ≥25, ≥35, and ≥45. Cut points representing a reasonable compromise between sensitivity and specificity were identified for 4FABE HI of ≥25, ≥35, and ≥45.
Table 15: Suggested cut points, sensitivity and specificity, and likelihood ratios for screening hospitalised adults*

<table>
<thead>
<tr>
<th>Screening target condition (4FABE)</th>
<th>Positive screen (Screening Fail)</th>
<th>Negative screen (Screening Pass)</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Likelihood ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 25dB</td>
<td>≤ 90%</td>
<td>&gt; 90 %</td>
<td>87%</td>
<td>58%</td>
<td>3.62</td>
</tr>
<tr>
<td>≥ 35dB</td>
<td>≤ 80%</td>
<td>&gt; 80 %</td>
<td>88%</td>
<td>78%</td>
<td>3.97</td>
</tr>
<tr>
<td>≥ 45dB</td>
<td>≤ 70%</td>
<td>&gt; 70 %</td>
<td>94%</td>
<td>77%</td>
<td>5.33</td>
</tr>
</tbody>
</table>

*Note to interpreting table 15. Identify the preferred target condition in the left-hand column, read the screening fail and pass criteria from the second and third columns, and sensitivity and specificity from the fifth and sixth columns. For example, to screen for 4FABE hearing impairment ≥ 45 dB, a screening score > 70% is a screening pass result (HI > 45 dB not present) with a sensitivity of 94%.

An important clinical finding was that the screening tool can identify hearing loss and provide information about the degree of loss and efficiently identifies patients with very mild, mild and moderate or greater HI in the better ear. The screening tool assists with identifying and prioritising patients with significant bilateral hearing loss who might benefit from inpatient hearing and communication support.

There are several complex factors that affect the identification and management of HI. First, the onset of acquired sensorineural HI is typically slow and
insidious. As a result, individuals often do not recognise they have HI (Yueh et al., 2003). Even once they recognise hearing problems, many adults with HI actively work to deny or disguise their impairment (Backenroth & Ahlner, 2000; Yorgason et al., 2007; Wallhagen, 2009). Thus, screening methods that rely on self-report of hearing loss or self-assessment of disability have relatively poor sensitivity to HI. However, HI is characterised by its deleterious impact on the ability to understand speech, and this impact is independent of the recognition or acknowledgement of a HI.

Along with identifying HI with good specificity and sensitivity, the speech screening score also provides a good insight into the person’s ability to hear conversational level speech in a hospital setting. The screening objectively assesses Activity (Saunders et al., 2005) and identifies Activity Limitations resulting from HI (Timmer et al., 2015).

The choice of cut point and the fact that the test has good specificity both help to minimise false positive screening results. A range of factors other than HI including age and cognition can affect speech discrimination performance. Screening fails not attributable to hearing loss still offer insights into the patient’s ability to discriminate words at conversational levels. Although false positives are not desirable in terms of screening performance, false positive results for a speech-screening test may be clinically relevant.

The simplicity of the AB words as a screening tool has several benefits. The AB words screening test can be completed in around five minutes: approximately one minute to explain how the screening test works and a further minute to
administer the test. Arguably the most important few minutes are those spent after the test discussing the results and the next steps.

The details of testing performed using sophisticated technology or hearing tests performed via recordings or under headphones can be somewhat abstract to the patient and the observer. The patient does not know what they have misheard or not heard, and family members observing the assessment cannot hear the stimulus words, so neither has a good sense of how well the patient performed. The simple structure of the AB word screening test and the ‘live voice’ delivery enable observers and patients to understand the process and results of the test with very little explanation. Family members observing the test can hear the stimulus and the response and more easily understand the difficulty the patient may be experiencing.

Because of the ‘real time’ results and transparency, the screening process provides an effective context for discussing the implications of HI with the patient and their families. This is a valuable, focussed opportunity to educate and support patients and their family in their understanding of their hearing. The process engages patients with HI and their communication partners to develop both an immediate and longer-term HI management strategy, an important step as one of the factors most strongly associated with successful hearing aid outcomes is the positive support of significant others (Hickson, Meyer, Lovelock, Lampert, & Khan, 2014).

The AB words screening test can be performed as and when the opportunity arises, because it requires very little equipment or special preparation. The study population was limited to hospitalised adults, and the screening was
typically performed at the patient’s bedside. However, the test can be performed in any reasonably quiet conditions, which makes it ideal to use in any consulting or primary health care setting, provided there is a suitable referral pathway for following up screening fails.

Any member of the health care team can administer the AB words screening with minimal training and equipment. The screening procedure includes measuring and managing background noise; therefore, a device to measure sound pressure level is required. Inexpensive sound level meters are readily available, as are smart phone ‘apps’ (Giudicelli, 2011). Screeners need adequate knowledge of hearing loss and the referral process, the capacity to explain the test and the test results consistent with a person-centred model of care. Screeners need to be able to hear and transcribe the patients’ response to accurately score the screening test, and should not have a strong accent or speech production defect. Screeners should be competent in measuring and reducing background noise, accurately measuring their voice levels, and test scoring and follow-up processes.

Screening methods based on speech discrimination exploit the relationship, albeit imperfect, between hearing levels and speech discrimination. The AB words screening test provides a rapid screening assessment of the individual’s ability to discriminate conversational-level speech and can be used to compare performance in different listening conditions, e.g. with or without hearing aids, and with or without lip-reading. Observing the performance in different listening conditions also serves as a useful education strategy for patients, family and health care staff.
The primary aim of hearing screening in the research hospital is to identify patients who would benefit from immediate hearing care intervention to improve their communication and reduce healthcare associated risks while in hospital. A secondary aim of screening is to identify patients with milder loss who might benefit from further information or outpatient follow up. The results of the evaluation showed the AB words screening tool has very good sensitivity and specificity to support the inpatient screening process.

Chapter summary

The current chapter reported the evaluation of the performance of AB words as a screening tool as it is currently used at the research hospital. The approach to data analysis was described, and the results showing very good sensitivity and specificity of the AB words tool to detect hearing impairment in hospitalized adults were presented. The chapter concluded with a short discussion about the benefits of using AB words as a screening tool.
Chapter 6: The patient story

Overview of Chapter 6

Chapter 6 describes the experiences of Mr G, a Deaf man, during two hospital admissions. The chapter briefly describes Mr G, his background, and his reasons for participating in the current research. The chapter outlines the circumstances surrounding Mr G’s admission into hospital through the emergency department, planning his discharge home, and subsequent readmission for surgery.

Mr G’s experiences and health outcomes were very different for the two hospital admissions, although both admissions were for the same medical condition and surgical treatment. The chapter explores the different experiences and outcomes within the context of Mr G’s deafness, use of sign language and health literacy (Personal Factors), and the Environmental Factors that influence Mr G’s Activity Limitations and Participation Restrictions in an English-speaking healthcare setting. The experiences of three other participants are described to compare with Mr G’s experience and highlight a common theme.

The effect of inadequately addressing communication needs on patient experience, safety and health outcomes are discussed in relation to the policy and legislative framework for health, and with particular reference to the National Safety and Quality Health Service Standards (ACSQHC, 2011) and the Australian Charter of Healthcare Rights (the Charter) (ACSQHC, 2008).
Listening to the Patient Story

Patient stories help health services understand how their services are perceived by their patients; they describe an experience of care with a focus on the subjective experience of the patient rather than on the symptomatology or the technical aspects of care, although symptoms or treatment methods may be part of the story. As such, patient stories are a type of qualitative ‘case study’, suggestive of, but not necessarily derived from phenomenology. Patient stories appear to have originated from stories about medical errors that first appeared in the mainstream media. Millenson (2002) attributed the beginnings of a systematic response to improving patient safety to focussed media attention, and suggested that external pressure is often the necessary stimulus to prompt us “to consult our internal ethical compass” (Millenson, 2002, p. 62). Patient stories evoke an emotional response.

Wilcock, Stewart Brown, Bateson, Carver, and Machin (2003) assert that storytelling in healthcare quality improvement gives storytellers more control, and the story, often easy to understand and remember, enables a better understanding of the underlying needs. Patient stories are particularly effective in identifying failure of the system to deliver person-centred care.

The focus of this chapter is the story of a Deaf man named Mr G who was purposively sampled after complaining about his hospital care. The stories of Mr B, Mrs S and Mrs L are also presented and highlight a common theme. Mr B and Mrs S were participants from the prevalence study while Mrs L was purposively sampled after her daughter complained about her care.
Mr G’s story highlights some key issues that affected the quality and safety of the care he received, as well as his experience of care. The current chapter seeks to describe Mr G’s experience, and examine the experiences from the perspective of the applicable policy, legislative and regulatory frameworks, with particular reference to the National Safety and Quality Health Standards (NSQHS) (ACSQHC, 2011) and the Australian Charter of Healthcare Rights (the Charter) (ACSQHC, 2008). The approach is consistent with Mr G’s desire that his story should educate health professionals and improve healthcare safety and quality for Deaf people. Studies of healthcare experience with Deaf and HI participants consistently identify themes relating to person-centred care and the safety and quality of care (Ubido et al., 2002; Iezzoni et al., 2004; Napier & Kidd, 2013) thus also support this approach.

**The National Safety and Quality Health Standards**

The Australian Commission on Safety and Quality in Health Care (ACSQHC) is an Australian Government agency that leads and coordinates national improvements in safety and quality in health. The ACSQHC develop and publish the National Safety and Quality Health Service (NSQHS) Standards against which Australian health services are accredited (ACSQHC, 2011).

The NSQHS standards provide a practical balance between quality assurance and quality improvement, and stipulate minimum standards for safety and quality of care across 10 standards. The standards focus on priority areas that involve large numbers of patients, where there are known deficiencies in performance, and where evidence-based and achievable quality improvement strategies are available. Standards 1 and 2 provide an overarching framework:
standard 1 focuses on governance, and standard 2 establishes a mandate for delivering patient-centred care and ensuring consumer participation in all aspects of the design, delivery and evaluation of the health service. Standards 3 to 10 address specific areas of care (ACSQHC, 2011). In addition to standard 1, standard 4: Medication safety, standard 6: clinical handover, standard 7: Blood and blood products, and standard 9: Recognising and responding to clinical deterioration are the most relevant standards to Mr G's story. An overview of the NSQHS standards can be found in Appendix C.

The Australian Charter of Healthcare Rights

Standard 1.17 of the NSQHS standards refers to the requirement for health services to have a patient charter of rights consistent with the Australian Charter of Healthcare Rights (the Charter) (ACSQHC, 2008). The Charter outlines seven basic rights: Access, Safety, Respect, Communication, Participation, Privacy, and Comment. An overview of the Charter can be found in Appendix D.

In the context of the Charter and the NSQHS standards, Mr G's story is a reminder about patient expectations of health care and describes the human impact of health services falling short of those expectations. Relating Mr G’s concerns to the organisational goals of meeting the health standards is also a reminder of the partnership and shared purpose between patient and provider to deliver safe and effective care.
Mr G

Mr G’s background

Mr G is a 43-year-old deaf man whose preferred language is Australian Sign Language (Auslan). Mr G was born in Sydney in the late 1960s. His parents separated when he was a baby. Mr G describes not knowing his mother as a child because his father ‘took off with him’ in a backpack on the back of his motorcycle. Mr G grew up in the Northern Territory, and believed that he acquired his deafness after he hit his head falling out of his pram when he was three years old, because that was what his father told him.

Mr G cannot recall attending kindergarten and is not sure when he started school, but when he was about ten years old he attended a boarding school for the Deaf in Queensland for a short time. Mr G recalled enjoying being with other deaf children and he was excited that they used sign language. It was the first time he had seen other deaf children communicate. Mr G learned some of the basics of sign language from the other children and recalled that it felt good and natural to be able to communicate in this way. Mr G was unable to hear spoken language and had no opportunity to learn Auslan at an early age. Therefore, it is likely that Mr G’s language and communication skills, even in sign language, were rudimentary. In the absence of adequate early intervention and support, Mr G was already well behind his peers and struggled academically. Mr G described himself as a ‘naughty kid who played up and liked to chase the girls’ and consequently he ‘got into trouble a lot’. Mr G was unsure how long he stayed, but eventually he was ‘kicked out’ of the school for the deaf and returned to the Northern Territory where he lived and worked with his father.
Mr G described his relationship with his father as physically and mentally abusive; he described his father as a cruel, mean drunk who did not like deaf people. Mr G’s father refused to sign to him, other than the sign for “wait” and Mr G spent a lot of time waiting. Mr G tried to teach himself signs from a book but his father did not like this and would say “No!” and throw the book on the ground. By its nature, sign language is an overt symbol of deafness and Mr G’s father’s need to deny, hide or ignore Mr G’s deafness seemed to outweigh any desire to communicate with him.

Mr G worked on farms, cattle stations and abattoirs with his father, who took Mr G’s wages, sometimes by force, and spent it on alcohol. Mr G said, “I had an operation before”, pointing to a scar in the right iliac fossa. “I wasn’t able to rest after that operation because my father kept me working all the time, so my scar kept splitting apart and bleeding”.

When he was 18, Mr G left his father and set off on his own. He said “My life really started at 18”, partly because it was a fresh start, and partly because he felt he “didn’t know anything”. He described having to learn how to get around, shop, manage his money and his life, and how hard it was without help and being unable to communicate.

Mr G reunited with his mother in Sydney when he was about twenty-one and discovered he was the youngest of five children and that his eldest brother was deaf. Mr G now believes he was deaf from birth due to a genetic deafness. He was distressed about not knowing about his deaf brother and his own real story while he was growing up, but he also became depressed when he discovered his brother, with the benefit of Audiological care, early intervention, special
education and a supportive family, could read, write, speak and sign. He lamented, "Why am I so different?" He said he loves his family but feels he does not fit in. Mr G’s deaf brother is bilingual and can use Auslan to communicate with him and English to communicate with the rest of the family who cannot sign. “It depresses me that I don’t know English”...“English is my biggest problem”. Mr G now lives in regional Victoria and he earns a living through selling The Big Issue magazine in a suburban shopping strip and working in a supermarket and warehouse when the opportunity arises.

Mr G suffered from a painful health problem, which ultimately required an admission to hospital for surgical treatment. Mr G routinely faces barriers to accessing appropriate health care, although he feels he usually receives good care through his local community health services. However, the communication problems during his emergency care, admission to hospital, and discharge home, meant he did not understand his health condition or the proposed treatment.

Mr G described his frustration and fear about not knowing what was wrong with him and what was happening to him while he was in hospital, and not knowing what, if any, treatment he would need after he left the hospital.

Mr G is a large man with a shaved head and a robust physical presence. Mr G does not speak orally but along with signing he does make verbal sounds, often quite loudly. There was a marked contrast in Mr G’s physical presence when he was talking about his frustration and anger compared to when he discussed positive experiences.
The energy and activity of his signing at times could appear aggressive. Mr G has a gentle spirit, a ready smile and infectious laugh, but his physical appearance and manner could appear strange or threatening to people who had not met him before.

As part of ongoing education and initiatives to promote person-centred care, the Board, executive, management and clinical staff of the research health service have viewed the short film version of Mr G’s patient story. Mr G may not be able to read, write, or speak English, but through Auslan, he shows he is articulate, honest, and brave, and is a wonderful storyteller and educator.

**Mr G’s story**

During August 2012, Mr G felt unwell and experienced increasingly severe abdominal pain for several days, but was not sure how, nor how urgently, to seek treatment. He said:

_I can’t ring an ambulance from home, I can’t ring 000. It’s hard not to be able to communicate with the neighbours or be able to write down what’s wrong with me._

Mr G relied on his existing relationships with community health providers to help him access emergency care. He had a hydrotherapy session booked in a few days, and confident that an interpreter was usually booked for his session, he opted to wait to seek advice about his abdominal pain when he attended his appointment. He said:

_I thought I’d still go to my hydrotherapy appointment because I knew there’d be an interpreter there … so I just sat and waited for 4 days._
When I arrived, I said “I’m not sure if I can do hydrotherapy because I’ve got a really bad pain in my stomach”... and the lady from hydrotherapy said “You must go straight to hospital”.

Mr G felt very unwell and he realised he needed to go to hospital, but he was reluctant to go because he was concerned he would not be able to explain what was wrong to the hospital staff. He discussed the issues with staff at his hydrotherapy appointment. In response, the hydrotherapy staff and interpreter phoned the Language Services Department of the hospital to explain the situation, and in turn, they contacted the interpreting agency to extend the duration of the interpreter booking to enable the interpreter to accompany Mr G to the Emergency Department (ED).

Waiting in the Emergency Department

Mr G and the interpreter waited for several hours in the Emergency Department, until Mr G was seen briefly by the doctor who indicated that he had a problem with his gall bladder and he would be admitted to the hospital. The doctor did not discuss his condition or treatment in any detail. Mr G said:

At emergency we had to wait and wait. We waited for a while and then they said, “You’re fine to go in”. I spoke to the doctor with the interpreter, and they said I had to go up to [level xx] straightaway.

The admission process took some time rather than happening “straightaway”. The interpreter had to leave to put money in the parking meter and re-arrange another booking throughout the afternoon, but essentially she waited with Mr G until after the end of business hours. Unable to remain indefinitely, the interpreter discussed Mr G’s communication needs, including his inability to
read and write, with the nursing staff and gave them information about how to access the interpreter service after hours, including the phone number, before she left. The interpreter reassured Mr G she had explained his communication needs and his concerns to the nursing staff, and had emphasised that he could not hear, read, or write.

I have to stay in hospital

Eventually Mr G was admitted to the ward where he had to wait again for the doctor and another interpreter to attend. He became increasingly concerned and distressed about what was going to happen to him and not being able to communicate with the nursing staff. It is not clear from the medical record whether the ED staff did not hand over the information provided by the interpreter about Mr G’s communication needs to the ward staff, or if the response to that advice was inadequate. Regardless, while the use of notes with Mr G was evidence that the staff knew Mr G was deaf, the use of written notes also implied that the staff assumed that Mr G could read and write. Mr G knew the interpreter had explained that he could not read and write to the staff, so from Mr G’s perspective, his needs were ignored.

Can I have an interpreter?

Although Mr G did not receive much information while he was in the Emergency Department, he was able to understand all the information he did receive through the interpreter. In contrast, all of the communication with him on the ward was through written notes, and Mr G could not understand them. He would point and gesture to ask for clarification, but could not understand the response:
So when I arrived at the ward, the nurses were writing me notes... thought, “What does this mean”? ... It was difficult to read and I was asking, “What is this word?” And they would explain it again with more words.

Mr G asked the staff for an interpreter the only way he could: using props and gestures:

_I got a card out of my wallet and said “this is the interpreting agency, please get an interpreter”. Because they didn’t know sign language I thought that if I showed them the card they would know to book an interpreter, but then they’d come back and say, “No it didn’t work, we can’t get an interpreter”, and then they’d start writing again. I was getting very angry and very frustrated. Looking at the notes, trying to be determined to be able to read them, but it was very difficult. I’d think, “What’s this word again?” It was so long. Anyway, the nurses would come and go. I’d think, what am I doing? I’m just sitting here. Please phone the interpreter again. So I gave them the card again, but it didn’t work. I think three times it didn’t work. It was making me very frustrated._

**Everyone’s talking about me**

Mr G did not understand what was wrong with him, did not know what treatment he would need, and he felt isolated and left out of the discussions about him:

_They were all talking about it but I didn’t know. They were writing me notes, but I didn’t know...I was fed up. They’d all talk between themselves but I had no idea what they were saying. Everyone’s talking about me - I don’t know what they’re saying. There’s no one to communicate with. I felt like I was a bit trapped._
I am frustrated and angry

Mr G became increasingly frustrated about being told things and asked questions in written notes, and described feeling increasingly stressed and worried:

It was difficult. It was very hard to read. I was getting quite frustrated.

I could feel the pressure building up inside of me, when they kept asking me questions all the time. It was very hard to try to work out the pieces of the puzzle; it was awful. It’s very difficult trying to work out English by myself. I was trying to be patient but I was sweating it out, I felt worse and worse, and I couldn’t understand English. I was getting quite angry.

Mr G was suffering from a painful but relatively minor condition for which very safe and effective surgical treatment was readily available. Planning for the surgery was underway, but he did not know that. Mr G worried unnecessarily that his condition was very serious because he had no opportunity to discuss what was wrong with him and the appropriate treatment:

Being by myself, not having any support, or an interpreter, I felt that maybe I was going to die.

I don’t understand what’s wrong with me

Mr G’s understanding of his condition was limited to a name: “GB”. When there is no appropriate sign in Auslan for a particular word, the usual approach is to ‘finger spell’: spell using English letters on the fingers. It is also common to abbreviate names to initials; therefore, gall bladder became “GB”. “GB” was the name of an abstract concept with which Mr G was not familiar.
I knew there was something wrong with my stomach. “GB”: Gall bladder I think. They needed to fix it. I didn’t know whereabouts it was or what they had to do. I didn’t even know what the name of a gall bladder is. I’m telling them where the pain is but I’m not sure what a gall bladder is. It’s difficult when I don’t know the names of the parts of my body. I just knew it was sore and it was getting worse.

I can communicate, but not in English

Mr G is articulate and confident communicating in his preferred language:

I can sign really well and communicate with other people who can sign but I can’t talk. I can sign really well and communicate as much as I need to in Auslan, but written English is very difficult.

He also has highly developed skills in gesture and mime that sometimes enable him to communicate his basic needs and wants to others who can’t understand Auslan, but even if he can get his point across, he cannot then understand the response:

If I say, “I’ve got a pain here, what’s the name of that, what does that mean”, I can’t get the answer back unless it’s in Auslan … If I don’t get it in Auslan it just goes over my head.

Having to try to communicate in English was emotionally very difficult for Mr G, who was feeling increasingly unwell:

I was sweating it out; I was very angry and worried because I couldn’t understand English. I’m not experienced with writing at all, but they thought I was. Yes I can understand small words but these long words - I didn’t know what they meant … what did they mean these long words? I didn’t know what they meant.
I feel embarrassed and fed up

Mr G reported many times throughout both interviews that he felt very embarrassed about the communication barriers that he faced:

*I feel embarrassed that I can’t communicate with other people. I feel shit inside in myself. I feel withdrawn ... I hate the fact that I’m illiterate.*

Mr G blamed himself for being illiterate, rather than his deafness or lack of educational opportunities. Many deaf people, especially people Mr G’s age and older, struggled to develop oral and written language, which directly resulted from insufficiencies in diagnosing deafness and lack of assistive technology and educational support.

*I should have learned English when I was growing up and I haven’t improved over the last few years when I’ve been trying to learn. So again, I looked at these notes, and I just say yes ... OK yes ... because I’d get so frustrated that I couldn’t understand English. I tried my best, but I just couldn’t read ...*

I’m in pain

Mr G was experiencing a lot of pain and the pain made it even more difficult for him to communicate:

*It’s very hard to communicate, especially when you’re in pain. I was pointing and they were puzzled and they were trying to explain things to me but I was getting very frustrated because I was in pain.*
I say yes

Mr G’s frustration with his health professionals and himself was abundantly evident as he described how he tried to make sense of the written word:

In my mind I was fed up with them but I was fed up with me for not being able to know what it said, so that’s why I would just say yes. They would give me all these questions, I’d answer, and then they’d give me another question – they just kept coming at me … I would just say ‘yes’ and answer ‘yes’ and hope that was the right answer.

Mr G signed a form consenting to an anaesthetic, administration of blood products, if necessary, the removal of his gall bladder via keyhole surgery, and repair of an abdominal hernia on the day he was admitted to hospital. He later admitted that he did not know what a gall bladder was, where it was, what function it played nor how it was to be treated. He did not know what he signed:

I was given a form, I looked at it and there was lots of writing and they said, “You need to sign it”. I didn’t know what they were saying and I didn’t know what the form was for … I couldn’t read it so I didn’t know what it was for.

Mr G readily acknowledged that it was unwise to sign a document that he didn’t understand:

They asked me to sign a paper when I didn’t have an interpreter. I just signed it. That was wrong of me. I didn’t know what it was.

When asked, Mr G had very clear reasons for his decision to sign the consent form:
If I don’t sign it (the consent form) it will cause trouble, there’ll be more questions and more notes given to me, and that will cause more problems so I’ll make it easy and sign it. I wanted all the communication through writing and all the nurses to go away. It was horrible. It was awful. I was fed up.

The top boss came and he would write notes to me—the doctor—and then I would say, “What’s this?” and he would write again, so it just made the problem worse when I asked, “what does it mean?” So I think I’ll just say yes. Yes. Yes. Yes, that’s fine. Yep that’s fine. I don’t know what I’m saying yes to, but yep that’s fine.

Mr G’s doctor had scheduled his surgery for the following day. The next morning, the anaesthetist met with Mr G to conduct a pre-operative assessment. The anaesthetist noted in the medical record their concern that there was no interpreter booked to facilitate the consultation. The anaesthetist cancelled the surgery, expressing the belief that the previously documented consent for surgery was not sound. Mr G was not aware that the surgery had been booked and subsequently cancelled until discussing his concerns with his community health clinicians some weeks later.

I’m going home

Mr G stayed overnight in hospital and by later the following afternoon was still waiting for an interpreter to help him understand what was happening. Then Mr G had a visit from a friend who is an Auslan interpreter, and although they had not been booked or engaged by the hospital to help with Mr G’s care:

The staff told her I was going home, so she told me. She told them I need an interpreter.
Mr G was not particularly concerned about his privacy being breached when the staff discussed his discharge plan with his visitor rather than him. Mr G was concerned about what was wrong with him:

*I felt like they'd given up and I was sent home ... and I thought, what’s the decision, what’s going to happen? I didn't know. At the time it was very confusing ... the boss of the hospital had decided I was going home.*

Mr G still had no advice about his condition or treatment, or what was likely to happen to him, but he was relieved to be going home:

*I could have arrived home and died - I didn't know. I don't know what everyone was talking about ... I think they were planning the operation and then they decided to drop it ... I thought YES! I'm outta here! I can go home. And then they sent me home ... It was crazy.*

**What are the tablets for?**

Mr G had been given some tablets but he wasn't sure if they were to help with the pain or if they were to cure the problem:

*They had given me some tablets and that had made the pain go away a little bit- it still felt a bit funny, but most of the pain had gone. I thought that maybe the tablets had fixed it.*

When his friend the interpreter visited, they explained to Mr G that his tablets were for the pain. His friend read the labels and explained when and how to take them.

*Once she explained I was happy to take them, but I could not read what they were for. She told me when to take them...*
Now what?

When Mr G was discharged from hospital, he did not know that the hospital was planning to readmit him again soon for surgery. Mr G was at home for a week when he received a letter from the hospital to say that he had been booked for surgery. Because he could not read the letter, he took a photo of it with his phone and emailed it to an interpreter, who then translated it back to him in Auslan via video call. As well as the date and time to attend for the surgery, the letter contained important information about preparing for the surgery, including the requirement to fast beforehand.

Going back to hospital – will it be different this time?

Mr G was reassured to know that there was a plan for his treatment, but he was concerned about making sure he had an interpreter to help him understand what was going to happen when he went back to hospital. In every practical sense, it is difficult to make a complaint about communication, as a person with communication impairment or without a shared language. Mr G again made use of the relationships he had built with the community health service to voice his concerns about his hospital experience. His complaint helped ensure that a more appropriate response to his communication needs was in place for his next hospital admission.

Yay there is an interpreter!

Mr G was nervous about going back to hospital and very apprehensive about having to manage without an interpreter.

Is there an interpreter? Please be an interpreter! Yay there is an interpreter!
Mr G danced and waved his arms in the air when retelling this part of his story - such was the celebration and relief he felt at knowing he had an interpreter.

*It was so much better when I had the interpreter, it was excellent. I thought, “Good, we’re going to start afresh”. It was so much better.*

**I understand what is happening**

Mr G had the interpreter with him throughout the admission, consent, and pre-operative process, and again in the recovery room. The doctors explained Mr G's medical problem and described the treatment, and repeated the consent process, and in doing so, met Mr G's needs:

*Once I could understand what was happening I was happy and could go straight in to have the operation.*

Mr G was reassured as he woke from the anaesthetic to find the interpreter present and consequently he could communicate with his nurse:

*When I woke up I was quite drowsy and the interpreter was there again. I thought, “Excellent!” That was much better. I could have assistance while I was trying to wake up and they could tell if I was sick or not. We were talking back and forth between the nurse and interpreter. The interpreter would read things and then interpret them to me so I could understand it.*

**I can do things like everyone else**

The interpreter enabled an entirely different experience for Mr G. All along, Mr G wanted to be an informed health consumer who asked questions, listened to expert advice, and made appropriate decisions. Accessible, person-centred
health care enabled Mr G to be an informed, active health consumer. Mr G was also able to experience other aspects of hospital care in a different light:

> It’s a much smoother process when I have an interpreter with me. I could ask questions. I could choose my food and not just order everything on the menu. I was able to watch the TV - the interpreter was able to book that for me. I was given a questionnaire, and I was able to answer that. The interpreter could read everything and explain it to me.

**I can ask questions and talk about what I need**

Mr G never expected to have an interpreter at all times during his hospital stay. However, having the interpreter at key moments in care meant that he could ask questions and understand what was happening. Having the interpreter present on admission also enabled Mr G and the hospital staff to put an agreed communication strategy in place:

> I told them that I couldn’t understand any English, that I was like a baby and I couldn’t understand any English. Above my bed, they put a sign that I was deaf and I thought that was fantastic…and they put a sign that said I couldn’t understand English. When I needed to talk more in depth, that’s when I had an interpreter.

The interpreter read and translated all the post-operative and discharge written information so Mr G had an opportunity to think about that information and ask questions before he was discharged. The health care team explained to Mr G important signs and symptoms and how to get help should he need it. Follow up appointments were also arranged, with interpreters booked, so Mr G
understood the expectations for his care over the coming weeks. He said he felt he knew what to do and when to do it.

**Staff responses to Mr G’s story**

The researcher discussed Mr G’s concerns with several staff members during the follow up of his complaint. There was a striking mismatch in perceptions about the communication between Mr G and some of his health professionals during the first admission. Staff believed they were communicating effectively, and most expressed sorrow and regret that Mr G’s experience was distressing. However, some staff would not accept Mr G’s description of events and were adamant that he had understood them, a view reminiscent of Kuhn (1962) in which he found that even committed professionals tend to ignore evidence that contradicts what they already believe.

One staff member asserted that Mr G was not physically harmed during his episode of care and that in cancelling the surgery, the anaesthetist ensured that what should have happened did happen. Not only had there been a serious risk of Mr G having surgery without understanding or consenting to the procedure, it would not have been the first time. When Mr G spoke of the surgery he had while still living with his father he said, “I don't even know what that was for”.

Mr G was fortunate not to have suffered any physical harm during his hospital admission, however he clearly expressed that he was emotionally harmed. Patients commonly emphasize emotional harm more than physical harm (Massó Guijarro, Aranaz Andrés, Mira, Perdiguero, & Aibar, 2010), yet in the current system of incident monitoring, emotional harms tend not to be investigated or
managed in the same way as physical harms. Emotional harms are often treated as complaints, whereas physical harms are rightly subject to more detailed investigations and root cause analysis. However, emotional harm can be reported and investigated within the same incident management framework as physical harm, and without acknowledging and systematically investigating and addressing this type of harm, it will inevitably continue (Sokol-Hessner, Folcarelli, & Sands, 2015). Furthermore, Levinson and Shojania (2011) suggest that significant system improvements are likely if the methods for analysing and preventing serious medical errors were applied to breakdowns in person-centred care. It is also true that efforts to improve patient experience often improve the experience of health care workers (Levinson & Shojania, 2011).

**Mr G’s story and the NSQHS standards**

The care of an individual patient is not routinely measured against health standards. The literature broadly describes themes in the quality and safety of care of people who are deaf or HI but stops short of articulating the interaction between HI and the specific aspects of care. Mapping Mr G’s concerns to precise components of care provides a useful insight into the nexus between the patient experience of care and the safety and quality of care. This process may also identify systematic problems and new solutions to them. Standards 1, 4, 6, 7, 9, were particularly relevant themes in Mr G’s story, and the following sections identify specific standards that were not met in the provision of care during Mr G’s first admission.
Governance and quality improvement systems (NSQHS standard 1)

The ‘Governance for Safety and Quality in Health Service Organisations’
standard describes the quality framework required of health services. Although
many of the following mechanisms and processes are deemed to be ‘in place’,
the provision of Mr G’s care identifies that in practice they may not always be in
use.

1.8.1 Mechanisms are in place to identify patients at increased risk of harm

1.14.1 Processes are in place to support the workforce recognition and reporting
of incidents and near misses

1.17.2 Information on patient rights is provided and explained to patients and
carers

1.17.3 Systems are in place to support patients who are at risk of not
understanding their healthcare rights

1.18.1 Patients and carers are partners in the planning for their treatment

1.18.3 Mechanisms are in place to align the information provided to patients with
their capacity to understand

1.19.2 Systems are in place to restrict inappropriate access to and dissemination
of patient clinical information

Medication Safety (NSQHS standard 4)

The ‘Medication safety’ standard requires systems and strategies to ensure
clinicians safely prescribe, dispense and administer appropriate medicines to
informed patients (ACSQHC, 2011). During Mr G’s first admission, either he did
not receive the information about his medication, or he did not receive it in a
way he could understand. Similarly he either wasn’t asked, or didn’t understand, questions about drug allergies.

4.7.1 Known medication allergies and adverse drug reactions are documented in the patient clinical record

4.13.1 The clinical workforce provides patients with patient specific medicine information, including medication treatment options, benefits and associated risks

4.15.1 Information on medicines is provided to patients and carers in a format that is understood and meaningful

**Clinical handover (NSQHS Standard 6)**

The ‘Clinical Handover’ standard describes the systems and strategies for effective clinical communication whenever accountability and responsibility for a patient’s care is transferred (ACSQHC, 2011). Mr G was unable to participate in the handover from the Emergency Department to the ward or any handover on the ward because being Deaf he could not understand the handover in English.

6.5.1 Mechanisms to involve a patient and, where relevant, their carer in clinical handover are in use

**Blood and blood products (NSQHS Standard 7)**

The ‘Blood and Blood Products’ standard describes the systems and strategies for the safe, effective and appropriate management of blood and blood products so the patients receiving blood are safe (ACSQHC, 2011). The procedure Mr G needed was unlikely to require the use of blood or blood products but he was
asked to consent to their use a precaution. When told via the interpreter, Mr G had no particular concerns about blood products or relevant contraindications, but he was unaware that he had consented to their use.

7.10.1 Information on blood and blood products is provided to patients and their carers in a format that is understood and meaningful

7.11.1 Informed consent is undertaken and documented for all transfusions of blood or blood products in accordance with the informed consent policy of the health service organization

**Recognising and Responding to Clinical Deterioration in Acute Health Care (NSQHS standard 9)**

The ‘Recognising and Responding to Clinical Deterioration in Acute Health Care’ standard describes the systems and processes required to respond effectively to patients when their clinical condition deteriorates (ACSQHC, 2011). Mr G was unwell and felt that he was getting worse, and had no way to report this nor to be reassured, because he had no way to communicate. Although his condition was not life threatening, he wondered if he was going to die.

9.7.1 Information is provided to patients, families and carers in a format that is understood and meaningful. The information should include:

- the importance of communicating concerns and signs/symptoms of deterioration, which are relevant to the patient’s condition, to the clinical workforce
- local systems for responding to clinical deterioration, including how they can raise concerns about potential deterioration
9.9.2  Information about the system for family escalation of care is provided to patients, families and carers

Performance against the Australian Charter of Healthcare rights

In relation to his first hospital admission, Mr G could access health care that could deliver the technical aspects of his health care ('Access'), even if the care itself was not accessible. He was able, with support, to exercise his right to comment on his care and have his concerns addressed ('Comment'). Mr G’s privacy was breached when his visitor was told of his discharge plan, but this did not concern Mr G. It is possible that Mr G was so accustomed to needing an interpreter in the health setting, and therefore accustomed to other people being aware of his health details that his visitor interpreting for him in this instance was not out of the ordinary, and they could help him by telling him he was being discharged. Mr G had no concerns about the technical skill and competence of his health professionals ('Safety').

Mr G was most concerned about three health care rights: respect, communication, and participation; they were not well supported during his first hospital admission. Mr G was denied his rights to respectful care, and open, timely and appropriate communication in a way he could understand. Mr G was excluded from making decisions and about his care and his course of treatment and felt angry, frustrated, and worried. He was unable to understand what was wrong with him and what could be done to help.
Mr G’s expectations of his health care were modest. He wanted to know what was wrong with him and the treatment he needed. He wanted to know what his tablets were for, and when he should take them. He wanted to be able to watch the TV while he recuperated, and to choose his meals from the menu. He wanted to feel that the people he was relying on to help him get better, knew who he was and what mattered to him. These expectations were addressed during his second admission by engaging an Auslan interpreter to support key moments of care, communicating with health literacy needs in mind, working with the interpreter to develop a shared strategy for communication when an interpreter wasn’t present, and ensuring this information was handed over to all staff caring for Mr G. His concerns were also addressed by many staff, who, in response to Mr G’s honest feedback, made a genuine attempt to learn and improve their practice by reappraising their approach to communication: by listening and responding.

Along with rights, the Charter brings responsibilities. Mr G was aware that he should not have pretended to understand what his health care team was saying, but he felt disempowered and unable to act. The desperation and resignation of a woman in a similar circumstance is demonstrated by her comment, “I just sit there and agree to understand” (Ubido et al., 2002, p. 251). When meeting with Mr G, there was an opportunity to discuss the importance of his role as a self-advocate, so that he would not feel compelled to agree to anything he did not understand again.
Other legislative, regulatory and policy relevant to communication access

The Victorian Government Language Services Policy is a response to evidence that effective communication is essential to the delivery of high quality services. The language services policy includes the language needs of people who are Deaf and who use sign language, and requires that professional interpreting and translating services be used when essential information is being communicated and significant life decisions are under consideration. Specifically the policy outlines explicit recommendations and mandatory requirements for use of interpreters, virtually all of which applied to Mr G’s circumstances (Department of Human Services, 2014).

The Australian Disability Discrimination Act (1992) (Attorney General’s Department, 2010) also includes provisions for Deaf people to access health care and other services through Auslan interpreters, as does the Charter. It is striking to consider that although the right to have an interpreter is enshrined in National and State legislation, policy, the Health care standards, and in organisational policy and procedure, Mr G still couldn't get an interpreter when he repeatedly asked.

Mr G’s biggest problem

Throughout the interviews, Mr G was very clear about his concerns and his regrets. One particularly interesting observation was that Mr G’s “biggest problem” was ‘English’: not deafness. He regretted not learning to read and write. In many respects Mr G’s perspective exemplifies the logic of the
International Classification of Functioning, Disability and Health (ICF) (World Health Organisation, 2001). Within the ICF framework, the disability a person with a medical condition or impairment ultimately experiences the interactive result of the impairment, Personal Factors, Environmental Factors and the nature of the activity. Mr G claims that he can communicate as much as he needs to in Auslan, and only experiences Activity Limitations (problems communicating in English) and consequently Participation Restrictions (problems participating in health situations) because he cannot speak English and his health professionals cannot speak Auslan.

Mr G is an outlier because he is Deaf and speaks Auslan, and because he made a complaint about his experiences. However, Mr G’s story is not unique. Lowrie (2014) reported on a study of Auslan interpreter use in hospitals in Victoria, Australia, and found that 62.5% of respondents reported not being provided with an Auslan interpreter when they asked for one, and instead they were required to communicate via pen and paper, gesture, guesswork or family assistance. Deaf and hearing impaired participants in a study by Iezzoni et al. (2004) expressed similar concerns. People who are HI but use spoken language also report similar frustrations when their requests for health professionals to face them when speaking, to slow down their speech, to write down key words and so on, are ignored. Similar examples were identified in the current study.
Other patient stories

Mr B

For example, Mr B was an 86-year-old male participant who could speak but was profoundly deaf and reliant on other people to write notes to him to communicate. Mr B had ‘radical mastoidectomy’ surgery on both ears more than forty years ago and consequently he had a mixed HI and wore a high powered ‘bone conductor’ body level hearing aid. Mr B felt he did not derive much speech recognition benefit from the hearing aid or from lip reading, but that the hearing aid provided some awareness of sound and helped him to maintain his speech quality. He said that without it he felt very ‘cut off’ from the world. Because Mr B could speak quite well, he repeatedly (verbally) asked his health professionals to write things down for him, explaining that he could not hear them. Mr B reported that health professionals would sometimes write things down, but often seemed reluctant or too busy and would soon revert to talking to him again, or cut the conversation short.

Mr B’s family reported that after many years of Mr B’s deteriorating general health and frequent trips to hospital, they realised that the only way they could ensure he received information and understood what was going on while he was in hospital was if they were there to listen and transcribe the information for him. Consequently, Mr B’s family established a roster whenever he was in hospital to ensure he was never left alone during his waking hours. Mr B’s family have never complained about the care provided by the hospital and spoke favourably about the care. However, their actions suggest they were highly
motivated to prevent any issues and advocated strongly on his behalf to ameliorate the Environmental Factors that were barriers to communication.

Mrs L

Like Mr B, Mrs L relied heavily on family support to help her communicate. Mrs L was 100-years-old and profoundly deaf since birth. Her daughter, Mrs T, indicated that Mrs L was a good lip reader, provided people looked directly at her and spoke slowly and clearly. Mrs T visited daily and each day spoke with the nurses about Mrs L’s deafness and reminded them about how best to communicate with her.

Mrs T made a complaint on behalf of Mrs L about the way the hospital staff were communicating with her mother, and reported three separate incidents. In the first incident, Mrs T saw a note on her mother’s medical record saying the ‘falls risk assessment’ “not completed - patient not responding appropriately - has dementia”. Mrs T felt the risk assessment was particularly important as her mother was admitted for treatment following a fall.

In the second incident, Mrs T arrived on the ward to find a nurse ‘yelling’ at Mrs L while trying to lift her with an electric hoist. Mrs T reported that the nurse appeared to be in a hurry and was not looking at her mother when she was giving instructions. The nurse did not notice that Mrs L’s legs were not correctly positioned and consequently Mrs L fell from the hoist as it was lifted. Fortunately, Mrs L was physically unharmed but was, like Mr G, ‘emotionally harmed’ and distressed by the incident.
In the third incident Mrs T spoke with the physiotherapist to determine why Mrs L had not had any therapy for the two weeks she had been hospitalised, and was told that Mrs L had not been responsive when approached by the physiotherapist. Mrs T explained Mrs L’s deafness to the physiotherapist and therapy was commenced immediately. Once aware of the HI, Mrs T felt the physiotherapists were very responsive to Mrs L’s communication needs. The physiotherapist made a referral to Audiology who provided signs about communication for Mrs L’s room and further advice about communication.

Mrs T reported that there were many nurses who were wonderful with Mrs T and could communicate well with her. However, Mrs T had been admitted to hospital twice in the previous twelve months and both times Mrs T was concerned about the identification of, communication about, and communication with, people who are deaf. Her mother became upset and confused at times during her admissions and Mrs L believed communication was a contributing factor.

Mrs S

In contrast, Mrs S was a 67-year-old female participant who did not need family support to manage her communication. She confidently described her moderate, mildly asymmetrical bilateral sensorineural HI. She had bilateral hearing aids for just over four years after first noticing a deterioration in her hearing approximately five years earlier at the age of 62. She reported wearing her hearing aids “all of the time” and said she “would not be without them”. When questioned about her reasons for first having her hearing tested, Mrs S
reported that she “wasn’t prepared to put up with missing out on things” if there was something she could do to improve her hearing.

Mrs S’s story marks her out as an outlier in several ways. With an average HI of 41.25 dBHL 4FA in the better ear, her HI is significantly less severe than Mr G’s, Mr B’s or Mrs L’s, but was worse than the average and median HI for her age cohort in the current study. It is not possible to know the precise details about the onset of Mrs S’s HI but she did not notice any sudden change in her hearing, and she reported having had her hearing assessed within a year of noticing the problems. She also reported getting hearing aids and using the hearing aids as soon as the HI was confirmed. Mrs S’s actions in response to the onset and management of HI contrast markedly with the usual findings in the literature.

Mrs S presented as very well informed about her HI and extremely proactive about managing the HI, including in the health setting. Mrs S reported that it is often difficult for her to hear clearly in the hospital setting because of background noise, people turning away when speaking, health professionals wearing masks during procedures, or speaking too quickly. Mrs S described a range of situations she found difficult and the strategies she uses. In her very pragmatic and determined style she described herself as “a bit relentless”. If she wasn’t sure what someone said, she would ask them to repeat it. She would ask people to stand or sit in certain positions to improve her view of them. She would turn off the TV or close the door to reduce the background noise. She always carried a notebook, and if there was a word or phrase she could not understand she would ask for it to be written down. She was a remarkable self-
advocate, but despite her pragmatism and determination, she reported that her strategies were not always met with helpful responses.

However, Mrs S experienced fewer Activity Limitations and Participation Restrictions than Mr G, Mr B or Mrs L, in significant part because her impairment was less severe, but also because the relevant Personal Factors were facilitators of, not barriers to participation, and consequently she was very adept at actively managing Environmental Factors.

Assumptions about communication

Each of these stories reflect people who are deaf or HI who have different communication support needs—they need different facilitating Environmental factors—to communicate effectively. Each participant or their family repeatedly expressed those needs. Despite Mr G’s frequent requests for an interpreter, his health professionals appeared to make assumptions about how best to communicate with him, and repeatedly required him to communicate in a way that did not meet his needs and affected his experience and the safety and quality of the health care he received. The tendency for health professionals to make assumptions about how best to communicate with people with HI appears to be a consistent theme.

Conclusions

There is no single way to support communication with someone who is deaf or HI. At times lip-reading or notes or gestures are ‘good enough’. Good enough to buy the paper from the milk bar. Good enough to pay for petrol. Not good enough to help one make life changing decisions, especially if one cannot read
or write. Notes would have been good enough for the Deaf man paying his pathology bill, or Mr B whose family kept a bedside vigil, because by reaching for the pen and paper they showed what they needed in those circumstances. And even then, the obvious was missed.

Communication needs are sometimes obvious and sometimes they are not. Person-centred care is about asking, listening, and responding with appropriate individualised support. The deaf and HI participants in the study by Iezzoni et al. (2004) suggested the best way to identify how to optimise communication with a deaf or HI patient was to ask them. It would seem just as important that health professionals listen to the answer.

There is a comprehensive policy, legislative and health service standards framework that requires health services to provide safe and person-centred care and respond to Analyzing the patient experience in terms of the detailed context of the standards, the Charter and legislation makes explicit the responsibility of the health service to address communication access if not to provide person-centred care, then at least to meet accreditation standards.

**Chapter Summary**

Chapter 6 introduced Mr G and retold his experiences of two hospital admissions. The chapter explores Mr G’s communication needs and those of three other participants and their experiences when those needs were not met. The consequences of inadequate communication support were considered within the policy and legislative framework for health, particularly the NSQHS
standards (ACSQHC, 2011) and the Australian Charter of Healthcare Rights (ACSQHC, 2008).
Chapter 7: Discussion

Overview of Chapter 7

The purpose of chapter 7 is to bring together the findings of the current research, discuss the findings in the context of the relevant literature, and highlight the contributions of the current research to the literature.

The HI prevalence is very high in the study population and the significance of these findings is discussed in relation to the findings of other population-based studies. In particular, the pattern of increased prevalence and severity in the youngest cohort is considered. The consequences of the earlier ageing of these ears, including the pattern of increased severity are discussed in terms of the projected prevalence of HI for this cohort. The likely links with cardiovascular disease and the possibility that some HI may be preventable and an early warning sign of CVD are discussed. HI identification, hearing aid use and documentation of hearing related information in the medical record is discussed.

The results of the screening test evaluation are discussed and the role of hearing screening in the acute setting are considered, especially in relation to the opportunities for secondary prevention and minimising the negative consequences of HI by intervening early. The suitability of the acute hospital as a screening location is discussed in relation to published commentary about improving the management of HI.
Prevalence and severity of HI

The current study provided precise Audiological estimates of prevalence of HI in a population of acute hospital inpatients. The data indicated that prevalence of HI increased with age, better ear prevalence (bilateral HI) was lower than worse ear prevalence, and the prevalence of HI was typically higher in males than females, which is consistent with the published literature discussed in chapter two (Davis, 1989; Cruickshanks et al., 1998). However, the prevalence of HI in the study population was consistently and significantly higher than published reports of HI prevalence in the general population (Davis, 1989; Cruickshanks et al., 1998; Wilson et al., 1999) and some gender differences in prevalence were noted.

One explanation for the high prevalence of HI in the current study compared to previous studies could be that the prevalence of HI has increased in the Australian population in the intervening years. The most recent international population based cross sectional study of HI prevalence: the Canadian Health Measures Survey (CHMS) reported on audiometric data collected from 2012–2013 (Feder, Michaud, Ramage-Morin, McNamee, & Beauregard, 2015). The CMHS study reported similar prevalence estimates to those reported in Australia (Wilson et al., 1999), the United States (Agrawal et al., 2008; Lin et al., 2011) and the United Kingdom (Davis, 1989), and at much lower rates than the current study. Therefore, there is broad consistency in the findings of international cross-sectional population-based prevalence estimates of average HI, which do not appear to have significantly changed over the last three decades. Agrawal et al. (2008) also compared HI prevalence across three

The current study results are also consistent with the previous findings of Poltl and Hickson (1990), O’Halloran et al. (2009) and Herron and Wharrad (2000) who reported HI prevalence between 79–90% in geriatric and stroke wards. Together these results suggest that the large difference in HI prevalence between the current study and previous reports of HI prevalence, do not simply reflect an increasing prevalence of HI in the age-matched general population over time, rather a difference relating to the composition of the sample population, that is, the difference between adults in the general community and a sample of hospitalised adults.

**Prevalence of HI in the 51–60 age group**

The small sample of participants in the 51–60 age group, the youngest cohort in the current study, yielded interesting findings. The exponential increase in HI prevalence usually observed after age 50 appears to have commenced and progressed at a younger age in this cohort of hospitalised adults. These ears have prematurely aged.

Similarly, Agrawal et al. (2008) described a steep increase in HI prevalence in the 40–49 years age group of participants who smoked, worked in noisy environments, and those with cardiovascular risk factors, whereas for those participants without risk factors, the steep increase occurred 20 years later. Agrawal et al. (2008) also noted an increase in prevalence of high frequency loss among younger age groups for example, 17% in 30–39 year olds.
However, Zhan et al. (2009) found significant generational differences in the participants of the population based ‘Epidemiology of Hearing Loss Study’ (EHLS) and the study of their adult children, the Beaver Dam Offspring Study (BOSS). The authors reported age-specific prevalence of HI was lower for more recent birth cohorts, and that the effect was stronger for males than females. They propose that HI with ageing is preventable, or ‘delayable’ by managing modifiable risk factors such as noise exposure, smoking, and diet and lifestyle.

The higher prevalence and increased severity of HI in the youngest cohort of the current study may be explained as the inverse of the findings of Zhan et al. (2009): that exposure to risk factors among the current study cohort, associated with the illness that has brought them to hospital, is responsible for their prematurely aged ears.

A detailed analysis of risk factors for HI was not included in the current study. It is possible that the increased prevalence and severity of HI in the younger females in the current study reflects underlying pathophysiological changes such as CVD and/or other chronic health conditions, which may also increase the need for acute medical care. However, the average HI of females in the 61–70 age group in the current study showed better low frequency thresholds and worse high frequency thresholds than the female participants in the 51–60 age group, and only subtle evidence of ‘gender reversal phenomenon’ (Jerger et al., 1993). Therefore, whatever the causes of the unique pattern of HI severity and prevalence in the 51–60 age group of the current study, it did not measurably affect females in the older age groups: it may be evidence of a ‘newer’ trend. Low socioeconomic status is frequently reported as a risk factor for HI and this
points to an important, modifiable, health disparity (Barton, Bankart, & Davis, 2005).

The public health implications of the current study, like those of Agrawal et al. (2008) are emphasised by the significant projected increases in prevalence of HI. Although the current study is cross sectional, it does offer some insight into the progression of HI. As the population ages, we can expect the population prevalence of HI to increase. Similarly, if HI progresses at an earlier age, further increases in prevalence will follow. The possibility of preventing or postponing HI through risk factor reduction and minimising morbidity through screening may yield substantial public health benefits.

Prevalence and severity of HI are closely related concepts as the criterion for HI is based on a measure of HI severity. However, the HI severity and audiogram shapes offer some additional insights into HI in the current study cohort. Normal hearing was uncommon in the study population at any age, with mild and moderate HI occurring more frequently than normal hearing overall and in each age range. Half of all current study participants had a significant bilateral HI.

**Use of Hearing Aids**

Davis et al. (1992) and others have demonstrated that HI ≥ 35dB 4FABE is the ‘tipping point’ at which hearing aid use is manifestly beneficial to communication, and others have shown evidence of secondary prevention (Hogan, O’Loughlin, Miller, et al., 2009). Age-related HI is not reversible, but communication therapy and hearing technology are effective strategies to ameliorate the impact of HI. Half of all the current study participants, and more
than 85% of participants aged over 80 years had HI ≥ 35dB 4FABE, and were likely to benefit from amplification but less than 24% (CI: 18.1–30.3%) of the study participants reported using a hearing aid.

Previous reports of hearing aid use suggest only 15–25% of people who would benefit from a hearing aid have one (Davis, 1989; Wilson et al., 1999; Access Economics, 2006; Gopinath et al., 2011). While the rate of hearing aid use in the study population is no worse than previously reported, the prevalence of HI ≥ 35dBHL 4FABE in the study population of hospitalised adults is significantly higher, therefore low rates of hearing aid usage have even greater impact in an acute hospital population.

Many of the study participants who reportedly had a hearing aid were not necessarily ‘well aided’ while they were hospitalised: hearing aids were frequently left at home, damaged, or no longer suitable for their degree of HI. Approximately 16% of study participants who reported using a hearing aid had a hearing aid that was adequate for their HI. Therefore, only a very small proportion of study participants with significant HI have optimally managed HI.

Participants who had significant problems communicating were offered an Audiology review as an inpatient. As part of the Audiology follow up, many were loaned listening devices for the duration of their admission, as a substitute for hearing aids left at home or when their own hearing aids were not functioning adequately, and for those who did not have a hearing aid.

After completing the hearing assessments and discussing their HI, a significant proportion of study participants were offered Outpatient Audiology follow-up, and 70% (CI: 58.2–80.0%) of participants who were offered outpatient follow
up accepted the referral, either to review their current hearing aid fitting or to pursue a hearing aid fitting for the first time. The current study protocol did not include follow up of new referrals, therefore it is possible that some participants may have consented to the referral but not taken any further action. However, the positive response to the offer of referrals in the current study suggests the opportunity to assess and discuss hearing in the acute hospital environment may have been conducive to participants making decisions to seek further help for their HI.

**Documentation about HI in the medical record**

Documentation about HI or hearing aids was frequently absent or incorrect. It is likely that the absence of a requirement to document hearing status or communication needs in the medical record, and the lack of a systematic method and specific location to record the information has contributed to the significant variation seen in practice in the current study. Admission documentation is effectively a checklist of key information and tasks. There are generally no blank spaces and limited opportunities for free text on the forms because the ‘real estate’ on admission documents is tightly contested, as is the responsibility to complete and follow up the tasks.

The admission documentation processes in the research hospital did not support consistent clinical practice to ask, assess and document hearing or other communication impairments. When there is no designated space to record information about hearing, and no prompt to ask questions about it, the message is invariably that hearing and communication are not relevant to the
episode of care. The absence of documentation and processes about HI likely speaks to gaps in clinical care about HI.

The absence of documentation also limits research about HI in the acute health setting and has implications for quality and safety research. Adverse events are often identified and evaluated using retrospective systematic record reviews (Brennan et al., 1991; Wilson et al., 1995; Baker et al., 2004; Ehsani et al., 2006; Sari, Sheldon, Cracknell, Turnbull, et al., 2007). Systematic record review is considered the gold standard method of detecting adverse events (Blais, Bruno, Bartlett, & Tamblyn, 2008), especially those resulting in patient harm (Sari, Sheldon, Cracknell, & Turnbull, 2007). However, case review is retrospective and depends on the quality of the documentation in the patient record. Not surprisingly, when documentation is missing, adverse events are less likely to be detected (Wilson et al., 1995). When documentation about HI is missing, it will not be included as part of the analysis of an adverse event, even though it may have been a contributing factor.

The requirements around documentation in the medical record are contained in the NSQHS standards (ACSQHC, 2011) and stipulate that the patient record identifies all aspects of the patient’s care; is accurate, integrated and readily at the point of care; and allows for systematic against the requirements of the NSQHS standards. The standards do not explicitly address HI or communication impairment, although it could be argued that they do so in spirit, if not to the letter. The Joint Commission (2010) makes explicit recommendations to improve effective communication, cultural competence, and patient- and family-centred care across the care continuum. The ‘Roadmap for Hospitals’ includes
detailed guidelines and checklists for each stage of the care continuum. For example the admission checklist includes:

- Inform patients of their rights
- Identify the patients preferred language for discussing healthcare
- Identify whether the patients has a sensory or communication need
- Determine whether the patient needs assistance completing admission forms
- Collect patient race and ethnicity data in the medical record
- Identify if the patient uses any assistive devices
- Ask the patient if there are any additional needs that may affect his or her care
- Communicate information about unique patient needs to the care team.

(The Joint Commission, 2010, p. 5)

There are variants of the checklist for different stages of care for example, discharge and transfer and end of life care, and for the health workforce and system more broadly. Had the items on the admission checklist been considered during Mr G’s admission, as they were during his second, we may not have heard Mr G’s story. Information gathered from a checklist like this would be of most value if carefully documented in a predictable location in the medical record so that the information is always readily available. Along with the checklist methodology, a systematic response to addressing individual needs is also required: it is not enough to merely document the issue, if the patient has a sensory or communication need, an appropriate response is required.

Patients present for health care with a unique set of needs: in ICF (World Health Organisation, 2001) parlance this unique set of needs is a combination of a health condition, which involves body structures and functions, along with the
individual’s Personal Factors some of which can be identified through a checklist as described above. Working through the checklist items highlights vulnerabilities or Activity Limitations. By modifying the Environmental Factors the impact of impairments can be reduced.

**Health literacy**

Health literacy is the ability to obtain and understand health information and make appropriate health decisions (ACA, 2010). Health literacy is an enabler of communication and participation in health (Hill, 2011). The low levels of spontaneous help-seeking for HI and hearing aid use among the current study participants suggest that key messages about hearing health are not working adequately. However, the positive response to hearing screening, discussion and offers of referral for follow up in the current study suggested that information about HI does positively influence treatment choices.

Key messages for older people include the fact that they can expect their hearing to deteriorate (Cruickshanks et al., 2003), but they should not wait for it to deteriorate or persist in ‘getting by’ without help while the negative consequences of untreated hearing manifest and multiply. The efficacy of early intervention for acquired HI has been established (Davis et al., 2007).

Key messages for health providers include the fact HI prevalence is very high in older people and that once a person has HI, their access to information and expertise about their health is mitigated through their ability to hear and communicate. In addition to the complexity of hearing and understanding during a health consultation, it is important to note that a significant amount of
mainstream health promotion is accomplished through oral language: listening to someone speak in person or on radio and television (Alexander, Ladd, & Powell, 2012). Given the prevalence of HI in older people, health promotion aimed at older people should explicitly target their hearing needs. In addition, care of patients with diabetes, CVD or other conditions that entail an increased risk of HI should include contemporary and positive advice about HI and early referral for hearing care. In turn, better HI management will likely support better access to information and health literacy in broader areas of health.

Health promotion material intended for a signing Deaf audience should be provided in Auslan. Captioning of video materials can be of benefit to people with varying degrees of HI. Written information can be an aid to understanding but is only of use if the target audience can understand them (Caposecco, Hickson, & Meyer, 2014), so visual accessibility and readability must be considered. For individualised care, health professionals should always ask the patient what works for them.

Napier and Kidd (2013) found that Deaf people often have low levels of English literacy, limited health care knowledge and few opportunities to access health education. Consequently, a lot of effective communication may need to be accomplished within a health care consultation to ensure a patient is well informed; the lower the level of health literacy, the more the patient is relying on the interpersonal communication in a health appointment.

**Health literate and accessible organisations**

While health literacy is usually discussed as an individual attribute, health literacy is a shared responsibility and reflects the interaction between an
individual and the demands of the health care system (Parnell, McCulloch, Mieres, & Edwards, 2014). Organisations and health professionals can be ‘health literate’. The Joint Commission (2010) assert that health services and health professionals should be equipped and prepared to identify and respond to the range of each patient’s demographic and personal characteristics and not just their specific clinical concerns. The current study identified the need for further training for health professionals to recognise, understand and respond to the needs of people with HI, and the needs of the signing Deaf community. Once again the ICF Environmental Factors (World Health Organisation, 2001) provide a useful conceptual model for enabling participation.

The *Disability (Access to Premises-Buildings) Standards 2010* (Premises Standards) aim to ensure greater and dignified access to and use of buildings by people with a disability as well as to provide certainty to the building industry in meeting its obligations under the *Disability Discrimination Act 1992*. There seems to be much less certainty about how to ensure communication access. The current study showed that mild and moderate bilateral HI were both more common than normal hearing in the study population, therefore the uncertainty must be addressed. The practice of ‘universal precautions’ is embedded in the health culture: baseline safeguards apply in every situation, and additional safeguards are applied in higher risk situations. The same concept can be usefully applied to communication access. Universal design principles for HI include strategies such as buzzing pagers in waiting rooms; ensuring captioning is routinely available on televisions or any video presentations, ensuring all phones have volume controls and inbuilt telecoils for use with hearing aids, acoustic treated to minimise background noise and so on. Higher risk situations
may require the use of an interpreter, ensuring a patient has their hearing aids, taking extra time to repeat and clarify, and so on.

**Improving the identification of acquired HI**

McMahon et al. (2013) discuss the need for a systematic strategy to identify adults with acquired HI, citing the increased prevalence of HI in adults, the disease burden of undetected HI and the availability of effective interventions. They propose a range of sensible population level community based strategies to screen for HI. HI identification and management seems ideally suited to the primary care environment, and yet experience to date suggests that it has not been very effective (Schneider et al., 2010).

In an ideal world, HI would be appropriately managed early and often in the community. However, screening for HI in hospital may be an appropriate part of a comprehensive strategy to improve HI identification and management in adults. In the same way that hospital-based newborn hearing capitalises on the ‘captive audience’ of a birthing centre, acute hospitals host significant numbers of older, at-risk adults in an environment focussed on improving health and wellbeing.

The findings from the current study suggest that hearing screening in an acute hospital is a viable approach to successfully identifying acquired HI in adults. The acceptability of providing hearing screening in the acute hospital was not formally assessed as part of the current study, however, as only 6% of those invited to participate in the study declined it is reasonable to infer that most eligible patients were comfortable discussing and participating in activities to
screen for HI during the acute care admission. Furthermore, the 70% positive
response to referrals for follow-up also suggests that participants responded
positively to the assessment.

Gopinath et al. (2012) found that measured HI was strongly associated with
future moderate or severe hearing handicap, and consequently more depressive
symptoms and poorer health. They propose that preventive strategies could
help preserve an older person’s mental and physical function. Furthermore,
older people with HI and in poor health are least likely to seek help for their HI,
but are at highest risk of future hearing disability, and future health problems
(Gopinath et al., 2012). When hearing screening occurs in an acute health
setting, alongside the other clinical care, part of the message is that hearing is an
important component to overall health and wellbeing.

In the complex care environment of the acute hospital, preventing functional
decline and adverse events in older patients is a priority in the provision of
person-centred care. Managing personal health and wellbeing relies on
appropriate management of communication and hearing needs. Identifying
people at higher risk of not understanding their treatment plan or participating
in decision-making enables some mitigating strategies to be put in place,
regardless of whether the patient acknowledges any disability. Individualised
hearing and communication support can address the ‘environmental factors’
that influence the experience of participation restriction and disability (WHO,
2001).

Acute hospital hearing screening engages both patients with HI and their
communication partners to develop both an immediate and longer-term HI
management strategy. Engaging the individual in this way actively supports their health participation and decision-making but also provides a platform for hearing care to support rather than compete with existing current public health initiatives. The health and wellbeing of older people is firmly on the public health policy agenda, as governments seek novel approaches to addressing the needs of an increasingly ageing population.

Individuals with HI might be reluctant to consider hearing aid use, but may be willing to trial a loan device while in hospital, even for a short time: perhaps just long enough for their doctor to explain their diagnosis. In the short term, this supported experience with amplification may help them better understand their health condition and treatment plan. Furthermore, providing patients with information about their HI and demonstrating effective HI management strategies in the acute health setting may enable patients to take some action towards recognising or seeking help for their HI.

An important clinical finding in the current study was that the AB words screening tool can identify HI and provide information about the degree of HI. The screening tool identifies patients with very mild, mild and moderate or greater HI in the better ear with good sensitivity and specificity, therefore the screening tool can be used to identify and prioritise patients with significant bilateral HI who might benefit from inpatient hearing and communication support. Patients with mild or minimal HI may not warrant further inpatient hearing care but they may benefit from a discussion about their hearing and the options available to them for follow up.
Better management of HI is also particularly important in the context of other complex communication problems, for which there is often no effective treatment. In contrast, there are effective strategies to ameliorate the effect of HI, particularly for the mild or moderate HI identified in the study participants of hospitalised adults.

The acute health setting is complex and fast paced. It has never been more important to be a well-informed health consumer who can actively participate in discussions and decision-making about one’s own care. Communication barriers—or Participation Restrictions—can result in misdiagnosis, poor therapeutic choices, reduced treatment compliance and poorer outcomes. When health professionals and patients cannot communicate effectively, patient experience and patient safety suffer (Lavizzo-Mourey, 2007).

**Strengths and limitations of the study**

The current study has several strengths including its relatively large, random sample and the use of a standardised protocol to measure hearing thresholds using pure tone audiometry. However, some limitations are important to consider.

PTA was usually performed in ambient conditions rather that the sound proof booth. However, it is possible to obtain reliable threshold results in ambient conditions (Maclellan-Smith, Swanepoel, & Hall, 2012), and it is commonplace to conduct hearing assessments for adults in quiet rather than sound treated conditions using insert earphones, especially in hearing aid clinics. Hospitals are not quiet places, but it was possible to achieve quiet by temporarily relocating or actively reducing background noise for the duration of testing.
Other studies of HI prevalence have also conducted testing in ambient conditions, for example (Wilson, 1997)

The sample size was appropriate for overall prevalence and prevalence within the 61–70, 71–80 and ≥ 81 years age groups but insufficient for prevalence within the 51–60 age group, particularly for gender specific results. However, the sample sizes for the age cohorts were proportional to the overall inpatient population. The sample population was weighted towards the older age cohorts than the AIHW national average inpatient data (Australian Institute of Health and Welfare, 2013) but is consistent with the regional ABS data (Australian Bureau of Statistics, 2016)

A large proportion of eligible participants were ‘missed’- never invited to participate, reflecting the relatively fast ‘turnover’ of hospital beds. However, once invited, a high proportion of people agreed to participate, resulting in a 27.8% population response.

Patients with an eligible but relatively short length of stay were less likely to have been invited to participate in the study. The longer a patient was available on a ward, the more likely they were to have been approached and all data collected. This may have led to less complex patients being inadvertently excluded. Conversely, patients with intensive treatment requirements as an inpatient may have been busy: at medical imaging, radiotherapy, physiotherapy and so on when the researcher attempted to visit.

Inter-rater reliability was not assessed as part of the screening test evaluation because the scoring procedure for the screening test is the same as the AB words diagnostic test which has been extensively evaluated (Boothroyd, 1968,
1968; Markides, 1978; Boothroyd, 2008). Inter-speaker variability is an important consideration in live voice speech testing but was not assessed as part of the screening test evaluation. There are critics of the use of ‘live voice’ speech discrimination tasks for diagnostic purposes (Silverman & Hirsh, 1955; Penrod, 1979; Mendel & Owen, 2011), however other hearing screening tests e.g. whispered voice use live voice presentation (Pirozzo, Papinczak, & Glasziou, 2003), and live voice speech discrimination testing is routine clinical practice, particularly in paediatric audiology.

Boothroyd (1968) acknowledges that like other speech discrimination tests, the AB word lists are subject to some imprecision due to individual voice characteristics of the person speaking the test items, variations in the judgement of the tester, and confounders such as speech ‘defects’. However, he argues that provided the limitations are recognised, the use of short word lists and phonemic scoring enable the clinician to “obtain much useful information in a relatively short time” (Boothroyd, 1968, p. 9).

Mendel and Owen (2011) conducted a study of recorded versus live voice word recognition using two recorded versions of the 50 word Northwestern University (NU)-6 lists. They recommend the use of recorded materials to standardise assessments but acknowledged there were no significant differences in participants’ mean scores between live voice and recorded presentation. They noted variations between the lowest and highest scores but only 5.7% of the variance could be attributed to talkers, while 20.5% of the variance was attributed to ‘talker listener interaction’: an unknown factor or factors making discrimination of speech of a particular talker difficult for some
listeners but not others (Penrod, 1979). Penrod (1979) also noted that talker
differences accounted for only a small proportion of the variability in speech
discrimination scores and the talker-listener interaction accounted for more
variability.

Some listeners will perform more poorly due to the talker-listener interaction,
but this effect is not exacerbated by live voice presentation. Recorded speech
discrimination materials do standardised test administration, however when
using the AB word screening test, variance due to speaker differences among
‘standard’ English speakers is likely to be small. However, use of speakers with
strong accents or speech impediment may affect screening results.

Speech screening was performed before audiometry, which blinded the
researcher to the measured level HI at the time the speech screening was
undertaken. However, other details available to the researcher including the
person’s hearing history, gave the researcher some insight into the patients
hearing which could have introduced some bias. However, the standardised
scoring convention for AB words is explicit, unambiguous, and well documented
in the literature, which enhanced the objectivity of the scoring process.

There were no participants with severe to profound losses included in the
screening test evaluation, reflecting the relatively low prevalence of severe to
profound losses in the sample population of the HI prevalence study from which
the current study sample was drawn. However, the pattern of increasing
sensitivity and specificity with increasing HI supports the utility of the test in
identifying more severe HI.
Mr G’s story is powerful, but is still a case study of one individual. Mr G’s experiences are not representative of the entire Deaf community or indeed of every deaf or HI person; however, Mr G’s concerns (Activity Limitations and Participation Restrictions) are consistent with other reports in the literature. In a sense the fact that he is just one person mirrors an important point of the current thesis: that the individual patient has individual care needs. Mr G is also an outlier: an extreme case, an obviously Deaf man, and yet this did not appear to help identify him as someone who needed additional support to communicate in an acute health setting.

An experienced interpreter with NAATI (National Accreditation Authority for Translators and Interpreters Ltd) accreditation assisted with both interviews with Mr G. Human error in the interpreting is possible, but the manner of interpreting and informal style of both interviews included frequent opportunities for clarification and consultation.

Signed languages have no written form so there may be aspects of the original Auslan form that are not precisely captured in written or spoken English. The information presented in the current study was collected over two sessions with significant opportunity to collaboratively revise and clarify meaning through the interpreter; therefore, the likely impact of any loss of information is minimal.

The second (filmed) interview was five months after the original hospitalisation. In the intervening period, Mr G had discussed his story with two Community Health staff members and the researcher. The researcher documented different aspects of Mr G’s story over the two sessions. For example, Mr G’s good
experience during the second hospital admission was documented at the first interview as a broad impression only. During the second interview, the researcher documented in detail those aspects of care that were most important to Mr G. Mr G’s recall of his experience was consistent across both sessions with the researcher and in the initial report of the complaint.

The researcher had several roles in the follow-up of Mr G’s complaint. The professional roles involved investigating and responding to the incident and complaint, including speaking with staff, the interpreting agency and Mr G. The researcher actively managed the different roles, debriefing with research and professional supervisors to ensure appropriate and ethical practice.

**Future research**

The current study addressed several questions but it has raised other questions. The ethics approval for the current study included approval to maintain a data bank of participants’ hearing and health results including demographic and coding details of their hospitalisation that have not been reported as part of this thesis. Other data including high frequency thresholds have been recorded for a significant proportion of participants, which warrants some future analysis. The high frequency data and the clinical coding may enable some further exploration of the links between CVD and HI, and diabetes and HI. The data bank also makes it possible to study the current study cohort longitudinally. It would be particularly interesting to follow the hearing levels of the younger cohorts in this study. A larger sample of hospitalised adults in the 50–60 age group and a detailed analysis of their risk factors would build knowledge about
acquired HI and whether there is further evidence of the early ageing effect seen in the current study.

Further research is needed to identify whether participation in HI screening in the acute hospital improves identification of HI and take up of hearing habilitation in the medium and longer term. Additionally, evaluation of targeted screening of adult outpatients in their forties and fifties with CVD or other risk factors may be appropriate.

**Conclusions**

The current thesis reported on new evidence about the prevalence and impact of HI in acute care. The results demonstrated that HI prevalence and severity increase with age and that the current population of hospitalised adults demonstrated significantly higher prevalence and severity than the general population. HI in the current study was markedly more common than normal hearing and flags the need to ensure that hospital buildings, services and processes of the future are designed and delivered with communication accessibility in mind.

The current thesis considered the prevalence and impact of HI across the spectrum of severity from those adults experiencing the onset of changes to their hearing through to those experiencing increasing difficulties understanding conversational speech, to Mr G who is Deaf but views his deafness as part of his cultural identity rather than a disability. Mr G may not consider himself disabled, but he experienced disability in an inaccessible setting.
The current thesis evaluated a simple hearing-screening test with very good sensitivity and specificity, which is fit for purpose in the health setting. Screening and supporting HI in the hospital setting supports safety, quality and person centred care in that setting and encourages community follow up of HI.

High quality medical care is contingent on health practitioners listening and responding to patient concerns, and patients understanding diagnostic information and therapeutic advice (Lavizzo-Mourey, 2007). The mandate to provide more effective, person centred health care by identifying HI and supporting communication in acute care, can also contribute to the strategy to reduce the disease burden of HI the community. A modest investment in Audiology services in hospitals would support accessibility in acute care and improve the identification of HI among hospital patients.

The participants in the current study were individuals who experienced disability or Participation Restriction differently. Environmental factors can enable participation or worsen disability. The health system and health services can be more accessible and responsive. In particular, there is an urgent need to improve the response of clinical and other front line staff to HI and deafness. Health professionals can better support people by being prepared to use a range of assistive communication strategies, but not prescribing which strategies should be used. The patient is expert in directing communication choices, if we let them.

There was nothing hidden or invisible about Mr G’s deafness, nor the deafness of the man I met many years ago trying to pay his bill. Everybody in the office knew he could not hear. Everybody spoke in very loud, very exaggerated voices
to him, but being profoundly deaf he could not hear any of it. He has never heard the spoken word. He carried pen and paper and used his communication tools to write them notes, and in response they mouthed and mimed and enunciated with great effort, again and again...until eventually something 'clicked', and they began to write things down for him too. The message here is not to write everything down, or to avoid writing everything down, but to listen and respond to what the individual needs.

There is an extraordinary mismatch between the enormous disease burden of HI and the barely perceptible whispered public health response. There are opportunities to prevent HI. There are opportunities to prevent the negative consequences of HI and there are opportunities to ensure people with HI experience accessible health care that enables their participation. In writing this thesis, the current researcher has joined a chorus of many (Wilson et al., 1992; Hogan, O'Loughlin, Miller, et al., 2009) who, for several decades, have described HI as an underestimated public health problem and proposed strategies for redress. Nevertheless, HI in adults remains universally and chronically under-assessed and under managed at the individual, health service, and public health levels. All the while, our ageing population means that the impact of HI has even greater significance into the future. The mounting evidence about the prevalence and impact of HI is a 'positive cue to action' for the affected individual, health professional, health service, hearing care industry, and health policy makers. One hopes it does not fall on deaf ears.
Appendix A: Barwon Health Ethics Approval

Professor Trisha Dunning
Centre for Nursing and Allied Health Research
Kitchener House, Barwon Health
PO Box 281
25/08/11

Dear Professor Trisha Dunning

Title Hearing loss and quality and safety outcomes in acute care

AURED reference N/A
Barwon Health reference 11/72
Protocol reference Version 1
Research team Professor Trisha Dunning, Dr Sally Savage, Ms Lisa Jane Moody

Thank you for submitting the above for our consideration. Your project was considered in relation to the National Statement on Ethical Conduct in Human Research (2007) and I am pleased to advise that you have been granted approval by the Barwon Health Human Research Ethics Committee (HREC) from the date of this letter.

The site to which this approval pertains is: Barwon Health

Documents approved in support of this approval:

<table>
<thead>
<tr>
<th>Document</th>
<th>Version</th>
<th>Date</th>
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<tbody>
<tr>
<td>NEAF</td>
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<td>VSM</td>
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<tr>
<td>CV : Lisa Jane Moody</td>
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<tr>
<td>CV : Professor Trisha Dunning</td>
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<tr>
<td>CV : Dr Sally Savage</td>
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<tr>
<td>Interview Guide</td>
<td>11.72 Interview Guide v1 05/07/11</td>
<td></td>
</tr>
<tr>
<td>Participant Information and Consent Form</td>
<td>Version 2 19/08/2011</td>
<td></td>
</tr>
<tr>
<td>Database</td>
<td>Database created from study data: Keeper L.J. Moody of Barwon Health</td>
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</table>

Please note that in addition to the HREC approval of the research project, there is creation of and ongoing existence of a database which may be used for further research projects in the future.
Appendix A: Barwon Health Ethics Approval (Cont.)

Your obligations under this approval include notifying the Committee of any intent to deviate from the approved protocol and of the occurrence of any untoward events.

It is now your responsibility to undertake the following:

1. To inform any personnel who should be aware of this project of this approval
2. To ensure, if applicable, that accurate documentation of the consent process is recorded in the participant’s hospital history and that a copy of the participant information and consent form is also placed in the hospital history.
3. To advise the Committee, in writing, of any changes you wish to make to the running of the project, including extending beyond the anticipated completion date or any discontinuation prior to the expected date. Please supply reasons
4. To advise the Committee, in writing, of any adverse events that impact upon the site
5. To supply written annual reports on the anniversary of your approval advising of the progress of the project and a final report advising of completion
6. Please note: Research projects to be undertaken at private institutions are not covered by the Barwon Health Medical Malpractice Policy.

In the case of medical research, care should be taken to ensure that the investigator’s medical insurance policy is current and the institute in which the research is conducted is adequately insured. It is the responsibility of the investigator to ensure adequate coverage in the event of litigation

Please note that template forms for reporting changes to the project may be obtained from the Barwon Health website http://www.barwonhealth.org.au/research/default.aspx

Barwon Health may conduct an audit of your project at any time.

Should you require any further information concerning the Committee’s approval of your research or have any concerns regarding the reporting requirements please contact the Office for Research, on 5226 7920.

Finally, in all future correspondence regarding your study please quote the Barwon Health reference number and full title of your research project.

On behalf of the Committee, best wishes for your project.

Yours sincerely

Signature Redacted by Library

SIMON FRENCH
CHAIR
Human Research Ethics Committee
Appendix B: Deakin University Ethics Approval

DEAKIN UNIVERSITY
Human Ethics Research
Office of Research Integrity
Research Services Division
70 Elgar Road Burwood Victoria
Postal: 221 Burwood Highway
Burwood Victoria 3125 Australia
Telephone 03 9251 7123 Facsimile 03 9244 5581
research-ethics@deakin.edu.au

Memorandum

To: Prof Trisha Dunning
    School of Nursing & Midwifery

cc: Ms Lisa-Jane Moody

From: Deakin University Human Research Ethics Committee (DUHREC)

Date: 07 September, 2011

Subject: 2011-194
Hearing loss and quality and safety indicators in acute care

Please quote this project number in all future communications

Approval granted by Barwon Health HREC for this project will be noted at the DUHREC meeting to be held on 26 September 2011.

It will be noted that approval has been granted for Prof Trisha Dunning, School of Nursing & Midwifery, to undertake this project as stipulated in Barwon Health HREC approval documentation.

The approval noted by the Deakin University Human Research Ethics Committee is given only for the project and for the period as stated in the memo. It is your responsibility to contact the Human Research Ethics Unit immediately should any of the following occur:

• Serious or unexpected adverse effects on the participants
• Any proposed changes in the protocol, including extensions of time.
• Any events which might affect the continuing ethical acceptability of the project.
• The project is discontinued before the expected date of completion.
• Modifications are requested by other HRECs.

In addition you will be required to report on the progress of your project at least once every year and at the conclusion of the project. Failure to report as required will result in suspension of your approval to proceed with the project.

DUHREC may need to audit this project as part of the requirements for monitoring set out in the National Statement on Ethical Conduct in Human Research (2007).

Human Research Ethics Unit
research-ethics@deakin.edu.au
Telephone: 03 9251 7123

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Appendix C: National Safety and Quality Health Service Standards

1. Governance for Safety and Quality in Health Service Organisations which describes the quality framework required for health service organisations to implement safe systems.

2. Partnering with Consumers which describes the systems and strategies to create a consumer-centred health system by including consumers in the development and design of quality health care.

3. Preventing and Controlling Healthcare Associated Infections which describes the systems and strategies to prevent infection of patients within the healthcare system and to manage infections effectively when they occur to minimise the consequences.

4. Medication Safety which describes the systems and strategies to ensure clinicians safely prescribe, dispense and administer appropriate medicines to informed patients.

5. Patient Identification and Procedure Matching which describes the systems and strategies to identify patients and correctly match their identity with the correct treatment.

6. Clinical Handover which describes the systems and strategies for effective clinical communication whenever accountability and responsibility for a patient’s care is transferred.

7. Blood and Blood Products which describes the systems and strategies for the safe, effective and appropriate management of blood and blood products so the patients receiving blood are safe.

8. Preventing and Managing Pressure Injuries which describes the systems and strategies to prevent patients developing pressure injuries and best practice management when pressure injuries occur.

9. Recognising and Responding to Clinical Deterioration in Acute Health Care which describes the systems and processes to be implemented by health service organisations to respond effectively to patients when their clinical condition deteriorates.

10. Preventing Falls and Harm from Falls which describes the systems and strategies to reduce the incidence of patient falls in health service organisations and best practice management when falls do occur.

The 10 National Safety and Quality Health Service Standards (ACSQHC, 2011, p. 8)
Appendix D: Australian Charter of Healthcare Rights

**AUSTRALIAN CHARTER OF HEALTHCARE RIGHTS**

The Australian Charter of Healthcare Rights describes the rights of patients and other people using the Australian health system. These rights are essential to make sure that, wherever and whenever care is provided, it is of high quality and is safe.

The Charter recognises that people receiving care and people providing care all have important parts to play in achieving healthcare rights. The Charter allows patients, consumers, families, carers and services providing health care to share an understanding of the rights of people receiving health care. This helps everyone to work together towards a safe and high quality health system. A genuine partnership between patients, consumers and providers is important so that everyone achieves the best possible outcomes.

**Guiding Principles:**
These three principles describe how the Charter applies in the Australian health system.

1. **Everyone has the right to be able to access health care and this right is essential for the Charter to be meaningful.**

2. **The Australian Government commits to international agreements about human rights which recognise everyone’s right to have the highest possible standard of physical and mental health.**

3. **Australia is a society made up of people with different cultures and ways of life, and the Charter acknowledges and respects these differences.**

**What can I expect from the Australian health system?**

<table>
<thead>
<tr>
<th>MY RIGHTS</th>
<th>WHAT THIS MEANS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Access</strong></td>
<td>I have a right to health care. I can access services to address my healthcare needs.</td>
</tr>
<tr>
<td><strong>Safety</strong></td>
<td>I have a right to receive safe and high quality care. I receive safe and high quality health services, provided with professional care, skill and competence.</td>
</tr>
<tr>
<td><strong>Respect</strong></td>
<td>I have a right to be shown respect, dignity and consideration. The care provided shows respect to me and my culture, beliefs, values and personal characteristics.</td>
</tr>
<tr>
<td><strong>Communication</strong></td>
<td>I have a right to be informed about services, treatment, options and costs in a clear and open way. I receive open, timely and appropriate communication about my health care in a way I can understand.</td>
</tr>
<tr>
<td><strong>Participation</strong></td>
<td>I have a right to be included in decisions and choices about my care. I may join in making decisions and choices about my care and about health service planning.</td>
</tr>
<tr>
<td><strong>Privacy</strong></td>
<td>I have a right to privacy and confidentiality of my personal information. My personal privacy is maintained and proper handling of my personal health and other information is assured.</td>
</tr>
<tr>
<td><strong>Comment</strong></td>
<td>I have a right to comment on my care and to have my concerns addressed. I can comment on or complain about my care and have my concerns dealt with properly and promptly.</td>
</tr>
</tbody>
</table>

For further information please visit www.safetyandquality.gov.au

The Australian Charter of Healthcare Rights (ACSQHC, 2008)
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Giudicelli, P. (2011). Digital Sound Meter FREE (Version 1.1.1) [Mobile application software].


Millenson, M. L. (2002). Pushing the profession: how the news media turned patient safety into a priority. Quality and Safety in Health Care, 11(1), 57-63. doi: 10.1136/qshc.11.1.57


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