Wheelchair and seating prescription practices: a service evaluation in a sub-acute rehabilitation centre

by

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Thesis

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Abstract

Introduction

Assistive devices are commonly used to support the independence of people living with disability by facilitating participation and enhancing overall wellbeing. Wheelchairs are a common assistive technology used to enhance mobility. Wheelchair and seating prescription is a complex, time consuming, and costly but important, intervention for people with mobility limitations. For many new wheelchair users, prescription occurs during an inpatient rehabilitation admission.

Aim

The primary aim of this study was to evaluate an inpatient rehabilitation centre's existing wheelchair prescription service to explore strengths and weaknesses and provide guidance about areas for service development. The service evaluation considered the perspectives of staff and service users. In addition, a systematic review was conducted in order to identify which outcomes are commonly measured and the outcome measures used following new wheelchair and seating prescription.

Method

Systematic Review

A systematic search was performed in four databases based on the following inclusion criteria: (1) prescription of a new wheelchair and/or seating system for long term use (2) participants aged 18 years or over. Details of the outcome measures used within the study were extracted and grouped by categories.

Service Evaluation

Community dwelling wheelchair users who had recently received services from the rehabilitation centre were invited to participate in a semi-structured telephone interview to

explore their perception of the wheelchair prescription service. Participants were also asked to complete the Quebec User Evaluation of Satisfaction with Assistive Technology 2.0 (QUEST 2.0) and the WHO Quality of Life-BREF (WHOQOL-BREF). Rehabilitation clinicians completed a survey regarding their wheelchair prescription experience, confidence and training needs in this area.

Results

Systematic Review

Thirty-nine studies were included in this review; the studies used a range of methodologies but overall the quality of the included studies was found to be low and the populations heterogeneous. Activity and participation were the most commonly studied outcomes. Study-specific tools were used more often than standardised measures. Within the included papers, the psychometric properties of the standardised outcome measures were seldom reported.

Service Evaluation

Eight people who used wheelchairs as their primary means of mobility completed the two surveys (QUEST 2.0 and WHOQOL-BREF) and the semi-structured interview. Qualitative data revealed a high level of satisfaction with the wheelchair prescription although many of the participants had sourced alternative wheelchairs following discharge. Staff survey results (N=42) indicated that knowledge of clinical guidelines related to wheelchair prescription was varied and over half of the staff members did not feel confident in prescription practices.

Conclusions

Services should ensure that wheelchair prescription practices optimise client satisfaction and meet their needs while creating an environment in which staff develop and maintain

their skills in this specialised area of practice. The complexity of measuring wheelchair prescription intervention needs to be recognised; the use of standardised outcome measures should be employed to demonstrate the benefits of wheelchair prescription and make findings meaningful to consumers, clinicians, and service providers.

DECLARATION

I certify that this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

Signed:

Date: 20.11.17

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List of Abbreviations

BRSM	British Society of Rehabilitation Medicine
CASP	Critical Appraisal Skills Programme
CHART	Craig Handicap Assessment and Reporting Technique
COPM	Canadian Occupational Performance Measure
C-QUEST	Quebec User Evaluation of Satisfaction with Assistive Technology (Chinese version)
D-QUEST	Quebec User Evaluation of Satisfaction with Assistive Technology (Dutch version)
EPIOC	electric-powered indoor/outdoor chair
EQ-5D VAS	EuroQol 5D Visual Analogue Scale
EQ-5D	EuroQol 5D
FEW	Functioning Everyday with a Wheelchair
FIM	Functional Independence Measure
FONE FIM	Functional Independence Measure (telephone version)
ICC	intra-class correlation coefficients
ICF	International Classification of Functioning, Disability and Health

IPPA	Individually Prioritised Problems Assessment
MBI	Modified Barthel Index
MFRT	Modified Functional Reach Test
MMSE	Mini Mental Status Examination
NHS	National Health Service
NOMO 1.0	Nordic Mobility-related Participation Outcome Evaluation of Assistive Device Interventions
OPHI	Occupational Performance History Interview
PASIPD	Physical Activity Scale for Individuals with Physical Disabilities
PIADS	Psychosocial Impact of Assistive Devices Scale
QUEST	Quebec User Evaluation of Satisfaction with Assistive Technology
RAND SF-36	RAND Short Form-36
RESNA	Rehabilitation Engineering and Assistive Technology Society of North America
RNLI	Reintegration into Normal Living Index
SATS	Satisfaction with Assistive Technology Services
SIP68	Sickness Impact Profile 68

SIPSOC	Mobility range and social behaviour subscales of the SIP68
SCI	Spinal Cord Injury
TBI	Traumatic Brain Injury
UAL	Utrecht Activity List
UK	United Kingdom
US	United States
WHOQOL–BREF HK	World Health Organization Quality of Life Questionnaire (abbreviated Hong Kong version)
WHODAS II	World Health Organization Disability Assessment Schedule II
WhOM	Wheelchair Outcome Measure

Chapter 1: Introduction

Assistive devices are commonly used to promote the independence of people living with disability by facilitating participation and enhancing overall wellbeing. A “wheelchair is one of the most commonly used assistive devices for enhancing personal mobility” (World Health Organization, 2008, p. 7). The capabilities and needs of adults who use a wheelchair to assist with mobility vary; their goals may be personal, and they will hold individual expectations relating to their wheelchair needs. For these reasons, wheelchair and seating prescription can be a complex, time consuming, and costly but important, intervention for people with mobility limitations. For many new wheelchair users, wheelchair and seating prescription occurs during an inpatient rehabilitation admission.

1.1 Current study context

This study was based in an Australian public health service, Alfred Health. Alfred Health is a major metropolitan health service in Melbourne, Victoria, serving a catchment population of approximately 400 000 people. It provides services ranging from emergency medicine to residential aged-care facilities. Alfred Health is comprised of The Alfred (334 multi-day bed acute hospital), Caulfield Hospital (367 bed sub-acute service, (205 rehabilitation and aged care), and Sandringham Hospital (88 multi-bed community hospital). This study was based at Caulfield Hospital, which specialises in rehabilitation, aged care, community service, and aged mental health. The hospital also plays a state-wide role in rehabilitation services, which include the Acquired Brain Injury Rehabilitation Centre, neurological rehabilitation, spinal rehabilitation, and care for amputee patients. Every year approximately 4500 people are discharged from Caulfield Hospital and there are almost 2000 discharges from rehabilitation wards (Alfred Health Connect, n.d.)

1.2 Statement of problem

Within Alfred Health it is estimated that 65 wheelchairs are prescribed per year within the 205 bed rehabilitation and aged care inpatient service at Caulfield Hospital (this does not include the Acquired Brain Injury Rehabilitation Centre). This estimate is based on unpublished reviews of medical and appliance centre records, as the organisation does not formally collect and report these data. The care of patients at Caulfield Hospital within the rehabilitation and aged care services is mostly funded by the state government as there are few compensable patients admitted. The inpatient service does not offer a dedicated wheelchair and seating service. The wheelchair and seating prescriptions are managed by a single allied health discipline; physiotherapy. Prescription occurs as part of the patient's rehabilitation program when a goal for wheelchair and/or seating prescription is identified. The patient's allocated physiotherapist is responsible for completing these interventions. The involvement of other allied health staff is available as needs are identified. For example an occupational therapist may be consulted regarding home environment details or to complete community access training. Caulfield Hospital does not have contractual agreements with any suppliers and the suppliers are chosen at the discretion of the staff involved in the wheelchair prescription and the patient. According to the work completed by Schmidt (2014), Caulfield Hospital would be considered a primary seating service with a "Network Team; an informal team formed by a primary prescribing clinician in collaboration with a consumer to procure appropriate wheelchair and seating system from a network of wheelchair suppliers" (p. 134).

Although the number of wheelchair and seating prescriptions at Caulfield Hospital is not large relative to the number of patients receiving care overall, the outcomes for wheelchair users are important. A wheelchair that is poorly matched to an individual can adversely

affect independence, participation, and increase the financial burden for the wheelchair user (Lukersmith et al. 2013). Not only are disability rates (World Health Organization, 2011) and the use of assistive technology on the rise (World Health Organization, 2016) but also the Australian disability sector is changing with the introduction of the National Disability Insurance Scheme (NDIS). The National Disability Insurance Agency have highlighted a strategic priority in relation to assistive technology is to “support and stimulate an informed, active, participant-led demand by empowering participants to choose technology that best supports their needs” (National Disability Insurance Scheme, 2015, p. 3). All of these factors have the potential to impact on the service provided by Caulfield Hospital and other rehabilitation facilities. Services will need to respond to these changes providing a service that is sustainable in a growing consumer driven market. However there is a lack of appropriate and transferable evidence toward wheelchair and/or seating prescription. The lack of a single, high quality clinical practice guideline around wheelchair prescription also affects the service quality. Availability of a high quality clinical practice guideline would provide a synthesis of the best available evidence and recommendations; improving service quality and the ability to meet the needs of a changing market. In order to be accountable, demonstrate effectiveness, and ensure the needs of patients are met, the need for a service evaluation was recognised.

1.3 Aims and objectives

This thesis firstly presents a systematic review that aimed to address the following question:

1. Following new wheelchair prescriptions, what outcomes are being measured and what are the outcome measures used?

The results of the systematic review will be used by the service to inform future data collection to enable benchmarking against other services.

Secondly a service evaluation was completed. The aims were to:

1. Evaluate the strengths and limitations of existing wheelchair prescription processes in a sub-acute rehabilitation centre.
2. Evaluate the satisfaction and quality of life for new users prescribed their wheelchair during an inpatient sub-acute rehabilitation admission.

The data for the service evaluation were collected using both quantitative and qualitative methods. Clinicians involved in wheelchair and seating prescription and clients of the service participated in the evaluation.

1.4 Study synopsis

This first chapter has highlighted the importance of wheelchair and seating prescription, provided context for the study and the aims and objectives. Chapter two provides a literature review related to wheelchair and seating prescription. This is followed by a systematic review (Chapter 3, study 1) examining the outcomes measured post-prescription of a new wheelchair and/or seating system. This chapter will be submitted for publication, and as such, presents the discussion within the chapter. Chapters four (study 2, service evaluation) and five (study 3, mixed method client satisfaction study) together present the method and results of a service evaluation of the wheelchair and seating service at a sub-acute rehabilitation centre in Melbourne, Australia. The discussion to this service evaluation is presented in Chapter six. Finally the limitations, recommendations and conclusion are presented in Chapter seven, which brings this thesis into clinical and research context.

Chapter 2: Literature Review

This literature review describes the significance of wheelchair and seating interventions, the benefits and challenges of wheelchair prescription and state of current practice in other settings. A literature search was completed using CINAHL (Cumulative Index to Nursing and Allied Health Literature), Medline, Embase, OTSeeker and Cochrane databases using terms relating to assistive technology, wheelchair and seating prescription, mobility and disability, service delivery, and clinical practice guidelines.

2.1 Disability

Disability can be complex, ever changing and multidimensional (World Health Organization, 2011). Disability is not easily defined and there is lack of agreement regarding a definition. The World Health Organization (2011) describes 'disabilities' as "an umbrella term, for impairments, activity limitations, and participation restrictions" (p. 4). An impairment is a problem in body function or structure; an activity limitation is a difficulty encountered by an individual executing a task or action; while a participation restriction is a problem experienced by an individual in involvement in life situations (World Health Organization, 2011, p. 5). Experiencing disability (either temporarily or permanently) is common across the lifespan, in particular increased difficulties in activity performance during ageing (World Health Organization, 2011). Most people with disabilities experience a combination of impairment, activity limitation, and participation restriction (World Health Organization, 2011). Even if disability is not experienced at a personal level the World Health Organization (2011) reports that many people will know or provide care for someone living with a disability.

2.2 Assistive Technology

It is estimated that between 10% and 15% of the world's population live with a disability (World Health Organization, 2015, p. 2). Rates of disability are on the rise secondary to an ageing population, who are at higher risk of disability and those with a disability ageing as they have increased vulnerability to age related conditions (World Health Organization, 2011). People with a disability often use assistive technology. Approximately 1.9 million of the Australian population that live with a disability rely on assistive technologies to live independently (Australian Institute of Health and Welfare, 2005). The use of assistive technologies by persons with a disability has been shown to increase their autonomy, their ability to live independently, to participate in personal, domestic and community activities, and have a greater sense of community inclusion (Scherer & Glueckauf, 2005; Borg et al., 2012; National Disability Insurance Scheme, 2015). The optimisation of abilities through the use of assistive technology can lead to greater economic and social participation through increased employment and education opportunities (Carver, Ganus, Ivey, Plummer & Eubank, 2016; Lenker, Harris, Taugher & Smith, 2013; National Disability Insurance Scheme, 2015). Assistive technologies have been described as powerful tools when they meet the individual needs of the user and the user's environment (World Health Organization, 2011).

Definitions and terminology surrounding assistive technology can vary within the literature, legislation, and policies. The World Health Organization (2011) defines an assistive technology device, as "any device or system that allows individuals to perform tasks they would otherwise be unable to do or increases the ease and safety with which tasks can be performed" (p.101). The term assistive technology can also encompass the services used when a device is obtained. Steel and Layton (2016) noted that within Australia the term aids and equipment is often used synonymously with assistive technology. For the

purpose of this thesis, assistive technology is defined according to the World Health Organization definition (World Health Organization, 2011).

Commonly used assistive technologies include: crutches, prostheses, orthoses, wheelchairs, hearing aids, cochlear implants, white canes and communication boards (World Health Organization, 2011, p. 101). One of the most commonly used assistive technologies to enhance mobility is the wheelchair (World Health Organization, 2008). A wheelchair is defined as an assistive device, which enhances personal mobility and facilitates participation, for a person with walking limitations (World Health Organization, 2008, p. 11). In addition to a wheelchair, a seating system can be required. Proper seating can be designed to accommodate or prevent postural deformities. The proper seating can have a dramatic effect on a person's mobility, comfort, and ability to perform tasks from a wheelchair by providing adequate support (Cooper, 1998, p. xii). The World Health Organization (2008) estimates that worldwide, 65 million people need a wheelchair and only 5-15% have access to one. In 2015, 4.3 million Australians were living with a disability and around half used aids or equipment to help with their disability (Australian Bureau of Statistics, 2015). Of those that used aids or equipment, 639 300 people with a disability used mobility aids; with around 190 000 people reporting that they used either a manual or electric wheelchair (Australian Bureau of Statistics, 2015). The use of wheelchairs as an assistive technology device is reported to be on the rise and this trend is predicted to continue (Harris & Sprigle, 2008; Pousada García et al., 2015). For example, in the United States, approximately 3.3 million persons of their population of 291.1 million (1.4% of the population) use a wheelchair or similar device (US Census Bureau, 2008). This is up from 2.7 million in 2002.

Mobility impairments can be caused by several factors including injury, accident or trauma or disease and disease progression. The use of a wheelchair facilitates increased mobility and can assist ameliorate the limitations caused by mobility impairments. Mobility allows an individual to move from one place to another and is considered central to daily life (Iezzoni, McCarthy, Davis & Siebens, 2001, p. 235). People mobilise not only for health and wellbeing but to perform activities of daily living and participate in life roles including socialising and working. For some wheelchair users, the transition from walking to mobilising using a wheelchair occurs later in life due to a new onset of disease, disease progression, and/or ageing. This change can be rapid or gradual. During a rapid change Cooper (1998) stresses the "person undergoes a dramatic change in sense of self and autonomy" (p. 11). Not only does the use of a wheelchair have an effect on identity and requires a psychosocial adjustment, it also requires the acquisition of new skills. Fulltime wheelchair users can use their wheelchair for 16 hours per day, 365 days per year – there are few devices that experience this much use (Cooper, 1998, p. xii).

Along with a rise in disability rates (World Health Organization, 2011) and use of assistive technology (World Health Organization, 2016) is the increase in diversity of wheelchairs available and rapid advancement of the technology (Steel, Layton, Foster & Bennett, 2016, p. 235; Hoenig, Giacobbi, & Levy, 2007). This creates a challenge for clinicians involved in the prescription process for wheelchair and seating devices, and for those requiring a wheelchair and/or seating system. Clinicians are required to keep up to date with knowledge about the vast and growing range of wheelchairs available. A wheelchair may be manually propelled, power assisted, or attendant propelled, and the range within these types of wheelchairs varies significantly in specific characteristics (size, weight, performance, features) they offer and in their cost. A specialised wheelchair in Australia is

said to cost between $10 000 and $35 000 (Schmidt, 2014, p. 441). Schmidt (2014, p. 441) has also exposed the hidden costs to wheelchair prescription in providing an Australian benchmark, reporting a primary therapist may be contributing up to 35 clinical hours for a custom made wheelchair prescription (i.e. assessment, fitting, trial, provision and training). Likewise the client and their care provider are said to spend an estimated 60 hours of their time participating in the wheelchair and/or seating prescription process. As an appropriate wheelchair prescription can aid in participation, productivity, quality of life and the time and financial cost significant, clinicians and service providers should ensure the services they provide are meeting the goals of their service users.

2.3 Implications for society

Costs and benefits of the wheelchair and service provision – not just a monetary value

For individuals benefitting from increased mobility as a result of access to a wheelchair for mobility, it is difficult to attribute a real cost. However, as a society the cost of wheelchair prescription and provision is significant. In 2006/2007 it was reported the cost of the wheelchair service as part of the National Health Service (NHS) in the United Kingdom (UK) was approximately £125.8m per year to operate (Department of Health, 2010). In Australia, the cost of wheelchair and seating prescription is relatively unknown due to variations in policy and funding between each state and territory. It is reported the cost of a power wheelchair with complex controls and customised seating can retail for between AU$15,000 and AU$40,000 depending on the details of the products and services provided (Assistive Technology Suppliers Australasia, 2014). Furthermore the additional costs of service delivery and lifetime maintenance and repairs should also be accounted for.

Wheelchair Abandonment

In spite of the significant cost outlay to obtain a wheelchair, growing data suggests that wheelchairs are frequently abandoned (Verza, Lopes Carvalho, Battaglia and Messmer Uccelli, 2006). A wheelchair may be abandoned for multiple reasons: (1) a prescription may not meet the needs of the user, carer, or environment or enable achievement of goals: and (2) psychosocial factors may contribute to the abandonment of assistive technology due to the use of a wheelchair emphasising a change in function and identity and a reliance on an external factor (Kittel, Di Marco & Stewart, 2002). As new wheelchair users are adjusting to both disability and the acceptance of needing a wheelchair, they can experience the change in function and identity more intensely, and this can affect the use of a wheelchair (Kittel et al., 2002). Abandonment of a wheelchair can be related to many factors. From a health professional perspective Verza et al., (2006) suggests abandonment can be seen as a failure for the team. The team may question if the needs and opinions of the wheelchair user were thoroughly considered, if appropriate training was provided to the wheelchair user, if the prescribing clinician had the appropriate skills or if the wheelchair performance met the wheelchair users goals. This questioning could lead to a negative impact on the healthcare team/patient relationship. A trustworthy team relationship has been shown to enhance the prescription process, creating a collaborative team approach to problem solving (Schmidt, 2014, p. 274). In a health care environment, where, there is an increased need to justify costs and be accountable, abandonment demonstrates a significant waste of resources (Kittel et al., 2002) due to a failure to meet the goals and needs of the wheelchair user. Abandonment can lead to a missed opportunity to enhance an individual's quality of life (Kittel et al., 2002) and autonomy, and the user's needs continue to be unmet (Verza et al., 2006).

Health of the user

The continued use of an inappropriate wheelchair and/or seating system can also lead to health complications for the user. These may include injury during wheelchair use, pressure injuries, postural changes and implications for respiratory health. The societal costs of these complications can be vast. A pressure injury, for example can have implications for the wheelchair user such as infections, permanent disfigurement and risk of death (Allman, 1997). There is also the potential disruption to activities of daily living caused by prolonged hospitalisation and bed rest to treat more advanced pressure injuries (Ryan, 2006). More importantly provision of appropriate seating has also been shown to have health benefits for the wheelchair user. Dolan and Henderson (2014) reported there is some evidence that wheelchair seating can "enhance cognitive function, communication skills, dexterity, respiratory capacity and physical endurance, reduce spasticity and the development of contractures and facilitate activities of daily living" (p.136). The provision of appropriate seating is therefore a crucial element of wheelchair prescription as it enables social and family participation and improves quality of life for wheelchair users (Dolan & Henderson, 2014).

Caregiver Assistance

As a result, through enabling independence in activities and increasing participation in valued life roles and routines, wheelchairs may reduce the demand for assistance given by caregivers. Indeed, a central goal of wheelchair and seating prescription is to increase users independence (Requejo, Furumasu, & Mulroy, 2015), which has the potential to reduce caregivers need to provide hands on assistance. A number of quantitative and qualitative studies have investigated the value of the prescription of a wheelchair from the perspective of caregivers. Frank, Ward, Orwell, McCullagh and Belcher (2000) found that 86% of participants in their study reported the provision of a power wheelchair had made

life for their partner/carer easier in one or more ways (e.g., the user was able to go out alone, the carer could go out and was more confident with leaving the user alone at home and there was a reduction in transfers in/out of the wheelchair). In another study (Samuelsson & Wressle, 2014) the effects of power wheelchairs or scooters on occupational performance, social participation, health and life satisfaction was evaluated. Overall this study identified that the need for carer assistance in the form of pushing to facilitate outdoor mobility was significantly decreased through access to a powered wheelchair or scooter. The authors also undertook a cost-benefit analysis concerning the impact of greater wheelchair user independence and reduced carer hours. Results demonstrated that access to a power wheelchair decreased the need for assistance from carers by an average of four hours per week which equated to an estimated 6227 euros per year per user were saved. Likewise Frank, Neophytou, Frank and de Souza (2010) found that 39% of respondents in their study reported reduced burden for their carers following the provision of a power wheelchair. Over half of the respondents attributed this benefit to the reduced need for the wheelchair user to be pushed in their wheelchair. Demers et al. (2009) concluded provision of assistive technology can have a positive impact on caregivers by reducing the level of care required and the physical effort associated with providing care. It is also suggested the health and wellbeing of the carer can be maintained and further health complications prevented due to this reduction in level of care required and the physical effort associated with providing care. Of key clinical concern is evidence provided in a study (Roberts, Young, Andrew, McAlpine & Hogg, 2012), which demonstrated, that of 195 unpaid carers who cared for a wheelchair user (90% manual wheelchair users) 62% of carers did not feel they had their needs considered during wheelchair assessment and prescription. Furthermore 76% reported their health status and ability to push a manual wheelchair had not been taken into account. Similarly,

in an earlier qualitative study, Smith, McCreadie and Unsworth (1995) found the carers that participated in their study, mostly aged between 50 and 59 years, reported an inability to push or lift the prescribed wheelchair due to their own health conditions. It was apparent that these health limitations were examined during the assessment process but not considered at the time of wheelchair prescription. This finding suggests that the assessment of carer needs is currently insufficient. Certain wheelchair features, such as a lighter weight, can positively influence the carer's capacity and confidence to manage the wheelchair (Kirby, MacDonald, Smith, MacLeod & Webber, 2008). A comprehensive wheelchair prescription should take into account the caregiver's needs by identifying the necessary features that may ease the demands on caregivers and lead to better health outcomes for both the wheelchair user and carer.

Employment/participation – maximise abilities

In the absence of adequate wheelchair prescription, wheelchair users can find themselves caught in a cycle of being unable to work, participate, access their community, and access education (Carver et al., 2016). A wheelchair has been described as the most important mobility device used by persons with a disability; however, it has also been identified as the device most commonly associated with barriers to participation. It should be noted that the wheelchair may be the limiting factor (too wide to use in tight spaces, too heavy to push, or to hard to manoeuvre) rather than the disability or physical limitation (Chaves et al., 2004).

The importance of an appropriate and suitable wheelchair has been well established (World Health Organization, 2008). In a mixed methods study, Carver et al. (2016) found the majority of respondents indicated that their mobility device enabled independence and safety. One respondent said: "having a properly configured wheelchair allows me to be an active, independent member of my community. Any investment in mobility pays dividends

in employment, use of discretionary income and lower caregiver burden" (p. 475). Two systematic reviews found that power wheelchairs improved user activity and participation, and had a positive association with the ability to engage in occupations. The authors of both reviews, however, highlighted methodological limitations (low quality of included studies), which may have influenced their findings by reducing the comparability and hampering the ability to draw conclusions on effectiveness (Fomiatti, Richmond, Moir & Millsteed, 2013; Salminen, Brandt, Samuelsson, Töytäri & Malmivaara, 2009). So while it is intuitively known that a wheelchair can directly influence a user's participation, there is limited evidence regarding the ways assistive technology can enhance or inhibit participation (Carver et al., 2016).

In summary, the implications of wheelchair prescription can have both a positive and negative influence for society and the individual wheelchair user. The benefits of a wheelchair, while not always monetary, are invaluable by facilitating independence and participation and reducing caregiver assistance. However, negative outcomes can occur with inappropriate prescriptions such as abandonment, health issues for the wheelchair user and caregiver and reduced participation. For these reasons high quality services are required to ensure an individual is fitted with the most appropriate wheelchair that reduces cost to society through inappropriate prescriptions and subsequent abandonment or the development of serious health complications, which add to further societal costs.

2.4 Best practice in wheelchair and seating prescription

Clinical practice guidelines and standards in health care are provided to assist in improving the quality of care, eliminate unnecessary variations to practice, encourage service development, and allow measurement and benchmarking of service outcomes (Hakkennes & Dodd, 2008). The terms 'standards' and 'guidelines' are often used

interchangeably (Turner-Stokes, 2003), however, standards are defined as the quality of service delivery at the population level, while guidelines provide guidance to the clinician for individual patient care (Turner-Stokes 2003 p. 135). Turner-Stokes (2003) also highlighted the challenge of using guidelines in clinical practice and reported that guidelines must be correct and remain current through ongoing research. The delivery of wheelchair and seating prescription varies worldwide. In Australia, there is limited availability of high quality standards and guidelines (Schmidt, 2014, p. 5). There are a number of different wheelchair and seating prescription practice guidelines and standards that describe best practice and these are developed by a variety of different bodies (national and local), however, it is unknown how often they are used in practice. There are no guidelines or standards that are used internationally. A literature search identified a set of clinical standards and region, population, or service specific clinical practice guidelines. The set of state based clinical standards and some of the national and international guidelines that are readily available are compared and contrasted below. Following this, a summary of the guidelines is provided in Table 1.

Comparison and contrast of standards and guidelines

Using a working group methodology, a set of clinical standards was developed for the National Health Service (NHS) wheelchair and seating services in Scotland (Dolan, 2013). The standards are designed to be used by wheelchair and seating services within the NHS. The final standards include five steps (Figure 1) in the wheelchair and seating prescription service delivery process. The steps recognise the need to encourage and measure improvements for a consistent approach to service delivery. Upon introduction of the standards within the NHS it was found they were challenging to adhere to, but achievable (Dolan, 2013).

Standard 1. Assessment of mobility and mobility needs

Standard 2. Specialist assessment

Standard 3. Clinical follow-up and planned review

Standard 4. Equipment provision and management

Standard 5. Quality management and service improvement

In addition to the five standards, the following criteria were also a part of the standards:

- The requirements for referral and prescription forms
- A list of factors that should be taken into consideration during a specialist assessment
- The minimum facilities and/or equipment that should be available
- Information available to the public
- Glossary of terms

Figure 1: **National Health Service (NHS) wheelchair and seating services in Scotland - final standards (Dolan, 2013)**

In addition to the clinical standards, five guidelines were located that related to either wheelchair prescription (4 guidelines) or specialised seating (1 guideline). In 2008, The World Health Organization developed and published guidelines titled “Provision of Manual Wheelchairs in Less Resourced Settings” (World Health Organization, 2008). These guidelines were developed as part of the World Health Organization’s commitment to “provide support to Member States in building up a system for producing, distributing and servicing assistive devices” (World Health Organization, 2008, p. 15). The World Health Organization guidelines are designed to address key areas of wheelchair provision. They focus on important elements at all stages from design and manufacture through to service provision, delivery, and staff training. The guidelines are intended to be used with flexibility and they are not considered a complete guide. More recently, the Rehabilitation Engineering and Assistive Technology Society of North America (RESNA), which is an

American peak body in assistive technology, published the “Wheelchair Service Provision Guide” (Arledge et al., 2011). The RESNA guide is designed to provide a framework in which the necessary steps in wheelchair prescription can be identified. The steps published are similar to those highlighted in the World Health Organization guideline and address areas such as: “referral, assessment, equipment recommendation and selection, funding and procurement, product preparation, fitting, training and delivery, follow-up, maintenance and repair, and outcome measurement” (Arledge et al., 2011, p. 3). The RESNA guide, although comprehensive, is also kept intentionally broad.

Within the Australian context, EnableNSW and Lifetime Care and Support Authority narrowed the population and developed the “Guidelines for the Prescription of a Seated Wheelchair or Mobility Scooter for People with a Traumatic Brain Injury [TBI] or Spinal Cord Injury [SCI]” (EnableNSW & Lifetime Care & Support Authority, 2011). Similar to the World Health Organization and RESNA guidelines, this guideline was not designed to replace clinical reasoning or skills, but should be used in a way that enhances practice. The EnableNSW and Lifetime Care and Support Authority guideline also covers the key components outlined in the RESNA guide; however, different terminology is used, potentially because of the narrowed focus on TBI and SCI. As part of a project designed to evaluate the wheelchair prescription practices of occupational therapists in a spinal cord injury rehabilitation unit in South Australia Di Marco et al. (2003) developed standards of practice. The standards of practice focused on three aspects of wheelchair prescription: (i) wheelchair selection; (ii) provision of education; and (iii) periodic follow-up. The development of the standards of practice by Di Marco et al. (2003) was unique, in that the authors developed objectives for wheelchair prescription, standards of practice, measurement tools, and a performance monitoring tool; not just clinical recommendations

for prescription. As this was part of a service evaluation, Di Marco et al. (2003) were the only authors to report on the implementation of the standards of practice. It was concluded that the development and use of standards of practice was a useful method for meeting the challenges of wheelchair prescription, and demonstrating the unique values and difficulties of this intervention. Importantly, the work of Di Marco et al. (2003) highlighted that support from both clinical staff and management is required to increase the success of implementation.

Finally, the British Society of Rehabilitation Medicine (BRSM) developed the “Specialised Wheelchair Seating National Guidelines” (British Society of Rehabilitation Medicine, 2004). The components covered in this UK guideline are similar to those covered in previously mentioned guidelines. They cover the assessment, prescription, delivery, and review of specialised wheelchair seating and education for clients and their carers. The target audience for all the guidelines were health care professionals or those involved in the prescription process; however, the guidelines developed by BRSM, RESNA, and the World Health Organization are acknowledged to have a wider audience including consumers, family members, caregivers, manufactures, funding source personnel, policy makers, managers at all levels, and developers of communication and advocacy material. Importantly, the World Health Organization guidelines are also specific to developing countries and so may be more or less relevant subject to geographical location.

The scope of wheelchair types also varied between the guidelines. Some guidelines are broader and cover manual and power wheelchairs and scooters (Arledge et al., 2011; EnableNSW & Lifetime Care & Support Authority, 2011, & Di Marco et al., 2003); whereas, others such as the World Health Organization guideline specifically address the needs of

manual wheelchair users. The BRSM specialised seating guidelines were not specific about the types of seating systems; however, the guidelines are designed to be used with those who require additional support, due to postural instability or musculoskeletal deformity.

The National Health and Medical Research Council (NHMRC) recommend those who are expected to use a guideline or benefit from their use be part of the development process. Involvement of stakeholders can improve quality, ensure guidelines are relevant and in an appropriate format for use, and increase the likelihood they will be used in practice (1998). Despite the acknowledgement that stakeholder involvement in the development of guidelines is key (National Health and Medical Research Council (NHMRC), 1998), involvement of stakeholders in the development of the guidelines discussed above was varied. The World Health Organization reported more than 25 wheelchair experts were involved in the development of their guidelines; the guidelines were discussed and presented at relevant conferences prior to finalisation and included peer review by 21 wheelchair experts. RESNA, the committee that developed the guide, represent the various stakeholders in the wheelchair service provision process; however, did not explicitly seek consultations with stakeholders as part of their development process. EnableNSW and Lifetime Care and Support Authority developed their guidelines in consultation with a working party of experts in the areas of brain and spinal cord injury, rehabilitation and assistive technology, consumer representatives, and researchers. BRSM reported their expert group consisted of wheelchair users, doctors, therapists, and engineers. The guidelines were circulated for wide consensus from members of relevant groups and presented at various national and international meetings; feedback was used to refine the content. Di Marco et al. (2003) used a different methodology that used data

from focus groups with clinicians working in the spinal unit to develop the guidelines. All guidelines involved a literature review during the development phase of the guidelines; however, only EnableNSW and Lifetime Care and Support Authority and BRSM reported on the levels of strength of evidence and provided a link to these within the guideline document.

Table 1: Wheelchair and Seating Prescription Guidelines

Guideline	Purpose / Scope / Population	Target Audience	Additional Notes
World Health Organization – Guidelines on the provision of Manual Wheelchairs in less resourced settings (2008)	**Purpose** The purpose of the guide is to promote, independence, personal mobility, and enhance quality of life of wheelchair users in less resourced settings by improving access to wheelchairs. Assist member States in the wheelchair service provision process. **Scope** The guidelines are designed to address key areas of wheelchair provision focusing on the design, production & distribution of wheelchairs, wheelchair services, & training of related staff. **Population (client group)** Manual wheelchair users in less resourced areas.	The target audience includes: policy-makers, managers at all levels, providers & users of wheelchair services; designers of wheelchairs; developers of communication & advocacy materials; groups of users; & individual users & their families.	• The guideline also includes a wheelchair service-training package. • Some recommendations within the guidelines are applicable to other types of mobility aids or devices (such as hand-powered tricycles) & for other types of users (such as temporary users). • This document is not a wheelchair manual. • Due to the many different contexts in which the guidelines may be applied and implemented, the recommendations should be used with flexibility.
Rehabilitation Engineering and Assistive Technology Society of North America – Wheelchair Service Provision Guide (Arledge et al., 2011)	**Purpose** The purpose of the guide is to provide an appropriate framework for identifying the essential steps in the provision of a wheelchair. **Scope** The wheelchair service delivery model includes the following components: referral, assessment, equipment recommendation & selection, funding & procurement, product preparation, fitting, training & delivery, follow-up maintenance & repair, & outcome measurement. **Population (client group)** All wheelchair users & types of wheelchairs.	The target audience includes: consumers, family members, caregivers, social service & health care professionals, suppliers, manufacturers, funding source personnel & policy makers.	• Outcomes should be measured at various points. • Standardised & validated measures should be used when possible to allow comparison. • Professionals involved in the provision of wheelchairs should apply outcome measures to raise the standard of practice, to support evidence-based practice & to improve the level of accountability. • This guide is intentionally broad & is not intended to replace clinical judgment related to specific client needs.

Guideline	Purpose / Scope / Population	Target Audience	Additional Notes
EnableNSW (NSW Department of Health) and the NSW Lifetime Care - Guidelines for the prescription of a seated wheelchair or mobility scooter for people with traumatic brain injury or spinal cord injury (2011)	**Purpose** The purpose of the guide is to provide best practice recommendations for prescribing the most appropriate wheelchair for an individual. **Scope** Includes guidance on the following components: goals & evaluation, assessment & review, capacity & performance, wheelchair features, propulsion, scooters, training, transport, maintenance. **Population (client group)** Those requiring a wheelchair following traumatic brain injury or spinal cord injury. Includes seated wheelchairs & mobility scooters, but excludes standing wheelchairs & prone trolleys.	The target audience includes: occupational therapists & physiotherapists who prescribe wheelchairs for people with spinal cord injury or traumatic brain injury & professionals with specific expertise who are involved in the prescription of a wheelchair; for example, rehabilitation engineers.	• Clearly highlights the level of evidence pertaining to each recommendation. • The guidelines are intended to inform & guide the therapist, but are not rigid regulations. • No studies were found that investigated the efficacy of the guidelines post implementation.
Standards for wheelchair prescription (Di Marco et al., 2003)	**Purpose** The guidelines & standards were developed to address variability of wheelchair prescription outcomes & develop a system of practice that demonstrates accountability & produce quantitative data. **Scope** Clinical guidelines –consider the functional, physical, postural & psychosocial aspects of wheelchair use. Measurement guidelines include a list of considerations for the selection of wheelchair features. A wheelchair maintenance education package is included. **Population (client group)** Designed for wheelchair users with a spinal cord injury attending inpatient rehabilitation at a spinal unit in Adelaide, South Australia.	The target audience includes prescribing therapists.	• Measurement tools not standardised.

Guideline	Purpose / Scope / Population	Target Audience	Additional Notes
British Society of Rehabilitation Medicine – Specialised Wheelchair Seating National Guidelines (2004)	**Purpose** The purpose of the guide is to improve the clinical care & on-going support delivered to people with disabilities who require specialised wheelchair seating; to improve the understanding of specialised seating & the potential benefits that it can impart; to stimulate further research in this area in order to provide the evidence base for further expansion of these services. **Scope** The guidelines cover the assessment, prescription, delivery & review of specialised wheelchair seating & also the information & advice provided to the person accessing the service & their carers. **Population (client group)** People of all ages, who require a wheelchair for mobility, but who also need additional support due to postural instability or musculoskeletal deformity. The guidelines also address the needs of the families/carers of these people with a disability.	The target audience involves a range of people, including: doctors; allied health professionals & engineers; commissioners & managers; voluntary & charitable organisations; & manufacturers. The guidelines also contain useful information for clients of these services, their families, carers, & friends.	• Clearly highlights the level of evidence pertaining to each recommendation.

In addition to the identified guidelines, Eggers et al. (2009) published the Wheelchair Service Delivery Model (Figure 2) for use within the American health care system with individuals following SCI. The model was designed based on data from 10 in-depth interviews with subject matter experts, integrated with available evidence. This resulted in a model highlighting the components of wheelchair service delivery process and included referral, clinic selection, needs assessment (functional, physiological, other), device justification, device provision and fitting, education, counselling, and follow-up. These components are similar to the key processes in the guideline by The World Health Organization, RESNA, and EnableNSW and Lifetime Care and Support Authority. The difference with the model developed by Eggers et al. is the ability to sub-model each component to provide additional detail that depicts various influences; for example, clients, providers, suppliers, payers, and the system (See Figure 2). Sub-models for each component have been developed; each shows how different factors influence wheelchair and service delivery, the appropriateness of the wheelchair provided, the health and safety issues associated with use, and functional outcomes. The authors reported the target audience was clinicians, who may use this model to understand varied influences on wheelchair service delivery. As highlighted by the authors, the ultimate aim of the model and any subsequent research is to guide the design of policies, practices, and guidelines to improve the standards of care of wheelchair service delivery.

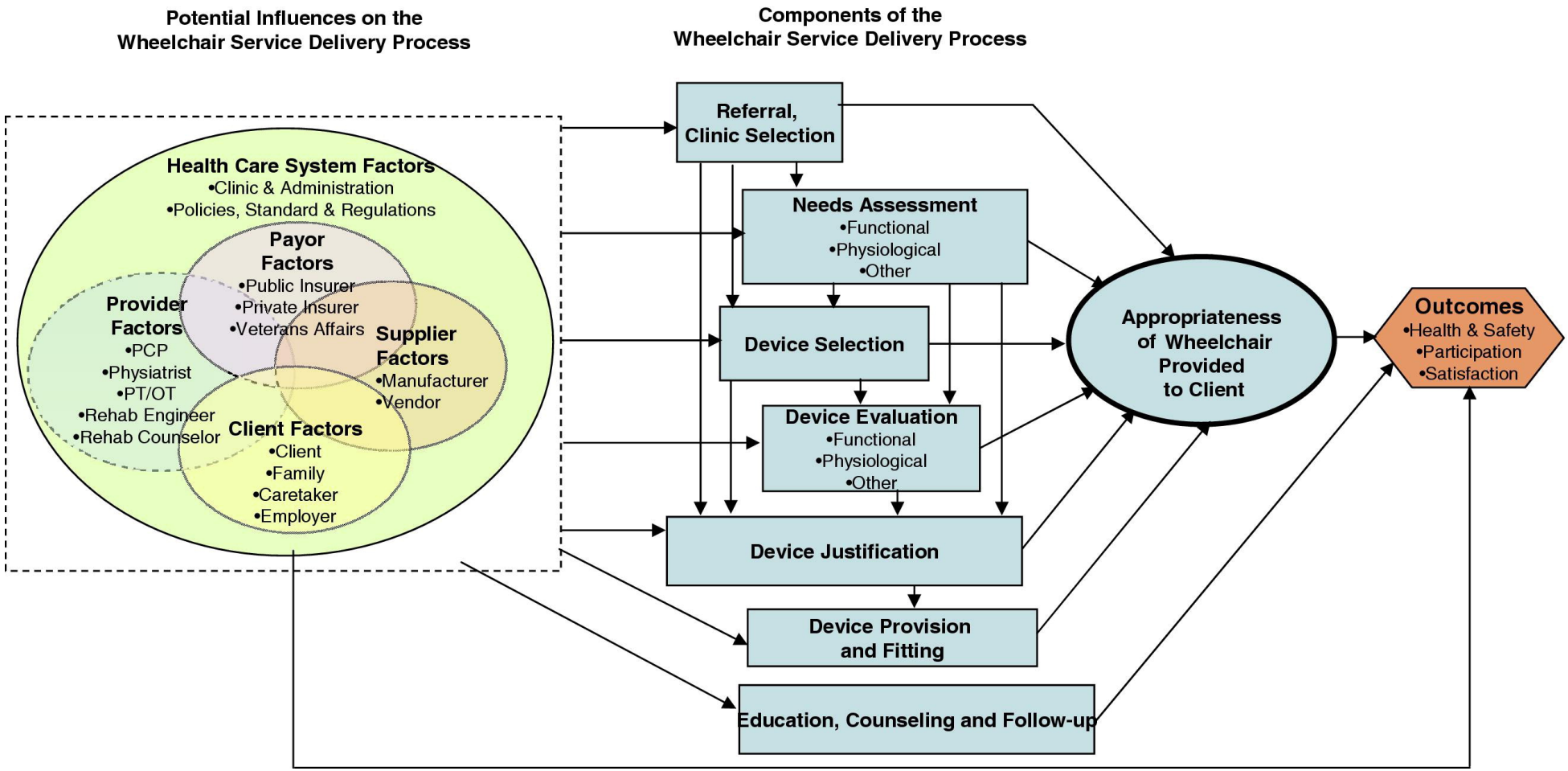


Figure 2: **Model of wheelchair service delivery (Eggers et al., 2009, p. 1033)**

Schmidt (2014) completed a qualitative study relevant to the Australian context that included 60 participants from four stakeholder groups (consumer, care provider, prescribing clinician and vendor) across metropolitan and non-metropolitan areas in Australia, and published the 'Six Australian Seating Service Steps' (Figure 3). These steps define the specialised wheelchair and complex seating procurement process *(actual practice)* from service entry to wheelchair discharge within Australia. Schmidt's study is one of the first comprehensive studies of the Australian wheelchair and seating prescription landscape and provides useful insights into what occurs, given there is a lack of standardisation or consistent approach to wheelchair prescription across Australia.

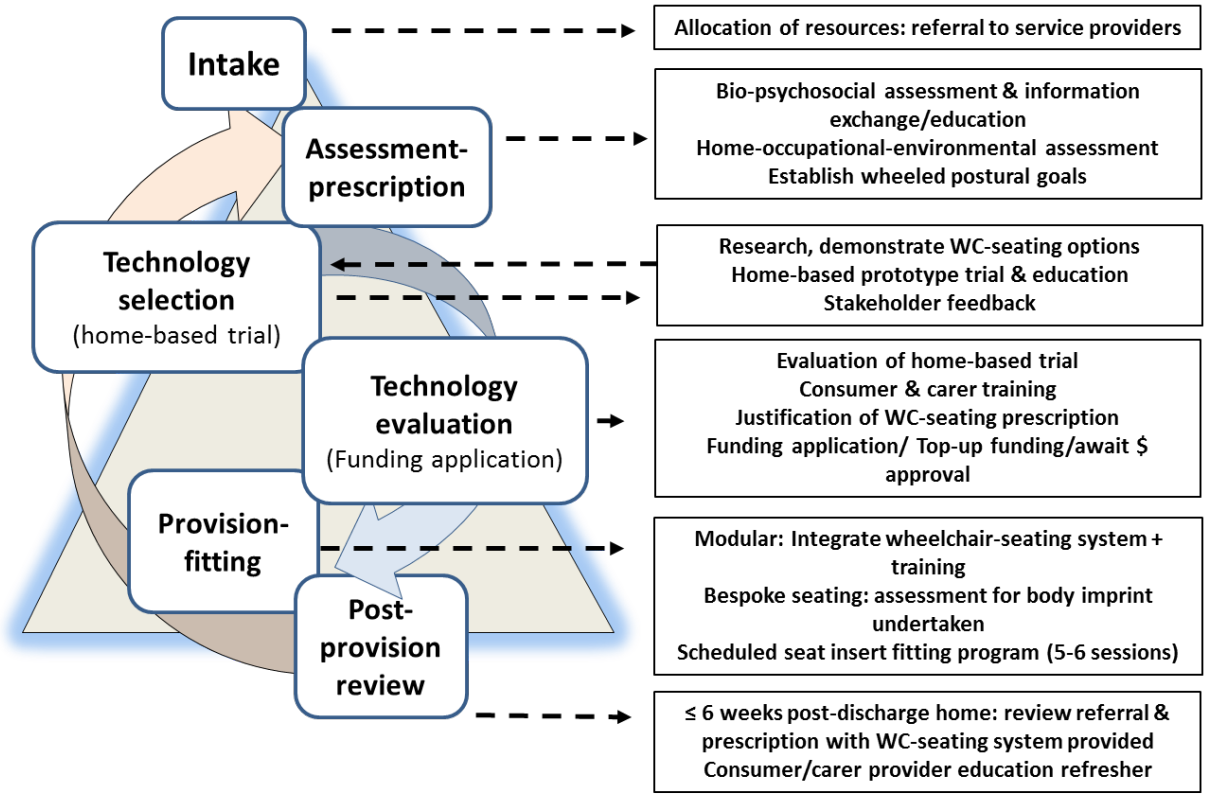


Figure 3: **The six seating service steps: a non-linear dynamic process within an Australian context (Schmidt, 2014, p. 427)**

Standards of practice, clinical practice guidelines, and models, directly related to wheelchair and seating prescription interventions have been presented; however, wheelchair and seating prescription is often multifactorial and needs to take into consideration more than just the mobility and seating needs of the individual. To support this multifactorial intervention clinicians may use clinical practice guidelines not specific to wheelchair and/or seating prescription. For example, the “Pan Pacific Clinical Practice Guideline for the Prevention and Management of Pressure Injury” (Australian Wound Management Association, 2012) provides support for pressure care decision making, being an integral component of appropriate seating prescription. Some of the readily available guidelines and their purpose are presented in Table 2.

In summary, although wheelchair and seating prescription services vary worldwide there are a number of guidelines available to inform clinicians. One of the challenges is having a consistent approach to guideline use across services. A lack of standardisation in wheelchair prescription service delivery processes and a lack of research evaluating delivery approaches has been highlighted in the research (Greer, Brasure & Wilt, 2012). To aid clinicians during the prescription process, the development of a standard practice for wheelchair assessment has been recommended (Arledge et al., 2011). This standard of practice would allow cross service comparisons to promote effective and efficient service provision.

Table 2: Complementary Guidelines to Wheelchair and Seating Prescription

Guideline	Purpose / Scope / Population	Target Audience
Pan Pacific Clinical Practice Guideline for the Prevention and Management of Pressure Injury (Australian Wound Management Association, 2012).	The purpose of the guide is to promote the prevention & optimal care of patients at risk of, or with, pressure injuries.	Medical professionals, allied health professionals, nurse practitioners, nurses, pharmacists, rural health workers, & indigenous health workers. Information source for consumers & informal carers.
Preservation of Upper Limb Function Following Spinal Cord Injury: A Clinical Practice Guideline for Health-Care Professionals (Consortium for Spinal Cord Medicine, 2005).	The purpose of the guide is to assist health care professionals when providing education to wheelchair users who have a spinal cord injury on upper extremity preservation methods. The guideline provides recommendations on proper performance of common activities, such as transfers & wheelchair propulsion.	Health professionals working with individuals who have a spinal cord injury & are wheelchair users.
24 hour Positioning (including Seating and Wheeled Mobility) Practice Guide for Occupational Therapists & Physiotherapists who Support People with Disability (NSW Family and Community Services, 2016).	The guideline links theory & practice around 24 hour positioning & how best to use the evidence to improve person-centred outcomes for people with disabilities.	Occupational therapists & physiotherapists working with people with disabilities.

2.5 Current practice

Current standards of practice, clinical practice guidelines, and models of practice related to wheelchair and/or seating prescription practice are varied, so too is the availability of funding for the equipment and associated services. In some countries, wheelchairs are provided as a part of the national health service; while in others, insurance companies, charitable organisations, and non-government organisations are responsible for wheelchair funding and provision. In the Nordic countries, for example, mobility devices are generally provided at no cost to the recipient, provided the mobility device is deemed to have a great effect on the recipient's life (Nordic Centre for Rehabilitation Technology (NUH), 2007). In the UK, the NHS runs local wheelchair services, which are responsible for the assessment, prescription, and ongoing maintenance of wheelchairs. Clients of the service are provided with a standard wheelchair at no cost but have the opportunity to part-fund, fully self-fund, or use a voucher system to purchase a wheelchair beyond what the NHS considers a standard wheelchair (National Health Service, 2015). In Australia, the funding systems and services for provision of a wheelchair differ between states and territories. In addition to the publicly-funded services there are state-based compensation schemes that support and fund the provision of wheelchairs, for example, the Australian workers compensation scheme and transport accident insurance schemes. State based compensation schemes vary widely and while some provide comprehensive coverage on a no-fault basis, others have a fault component meaning in order to receive adequate lifetime care and support the person sustaining the injury would need to successfully sue an at-fault party (Australian Government Productivity Commission, 2011). Schmidt (2014) identified four different wheelchair and seating service models within Australia, including: 1. Primary seating service; 2. Consultancy seating service; 3. Mobile seating service; 4. Annual outreach seating clinic. Schmidt (2014) also revealed the team composition was

often dependent on the service required (for example the complexity of the prescription) and the location (i.e. in home, clinic based or an outreach service). The composition of the team is also dependent on the skill of the individual clinician/s as opposed to the identified profession. Data on the Australian wheelchair and seating service process is limited (Di Marco, Russell & Masters 2003; Lukersmith, Radbron & Hopman, 2013). Due to the lack of data relating to the Australian wheelchair and seating service landscape there is no evidence to suggest one profession, one type of team composition (i.e. single discipline, multi-disciplinary, trans-disciplinary), or model of service delivery is superior to another but is often dependent on the services required (Schmidt, 2014).

The current funding and service provision arrangements for assistive technologies (including wheelchairs) in Australia have been described as fragmented and inefficient (Australian Government Productivity Commission, 2011). It has been reported, “people with various disabilities are unable to access the aids, equipment and technology essential to their daily functioning” (Australian Government Productivity Commission, 2011, p. 2). Considerable work by the Commonwealth Government in recent years to overcome these insufficiencies in the system has seen the introduction of the National Disability Insurance Scheme. The role out of the scheme began in July 2016 with all Australians predicted to have access by 2019-20. In future, spending on assistive technology is expected to reach a national cost of $1.06 billion per annum once the scheme is fully rolled out, and it is expected $395.3m will be allocated to personal mobility equipment (wheelchairs, walkers, hoist and transfer equipment). Spending of this magnitude is likely to impact the delivery of assistive technology in Australia, encouraging investment, and the development of emerging technology solutions. As knowledge of this spending filter through the Australian and global technology community, it is expected that Australia could become a hub of

assistive technology innovation (National Disability Insurance Scheme, 2015). At the time of this study, the full roll out of the National Disability Insurance Scheme was not complete and the participants were not in receipt of funding from the National Disability Insurance Scheme.

In conclusion, it is clear that wheelchair and seating prescription is complex and there are many factors that can influence prescription. Guidelines have been developed internationally to assist with improving the process of wheelchair prescription. Within Australia, however, the extent of guideline use is unknown and there is limited information about outcomes following wheelchair prescription.

Chapter 3: A Systematic Review of Outcomes Measured Following New Wheelchair and Seating Prescription Interventions in Adults

3.1 Introduction

Assistive devices are commonly prescribed by health professionals and widely used to support independence. One of the most commonly used assistive devices for enhancing mobility is the wheelchair (World Health Organization, 2008). According to the United Nations Convention on the Rights of Persons with Disabilities, effective measures should be taken to ensure quality assistive devices, including wheelchairs, are available at an affordable cost for people with disabilities (United Nations, 2006). Wheelchairs are considered a basic human right, because not only does a wheelchair provide mobility and postural support, but it also allows the user to have independence and participate in life roles and valued occupations, and supports health and wellbeing (Di Marco et al., 2003; Kenny & Gowran, 2014; Dolan, 2013).

Worldwide, the number of people who use wheelchairs is relatively unknown but it is approximated that 65 million people worldwide (1% of the world population) need a wheelchair (World Health Organization, 2011). Data from the United States (US) estimate that 3.6 million US citizens use a wheelchair (representing approximately 1.5% of the US population) (US Census Bureau, 2010). In the UK, it has been estimated that 1.9% of the population uses a wheelchair (National Health Service, n.d.). In Australia, the exact number of wheelchair users is unknown; however, population data demonstrate an increase in the proportion of people with disabilities using aids to assist with their mobility between 2003 (13%) and 2009 (15%) (Australian Bureau of Statistics, 2009). Due to higher rates of disability developing countries are reported to have a higher rate of

wheelchair use compared to developed countries, however, the number of people using a wheelchair in developed countries is still anticipated to increase due to ageing populations (World Health Organization, 2011).

Irrespective of whether an individual is from a developed or a developing country, the capabilities and needs of adults who use a wheelchair to assist with mobility vary (Dolan, 2013; Dolan & Henderson, 2014). Their impairments may be physical and/or neurological, their wheelchair needs specific and individualised, their goals related to wheelchair use personal, and they will hold individual expectations relating to their wheelchair needs (Di Marco et al., 2003; Dolan, 2013). For these reasons, wheelchair and seating prescription is a complex, time consuming, costly but important intervention for people with mobility limitations. A successful prescription of a wheelchair and seating system can increase a person's participation and independence in activities of daily living, and improve quality of life (EnableNSW & Lifetime Care & Support Authority, 2011, p. 15). In contrast, an inappropriate prescription can lead to negative consequences such as injury, feelings of abandonment and dissatisfaction, and insufficient activity and participation as compared to their identified goals (Lukersmith et al. 2013).

To achieve a successful prescription, the procurement process can involve the assessment of function, range of movement, user needs, environmental barriers or enablers, and roles and routines (Arledge et al., 2011). Wheelchair prescription may also include trials of different wheelchairs in various environments prior to a definitive prescription. The prescription process can be led by a single discipline or be multidisciplinary including, but not limited to, occupational therapists, physiotherapists, and rehabilitation engineers. Successful prescription depends on this thorough, and often multidisciplinary assessment (particularly with increased complexity) through which

outcomes are appropriately measured (Arledge et al., 2011; EnableNSW & Lifetime Care & Support Authority, 2011).

The use of outcome measures as part of any assessment process (e.g., in research studies, service improvement, clinical care or benchmarking activities) is essential to evaluate and demonstrate the effect of an intervention (Skinner & Turner-Stokes, 2006). Researchers and health professionals should use tools that meet their needs, are suitable for the target population, and are standardised to ensure reliability and validity data are available—such data are essential for the correct interpretation of the results (Unsworth, 2000). In addition, the use of commonly applied outcome measures facilitates the comparison of different studies and services. However, in the area of wheelchair prescription, it is unknown which outcome measures should be used by clinicians. Therefore, this systematic review aims to address this gap in knowledge through addressing the following research question:

> Following new wheelchair prescriptions, what outcomes are being measured and what are the outcome measures used?

3.2 Method

Search Strategy and Selection of Studies

A protocol for the systematic review was developed before conducting the review. See Appendix A for details of the protocol. Searches were conducted in Medline (1946 to July 2015), CINAHL (1986 to July 2015), EMBASE (1947 to July 2015) and PsycINFO (1806 to July 2015) for relevant studies without language restrictions (i.e., published in English). Search terms included terms related to wheelchairs (e.g., mobility device, powered indoor outdoor chair and power chair); terms related to use of wheelchairs (e.g., participation, occupation and activities of daily living); and terms related to satisfaction and quality of life

(e.g., personal satisfaction, confidence, and self efficacy). See Appendix B for details of the full search strategy. Titles and abstracts of journal articles were screened by one author (BR) to identify potentially relevant studies and exclude those that were clearly not relevant. A second author (KL) checked 20% of the citations for relevant studies. Two authors (BR and KL) independently assessed all studies obtained in full text to determine eligibility using pre-determined inclusion criteria (Figure 4). Disagreement or ambiguities were resolved by consensus or decision by a third author (NL) when required.

Design

- all study designs, including randomised controlled trials, quasi-experimental studies (including non-randomised controlled studies, before-and-after studies, and interrupted time-series studies) and observational studies (including cohort studies, case-control studies and case-series studies)

Participants

- adult participants or ≥75% aged 18 years and over
- community living in private dwellings, group homes or residing in residential care
- any diagnosis resulting in the requirement to use a wheelchair for mobility on a permanent basis

Figure 4: **Systematic review inclusion criteria**

Types of Studies

This review considered all study designs; randomised controlled trials, non-randomised controlled studies, before-and-after studies, interrupted time-series studies, observational studies (including cohort studies), case-control studies and case-series and qualitative studies.

Participants

Studies involving participants of either gender, aged 18 years and over (or ≥75% aged 18 years and over), who were community living in private dwellings, group homes or residing

in residential care were included. People with all health conditions were included, provided that a new wheelchair and/or seating prescription was required on a permanent basis.

Intervention

The intervention of the study required the new prescription of a manual or power wheelchair, scooter, or seating system. Prescription of the wheelchair may have occurred in any setting (inpatient, outpatient, community) and via any service delivery model (single health professional, interdisciplinary team, vendor led). The existing literature on assistive technology provides many different definitions of a wheelchair. For the purpose of this systematic review, we were concerned with either a manual or power wheelchair that assists an individual with their mobility needs. In addition to a wheelchair, a specialised seating system may be required. A seating system can be defined as a "postural support system, custom made or 'off-the-shelf' proprietary devices required in a wheelchair/buggy to improve function, prevent or reduce progression of musculoskeletal deformities, prevent tissue breakdown and improve quality of life" (Datta & Ariyaratnam, 1996, p. 365).

Outcome Measures

Data were extracted for all outcome measures.

Quality

The quality of all studies was assessed by two authors (BR and KL) using the PEDro scale (for randomised controlled trials) and the Newcastle–Ottawa Quality Assessment Scale (for non-randomised studies) (Wells et al., 2013); qualitative studies were assessed using the Critical Appraisal Skills Programme (CASP) tool (CASP, 2014).

Data Analysis

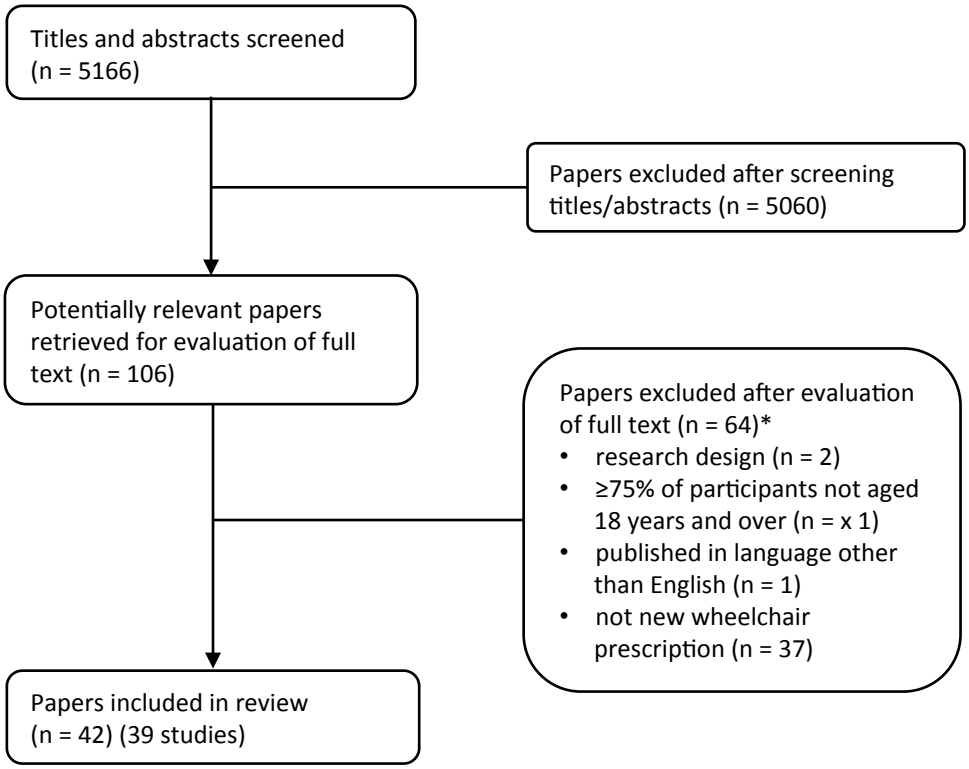
Data were extracted by one author (BR) using a custom form, and a 10% sample was checked for accuracy and completeness by a second author (KL). Reviewers resolved

discrepancies through consensus. Extracted data included design, participants, intervention, outcome measures, service delivery models, and results.

3.3 Results

Flow of the Studies Through the Review

The electronic search strategy identified 5166 papers (after the removal of duplicates). After screening titles and abstracts, 106 papers were retrieved for full text review. Of these 106 papers, 42 met the inclusion criteria. Six papers reported data from the same studies, therefore 39 studies were included in this review. Figure 5 outlines the flow of studies through the inclusion process.



* Papers may have been excluded for failing to meet more than one inclusion criteria

Figure 5: **Flow of studies through the review**

Characteristics of Included Studies

There was heterogeneity in the study designs and outcomes assessed. Characteristics of the N=39 included studies are provided in Table 3. The included studies were published between 1992 and 2015. Most studies (30/39; 77%) used a cross-sectional or cohort design (prospective and retrospective).

Table 3: Summary of Study Characteristics, Outcome Measures and Results (N=39 studies)

Study	Study design & follow-up time	Participants	Diagnosis	Region & Living arrangement	Mobility device	Service delivery	Outcome measures	Results/conclusions
Armstrong (2007)	Cohort 3 and 10 weeks	N=100 Age (y) = 34.48 (SD n/s) Gender = 93% m	Lower extremity paralysis and amputation	Afghanistan Not reported	Manual wheelchair	Three visits for wheelchair fitting and training (use and maintenance)	Study-specific tool: • wheelchair use, performance, and user satisfaction in relation to service and training	• The provision of a 'study wheelchair' in less resourced areas performs well and is favourable in relation to ease of propulsion, stability, transportability, seating comfort and appearance.
Auger (2010)	Multi-cohort 2 follow-up phone calls over 2 weeks	N=116 Age (y) = 65±10 Gender = 41% m	Neurological, musculoskeletal and medically complex	Canada Community dwelling or residential care	Power wheelchair or scooter	Not reported	Activity/participation: • WhOM • Life-Space Assessment	• User's life-space mobility increases after using the power mobility device and remains stable across the stages of initial and long-term use.
Barlow (2009)	Cross-sectional 1 month	N=30 Age (y) = experimental 72.2, control 1 36.7, control 2 52.0, (SD n/s) Gender = 53% m	MS, PD, SCI, dementia, TBI, CVA, CP, cancer, dystonia, developmental delay	Canada Community dwelling or residential care	Seating system	Face-to-face assessment team was comprised of OT, PT and seating technician, as well as physiatrist or orthotists	Satisfaction: • QUEST 2.0 (clients and therapists) Study-specific tool: • wait times, travel costs, therapist time • goal attainment	• The seating assessments completed via telerehabilitation, achieved the same level of client satisfaction and their goals were as likely to be met, as clients who were assessed face-to-face. • Telerehabilitation clients saved travel costs. • Telerehabilitation clients had shorter wait times for assessments than rural face-to-face clients but their interventions took the same amount of time to complete.

Study	Study design & follow-up time	Participants	Diagnosis	Region & Living arrangement	Mobility device	Service delivery	Outcome measures	Results/conclusions
Bates (1993)	Qualitative naturalistic study 9 months	N=1 Age (y) = 30 Gender = 100% m	SCI	US Inpatient rehabilitation centre	Manual wheelchair	Inpatient rehabilitation centre	Qualitative: • adaptation to wheelchair	• Adaptation to wheelchair has pragmatic & emotional components. • Therapists & patients can have conflicting wheelchair use goals • Initial attitudes towards wheelchair use can hamper patient acceptance of it as a useful tool. • Emotional acceptance of the wheelchair can affect successful pragmatic adaptation.
Bolin (2000)	A-B-A single subject experimental 3–6 week period pre-intervention 2–14 months during intervention 6–8 weeks post intervention	N=4 Age (y) = 25.75 (SD n/s) Gender = 100% m	SCI	Sweden Not reported	Seating	Outpatient clinic, further details not reported	Activity/participation: • MFRT • FIM–transfers component Impairments/health conditions: • Ashworth Scale • Spirometer test Study-specific tool: • wheelchair skills, maximum heart rate during wheelchair skills, perceived changes using a five-point scale	• Improvement was found in sitting position and posture. • The effect on performance varied. • The objective measures of balance, transfers, and spasticity did not correspond with the participant's perceived changes of performance.

Study	Study design & follow-up time	Participants	Diagnosis	Region & Living arrangement	Mobility device	Service delivery	Outcome measures	Results/conclusions
Buning (2001)	Cross-sectional 13.5 months (median)	N=8 Age (y) = 44 (SD n/s) Gender = 50% m	SCI, MD, MS, cardiopulmonary insufficiency, TBI	US Community dwelling	Transition from manual to power wheelchair	Outpatient service	Quality of life: • PIADS Participation: • OPHI Study-specific tool: • satisfaction using a Likert scale	• The transition to a power mobility device enhanced occupational performance, competence, adaptability, and self-esteem for people with severe mobility impairments.
Chan (2007)	Cross-sectional 3.79±3.72 years post injury (follow-up time post prescription of wheelchair not provided)	N=31 Age (y) = 41.68±11.17 Gender = 81% m	SCI	China Community dwelling	Manual or power wheelchair	Assistive technology provided by OT	Quality of life: • WHO QOL–BREF HK Satisfaction: • C-QUEST Activity/participation: • selected items (i.e., 'Participation Restriction' and 'Environmental Factors') of the ICF	• Community participation and human environment were more related to quality of life than to users' satisfaction with a wheelchair.

Study	Study design & follow-up time	Participants	Diagnosis	Region & Living arrangement	Mobility device	Service delivery	Outcome measures	Results/conclusions
Cullen (2008)	Cross-sectional 1 month post wheelchair provision	N=103 Age (y) = 65.6±13.5 Gender = 55% m	Arthritis, neurological conditions (MS, CVA, MND, PD, MD, CP); amputation; respiratory disease; SCI; other	Scotland Community dwelling	Power wheelchair	Standard clinic assessment	Activity/participation: • FEW Study-specific tool: • wheelchair use	• The rate of functional use of power wheelchairs was less than might be expected, particularly for outdoor use. • The power wheelchair was effective in meeting the participants' functional needs. • When environmental reasons were accounted for, the rate of power wheelchair use after 1 month was predicted by verbal recall, visual-construction ability, and global cognition.
Davies (2003)	Cohort Prior to provision of wheelchair 97 (SD 16) days post provision of wheelchair	N=64 Age (y) = 52±21 Gender = 44% m	MS, MD, other neurological, CP, SCI, CVD, musculoskeletal, mixed disabilities, RA, polio, other	UK Community dwelling	Power wheelchair	Wheelchair clinic	Quality of life: • EQ-5D Study-specific tool using visual analogue scale in a thermometer style: • impairments/health conditions, activity, participation, and quality of life	• No change was found in perceived health state. • Significant improvements were found in reduction of pain and discomfort, improved levels of mobility and perceived quality of life. • The use of visual analogue scales provided a more holistic set of outcome measures that demonstrate quality of life benefits beyond that of health state alone.

Study	Study design & follow-up time	Participants	Diagnosis	Region & Living arrangement	Mobility device	Service delivery	Outcome measures	Results/conclusions
de Groot (2011)	Cross-sectional 1 year post discharge from inpatient rehabilitation	N=109 Age (y) = 40.4±14.2 Gender = 73% m	Acute SCI (not progressive such as a tumour)	Netherlands Community dwelling	Manual wheelchair	Not reported	Satisfaction: • D-QUEST Quality of life: • PASIPD Activity/participation: • UAL • mobility range and social behaviour subscales of SIP68 (SIPSOC)	• Participants had a high level of satisfaction with the device itself but less satisfaction with the service delivery. • Participants with an incomplete lesion were slightly more satisfied with their device and the service delivery compared to participants with a complete lesion. • Active participants were more satisfied overall with their wheelchair. • Participants who were more satisfied with simplicity of use, durability and comfort showed increased participation.
R. Evans (2000)	Qualitative 1–2 years post wheelchair prescription	N=8 Age (y) = 55.5±11.54 Gender = 50% m	MS, CP, MND, CVA, transverse myelitis, polio	UK Community dwelling	Power wheelchair	National Health Service Wheelchair Service	• Semi-structured interview examining the effect that EPIOC use had on users' occupations	• Through EPIOC use occupation was enhanced and this may have had a positive effect on users' health.

Study	Study design & follow-up time	Participants	Diagnosis	Region & Living arrangement	Mobility device	Service delivery	Outcome measures	Results/conclusions
S. Evans (2007)	Qualitative 14 (range 9–19) months post provision of wheelchair	N=17 Age (y) = 69 (SD n/s) Gender = 53% m	SCI, MS, CVD, RA, polio, co-morbid disabilities	UK Community dwelling	Power wheelchair	Specialised wheelchair clinic	• Satisfaction—qualitative interview (device and service, use and safety)	• The following were reported: reduced burden on carers; increased independence and freedom; EPIOC use required carer assistance; size, weight and foldability affect use; users experienced difficulties with kerbs, slopes and steps; benefits of EPIOC outweigh the residual practical difficulties and concerns.
Frank (2000)	Cohort study 3.9 (SD 1.4) months post provision of wheelchair	N=124 Age (y) = 43±20 Gender = 42% m	MS, MD, CP, RA, other neurological conditions, polio, mixed impairments, SCI, CVD, spina bifida, other musculoskeletal conditions, other	UK Community dwelling	Power wheelchair	Wheelchair clinic	Study-specific tool: • wheelchair use, benefits for carers, component failures, accidents/mishaps	• There was an increase in personal independence for users and an ease of the burden on informal carers. • Over 10% of users had accidents within 4 months of power wheelchair use, some were attributable to mechanical/electrical failures. • A clinical review of the clients and chairs, and the monitoring of approved repairers' performance are essential.

Study	Study design & follow-up time	Participants	Diagnosis	Region & Living arrangement	Mobility device	Service delivery	Outcome measures	Results/conclusions
Frank (2010) Frank (2012)	Qualitative 14.3 (range 10–19) months post provision of wheelchair	N=64 Age (y) = 41.7±21.4 Gender = 50% m	MD, CP, MS, SCI, CVD, RA, other neurological conditions, spina bifida, other musculoskeletal conditions, multiple-impairment, polio, other	UK Community dwelling	Power wheelchair	Wheelchair clinic	• In-depth telephone interview	• EPIOC use reduced physical burden on family/friends and independence and freedom increased but other practical problems, during transportation and negotiating kerbs and slopes were not eliminated. • Most EPIOC users experienced pain: over 50% felt their pain was influenced by the wheelchair, while few felt their wheelchair eased their symptoms, participants developed strategies to assist with alleviating or coping with the pain and rehabilitation professionals need to work with wheelchair users to achieve appropriate pain management.
Fuchs (2003)	Cross-sectional 11.9 (range 1–26) months post approval of wheelchair	N=42 Age (y) = 79.3 (SD n/s) Gender = 26% m	CVA, OA, CVD, heart failure, TIIDM, pulmonary disease, dementia, other	Canada Residential care	Power or manual wheelchair, with two participants who received new seating components only	Seating and mobility clinic	Activity/participation: • FIM–transfer and locomotion Study-specific tool: • therapist and patient goals, onsite evaluation of fit, function, and effectiveness	• The therapist goals for 50% of participants were achieved. • The most frequently unmet goal was independent propulsion. • Eighty-six per cent of the 14 participants who completed the questionnaire reported overall satisfaction with their wheelchairs. • There were 93 instances of inadequate wheelchairs or components.

Study	Study design & follow-up time	Participants	Diagnosis	Region & Living arrangement	Mobility device	Service delivery	Outcome measures	Results/conclusions
Ganesh (2007)	Cohort study 7–21 days and 1 month post wheelchair provision	N=99 Age (y) = 65.68±12.9 Gender = 100% m	Heart / lung disease, stroke, PD, falls, fracture, joint fusion/replacement, arthritis, osteoporosis, amputation, diabetes, pressure ulcer, eye disease, cancer, emotional problems	US Community dwelling	Manual wheelchair	All wheelchairs prescribed by licenced PTs or OTs, or PT or OT assistants	Study-specific tool: • wheelchair transfers and propulsion and bathroom mobility method • wheelchair-related and environmental characteristics	• Despite provision of the wheelchair by trained professionals and the availability of a diverse range of wheelchairs, users commonly reported difficulty using the wheelchair.

Study	Study design & follow-up time	Participants	Diagnosis	Region & Living arrangement	Mobility device	Service delivery	Outcome measures	Results/conclusions
Garber (2002)	Cross-sectional 27 months (range 1–119) post provision of wheelchair	N=49 Age (y) = 64.71±9.25 Gender = 92% m	CVA	US Not reported	Not reported	Wheelchair prescribed during inpatient rehabilitation	Activity/participation: • FIM • CHART Impairments/health Conditions: • MMSE • Geriatric Depression Scale (Short Form) Health status: • Health Status Questionnaire Life events: • Major Life Events Scale Study-specific tool: • use and satisfaction	• One-third of the participants had stopped using their wheelchairs and only used them for an average of 13 weeks. • The participants who retained use of the wheelchair were satisfied with the performance. • Continued use of the wheelchair was associated with impaired mobility, physical dysfunction and physical dependence. • Socialisation and occupations were compromised following CVA.
Hoenig (2002) Hoenig (2003)	Cohort study 7–21 days post provision of wheelchair	N=153 Age (y) = 64.8±13 Gender = 92% m	Weakness, neurological acute orthopaedic	US Community dwelling	Manual or power wheelchair	Wheelchairs prescribed by clinicians	Study-specific tool: • wheelchair use in different life spaces, wheelchair and environmental characteristics	• Personal and environmental factors influenced wheelchair use. • Mobility limitations and environmental barriers were associated with restricted participation in diverse activities outside the home. • Wheelchair users appear to use their wheelchairs selectively, depending on their physical needs and the constraints of their environment.

Study	Study design & follow-up time	Participants	Diagnosis	Region & Living arrangement	Mobility device	Service delivery	Outcome measures	Results/conclusions
Hoenig (2005)	Quasi-experimental by day of the week 2 weeks, 3 and 6 months post provision of wheelchair	N=84 Age (y) = 65±13.7 Gender = 94% m	Weakness, poor balance/dizziness, fear of falling, pain, shortness of breath, other	US Community dwelling	Manual wheelchair	Physicians or mid-level practitioners ordered all wheelchairs or staff PTs or OTs recommended them Usual care group received standard care, intervention group received assessment from clinician with wheelchair-prescription training	Study-specific tool: • shoulder pain, wheelchair confidence, comfort and use and home modifications	• The intervention group had significantly greater wheelchair use than usual care at 2 weeks, and at 3 and 6 months. • Wheelchair use declined monotonically over time for the entire study sample. • There were no significant differences between the two groups in shoulder pain, wheelchair comfort or confidence or home modifications.
Kettle (1992)	Cross-sectional (quasi-random sample) Not reported	N=3082 Age (y) = 60-90 (70.9%); 40-60 (15%); up to age 14 (4%) Gender = 33% m	Arthritic conditions, stroke, other neurological conditions, amputations, cardiovascular conditions, respiratory conditions, ageing (including immobility)	UK Not reported	Manual or power wheelchair	Wheelchair service provided by the Disablement Services Authority; no further details reported	Study-specific tool: • wheelchair, use, satisfaction. • qualitative analysis: comfort, suitability, environmental issues, instructions on use	• Most users expressed satisfaction with their wheelchair. • The assessment did not consider the social and physical environment in which the wheelchair was to be used. • A significant minority of people lacked adequate information about their wheelchair and instructions on how to use it.

Study	Study design & follow-up time	Participants	Diagnosis	Region & Living arrangement	Mobility device	Service delivery	Outcome measures	Results/conclusions
Kittel (2002)	Qualitative Not reported	N=3 Age (y) = 32 (SD n/s) Gender = 33% m	SCI	Australia Not reported	Manual wheelchair	Wheelchairs prescribed during inpatient rehabilitation	• Semi-structured interview—factors influencing participants' decision to abandon their first manual wheelchair	• The combination of lack of experience in wheelchair use and selection, the functional limitations encountered with the design of the wheelchair and the manner and timing of the prescription process led to user dissatisfaction and ultimately abandonment of the wheelchair.
Lee (2015)	Cohort study 1 year (at least) post provision of wheelchair	N=70 Age (y) = 44.6±13.2 Gender = 61% m	CP, stroke, TBI, SCI	Korea Community dwelling	Power wheelchair	Prescribed EPIOC at Konkuk University Chungju Hospital	Activity/participation: • MBI • FIM post Study-specific tool: • socioeconomic status, current wheelchair use, social participation, psychiatric influences, difficulties and barriers, self-reported independence	• There was no difference in MBI scores pre and post testing, except in the category of wheelchair ambulation, which showed significant difference. • The FIM scores were significantly higher than the MBI scores. • Participants reported positive responses for questions related to frequency of social participation, helpfulness of EPIOC on confidence, influence on patients' emotions and self-reported degrees of independence.

Study	Study design & follow-up time	Participants	Diagnosis	Region & Living arrangement	Mobility device	Service delivery	Outcome measures	Results/conclusions
Löfqvist (2012)	Cohort study Pre-provision of wheelchair/ scooter 4 months and 1 year post provision of wheelchair/ scooter	N=34 Age (y) = 69±13.3 Gender = 68% m	Not reported	Sweden Community dwelling	Power wheelchair or power scooter	Not reported	Activity/participation: • NOMO 1.0	• The device increases independence in mobility outdoors, and indoors in locations other than the home. • Mobility while shopping, going for a walk, visiting friends, or the pharmacy was significantly easier after 4 months of power wheelchair use. • Eighty per cent of participants had their expectations of the power wheelchair or scooter fulfilled and judged the device much better or better than expected.
May (2010)	Mixed methods Pre-provision of wheelchair 4 and 12 weeks post provision of wheelchair	N=12 Age (y) = 56.75±19.75 Gender = 68% m	Most had neurological impairments	UK Community dwelling or residential care	Power wheelchair	National Health Service mobility centre Assessments incorporated visual, perceptual, environmental, and postural components	Activity/participation: • COPM Study-specific tool: • perceived quality of life—semi-structured interview (six participants)	• There was a statistically significant improvement in perceived occupational performance and quality of life.

Study	Study design & follow-up time	Participants	Diagnosis	Region & Living arrangement	Mobility device	Service delivery	Outcome measures	Results/conclusions
Pettersson (2006); Pettersson (2007)	Cohort study Pre-provision of wheelchair 4 (range 3–5) months post provision of wheelchair	N=32 Age (y) = 67 (SD n/s) Gender = 69% m	Stroke	Sweden Community dwelling	Power wheelchair or power scooter	Not reported	Quality of life: • PIADS • EQ-5D Activity/participation: • IPPA • WHODAS II Study-specific tool: • importance and satisfaction • checklist of significant life events	• Quality of life was positively influenced by an outdoor power wheelchair with regard to competence, independence, capability, quality of life, wellbeing, happiness, self-esteem and usual activities. • The participants who used their wheelchair more in summer and gave their wheelchair the most valuable score on the test indicated a significantly greater positive effect of the wheelchair than did the other participants. • The use of an outdoor power wheelchair had a positive effect on activity and participation.
Rousseau-Harrison (2009)	Cohort study Pre-provision 3–7 months post provision of wheelchair	N=42 Age (y) = 64.2±18.5 Gender = 38% m	Neurological, cartilage, bone or muscle, multi-factor condition	Canada Community dwelling or residential care	Manual or power wheelchair	Prescribed by the Mobility and Postural Assistive Devices Program; no further details reported	Activity/participation • RNLI	• Social participation improved significantly following wheelchair acquisition; however, confounding variables may have contributed to this improvement.

Study	Study design & follow-up time	Participants	Diagnosis	Region & Living arrangement	Mobility device	Service delivery	Outcome measures	Results/conclusions
Rousseau-Harrison (2012)	Qualitative 315 (SD 59) days post provision of wheelchair	N=10 Age (y) = 64.3±16.3 Gender = 40% m	80% of participants had a degenerative disease	Canada Community dwelling or residential care	Manual or power wheelchair	Prescribed by the Mobility and Postural Assistive Devices Program; no further details reported	• Semi-structured interviews—perceived effects on users' daily activities and social roles	• Changes in daily activities were generally considered by participants to be positive. • The participant expectations that were not met principally related to outdoor mobility. • The participants had not anticipated the effects post prescription of the wheelchair on social roles and emotional changes.
Samuelsson (2001)	Cohort study Pre-provision of wheelchair 6.5 (SD 3.3) months post provision of wheelchair	N=38 Age (y) = 43 (SD n/s) Gender = Not reported	SCI, MS, stroke, CP, spina bifida and mental disability	Sweden Not reported	Manual or power wheelchair and/or seating system	Most patients were admitted to the wheelchair clinic from the Centre of Neurology at the University Hospital in Linköping, Sweden	Impairments/health conditions: • Rhombo Medical Sensor Mat System • examination of pressure injury Study-specific tool: • wheelchair functionality, pain, wheelchair seating	• The study identified two main problem areas: seating discomfort and back pain. • Back pain was significantly reduced at follow-up. • Every problem defined by the participant was positively affected by the intervention as reported by the participants at follow-up.

Study	Study design & follow-up time	Participants	Diagnosis	Region & Living arrangement	Mobility device	Service delivery	Outcome measures	Results/conclusions
Samuelsson (2014)	Cohort study Pre-provision of wheelchair/ scooter 4 months post provision of wheelchair/ scooter	N=24 Age (y) = 67 (SD n/s) Gender = 38% m	Not reported	Sweden Community dwelling	Power wheelchair or power scooter	Prescribed by OT's and PT's	Health Quality of Life: • EQ-5D VAS Study-specific tool: • occupational performance, social participation, need for assistance, prescription process, cost benefit	• Power wheelchairs improved the users' daily lives, their ability to engage in mobility-related actives and their social participation. • For a majority of users, independence, feelings of safety and self-esteem increased, although overall health and life satisfaction were not significantly affected. • All users thought the therapist considered their needs. • Seventy-three per cent of users were satisfied with their device at follow-up.
Shore (2012)	Cohort study Pre-provision of wheelchair 12 months post provision of wheelchair	N=519 Age (y) = 54 (SD n/s) Gender = 57% m	Stoke, CP, hydrocephalus, spina bifida, MD, club foot, cancer, SCI, polio, PD, trauma/fracture, amputee, arthritis	Vietnam, Chile, India Community dwelling	Manual wheelchair	Donated wheelchair from Free Wheelchair Mission; no further details reported	Study-specific tool: • QoL, medical care, employment • change in health, function and integration into society, personal illness, hospitalisation, emotional health, pressure injuries and pain • lifestyle using ICF framework; time and distance travelled from home; wheelchair maintenance	• Receipt of a simple, depot-style wheelchair significantly improved quality of life, reported health and function of the participants following 12 months of use.

Study	Study design & follow-up time	Participants	Diagnosis	Region & Living arrangement	Mobility device	Service delivery	Outcome measures	Results/conclusions
Shore (2008)	Cross-sectional 79.9 (SD 8.0) months post provision of wheelchair	N=188 Age (y) = 50±25 Gender = 56.4% m	Amputee, accident, stoke, congenital disability, SCI, arthritis, other orthopaedic/ neurologic/general conditions	India and Peru Community dwelling	Manual wheelchair	Free Wheelchair Mission, wheelchair distributed by local workers	Study-specific tool: • wheelchair use (number of hours per day) • change in function (activities and participation using ICF framework) • wheelchair maintenance and repair • health and quality of life of users	• There was a significant improvement in mobility, self-care, domestic life, interpersonal interaction and relationships and community, social and civic life of users. • The repair statistics in this context were found to be similar to those in the US despite the more difficult economic conditions in the research countries. • There was a decrease in the number of pressure injuries with use of the wheelchair. • The effect on health and quality of life was generally viewed as positive by the users. • The intervention was cost-effective.
Sund (2013)	Cohort study Pre-provision of scooter 72.1 (SD 49.4) days post provision of scooter	N=134 Age (y) = 73.8±13.3 Gender = 52% m	OA, asthma, chronic bronchitis, MS, angina, stroke, polio, hypertension	Denmark and Norway Community dwelling	Power scooter	Local therapist providing assessment and prescription for scooters	Satisfaction: • SATS Study-specific tool: • service delivery process	• The service delivery process does not affect the outcomes in user satisfaction with the service. • The structure of assistive technology services affects the service delivery process.

Study	Study design & follow-up time	Participants	Diagnosis	Region & Living arrangement	Mobility device	Service delivery	Outcome measures	Results/conclusions
Suzuki (2000)	Cross-sectional Not reported	N=26 Age (y) = not reported Gender = not reported	Not reported	Hawaii Not reported	Not reported	Formal seating clinic—1–2 hour assessment by physical therapist	Study-specific tool: • satisfaction with service delivery	• Clients were very satisfied with the clinic's atmosphere, their therapist, and the programme's ability to identify individual goals and needs, and to justify insurance coverage for needed equipment. • The clients wanted more information about vendor and cost options, and better timed follow-up sessions with the therapist once equipment arrived.
Taylor (2015)	Cohort study 1 year post injury	N=1376 Age (y) = not reported Gender = not reported	Not reported	US Not reported	Manual or power wheelchair	Not reported	Study-specific tool: • type and quantity of wheelchair-skills training, methods used to determine wheelchair prescription, patient satisfaction with and continued utilisation of the wheelchair one year post injury	• Most patients participated in wheelchair-skills training, which varied in type and frequency. • It was found that assessment/prescription and fitting were more frequently performed than mat evaluations. • Most patients continued to use their wheelchair and were satisfied with its fit and function one year after their injury.

Study	Study design & follow-up time	Participants	Diagnosis	Region & Living arrangement	Mobility device	Service delivery	Outcome measures	Results/conclusions
Trefler (2004)	Cohort study with semi-crossover design Pre-provision of wheelchair and post provision at 3 and 6 months	N=34; Age (y) = 82.4±9.8 Gender = 19% m	Fear of falling, frailty, arthritis, paralysis	US Residential care	Manual wheelchair	Not reported; however, all wheelchair systems and evaluations were provided free of charge	Satisfaction: • QUEST 2.0 Study-specific tool: • wheelchair skills: forward propulsion in straight lines and ninety degree turns Health status • RAND SF-36 Activity/participation: • forward and lateral reach	• People residing in extended care facilities benefitted from receiving individually prescribed wheelchair systems. • The individually prescribed wheelchair systems were found to enhance elderly people's independent mobility, functional reach, feeling of wellbeing and satisfaction with their assistive technology.
Ward (2010)	Cross-sectional 28.79 months post provision of wheelchair	N=45 Age (y) = 57.9 (SD n/s) Gender = 60% m	ALS/MND	US Not reported	Power wheelchair	Multidisciplinary clinic	Study-specific tool: • patterns of selection, satisfaction and frequency of use, technical and psychometric influences, other aspects of decision making	• Test-driving more than one chair was very valuable 100% of the time. • More important features include; comfort, turning radius, ease of use, electronic, effective inside/outside performance. Less important features include; colour, style, size and speed. • Power features are used frequently. • Almost all evaluations were completed by an experienced clinician.

Study	Study design & follow-up time	Participants	Diagnosis	Region & Living arrangement	Mobility device	Service delivery	Outcome measures	Results/conclusions
Warner (2010)	Cross-sectional 21 days (within) post provision of wheelchair	N=123 Age (y) = 64.8±13 Gender = 92% m	Arthritis, OA, heart disease, eye disease, PD, respiratory condition, dementia, fracture, stroke, diabetes, cancer, depression, joint fusion, amputation	US Community dwelling	Manual or power wheelchair	Not reported	Study-specific tool: • Activity (hours per week), health status using two additive scales and modified version of CHART	• The strongest extrinsic factors correlated with engagement in leisure-time physical occupations were unpaid personal assistance in younger adults, and living alone for older adults.
White (1998)	Mixed methods Not reported	N=130 service users and 125 wheelchair therapists Age (y) = not reported Gender = not reported	Not reported	UK Not reported	Manual or power wheelchair	National Health Service wheelchair clinic	Study-specific tool: • Multiple choice postal questionnaire (staff and wheelchair users) Semi-structured interview: • wheelchair use, assessment modes and venues, delivery and repair aspects of the wheelchair, training needs, role of carers Case study: • seating clinic observations	• The following factors contribute to effective wheelchair provision: referral procedures; assessment and prescription; range of equipment; training; communication; resource management.

Study	Study design & follow-up time	Participants	Diagnosis	Region & Living arrangement	Mobility device	Service delivery	Outcome measures	Results/conclusions
Wressle (2004)	Cross-sectional 14–26 months post prescription of wheelchair	N=209 Age (y) = 67.5 (SD n/s) Gender = 35% m	Not reported	Sweden Not reported	Manual or power wheelchair (+ 260 walkers)	Not reported	Satisfaction: • QUEST 2.0 Study-specific tool: • wheelchair usage, users' opinions on device's influence on daily living and prescription of the mobility device	• Most devices were used daily and user satisfaction was high. • User satisfaction with service delivery scored lower than satisfaction with the device. • Prescription of a wheelchair had a positive effect on users' ability to be active, transport themselves, feel secure, and participate in social activities.

n/s = not stated; WhOM = Wheelchair Outcome Measure; MS = multiple sclerosis; PD = Parkinson's disease; SCI = spinal-cord injury; TBI = traumatic brain injury; CVA = cerebral vascular accident; CP = cerebral palsy; OT = occupational therapist; PT = physiotherapist; QUEST 2.0 = Quebec User Evaluation of Satisfaction with Assistive Technology 2.0; MFRT = Modified Functional Reach Test; FIM = Functional Independence Measure; MD = muscular dystrophy; PIADS = Psychosocial Impact of Assistive Technology Scale; OPHI = Occupational Performance History Interview; WHO QOL–BREF HK = abbreviated Hong Kong version of the World Health Organization Quality of Life Questionnaire; ICF = International Classification of Functioning, Disability and Health; C-QUEST = Chinese version of Quebec User Evaluation of Satisfaction with Assistive Technology; MND = motor neurone disease; FEW = Functioning Everyday with a Wheelchair; CVD = cerebrovascular disease; RA = rheumatoid arthritis; EQ-5D = EuroQol 5D; D-QUEST = Dutch version of Quebec User Evaluation of Satisfaction with Assistive Technology; PASIPD = Physical Activity Scale for Individuals with Physical Disabilities; UAL = Utrecht Activity List; SIP68 = Sickness Impact Profile 68; SIPSOC = mobility range and social behaviour subscales of the SIP68; EPIOC = electric-powered indoor/outdoor chair; TIIDM = type 2 diabetes mellitus; MMSE = Mini Mental Status Examination; MBI = Modified Barthel Index; NOMO 1.0 = Nordic Mobility-related Participation Outcome Evaluation of Assistive Device Interventions; COPM = Canadian Occupational Performance Measure; IPPA = Individually Prioritised Problems Assessment; WHODAS II = World Health Organization Disability Assessment Schedule II; RNLI = Reintegration into Normal Living Index; EQ-5D VAS = EuroQoL 5D Visual Analogue Scale; OA = osteoarthritis; SATS = Satisfaction with Assistive Technology Services; RAND SF-36 = RAND Short Form-36; ALS = amyotrophic lateral sclerosis; CHART = Craig Handicap Assessment and Reporting Technique

Quality

This review incorporated studies of varying study designs, including an experimental (N=1); observational (N=30); mixed-methods (N=2); and qualitative studies (N=6). Tables 4, 5, and 6 present the results of the critical appraisal of all included studies. There was only one quasi-experimental trial identified (Hoenig et al., 2005), and this was considered low quality. The body of qualitative research was also very small. Few qualitative studies reported on the role of the researcher in the research process (2/6) and two studies provided no or minimal detail on the method of analysis.

Table 4: PEDro Scores of Included Studies

Study	1	2	3	4	5	6	7	8	9	10	Total (0 to 10)
Hoenig (2005)	Y	N	N	Y	N	N	N	N	N	Y	2

Y = Yes; N = No
1 = Random allocation; 2 = Concealed allocation; 3 = Groups similar at baseline; 4 = Participant blinding; 5 = Therapist blinding; 6 = Assessor blinding; 7 = < 15% dropouts; 8 = Intention-to-treat analysis; 9 = Between-group difference reported; 10 = Point estimate and variability reported.

Table 5: Quality Appraisal of Included Studies (Newcastle–Ottawa Quality Assessment Scale)

Study	Selection					Outcome		
	1	2	3	4	5	6	7	8
Armstrong (2007)	N	NA	N	NA	NA	N	Y	Y
Auger (2010)	Y	Y	Y	N	N	Y	Y	Y
Barlow (2009)	Y	Y	N	NA	Y	N	N	Y
Bolin (2000)	N	NA	N	NA	NA	N	Y	Y
Buning (2001)	Y	NA	Y	NA	NA	N	Y	Y
Chan (2007)	Y	NA	Y	NA	NA	N	Y	Y
Cullen (2008)	Y	NA	Y	NA	NA	N	N	Y
Davies (2003)	Y	NA	N	NA	NA	N	Y	Y
de Groot (2011)	Y	NA	Y	NA	NA	N	Y	Y
Frank (2000)	Y	NA	Y	NA	NA	N	Y	Y
Fuchs (2003)	Y	NA	N	NA	NA	N	Y	Y
Ganesh (2007)	N	NA	Y	NA	NA	N	N	Y
Garber (2002)	Y	NA	Y	NA	NA	N	Y	Y
Hoenig (2002) Hoenig (2003)	N	NA	Y	NA	NA	N	N	Y
Kettle (1992)	Y	NA	N	NA	NA	N	Y	N
Lee (2015)	Y	NA	Y	NA	NA	N	Y	Y
Löfqvist (2012)	Y	NA	Y	NA	NA	N	Y	Y
May (2010)	Y	NA	Y	NA	NA	N	Y	N

Study	Selection					Outcome		
	1	2	3	4	5	6	7	8
Pettersson (2007) Pettersson (2006)	Y	NA	Y	NA	NA	N	Y	Y
Rousseau-Harrison (2009)	Y	NA	Y	NA	NA	N	N	Y
Samuelsson (2001)	Y	NA	Y	NA	NA	N	Y	Y
Samuelsson (2014)	Y	NA	N	NA	NA	N	Y	Y
Shore (2012)	N	NA	N	NA	NA	N	Y	Y
Shore (2008)	N	NA	Y	NA	NA	N	Y	Y
Sund (2013)	Y	NA	Y	NA	NA	N	Y	Y
Suzuki (2000)	Y	NA	Y	NA	NA	N	Y	N
Taylor (2015)	Y	NA	Y	NA	NA	N	Y	N
Trefler (2004)	N	Y	N	NA	N	N	Y	Y
Ward (2010)	N	NA	N	NA	NA	N	Y	Y
Warner (2010)	Y	NA	Y	NA	NA	N	N	Y
White (1998)	Y	NA	N	NA	NA	N	N	Y
Wressle (2004)	Y	NA	N	NA	NA	N	Y	N

Y = Yes; N = No; NA = Not applicable.
1 = Representativeness of exposed cohort; 2 = Selection of non-exposed cohort; 3 = Ascertainment of exposure; 4 = Outcome not present at baseline; 5 = Comparability of cohorts; 6 = Assessment of outcome; 7 = Sufficient follow-up duration; 8 = Adequacy of follow-up

Table 6: Qualitative Study Appraisal Outcomes (CASP)

Study	1	2	3	4	5	6	7	8	9	10
Bates (1993)	Y	Y	Y	Y	Y	NC	NC	NC	Y	Medium
R. Evans (2000)	Y	Y	Y	Y	Y	NC	Y	Y	Y	High
S. Evans (2007)	Y	Y	N	Y	Y	Y	N	N	Y	High
Frank (2010) Frank (2012)	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
Kittel (2002)	Y	Y	Y	Y	Y	N	N	Y	Y	High
Rousseau-Harrison (2012)	Y	Y	Y	Y	Y	N	N	Y	N	Medium

Y = Yes, N = No, NC = Not clear
1 = Was there a clear statement of the aims of the research? 2= Is a qualitative methodology appropriate? 3 = Was the research design appropriate to address the aims of the research? 4 = Was the recruitment strategy appropriate to the aims of the research? 5 = Was the data collected in a way that addressed the research issue? 6 = Has the relationship between researcher and participants been adequately considered? 7 = Have ethical issues been taken into consideration? 8 = Was the data analysis sufficiently rigorous? 9 = Is there a clear statement of findings? 10 = How valuable is the research?

Participants

The age of the participants varied across the studies, with some including children in the sample, and others focusing on the elderly (maximum age=102 years). Diagnostic categories also varied: while more than half of the studies (64%, 25/39), included people with a range of diagnoses, only 21% (8/39) included people with a single primary diagnosis such as spinal cord injury, stroke, or amyotrophic lateral sclerosis/motor neurone disease. The remaining six studies (15%) did not report on the diagnoses of participants, making

comparison between studies difficult. Mean follow-up time from wheelchair prescription to outcome assessment ranged from seven days to 3.8 years. More than half of the studies (51%) reported that participants lived in their own home, 13% resided in either residential care, or their own home, 5% in residential care and 2% resided in hospital. The remaining 29% of studies did not report living arrangements.

Intervention

Approximately one-third (31%; 12/39) of studies included prescription of both power and manual wheelchairs, 26% (10/39) included prescription of only manual wheelchairs, 38% (15/39) included prescription of power wheelchairs or scooters, one study included only seating systems, and one study did not report on the type of wheelchair used. Most studies (38/39) were based in a community or outpatient setting, and one was conducted in an inpatient setting.

Outcome Measures

Many different outcome measures were used in the studies, incorporating both study-specific (i.e. non-standardised) and standardised outcome measures to capture the data (Table 7). Twenty-five standardised outcome measures were identified and five studies reported on the psychometric properties (e.g., validity, reliability and responsiveness) of the tools used.

3.4 Research Question

Following new wheelchair prescriptions, what outcomes are being measured and what are the measurement tools used?

A total of 29 standardised outcome measures were used across 19 studies. Study-specific outcome measures (i.e. non-standardised) were used in 26 studies. Twelve studies used both standardised and study-specific outcome measures, and seven studies used standardised outcome measures only. To make sense of the large number of outcomes,

we categorised the outcomes into 12 different domains. These domains were caregiver assistance required, wheelchair use, cost, wheelchair skills, environmental factors, satisfaction (e.g., with the wheelchair and/or service delivery), process outcomes related to service provision, impairments/health conditions, activity and activity limitations/participation and participation restrictions, goal attainment, quality of life, and major life events. The outcome measures used according to outcome domains are summarised in Table 7.

Table 7: Summary of Outcome Measures

Outcome domains	Tools
Caregiver assistance required	• Study-specific tools
Wheelchair use	• Study-specific tools
Cost	• Study-specific tools
Wheelchair skills	• Study-specific tools
Environment factors	• Study-specific tools
Satisfaction with the wheelchair and/or service delivery	• QUEST (English, Dutch and Chinese version) • SATS instrument • Study-specific tools
Process outcomes related to service provision	• Study-specific tools
Impairments/health conditions	• Rhombo Medical Sensor Mat System • Ashworth Scale • Spirometer test • Geriatric Depression Scale Short Form • MMSE • Health Outcomes Institute Stroke Form–Later Outcomes • Study-specific tools
Activity and activity limitations/participation and participation restrictions	• FIM • PASIPD • NOMO 1.0 • UAL • WHODAS II • Life-Space Assessment • FEW • MBI

Outcome domains	Tools
	• IPPA • RNLI • Mobility range and social behaviour subscales of the SIP68 (SIPSOC) • CHART • MFRT • OPHI • COPM • Study-specific tool based on activity and participation section of World Health Organization's ICF • Study-specific tools
Goal attainment	• Study-specific tools
Quality of life	• PIADS • EQ-5D • WHO QOL–BREF HK • Health Status Questionnaire • RAND SF-36 • Study-specific tools
Major life events	• Study-specific tools

QUEST 2.0 = Quebec User Evaluation of Satisfaction with Assistive Technology; SATS = Satisfaction with Assistive Technology Services; MMSE = Mini Mental Status Examination; FIM = Functional Independence Measure; PASIPD = Physical Activity Scale for Individuals with Physical Disabilities; NOMO 1.0 = Nordic Mobility-related Participation Outcome Evaluation of Assistive Device Interventions; UAL = Utrecht Activity List; WHODAS II = World Health Organization Disability Assessment Schedule II; FEW = Functioning Everyday with a Wheelchair; MBI = Modified Barthel Index; IPPA = Individually Prioritised Problems Assessment; RNLI = Reintegration into Normal Living Index; Sickness Impact Profile 68; SIPSOC = mobility range and social behaviour subscales of the SIP68; CHART = Craig Handicap Assessment and Reporting Technique; MFRT = Modified Functional Reach Test; OPHI = Occupational Performance History Interview; COPM = Canadian Occupational Performance Measure; ICF = International Classification of Functioning, Disability and Health; PIADS = Psychosocial Impact of Assistive Technology Scale; EQ-5D = EuroQol 5D; WHO QOL–BREF HK = abbreviated Hong Kong version of the World Health Organization Quality of Life Questionnaire; RAND SF-36 = RAND Short Form-36;

Caregiver assistance required

Following the provision of a wheelchair, seven studies (reported in eight papers) reported on levels of dependence using either a qualitative design or outcome measures that were specifically designed for the study (Davies, De Souza & Frank, 2003; Frank et al., 2010; Frank et al., 2000; Hoenig, Pieper, Zolkewitz, Schenkman & Branch, 2002; Pettersson, Ahlstrom & Tornquist, 2007; Pettersson, Tornquist & Ahlstrom, 2006; Samuelsson & Wressle, 2014; Shore & Juillerat, 2012). Two studies (reported in three papers) (Pettersson et al., 2007; Pettersson et al., 2006; Samuelsson & Wressle, 2014) measured the level of assistance required from another person for specific activities such as mobilising outdoors, transferring, personal care, or charging the battery of the power wheelchair or scooter. In addition, self-reported levels of independence were also provided (Shore & Juillerat, 2012). Two studies reported on the perceived benefits of provision of a power wheelchair for carers, family, or friends. One study reported from the users' perspective only (Frank et al., 2000), and the other from the users' and carers' perspectives (Frank et al., 2010). White and Lemmer (1998) also reported users' perspectives and explored the role of carers in the use of a power wheelchair using a semi-structured interview. One study (Hoenig et al., 2002) collected data on the use of paid personal assistance to determine whether there was a relationship between hours of carer availability and the use of a wheelchair in certain life spaces. Results suggested personal factors such as help to propel the wheelchair influenced wheelchair use.

Wheelchair use

The outcomes associated with wheelchair use and wheelchair characteristics were reported in 19 studies, all of which used study-specific outcome measures. Wheelchair use was measured using the following variables: how often the wheelchair was used; number of hours of use per day; distance travelled; frequency of indoor versus outdoor use; and

frequency of use of power features (Armstrong, Reisinger & Smith, 2007; Frank et al., 2000; Garber, Bunzel & Monga, 2002; Kettle, Rowley & Chamberlain,1992; Lee et al., 2015; Pettersson et al., 2007; Pettersson et al., 2006; Samuelsson & Wressle, 2014; Shore, 2008; Ward et al., 2010; Wressle & Samuelsson, 2004) and adaptation to wheelchair use (Bates, Spencer, Young & Rintala, 1993). Data on wheelchair use were also collected to determine if a relationship between rate of use and rates of repairs and returns exists, and to establish predictors or influences of wheelchair use (Cullen, O'Neill & Evans, 2008; White & Lemmer, 1998). Six studies (Armstrong et al., 2007; Fuchs & Gromak, 2003; Ganesh et al., 2007; Hoenig et al., 2005; Kettle et al., 1992; Samuelsson, Larsson, Thyberg & Gerdle, 2001) reported on wheelchair characteristics such as fit, function, comfort, suitability, and wheelchair performance. Further outcomes associated with wheelchair characteristics and use included ease of learning to use the wheelchair, accidents, mishaps, component failures, reliability, breakdowns, repairs and maintenance (Frank et al., 2000; Kettle et al., 1992; Lee et al., 2015; Pettersson et al., 2007; Shore, 2008; Shore & Juillerat, 2012). Wheelchair abandonment was measured in one qualitative (Kittel et al., 2002) and one quantitative study (Garber et al., 2002).

Cost

In a prospective before-and-after study (Samuelsson & Wressle, 2014), the total cost of providing a rental power wheelchair or scooter was compared with the cost of in-home services (including personal assistance). To collate data, the researchers administered a study-specific questionnaire before providing the power wheelchair or scooter and again at 4 months after prescription. Another study (Barlow, Liu & Sekulic, 2009) compared the costs of clinic-based assessment and telerehabilitation assessment.

Wheelchair skills

Wheelchair skills were measured using study-specific outcome measures in four of the included studies. Data were collected on variables such as type and quantity of wheelchair-skills training provided during inpatient rehabilitation (Taylor et al., 2015) and the ability to perform forward and rear propulsion, turning, rear-wheel balancing, and climbing curbs (Armstrong et al., 2007; Bolin, Bodin & Kreuter, 2000; Trefler, Fitzgerald, Hobson, Bursick & Joseph, 2004). In some studies (e.g., Armstrong et al., 2007), the participants received wheelchair-skills training and this was reported; however, in other studies (e.g., Bolin et al., 2000; Trefler et al., 2004), no training was received. The method for measuring wheelchair skills also varied across studies. Methods included timing the participants in propulsion tasks (Bolin et al., 2000; Trefler et al., 2004), recording participants' perceived changes using a five-point scale (Bolin et al., 2000), or assessors ranking participants using a Likert scale from 1 (cannot perform activity) to 5 (mastered activity) based on participants' ability to perform each activity (Armstrong et al., 2007). In addition, Bolin et al. (2000) used the Cooper test (Cooper, 1968), which is a 12-minute run test used to measure aerobic fitness but did not provide details on how this was modified for wheelchair users.

Environmental factors

The environment in which the wheelchair is used can affect the success of wheelchair use. Using study-specific questionnaires, five studies (Chan & Chan, 2007; Hoenig, Landerman, Shipp & George, 2003; Hoenig et al., 2005; Hoenig et al., 2002; Lee et al., 2015) collected data on home adaptations and the difficulties, barriers, or facilitators encountered with the physical environment (e.g., uneven terrain, tight space, street crossing, steps in/out of house) following the prescription of a wheelchair. In many studies,

environmental factors were measured alongside wheelchair use or participation, suggesting that the two concepts are aligned.

Satisfaction with the wheelchair and/or service delivery

Measures of satisfaction were found in 14 included studies. All measured satisfaction with the wheelchair and/or the service delivery process, and in addition, one study (Samuelsson & Wressle, 2014) measured overall life satisfaction using a study-specific outcome meausre. Five studies (Barlow et al., 2009; Chan & Chan, 2007; de Groot, Post, Bongers-Janssen, Bloemen-Vrencken & van der Woude, 2011; Trefler et al., 2004; Wressle & Samuelsson, 2004) used a version of the Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST), which assesses the satisfaction of individuals who use assistive technology by allowing them to rate their device (wheelchair) and the service delivery of the device (wheelchair). Measuring a similar outcome, the Satisfaction with Assistive Technology Services (SATS) instrument was used in one study (Sund, Iwarsson, Andersen & Brandt, 2013). Using study-specific outcome measures, studies reported outcomes such as satisfaction with the service delivery process (Samuelsson & Wressle, 2014; White & Lemmer, 1998); satisfaction with the device and whether it met expectations (Ward et al., 2010); satisfaction with the service and the device (Suzuki & Lockette, 2000); and overall satisfaction with the device only (Fuchs & Gromak, 2003; Pettersson et al., 2007; Pettersson et al., 2006; Shore & Juillerat, 2012). One qualitative study investigated satisfaction with a power wheelchair and service providers (S. Evans, Frank, Neophytou & de Souza, 2007).

Process outcomes related to service provision

Several studies used study-specific outcome measures to collect data on the service delivery process or the methods used in prescribing a wheelchair. The following data were collected: steps taken in the service delivery process and how much time was spent on the

different steps (Sund et al., 2013); percentage of participants that received wheelchair-skills training sessions, evaluations with a physiotherapist and/or an occupational therapist, fitting sessions, and mat evaluations (Taylor et al., 2015); percentage of participants that received their evaluation from an experienced therapist, as well as information on the evaluation process, number of wheelchairs trialled, timeframe from assessment to delivery, and the delivery process (Ward et al., 2010); user's opinion on the prescription process and opportunity to participate in and influence the process, opportunity to receive and gather information and training, as well as the user's opinion on the fulfilment of their expectations, provision of follow-up and satisfaction with follow-up (Wressle & Samuelsson, 2004); staff and consumer perspectives on referral, assessment, supply and follow-up procedures, assessment modes and venues, range of wheelchairs available, staff training, user knowledge of the wheelchair and repair services (White & Lemmer, 1998), information provided in relation to the wheelchair and demonstration of its use, and the condition of the wheelchair on delivery (Kettle et al., 1992).

Impairments/health conditions

A change in health condition following the prescription of a wheelchair was measured in nine studies. Measuring the presence and/or number of pressure injuries, examination of pressure injuries and skin breakdown occurred in four studies that used study-specific outcome measures (Garber et al., 2002; Samuelsson et al., 2001; Shore, 2008; Shore & Juillerat, 2012). The Rhombo Medical Sensor Mat System was also used to measure changes in pressure distribution following intervention (Samuelsson et al., 2001). Other study-specific outcome measures were used to measure pain and discomfort or explore the experience of pain (Davies et al., 2003; Frank, de Souza, Frank & Neophytou, 2012; Garber et al., 2002; Hoenig et al., 2005; Löfqvist, Pettersson, Iwarsson & Brandt, 2012; Samuelsson et al., 2001; Shore, 2008; Shore & Juillerat, 2012), health status or medical

changes (Davies et al., 2003; Garber et al., 2002; Löfqvist et al., 2012; Shore & Juillerat, 2012), and falls and contractures (Garber et al., 2002). Depression, cognition, and occurrence of health issues (e.g. a new stroke or pressure injury) were measured using the Geriatric Depression Scale Short Form, Mini Mental Status Examination (MMSE), and The Health Outcomes Institute Stroke Form–Later Outcomes, respectively (Garber et al., 2002). Spasticity was measured using the Ashworth Scale and respiration was measured using a spirometer test (Bolin et al., 2000). In addition to the standardised outcome measure, a study-specific outcome measure was used to measure perceived change in spasticity and respiration from the users' perspective (Bolin et al., 2000). In contrast to determining the effect a wheelchair has on health conditions, one study (Hoenig et al., 2003) collected data on medical visits to establish which factor or factors predicted the number of medical visits.

Activity and activity limitations—participation and participation restrictions

The International Classification of Functioning, Disability and Health (ICF) defines activity as the execution of a task or action by an individual, and activity limitation as the difficulty an individual may have in executing activities. Participation is defined as involvement in a life situation, and participation restriction is defined as the problems an individual may experience in having involvement in life situations (World Health Organization, 2001). Many studies and outcome measures, measured activity and participation, thus these outcomes have been described together in this review.

Twelve studies were identified as having measured activity or participation following the prescription of a wheelchair and/or seating system using a standardised outcome measure (e.g., Auger et al., 2010; Bolin et al., 2000; Buning, Angelo & Schmeler, 2001; Cullen et al., 2008; de Groot et al., 2011; Fuchs & Gromak, 2003; Garber et al., 2002; Lee et al., 2015;

Löfqvist et al., 2012; May & Rugg, 2010; Pettersson et al., 2006; Rousseau-Harrison et al., 2009). The Functional Independence Measure (FIM) was the most commonly used tool (i.e., used in two or more studies). Details of the other tools used are presented in Table 7. In addition, seven studies used a study-specific outcome measure or adapted a pre-existing tool for the study. Tools were developed to measure outcomes such as change in mobility (Davies et al., 2003), forward and lateral reach (Trefler et al., 2004), physical mobility (Löfqvist et al., 2012), effect of power wheelchair on activity (Samuelsson & Wressle, 2014), performance of activities that were not expected at time of prescription (Pettersson et al., 2007; Pettersson et al., 2006), participation in employment, occupation and leisure activities (Warner, Basiletti & Hoenig, 2010), and social participation (Davies et al., 2003; Samuelsson & Wressle, 2014). Three studies (Chan & Chan, 2007; Shore, 2008; Shore & Juillerat, 2012) used the World Health Organization's ICF framework to create an outcome measure that captured data on changes in mobility; self-care; domestic life; interpersonal interactions and relationships; major life areas (e.g., education, leisure and non-remunerative work); and community, social, and civic life.

Users' perceived changes in sitting balance, ability to transfer and wheelchair propulsion were also measured (Bolin et al., 2000). Similarly, a self-estimation scale was used to measure the effect of the intervention on propulsion and transfers (Samuelsson et al., 2001). Two studies reported on user perception, exploring how the device influenced daily living (i.e., being active, socialising, being mobile, participating in leisure activities, feeling a healthy level of self-esteem, feeling safe and secure, and independence) (Samuelsson & Wressle, 2014; Wressle & Samuelsson, 2004). Fulfilment of mobility needs from the perspective of the consumers and carers was also reported by White and Lemmer (1998). However, only one study (Lee et al., 2015) reported on activity limitations and difficulties encountered with the ambulation of a power wheelchair. One qualitative study investigated

users' daily activities and perceptions of the effect of a first wheelchair on social participation (Rousseau-Harrison et al., 2012), and a second qualitative study using semi-structured interviews examined the effect of a power wheelchair on users' occupations (R. Evans, 2000).

Goal attainment

Client or caregiver goals and expectations were used as an outcome measure in four of the included studies. All four studies used study-specific outcome measures to collect the following data: the rate of goal achievement from the perspective of the user and the therapist (Barlow et al., 2009); frequency of the achievement of each identified goal from the perspective of the therapist only (Fuchs & Gromak, 2003); and fulfilment of the users' expectations, from their perspective, following prescription of a power wheelchair or scooter (Löfqvist et al., 2012; Samuelsson & Wressle, 2014).

Quality of life

Five studies measured quality of life following the prescription of a wheelchair. The Psychosocial Impact of Assistive Devices Scale (PIADS), which measures the effect of assistive technology on quality of life (Buning et al., 2001; Pettersson et al., 2007) and two generic quality-of-life outcome measures (Chan & Chan, 2007; Davies et al., 2003; Pettersson et al., 2007) were used in these studies. Details of the tools are presented in Table 7. In addition, one study asked participants to complete a visual analogue scale using the same dimensions as the EuroQol 5D (EQ-5D) (Davies et al., 2003). Another study reported on how the wheelchair had affected users' quality of life using a study-specific outcome measure (Shore, 2008). Self-reported health status or a change in health status was also reported using the Health Status Questionnaire (Garber et al., 2002), the RAND Short Form-36 (RAND SF-36) (Löfqvist et al., 2012; Trefler et al., 2004) and study-specific outcome measure (Shore, 2008; Shore & Juillerat, 2012).

Major life events

Two studies measured ‘major life events’ based on the hypothesis that this information needed to be captured because it can affect the success (or lack of success) of wheelchair use or influence the quality of life experienced by the wheelchair user (Garber et al., 2002; Pettersson et al., 2007; Pettersson et al., 2006).

3.5 Discussion

The aim of this review was to identify which outcomes are measured following the prescription of a new wheelchair and/or seating system. This review demonstrates that a multitude of outcomes are measured following the prescription of a new wheelchair and/or seating system.

This review summarised the outcomes of the 39 included studies into 12 categories, and within these categories, 104 outcome-measurement approaches were used by the 39 studies. Activity and participation was the most commonly studied outcome, followed by wheelchair use and then health condition or health impairment. The categories least reported were major life events, goal attainment, cost, and environmental factors. In a similar review that included only middle-aged and older-aged adults who used a power wheelchair, Auger et al. (2008) reported similar findings with 52 outcome measures used in their included studies. The diversity in the outcomes measured may reflect the complexity of individuals who require a wheelchair, the complexity of the device itself, and the different dependent factors (e.g., participation, mobility, quality of life, or health status) that the provision of a wheelchair and/or seating system can influence. The difficulties in measuring an intervention related to personal needs that are affected by various contextual and environmental factors also presents a unique challenge in this context (Hoenig et al., 2007).

In addition to a large diversity of outcome-measurement categories, there are many outcome measures used in research following the prescription of a new wheelchair and/or seating system. The present review found that study-specific outcome measures (i.e. non-standardised) were the most popular choice of tools with 14 (36%) studies using only study-specific outcome measures and a further 12 (31%) using a combination of study-specific and standardised outcome measures. Study-specific outcome measures enable the researcher to be specific about the outcomes of interest; however, the use of study-specific outcome measures that are not tested for reliability and validity make it difficult to compare the outcomes across different studies or settings. Differing priorities between clinicians and researchers may be one explanation for the popular choice of study-specific outcome measures. However, it has been highlighted there is no single valid and reliable outcome measure available that measures all goals relevant to wheelchair and/or seating prescription (EnableNSW & Lifetime Care & Support Authority, 2011, p. 21). Kenny and Gowran (2014) support this suggestion. They concluded, that in order to evaluate the process of providing a wheelchair and/or seating system more than one outcome measure would be needed to capture all the required information. It is likely that clinicians and researchers will create their own outcome measure to conduct a study if valid and reliable outcome measures appropriate to their aims are not available. The use of outcome measures to inform practice, where the psychometric properties are unknown or not studied, will reduce the rigor and trustworthiness of research and clinical practice.

In addition to concerns relating to the ability of tools to measure outcomes, the methodological quality of research has also been highlighted as problematic. The authors of this review conclude that the quality of the studies investigating the measurement tools

and outcomes for the prescription of wheelchairs and/or seating systems was low. This is not the first systematic review to highlight concerns with published research on wheelchair and/or seating-system prescription and the outcomes measured or methods used. Previous systematic reviews have attempted to use the available research to determine the effect of wheelchair prescription on activity engagement (Fomiatti et al., 2013), the occupational performance of users of wheeled mobility devices and their caregivers (Reid, Laliberte-Rudman & Hebert, 2002), and the efficacy of mobility devices in promoting activity and participation (Salminen et al., 2009). All three reviews stated that drawing conclusions was problematic, due to the poor methodological quality of studies, and the heterogeneous interventions and outcome measures.

This review found a low rate of reporting the psychometric properties of outcome measures, with only five studies providing a comprehensive description of the psychometric properties of the tools they employed in their study. Reid (2002, p. 121) highlighted similar findings, reporting only half of the studies in their critical review used reliable and valid outcome measures. One explanation for the lack of reporting on psychometric properties is the lack of availability of this information. A critical appraisal of outcome measures of wheelchair and/or seating-system provision by Kenny and Gowran (2014, p. 73) supports this conclusion, reporting a lack of availability of reliability and validity information for the outcome measures, both in the context of wheelchair and seating-system provision, and in other population groups or contexts. Similarly Mortenson, Miller and Auger (2008) found psychometric testing of the 11 wheelchair specific outcome measures identified in their study was limited. To increase the comparability of gathered evidence, study-specific outcome measures should be avoided unless validated prior to

use and psychometric properties of outcome measures should be considered and reported in the studies (Salminen et al., 2009, p. 705).

3.6 Strengths and Limitations of Study

This review has strengths and limitations. A strength of this review is the replicable method used, including the quality rating of each contributing paper. Due to timeframes for completion a limitation of this review is that only 20% of title and abstracts were reviewed by a second author and only 10% of the data extraction was checked for accuracy and completeness by a second author. As with any review, the findings are drawn from the existing body of research. The included studies varied in the populations studied, the types of outcomes reported, and importantly, in the quality ratings (for both quantitative and qualitative studies). The level of quality scores may have been influenced by the inclusion of studies from a large timeframe. Including studies from 1990 onwards provided us the opportunity to investigate whether there have been significant changes over time with the outcome measures used, but because the quality of reporting research has improved over the years, it is acknowledged that the earlier studies may have influenced the overall quality score. The exclusion of studies in languages other than English may have prevented review of high-quality studies reporting on alternative outcome measures. Further, grey literature and conference proceedings were excluded, which may have led to overlooking research not yet published. The review included only one experimental trial therefore a meta analysis was not possible.

3.7 Clinical Implications of Study

This review concludes that in research on new wheelchair and/or seating prescription, the outcomes measured are variable, and the use of study-specific outcome measures is high, limiting comparability of outcomes. In future, it is critical that the research community

reaches a consensus on the use of outcome measures to enable cross-study comparisons. Key outcome domains to be reported must be developed and internationally recognised.

3.8 Conclusion

The population requiring wheeled mobility devices is heterogeneous and multiple factors such as the environment, the individual and the task can interact and affect the use of assistive devices and related outcomes. (Hoenig et al., 2007, p. 161). This can create substantial challenges for researchers in this field; however, there is a clear need for researchers to choose consistent outcome measures that are reliable and valid. (Hoenig et al., 2007, p. 162). An international consensus must be developed to enable research to demonstrate the benefits of wheelchair and seating interventions through cross-study comparisons and make findings meaningful to consumers, clinicians and service providers.

Chapter 4: Wheelchair and Seating Prescription: Staff Profile and Perspectives of the Service

4.1 Introduction

Chapter 2 (Literature Review) outlined how wheelchair and seating prescription is a specialist skill amongst allied health professionals and due to its complexity is an intervention that is time intensive. This background literature review also showed that wheelchair and/or seating prescription practices in Australia are performed using a variety of national and international models of care, however, little is known about the effectiveness and efficiency of these different standards of practice. Chapter 3 (Systematic Review, study 1) highlighted that in addition to there being multiple models of care, there is no consistent use of valid and reliable outcome measures. Furthermore, as reported by Kenny & Gowran the area of wheelchair and seating is complex and "no single outcome measure [suitable for evaluating wheelchair and/or seating prescription] captures all necessary information; trade-offs are inevitable" (2014, p. 75). Combined with the difficulties noted within the available evidence is the lack of routine data collection of wheelchair and/or seating prescription practices at Caulfield Hospital, making problem identification and recognising areas for service development difficult. One of the first steps in enhancing best practice in a clinical setting is to understand the gap between best practices and actual practices (Graham et al., 2006). Given the likelihood that wheelchair and/or seating assessment and prescription is highly dependent on the individual clinician and their skills, a service evaluation is needed to better understand these processes prior to making service development recommendations.

Service development commences with identifying the issues and problems. Allied health services commonly use the Knowledge to Action Cycle (Figure 6) (Graham et al., 2006) to guide service development and improvement. Within the Knowledge to Action Cycle, the first phase is to identify the problem. Seeking the perspective of staff involved is essential to the evaluation. This component of the service evaluation of the wheelchair and seating service provided at Caulfield Hospital examines staff experience and aspects related to the service such as strengths, areas for development and guidelines and resources used to guide practice. The inclusion of staff in the evaluation (coupled with clients) is the first step in ensuring Caulfield Hospital has an environment in which staff develop and maintain their skills and integrate these skills with the best available evidence to deliver high quality evidence-based interventions. It is essential to first identify the problem, in order to create an evidence-based service at Caulfield Hospital.

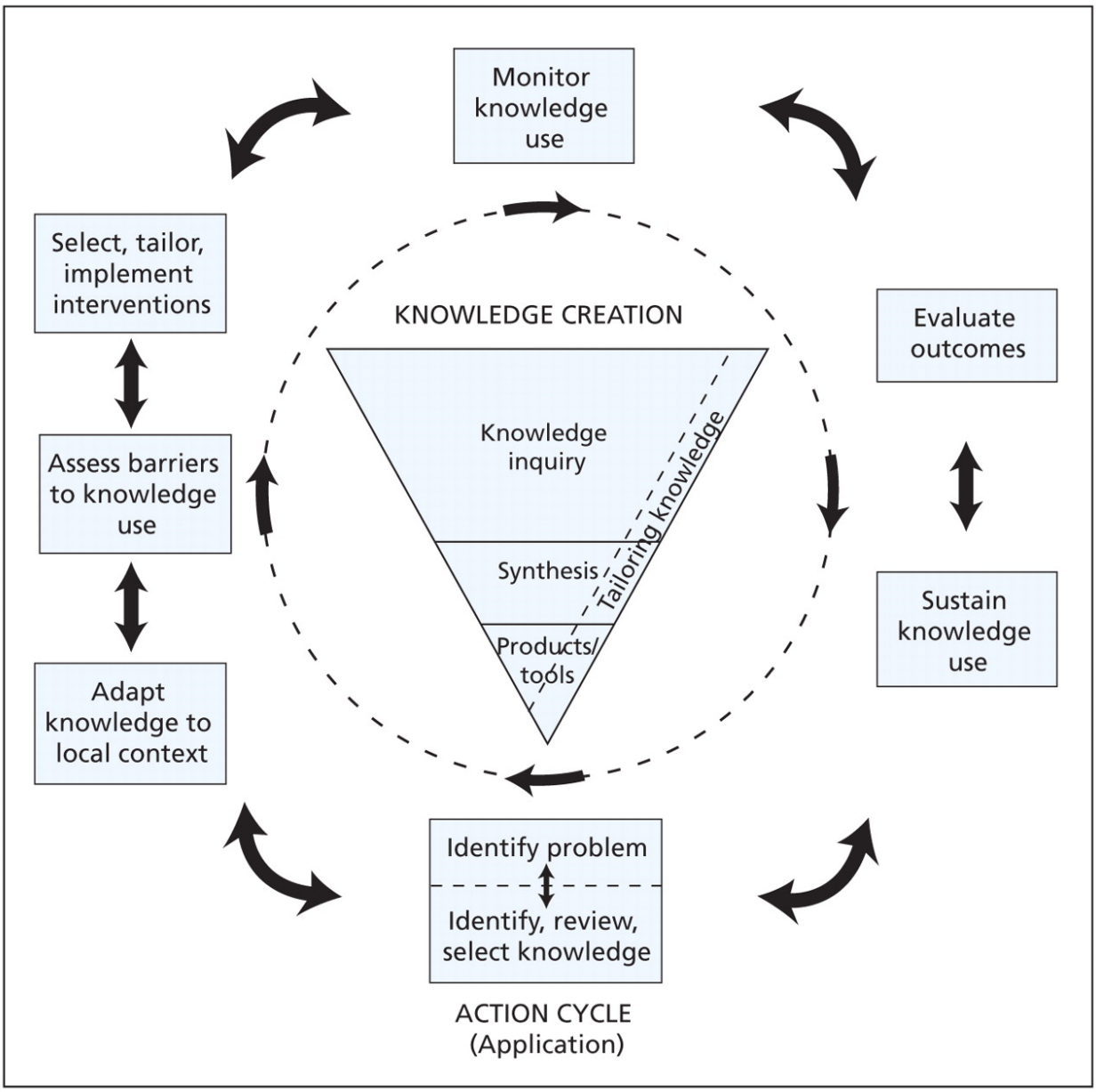


Figure 6: **Knowledge to Action Cycle (Graham et al., 2006)**

4.2 Methods

Aims

The primary aim of this study was to establish a staff profile regarding experience and confidence in wheelchair and seating prescription, and identify resources used to guide clinical practice in relation to the prescription of wheelchairs and/or seating systems.

Secondary aims included:

- To explore staff perceptions of service strengths and areas for service improvement

- To explore the training needs identified by staff

Ethical considerations

Ethics approval to conduct this project was received from The Alfred Health Ethics Committee (127/15) and the Southern Adelaide Clinical Human Research Ethics Committee (SAC HREC) – Clinical Research (278.15 – HREC/15/SAC/235). The approval letters are presented in Appendix C and D.

Development of the survey

In the absence of an appropriate existing outcome measure, that would measure issues specific to the organisation, a survey was designed specifically for this study. The survey included questions regarding profession, experience in wheelchair and seating prescription, service strengths and areas for development, professional development attended, and resources or guidelines used to guide practice. A copy of the survey is presented in Appendix E. The survey was developed by the author (BR) to explore issues specific to the organisation and was refined in conjunction with supervisors KL and NL.

Participants

The survey was sent to all occupational therapists (N=30), physiotherapists (N=42), and allied health assistants (N=10) employed by Alfred Health and working within the sub-acute rehabilitation and aged care units in September 2015. Physiotherapists and occupational therapists were included as they are responsible for either leading (physiotherapists) or being involved in components (occupational therapists) of the wheelchair and seating prescription interventions. Allied health assistants were included as they are involved in the maintenance and set-up of wheelchair and seating systems and the practice of wheelchair skills with clients (under the direction of physiotherapists and occupational therapists). Staff working in Alfred Health's Caulfield Hospital Acquired Brain

Injury Unit or community and ambulatory services were excluded as within these units wheelchair prescription is not led by physiotherapy.

Managers of the occupational therapy and physiotherapy departments were approached by the first author (BR) and assisted in identifying all eligible staff. Identified staff were sent an email by the author with a link to the survey and the Participant Information Form (Appendix F), and were invited to participate. Three reminders were sent to staff over a period of three months. Consent was implied via completion of the survey and all responses were anonymous.

Data collection

Survey responses were collated using SurveyMonkey Inc. and exported to an Excel spreadsheet.

Data Analysis

Descriptive statistics (means, standard deviations, counts, range) were used to report staff characteristics. Within the survey qualitative data regarding professional development attended, service strengths and areas for development and resources or guidelines used to guide practice were categorised in order to make meaning of the information and present themes.

4.3 Results

A total of 82 occupational therapists, physiotherapists, and allied health assistants working in the sub-acute rehabilitation setting were invited to participate; 43 staff (52%) completed the survey. Of the 43 respondents, just under half (N=20) reported they were involved in wheelchair and seating prescription interventions. Staff characteristics are detailed in Table 8.

Table 8: Staff Characteristics

Characteristic	Result
Age, n (%)	
20-30years	21 (49%)
31-40years	12 (28%)
41-50years	7 (16%)
>50years	3 (7%)
Profession, n (%)	
Occupational therapist	20 (46%)
Physiotherapist	19 (44%)
Allied health assistant	4 (9%)
Experience in profession, n(%)	
1 to 3 years	12 (28%)
4 to 8 years	14 (33%)
9 to 12 years	4 (9%)
13 to 16 years	4 (9%)
>16 years or more	9 (21%)
Experience in prescription/seating, n(%)	
Less than 1 year	18 (42%)
2 to 4 years	9 (21%)
5 to 7 years	5 (12%)
>7 years	11 (26%)

Note: Numbers may not add up to 100% due to rounding

Confidence

Respondents were asked to rate their level of confidence in wheelchair and seating prescription interventions on a Likert scale. Just under half of respondents (44%) agreed or strongly agreed they felt confident in wheelchair and seating prescription interventions (Table 9). For those that spent greater than one hour per week participating in wheelchair and seating prescription interventions, 88% (N=7) of respondents agreed or strongly agreed they felt confident in wheelchair and seating prescription.

Table 9: Staff Confidence in Wheelchair and Seating Prescription

Confidence, n (%)		
"I feel confident in wheelchair and seating prescription"	Strongly disagree	4 (9%)
	Disagree	17 (39%)
	Neither agree nor disagree	3 (7%)
	Agree	15 (35%)
	Strongly agree	4 (9%)

Note: Numbers may not add up to 100% due to rounding

Time

Only eight respondents (20%) reported that they spent more than one hour per week (on average) completing wheelchair and seating prescription tasks (Table 10).

Table 10: Time per Week Involved in Wheelchair and Seating Prescription

Time, n (%)	Result
None	15 (35%)
Less than 1 hour	20 (46%)
1-2 hours	4 (9%)
3-4 hours	2 (5%)
Greater than 4 hours,	2 (5%)

Note: Numbers may not add up to 100% due to rounding

Professional development

Over half of the respondents (63%) reported that they had attended professional development in relation to wheelchair and seating prescription and provided examples of the educational activities. Examples are provided in Table 11. Over half (53%) of the training was provided informally (e.g. workplace in-services) rather than through external workshops, conferences, or accredited courses. Of those reporting active involvement in wheelchair and seating prescription, 71% reported they had attended professional development. Over half (59%) was training led by a vendor or a departmental in-service training and the remaining 41% was more formal training run by the Independent Living Centre, professional associations, or attendances at conferences. Physiotherapists were more likely to have participated in professional development compared to occupational therapists (Figure 7).

Table 11: Professional Development Attended by Staff

What types of professional development has been attended?
Formal workshop • Independent Living Centre • University subjects as part of Occupational Therapy Masters program • The NSW Agency for Clinical Innovation State Spinal Cord Injury Service • Online seating modules • Physiotherapy Association Wheelchair Prescription and Seating Course • Vendor/Supplier led workshops • Occupational Therapy Association run workshops • Occupational Therapy Australia conference
Informal workshop • Local departmental in-service training • Networking with other organisations providing wheelchair and seating services • Networking with vendors

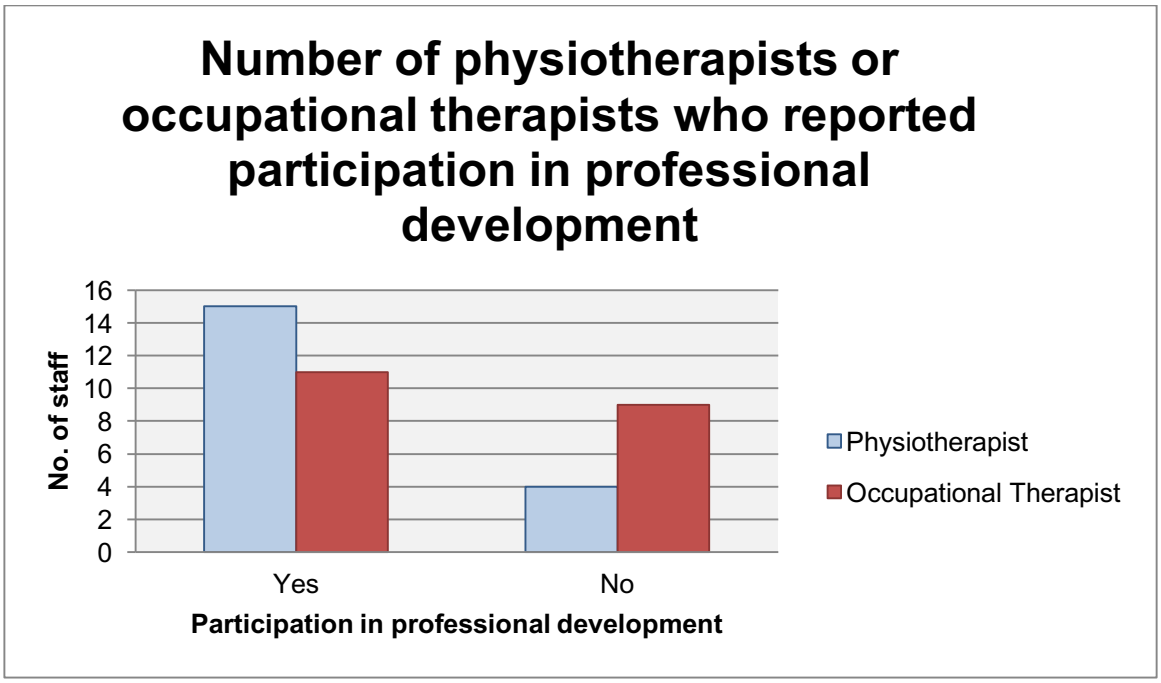


Figure 7: **Staff participation in professional development**

Strengths and opportunities for development

When respondents were asked to describe the strengths of the current service, 28 people provided a response. All responses are listed in Table 12. Common responses (reported by two or more respondents) included: availability of knowledgeable and experienced clinicians, availability of chairs to trial, and good relationships with vendors/suppliers.

Respondents were also asked to identify how the current service could be developed.

Thirty-three respondents provided a response. Responses are detailed in Table 12. Common responses included: developing a structured interdisciplinary service with purpose built space, allocated resources and guidelines, and an increase in professional development.

Table 12: Service Strengths and Areas for Development

What are the strengths of the service?	How could the service be developed?
• Knowledgeable clinicians • Experienced staff • Multidisciplinary team approach • Service is well connected to a variety of vendors providing a range of equipment • Ability to meet patients individualised needs • Reduce workload for ward based staff planning other elements of discharge • Ability for patients to trial different wheelchairs and extend trial beyond gym space • Specialist (quality) allied health assessment • Mix of junior and senior staff allowing professional development • Access to complementary tools (e.g. pressure mapping)	• Further guidelines • Multidisciplinary team approach • Development of the service into a specialist structured seating service with sufficient time and resources allocated • Addition of purpose built space • More access to complementary tools (e.g. pressure mapping) • More systematic approach to tracking loan equipment • Capacity to follow-up and alter seating over time as needs change • Evaluation of current service • Ability to see more clients that may benefit from service • More options in terms of wheelchairs available • More professional development – including regular 'refresher' updates • Use of standardised assessment forms • Structured mentoring system for more junior staff • Occupational Therapy involvement in the service • Greater consideration of individual needs (e.g. home environment, carers, transportation) • Improved triage of referrals with experienced therapists responsible for more complex cases

Use of guidelines

Less than half (40%) of respondents provided a response when asked about guidelines or resources they used to guide practice. Of the 40% (N=17) that provided a response 35% (N=6) reported they spend greater than one hour per week completing wheelchair and/or seating prescription interventions. Of those more involved in the wheelchair and/or seating prescription interventions 84% reported using externally developed guidelines and 16% reported directing junior staff to internally developed resources but not using these themselves. Of those that provided a response 30% reported using senior clinicians as resources. Of the 60% who reported they were not aware of guidelines or did not answer the question, 8% spent greater than one hour per week completing wheelchair and/or seating prescription interventions. The guidelines mentioned are presented in Table 13. Five different types of guidelines were identified; four of these resources are Australian.

Table13: Guidelines used by Staff

What guidelines or resources do staff use to guide practice?
Guidelines • Guidelines for the prescription of a seated wheelchair or mobility scooter for people with a traumatic brain injury or spinal cord injury • Promoting Airway Safety when Prescribing Harnesses for Wheelchairs and other Seating Devices: Guidelines for Prescribers • Victorian State Wide Equipment Program – Prescriber Manual – Adult Wheelchairs and Scooters • The Clinical Practice Guideline for the Prevention and Management of Pressure Injury • Wheelchairs and Mobility Scooters: A guide for safe travel in Queensland
Websites • Independent Living Centre • Paralysed Veterans of America • The NSW Agency for Clinical Innovation State Spinal Cord Injury Service
Information Resources • Manual Wheelchairs – Information Resource for Service Providers – Spinal Outreach Team and School of Health and Rehabilitation Sciences University of Queensland

Chapter 5: Wheelchair and Seating Prescription in a Sub-Acute Rehabilitation Setting; the Wheelchair Users Perspective

5.1 Introduction

Chapter 2 (Literature Review) describes the importance of appropriate wheelchair and seating prescription to the individual wheelchair user. The costly outcomes to society if the prescription is unsuccessful and inappropriate are also highlighted. A dynamic relationship exists between the wheelchair user and the wheelchair itself. No two wheelchair users are the same; they will have differing abilities that influence their wheelchair use, personal goals, and different wheelchair configurations. Therefore, the perceptions of the wheelchair user and outcomes at an individual level are a vital aspect of this service evaluation. In order to capture this complexity, a qualitative approach to data collection was chosen. Qualitative research allows the exploration of meaning; it enables rich, detailed data that provides a thorough description of events or experiences (Nayar & Stanley, 2015; Braun & Clarke, 2013). It allows exploration of the ideas and concerns of the participants and can complement quantitative data collection.

In addition to qualitative data collection there are also a number of outcomes that can be useful to measure quantitatively following wheelchair prescription. These were identified in the systematic review in Chapter 3. From the perspectives of wheelchair users, the impact on quality of life is perhaps the most important outcomes indicator (Lenker, Scherer, Fuhrer, Jutai & DeRuyter, 2005). In regards to measuring service delivery, it has been argued that user satisfaction can be used as a quality indicator, demonstrating evidence for more or less successful service delivery processes (Sund et al., 2013). Associations between satisfaction with care and other outcome measures such as clinical outcome,

quality of life, functional status, cost factors, and comfort can also be investigated (Demers, Weiss-Lambrou & Ska, 2002b). In order to evaluate and develop the service at Caulfield Hospital it was imperative that wheelchair users who have experienced the service were provided with the opportunity to offer their insights on the service including satisfaction levels and self-perceived quality of life.

5.2 Methods

Aims

The primary aim of this study was to explore the wheelchair user perspective of the process of wheelchair prescription and their post-prescription satisfaction with the wheelchair, the service delivery, and quality of life.

Design

This service evaluation involved both qualitative and quantitative data collection methods. A descriptive approach (Stanley, 2015, p. 21), using qualitative semi-structured interviews and two quantitative surveys was used. Participants were recruited from Caulfield Hospital. At the time of recruitment, all participants had previously been admitted for inpatient rehabilitation and prescribed a manual or power wheelchair for long-term use. The author who completed all data collection is employed at Alfred Health as an occupational therapist but was not the primary occupational therapist for any of the participants recruited for this study. The author is involved in wheelchair and seating prescription by referral from physiotherapists, as at Caulfield Hospital occupational therapy is not the lead allied health discipline for wheelchair prescription. Ethics approval to conduct this project was received from The Alfred Ethics Committee (127/15) and the Southern Adelaide Clinical Human Research Ethics Committee (SAC HREC) – Clinical Research (278.15 – HREC/15/SAC/235). The approval letters are presented in Appendix C and D.

Participants

Participants were adults aged over 18 years and were an inpatient at Caulfield Hospital between 1st January 2014 to 31st December 2014. The time period was chosen to enable identification of sufficient number of wheelchair users but reduce the potential for recall bias of including participants who were prescribed their wheelchair greater than two years previously. The time period of 2014 was also chosen to allow adequate time for wheelchair users to obtain their wheelchair if they had accessed state government funding, as this can often be delayed. The aim was to recruit as many participants as possible within the timeframe and resources available. People were eligible if they: were of English speaking background (due to the lack of resources for translation services), did not have a cognitive impairment that would impact on their ability to participate in the study, and had been prescribed either a manual or power wheelchair for long term use (i.e. not due to a short term weight bearing restriction) during their inpatient admission. Participants could reside in any type of dwelling and have any diagnosis. Participants were included if the prescription was finalised but they were yet to receive their definitive wheelchair at time of discharge. Participants were excluded if their wheelchair prescription was not finalised at time of discharge (i.e. a final decision on wheelchair type/model was not made).

Outcome Measures

Semi-structured interviews were used to gain in-depth insight into the wheelchair and seating prescription process and outcomes. The author and a number of key content experts (the manager of occupational therapy and physiotherapy departments and head of occupational therapy research at Alfred Health) developed the interview guide. Key questions explored participants experience of their wheelchair prescription and the service delivery. A copy of the interview questions is presented in Appendix G.

Satisfaction

Satisfaction related to the device and service delivery was measured using The Quebec User Evaluation of Satisfaction with Assistive Technology 2.0 (QUEST 2.0). The QUEST 2.0 is a client-centred outcome measure designed to evaluate a person's satisfaction with his or her assistive device and service provision. It is a 12-item survey in which users rate their satisfaction in the following areas: dimension, weight, ease of adjusting, safety and security, durability, ease of use, comfort, effectiveness, service delivery, repairs/servicing, professional service, and follow-up services. Users rate each item on a 5-point Likert scale: 1= very dissatisfied, 2= dissatisfied, 3= somewhat dissatisfied, 4= satisfied, and 5= very satisfied. The QUEST 2.0 yields a total score and sub-scores for the device and for services. In addition to rating satisfaction of the 12 items, users are invited to write comments regarding each item, and are requested to select three of the items they consider to be most important (Demers et al., 2002b). Previous studies have determined the reliability and validity of the QUEST 2.0 to be adequate, with test–retest reliability found to be high, with ICCs of 0.82, 0.82, and 0.91 for the 'Device' and 'Services' domains and the for total scores respectively (Demers, Monette, Lapierre, Arnold & Wolfson, 2002a). A copy of the survey is presented in Appendix H.

Quality of Life

Quality of Life (QoL) post-prescription was measured using the generic version of the WHOQOL-BREF (World Health Organization, 1996). The WHOQOL-BREF questionnaire consists of 26 questions, where each item is rated on a 5-point scale. The first two questions (Q1 and Q2) are global indicators of quality of life and satisfaction with general health. The remaining questions (Q3 – Q26) are scored in four domains: Physical Health (seven items), Psychological Health (six items), Social Relationships (three items) and Environment (eight items). Higher total or domain scores indicate enhanced self-

perception of quality of life. Scoring was completed as per the instructions provided in the user manual (World Health Organization, 1996) and scores were transformed to a 0-100 scale. The international WHOQOL-BREF has demonstrated good internal consistency reliability and construct validity during a survey carried out in 23 countries (N=11801) (Skevington, Lotfy & O'Connell, 2004). Other studies have also determined the validity and reliability of the WHOQOL-BREF to be adequate with test-retest reliability found to be high with ICC's of 0.63, 0.88, 0.95, 0.56, and 0.80 for the overall QoL/General Health, Physical Capacity, Psychological Well-being, Social Relationships and Environment domains, respectively (Lin, Hwang, Chen & Chiu, 2007). A copy of the survey is presented in Appendix I.

Data Generation

i) Quantitative outcome measures

Participants were identified using Alfred Health medical and equipment appliance centre records. The first author (BR) contacted participants in the order they were identified via these records. They were first contacted via telephone and invited to participate. If participants provided verbal consent they were sent, via the mail, two outcome measures (WHOQOL-BREF and QUEST 2.0) and the Participant Information Form (Appendix K) with a stamped return envelope. Results from the WHOQOL-BREF and QUEST 2.0 were de-identified and imported into an Excel spreadsheet.

ii) Qualitative interview

Participants who gave consent to participate in a qualitative interview by returning the two outcome measures were contacted by the first author (BR), by phone to make an interview time. Telephone interviews were completed by the author in a private room using the speakerphone function, recorded using a Dictaphone and memo taking. Participant

demographics were collected via Alfred Health medical records and imported into an Excel spreadsheet following participation in the semi-structured interview.

iii) Retrospective medical records audit

A retrospective medical records audit of the inpatient progress notes, discharge summaries, and related correspondence was completed to gather information regarding the service delivery process. The data collected were based on the RESNA "Wheelchair Service Provision Guide" (Arledge et al., 2011), which is described in Chapter 2 (Literature Review). This guide acknowledges the complexity of wheelchair service provision and identifies the steps required using a framework. Information collected was based on the wheelchair service provision process outlined in the RESNA guideline and included details on "assessment, equipment recommendation and selection, funding and procurement, product preparation, fitting, training and delivery, follow-up, maintenance and repair, and outcome measurement [including goal setting]" (Arledge et al., 2011, p. 3). The author collected all data using a data extraction form (provided in Appendix J).

Data Analysis

i) Qualitative analysis

All interviews were conducted by the author and transcribed verbatim by an external company. Identifying information was removed and replaced with pseudonyms. Braun and Clarke's six phases of thematic analysis (Braun & Clarke, 2013) were used to guide the analysis of the semi-structured interviews. The author read all the transcribed data multiple times to firstly become familiar with the data. NVivo (QSR International, 2010) was used to generate initial codes, which described the content within the interview; codes were then collated into categories so that similar codes were grouped together in a meaningful way. Further reflection on the data and codes led to development of themes and all relevant

data gathered related to the potential themes were collected. Themes were reviewed, followed by ongoing analysis to refine the specifics of each theme with clear definitions and names for each theme developed. The analysis was finalised with the write up of the results.

Methodological rigour of the qualitative analysis was ensured in a number of ways. Journaling and note taking following the interviews was completed to improve confirmability. NVivo was used to document an audit trail during the analysis phase where initial codes were collated into categories and finally into themes. The author also used supervision sessions to participate in de-briefing during the interview and data analysis phases. Finally the author discussed the interview and analysis process and the findings with a colleague experienced in qualitative research methods once themes were identified and defined. In this process initial codes and how they were collated into meaningful categories were reviewed. This was followed by a review of the themes, their definitions, names, and the related data.

ii) Quantitative analysis

Descriptive statistics (means, standard deviations, counts, range) were used to report participant characteristics and results of the WHOQOL-BREF and QUEST 2.0.

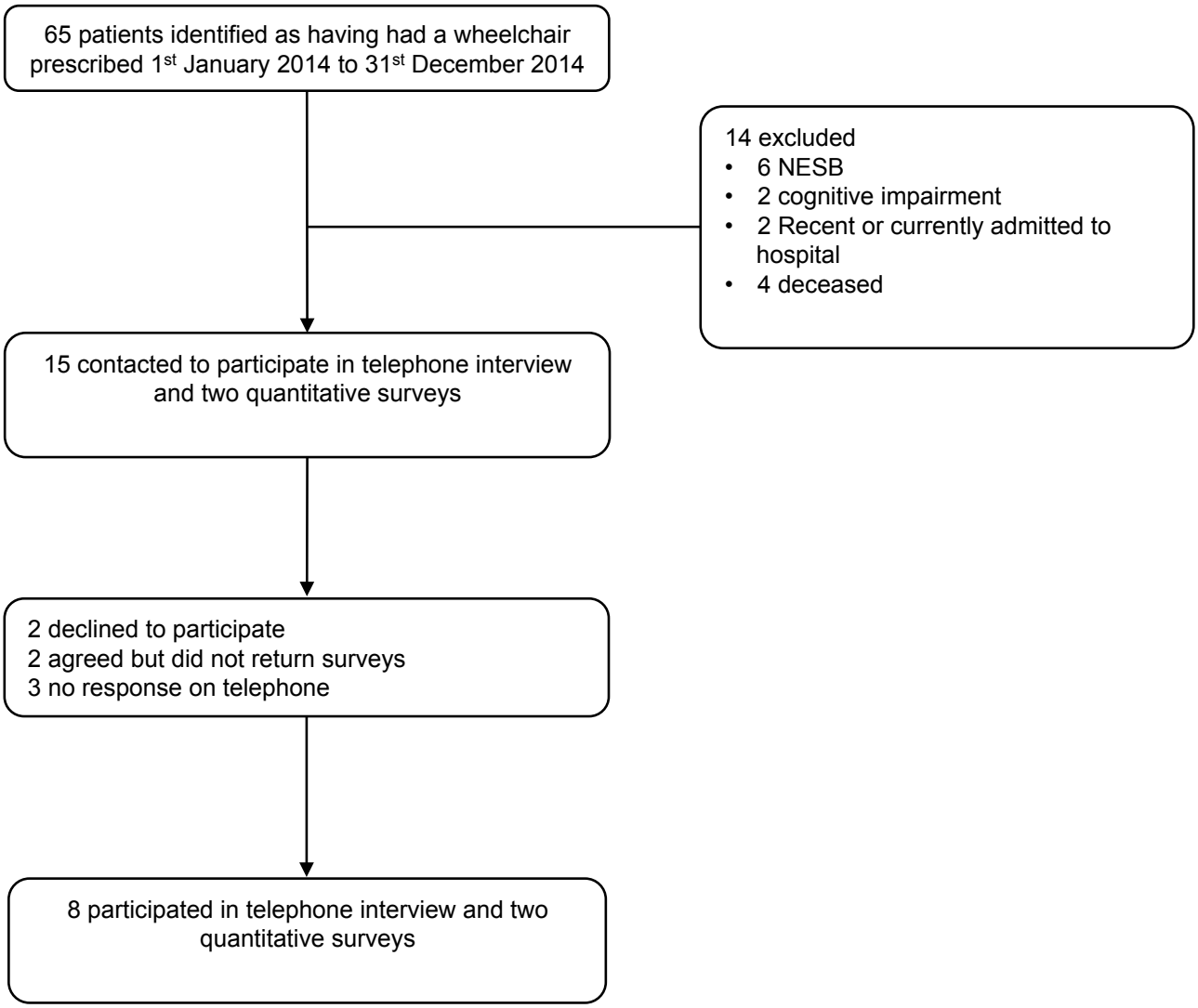
iii) Retrospective medical records audit

Descriptive statistics (percentages) were used to report results of the retrospective medical records audit.

5.3 Results

Fifteen eligible participants were contacted in the order they were identified from the medical and appliance centre records until eight agreed to participate in the interview and completion of the questionnaires (flow of participants is presented in Figure 8). The mean (SD) age of the participants was 64 (16.78) years, range 41-92 years, and six were male

(60%). Diagnoses included non-traumatic spinal cord injury and amputation. Demographics for the sample that participated in the semi-structured interview and quantitative surveys (N=8) are presented in Table 14.



NESB = Non English Speaking Background

Figure 8: **Flow of client participants**

Table 14: Mean (SD) or n (%) of Participant Demographics

Characteristic	Participants (N=8)
Age, mean ± SD (years)	64 ± 16.78
Gender male n (%)	6 (60%)
Marital Status n (%)	
Single	1 (13%)
Married	3 (38%)
Living as married	1 (13%)
Divorced	1 (13%)
Widowed	2 (25%)
Education n (%)	
High school	6 (75%)
College	2 (25%)
Medical diagnosis	
Spinal cord injury n (%)	2 (25%)
Amputation n (%)	6 (75%)
BMI on discharge, mean ± SD	30.65 ± 5.39
BMI at time of study, mean ± SD	27.51 ± 4.74
Unwell n (%)	1 (10%)
No pressure injury n (%)	8 (100%)
Type of wheelchair n (%)	
Manual	6 (75%)
Manual and power	2 (25%)
Length of admission, mean ± SD (days)	63 ± 66.9
Time since discharge, mean ± SD (days)	635 ± 169.3

Qualitative analysis of semi-structured telephone interviews

The thematic analysis of the data revealed four main themes: 'I wasn't the expert', 'Is one wheelchair enough?', 'Participation and independence' and 'Enablers and barriers' to wheelchair use.

I wasn't the expert

As new wheelchair users, the participants spoke about relying on staff knowledge and expertise on wheelchairs. Relying on treating therapist and suppliers to choose the 'right' wheelchair was underpinned by feelings of trust. Five of the participants specifically reported that they relied on guidance from their prescribing therapist.

> *You're relying on their [staff] advice and experience…it's sort of like you've got to go with what you've been told...it's the first one you've been in, and well that's the bees knees.* (Tom…)

William also described being a novice and having to trust his therapist and go with what he'd been told. Paul expressed he relied on staff as he lacked knowledge about alternative wheelchair options and what was best for him:

> *I mean they asked me how I felt but I mean a wheelchair's a wheelchair to me…I don't know what other types there is, but I think that they said that the one I've got was probably the best suited to me, anyway.* (Paul…)

Likewise, Iris talked about her lack of experience concerning the different types of wheelchairs available: "*Oh I didn't know much about wheelchairs…I've never had any experience with wheelchairs".*

In contrast, Mark queried the role of collaborative decision-making process between the healthcare team and the individual wheelchair user: "*From my point of view why do you*

ask a person who's never had a wheelchair in their life what the best wheelchair is going to be for them"?

Some found it difficult to take a decision-making role in the process as they were new to the experience and had nothing else to compare it to. On reflection most participants felt they now know a lot more about wheelchairs from the experience of using one.

Mark said *"…I know a lot more about wheelchairs now than I did then…".*

Participants also described relying on others for assistance during the prescription process. For example, Tom stated he relied on his wife, as he was heavily medicated during his rehabilitation and this affected his decision-making: *"Everything probably went through my wife, she took more in than myself at the time".* Don involved his daughter in all decisions regarding his wheelchair prescription: *"She was involved in it all".*

In contrast to relying on clinicians for their knowledge and family for their support, Mark talked about his preference for relying on other patients to learn from:

> *Communicating with others in wheelchairs is probably a better thing from my point of view and would've been better for me…a sort of group discussion with a few of the people that were in wheelchairs and others who'd had 30 years in a wheelchair.* (Mark…)

While participants perceived staff to be the experts in the wheelchair prescription process and relied on their knowledge, none reported any feelings of dissatisfaction towards their wheelchair prescription. However, suggestions of additional needs were implied in participant reports and are presented below.

Is one wheelchair enough?

Following wheelchair prescription and discharge from the service two participants, Don and Tom, progressed from a manual wheelchair to a power wheelchair due to a change in their needs. Don completed this without assistance from a healthcare professional while Tom completed this via an amputee outpatient clinic he was attending. William purchased a wheelchair lighter in weight due to difficulties getting his original wheelchair in and out of the car. This also enabled him to leave a wheelchair in the garage. Mark purchased a narrower wheelchair that was easier to manoeuvre in his home environment. Tom went on to borrow a lighter weight wheelchair from a family member, as it was easier for his wife to get it in/out of the car.

Mark reported the benefit of access to alternative wheelchairs in order to participate and to mobilise in different environments such as within the house and going outside:

> *I've bought two Aldi [supermarket] wheelchairs since all this has happened…I use the one that I got off you guys for basically going up the street, purely because its one advantage is that the push rings have got indentations on them…and the Aldi one's just a smooth ring. I have some really steep slopes that I have to access. The Aldi one is slightly narrower than the one I got from you guys therefore it's better inside the house, I don't knock the house around as much. If I travel somewhere, I take the Aldi one because it's narrower and a little lighter and it fits in the cars and things a bit better.* (Mark…)

Similarly William purchased an additional wheelchair from a supermarket, as it was lighter in weight and easy to manoeuvre in his home environment. Tom spoke about using a wheelchair that was his mother's as it was lighter and easier for his wife to get in/out of the car. Don, who was provided with a power wheelchair from his retirement village on discharge home, and reported the benefit of having access to both a manual and power wheelchair:

When I go out to my day program now I'm using a wheelchair taxi, I take the electric one on that. But if I go out with my daughter I take the manual [wheelchair]…other times I use the manual [wheelchair] because it is convenient. (Don…)

Don also spoke about how his medical condition impacted on his wheelchair use and reported, "*when you've got no legs it's a lot better than the other one*" (comparing the power wheelchair to the manual wheelchair).

While most participants were discharged with a single manual wheelchair, two participants were reportedly discharged from hospital with a power and manual wheelchair due to their individual needs. For one participant Iris, she reported not actually using the power wheelchair a lot..."*it just sits there*". Iris described not liking the power wheelchair from the start reporting it was "*cumbersome*" but that was all that was available at the time.

Participation and independence

Participants expressed the significance of gaining independence through access to a wheelchair in the early stages of their rehabilitation, and the experience and positives of this. Mark said "*All of a sudden I had this sort of mobility which at that stage was enormous to me…I was out dusk til dawn"*. Don valued being able to get to the gym independently: *"It was good to get a wheelchair to trundle up and down in"* and Andrew enjoyed being able to get out of the ward on weekends: "*To be able to get out of the wards on weekends was great for me".*

Following discharge home six participants expressed provision of their wheelchair as being positive and reported on the ability to participate in daily household, community and social activities. William reported his daily routine as:

> *Get out of bed, make my wife a cup of tea, go on the computer and check what's happened in the world, play Solitaire, play Jones in the Fast Lane, watch a bit of TV, talk to the dog. Occasionally now I'm going out on my four wheel scooter, just like a walk around the neighbourhood.* (William…)

Others described increased community reintegration. Tom said, "*I could, like I said go down the footy club, things like that. I can get dropped off by a taxi, let me have a bit of independence".* June also spoke about community activities *"We've just started going swimming, we go to the pictures, go out for lunch".*

Barriers and enablers to wheelchair use

Participants also described environmental influences or obstacles that prevented wheelchair use or needed adapting to enable wheelchair use. Iris described a lack of lighting and footpaths restricted her wheelchair usage outdoors or at night; whereas, Mark described his local town as "*not exactly wheelchair friendly but I do manage*". Don who did not identify anything that prevented use; however, planned trips out to avoid environmental barriers that would prevent use "my daughter parks near where there's a car entry so, that I can use the sloping gutter".

In addition to physical environmental barriers, two participants spoke of being restricted in the ability to use their wheelchair during adverse weather. Iris said *"I can't hold an umbrella and negotiate a wheelchair"* and Mark reported, *"If the weather's not good I'll probably be more likely to be stuck indoors".*

Not only was the physical environment and weather often a barrier to use, Iris reported she was unable to use her power wheelchair to get to the communal dining room/community

centre at her retirement village as they didn't allow motorised wheelchairs into the dining room. She spoke about trying to problem solve this but that meant relying on another person which is a barrier for Iris as she is unable to rely on anyone at her retirement village.

Four participants spoke about the home modifications they required in order to access their home using the wheelchair. All four described the home adaptations as small things *"I had four sliding doors, cavity sliding doors and I had to have a couple of little alterations done here"* (Iris); *"just a few ramps here and there would help for the wheelchair"* (Tom); *"we had to make a special step for me to get up"* (William). Andrew reported initially when returning home accessing his workshop was difficult, which impacted on his ability to work. Once the modifications were undertaken he was able to participate in work and leisure activities.

Satisfaction as measured by the QUEST 2.0

The mean score for the device and services domain indicates participants were quite satisfied with the device and with the service. The three most important items identified by the users were comfort, easy to use, and weight. The scores of all variables are shown in Table 15. Comments were made concerning satisfaction and dissatisfaction with repairs, wheelchair meeting and not meeting the needs of the users, time frame for government funded wheelchairs, and not receiving follow-up but identifying that follow-up had not been required.

Table 15: Satisfaction with Wheelchair and Seating Service Delivery and Device, as Measured Using QUEST 2.0

QUEST	Mean	Standard Deviation	Min - max
Device domain (N=7)	3.44	1.01	1 – 4.88
Service domain (N=8)	3.0	1.02	1.75 – 5
Total (N=8)	3.51	.98	1.42 – 4.90

Quality of Life as measured by the WHOQOL-BREF

Most (70%) people rated their quality of life as good and the remaining 30% rated it as neither good nor bad. Thirty per cent were satisfied with their health, 50% neither satisfied nor dissatisfied, 10% dissatisfied, and 10% very dissatisfied. The mean WHOQOL-BREF domain scores are presented in Table 16.

Table 16: Quality of Life as Measured Using WHOQOL-BREF Transformed Results (0-100 scale)

WHOQOL-BREF	Mean	Standard Deviation	Min - max
Physical health domain (N=8)	52.2	19.16	20 – 69
Psychological domain (N=8)	61.3	13.66	44 – 81
Social relationships domain (N=7)	62.4	19.11	25 – 94
Environment domain (N=8)	66.4	13.60	31 – 81

Retrospective audit of medical records

Medical records for the eight participants that participated in the telephone interview were audited. The medical records audit identified the following:

- Formal assessment forms or documentation were not used for the eight participants during the wheelchair and seating prescription process (all documentation was embedded in the progress notes involving a narrative description of the process).
- One participant had goals documented relating to the wheelchair prescription and what they wished to achieve with the use of a wheelchair, whereas, the others did not.
- Wheelchair trials were documented for two of the eight participants.
- No formal assessment process in relation to pressure care was documented for the eight participants; however, three of the eight participants received education related to pressure care from the staff member responsible for the wheelchair and seating prescription.
- Documentation in relation to funding was noted for five of the eight participants.
- Four participants received home assessments and use of the wheelchair within the home environment was documented for three of these participants.
- On discharge there was an absence of clear documentation regarding follow-up of the wheelchair prescription was for any of the participants.

Full results of the medical record audit are presented in Table 17.

Table 17: Retrospective Medical Records Audit (N=8 medical records)

Assessment					
Physical assessment		**Environmental assessment – home environment, work, recreation transport**		**Outcome measures and goal setting**	
MAT Evaluation / Assessment of posture	0% (0/8) formal assessment form. 100% (8/8) ROM/strength/tone documented as part of PT initial assessment and ongoing documentation	Home assessment completed	63% (5/8) documented	Completion of standardised outcome measure related to wheelchair prescription	25% (2/8) documented
Pressure care/skin issues/sensation	63% (5/8) documented as part of PT initial assessment 100% (8/8) BRADEN completed routinely by nursing staff	Access visit completed	25% (2/8) documented	Goals documented related to achievement of participation through wheelchair use	13 % (1/8) documented
Mobility/Transfers	100% (8/8) documented as part of PT initial assessment and ongoing documentation	Work/vocational considerations	12.5% (1/8) documented		
Balance	50% (4/8) documented as part of PT initial assessment and ongoing documentation	Recreation/leisure considerations	0% (0/8) documented		
Dimensions / Seating measurements	0% (0/8) formal documentation 25% (2/8) partial documentation (e.g. seat width)	Transport considerations	25% (2/8) documented		

Assessment			
Physical assessment		**Environmental assessment – home environment, work, recreation transport**	**Outcome measures and goal setting**
Pain	63% (5/8) documented as part of PT initial assessment/ongoing PT or OT documentation		
Cognition	25% (2/8) documented as part of PT initial assessment/ongoing PT or OT documentation		
Vision	38% (3/8) documented as part of PT initial assessment/ongoing PT or OT documentation		
Communication and Swallowing	0% (0/8) documented		

Equipment Recommendation, selection, funding, fitting, training and delivery					
Wheelchair selection & trials		**Funding**	**Fitting – wheelchair set-up**	**Training & Delivery**	
Wheelchair selection	0% (0/8) documented on decision making process for selection of wheelchairs for trial	50% (4/8) documented education provided to client regarding funding options	0% (0/8) documentation on fitting or set up of wheelchair	Wheelchair skills training	75% (6/8) documented wheelchair skills training provided to varying degrees
Wheelchair trials	25% (2/8) documentation on trials of wheelchairs (timeframe and details on trials limited)			Pressure care education	38% (3/8) documented
				Delivery of wheelchair	0% (0/8) documented details on delivery of wheelchair

Follow-up, repairs and maintenance			
Follow-up		**Repairs and maintenance**	
Referred for ongoing follow-up	88% (7/8) referred for generic ongoing follow-up through community rehabilitation centres or outpatient services 0% (0/8) documented planned follow-up in relation to wheelchair prescription	Education provided on repairs and maintenance	0% (0/8) documented

MAT Evaluation = Mechanical assessment tool; ROM = Range of movement; PT = Physiotherapy; OT = occupational therapy; Home assessment = assessment of home environment for discharge completed with occupational therapist and client present, +/- family members; Access visit = assessment of home environment by occupational therapist +/- family members, client not present;

Chapter 6: Discussion

The goal of healthcare is to deliver an effective service that meets the needs of its patients. In the case of wheelchair and/or seating prescription, there is insufficient evidence to audit service performance against an agreed set of criteria. This argument was clearly articulated in Chapter 3 (Systematic Review), which synthesised the research in regards to the outcomes measured following the prescription of a new wheelchair and/or seating system. Therefore, to better understand service delivery in context, the author conducted a service evaluation of the wheelchair and seating prescription service in a sub-acute rehabilitation centre; the methods and results of which are presented in Chapters 4 and 5. The use of consumer perspectives and experience should be central when evaluating assistive technology (Johnston & Dijkers, 2012). Therefore, the perspectives of new adult wheelchair users and staff working within this service were elicited using questionnaires and interviews to assess strengths and weaknesses of the service, staff knowledge and learning needs, user satisfaction and post prescription quality of life. Together, Chapters 4 and 5 serve to provide a complete evaluation and results of both phases of the study will now be discussed together.

6.1 Outcome measures for wheelchair prescription

The systematic review presented in Chapter 3 illustrated that there is a lack of consensus regarding the outcomes that should be measured following new wheelchair and/or seating prescription interventions. The review, which included 39 studies, found that the studies measured a range of outcomes including activity and participation, wheelchair use, and change in health condition or impairment. The included studies used a large number of tools to measure these outcomes. Thus, at present, it is not possible to identify the outcome measures that are commonly applied and means comparison of services or

benchmarking is not possible based on existing practices. Our audit revealed that no outcome measure was routinely used in clinical practice. In a country where health resources are scarce and there is increasing pressure for services to demonstrate efficacy, the service should review whether outcome measures can be introduced as part of routine practice. Given the lack of consensus regarding the best outcome measure, the service should review the available measures and consider which are able to measure the service to reflect its goals. More practical information, such as the time requirement for administering the measures and the psychometric properties of the measures, also need to be considered. In the short term, and in the absence of information about the best measure to use, an expert working group should be formed to review and recommend tools.

6.2 Standards and guidelines

The lack of consistency in measures being used may also reflect the lack of standards in relation to service delivery. No standards exist in Australia in relation to the provision of wheelchair and seating interventions. Standards in healthcare have been defined as the quality of service delivery (Turner-Stokes, 2003). Without the use of standards or a guideline, what should be measured, and benchmark objectives remain unknown. Scherer (1996) argues that the objectives and goals of the intervention must be identified in order to determine the most appropriate outcome measure. Standards can set a framework for the objectives of the intervention, allowing services to measure quality and to encourage improvements in performance. As reported in Chapter 2 (Literature Review), the delivery of wheelchair and seating prescription interventions in Australia is variable. Schmidt (2014) identified compounding factors to this variability to be “funding system variation, divergent service eligibility systems (i.e. compensable versus non-compensable), restrictive funding protocols and lack of funding policy transparency” (2014, p. 301). The results of this

service evaluation study have highlighted this lack of transparency further and have also highlighted variations within a single service. Clinicians surveyed in the study (Chapter 4) used a mix of resources to guide their practice and a consistent use of a guideline was not identified. Many staff respondents reported that they turned to senior clinicians for advice and the use of in-house resources, while others reported having knowledge of and/or using existing guidelines. Skill acquisition in wheelchair and seating prescription has previously been found to occur on the job because of an absence of formal education (Schmidt, 2014, p. 246). Staff respondents also highlighted that a more structured approach to the intervention was required. For clinicians working in a busy clinical setting, selecting what knowledge to apply is challenging (Petzold, Korner-Bitensky & Menon, 2010) and often individual knowledge is adapted to the local context. In chapter 4 (Service Evaluation) the Knowledge to Action Cycle (Figure 6) (Graham et al., 2006) was introduced. Following problem identification the next step for the service is to adapt knowledge (guidelines/standards) to their own local context. This will be a valuable step in developing an evidence-based service. Increasing the structure of the service through the use of standards of practice and guidelines may also engage the user in the process as it provides the opportunity to incorporate the users' perspective in a meaningful way (Di Marco et al., 2003). According to the Knowledge to Action Cycle, having clinical tools such as guidelines, will assist clinicians to readily make evidence-based clinical decisions (Graham et al., 2006). The future challenge for the evaluated wheelchair and seating service is to create a resource in an environment where there are currently no standards, and where both clinical practice and the use of outcome measures varies widely. Given that the service evaluation (Chapter 4) revealed that less than half of the staff felt confident to prescribe wheelchairs and/or seating systems, having a guideline would be extremely valuable. The service should therefore review existing guidelines together with the

available outcome measures, and then consider the context in which they work, to determine whether they are able to tailor and then implement a modified guideline in their service. The implementation of any guidelines into clinical practice should be strategically planned and evaluated. Prior to implementation, therefore, it is suggested that barriers to change are identified, strategies to deal with the barriers are developed, and the effectiveness of guideline implementation be measured (Hakkennes & Dodd, 2008). Such careful planning will likely increase the success of implementation.

6.3 Quality of life and satisfaction

Despite this evaluation identifying a number of weaknesses of the service, the client participants generally reported that they were satisfied with the device and service delivery, as well as self-reported high quality of life. Provision of follow-up and repairs and maintenance were the lowest scored subscales on the QUEST 2.0, however the qualitative analysis did not identify any similar themes. The results of the quantitative survey is not surprising because outpatient services to provide follow-up, maintenance or repairs are not provided by the sub-acute rehabilitation centre, and as such, it is plausible that clients attending the evaluated service may not receive these aspects of care *at all*. Clients are usually referred to community organisations, if follow-up is required. This aspect of care could be improved by offering routine follow-up and maintenance but the lack of follow-up tends to be common across services. In a scoping review of wheelchair service delivery processes, Greer et al. (2012) found “little follow-up is typically done [after delivery of a wheelchair], and that formal assessments of outcomes are rare” (p. 143). Wressle and Samuelsson (2004) reported similar findings in their study that included 209 users of either walkers, manual or power wheelchairs. Using the QUEST 2.0 they reported the lowest mean score was for follow-up, with more than half of respondents reporting they had not received any follow-up. The provision of follow-up has previously been reported as

challenging for services and clinicians due to the significant amount of work it can create; this can be unsustainable without an increase in availability of staff (Di Marco et al., 2003; Schmidt, 2014). The process of follow-up is difficult but can assist in managing and addressing issues with the wheelchair (Di Marco et al., 2003), and assist in developing clinical reasoning and knowledge (Schmidt, 2014, p. 245). A structure for formal follow-up after wheelchair and/or seating prescription should be considered, in particular for those clients with complex wheelchair and seating needs.

6.4 Alternative wheelchair needs

Without routine follow-up there is a risk that identification of clients' ongoing needs or changes in their needs will be overlooked. The analysis of the semi-structured interviews revealed that the wheelchair users' needs changed over time. Two client participants reported purchasing wheelchairs from a supermarket; another didn't use a power wheelchair prescribed due to the size and a policy at her retirement village, preventing use in the environment for which it was prescribed. In an Australian study, Schmidt (2014, p. 202) also found wheelchair users required more than one wheelchair to meet all of their occupational needs. The timing of the wheelchair prescription could also be a factor that leads to alternative wheelchair needs. Early in the rehabilitation process wheelchair users may be unsure about what they need or what they want to achieve through the use of their wheelchair, because they are adjusting to injury and a significant change in abilities. In a qualitative study, Kittle et al. (2002) recommended wheelchair users be provided with time to adjust to their situation and injury so that they are able to make informed decisions about what they require from a wheelchair. Schmidt (2014, p. 298) concurred and reported that novice consumers need time and support to become confident in making choices regarding their wheelchair. A second factor that may lead to alternate wheelchair needs is a change in function. Within the study reported in this thesis, one participant progressed to

having a bilateral trans-femoral amputation, a second reported a decline in their medical condition and another described a progression with their mobility, which enabled them to walk short distances. This is consistent with the findings of others; Phillips and Zhao (1993) found a change in needs of the user was the strongest factor influencing device abandonment. Abandonment of assistive technology including wheelchairs has been investigated in a number of studies (Kittle, 2002; Garber et al., 2002; Phillips & Zhao, 1993; Verza et al., 2006). Although abandonment was not an identified theme in the qualitative study, many participants reported seeking use of additional and alternative wheelchairs. This not only increases the cost for wheelchair users but may suggest their needs were not adequately assessed prior to prescription. Scherer (1996) reported strong factors relating to abandonment of assistive technology included: a change in needs, performance of the device, the meeting of expectations, and consumer involvement in device selection. Most abandoned devices were mobility aids and most were abandoned either during the first year or five years after. The reasons for alternative wheelchairs should be explored further in future service development, to determine if service changes such as routine follow-up can reduce the need for alternative wheelchairs.

6.5 Goal setting

The need for alternative wheelchairs may also indicate the needs and expectations of the client are not being thoroughly explored during the prescription process and a client-centred approach is lacking. Interestingly, analysis of the strengths of the service, as highlighted by staff respondents, did not reveal any client-centred processes were consistently completed. A component of client-centred practice includes a mutual goal setting process. The retrospective medical records audit highlighted goal setting was poor in relation to the wheelchair prescription. Goal setting is a formalised process within Caulfield Hospital, with standardised forms embedded within the electronic medical record

to encourage interdisciplinary goal setting. Goal setting, done at the start of the wheelchair assessment process can aid the therapist and client to focus on client-centred outcomes (Pimentel, 2008). It enables expectations to be set and to learn what all parties involved in the intervention want to achieve, thus allowing services to tailor more effectively to their local context. Without setting appropriate and realistic goals with each patient, a prescribing therapist may miss the opportunity to gain sufficient knowledge regarding what type of wheelchair the client wants, what they want to achieve through the use of their wheelchair, and the performance they expect from their wheelchair. Interestingly goal attainment was one of the least used outcome measures in the systematic review presented in Chapter 3, with only four included studies using goal attainment as an outcome measure. The most client-centred tools have been identified as those that involve setting client identified goals related to individual status and expected performance (Kenny & Gowran, 2014). The use of formal goal setting as an outcome (using measures such as Goal Attainment Scaling or the Canadian Occupational Performance Measure) may increase the client-centeredness of the service and increase shared decision-making between the client and the therapist. In light of the finding that wheelchair use and need varies over time, such goal setting should be viewed as an iterative process and not only conducted at commencement with a service.

6.6 Reliance on staff

Although client participants reported good levels of satisfaction and quality of life, a prominent theme in the interviews was the reliance on the prescribing therapists' knowledge and skills to determine which wheelchair would best meet their needs. All participants were new wheelchair users and therefore this was their first experience in having a wheelchair prescribed. Kittle et al. (2002) reported similar findings: the first prescription was influenced by a lack of familiarity with the prescription process and the

inexperience had a profound effect on the participants' ability to identify what they needed. In another study Plummer, Ito and Ludwig (2013) had similar findings where nearly half of respondents relied on others to tell them what they needed. Kittle et al. (2002) studied the factors that influenced the decision to abandon a wheelchair and found that at the time of prescription of their first wheelchair, participants' indicated that being an inpatient limited their expectations and knowledge of their needs upon re-entering community life. Over time, wheelchair users' knowledge grows through wheelchair use and this can improve the procurement process (Mortenson & Miller, 2008). Prescribing therapists are therefore challenged with creating experiences that enable the first time wheelchair user to see and imagine what they will be able to return to post-discharge with the use of their wheelchair. Prescribing therapist have a responsibility to engage the first time wheelchair user in discussions about their previous roles and routines and set goals for discharge that then enable an informed decision about wheelchair needs to be made. The reliance on staff knowledge and experience in new wheelchair prescription is not a new finding; however, the staff survey highlighted low levels of staff confidence. Less than half of the staff respondents reported that they felt confident in wheelchair and seating prescription interventions; this suggests that the service should look at strategies to improve staff confidence in an effort to improve the quality and consistency of service provision. These strategies may include professional development, formal mentoring arrangements for junior staff, and the implementation of standardised processes for wheelchair and seating prescription. The finding that clients rely on staff knowledge and recognising this has been reported in prior studies, this highlights the importance of having staff who are confident in their skills and knowledgeable in the area of wheelchair and seating prescription interventions.

Developing staff knowledge and skills, and promoting change in clinical practice is complex and influenced by many organisational and individual factors (Petzold et al., 2010). This study has enabled a better understanding of wheelchair and/or seating prescription interventions in this specific context from staff and users' perspectives. This enhanced understanding is the first step in identifying the problems and progressing through the Knowledge to Action Cycle. The results can be used to move through the process of adapting knowledge to local context and tailoring and implementing changes.

Chapter 7: Strengths and Limitations and Conclusion

7.1 Strengths and Limitations

This thesis included a systematic review (Chapter 3, study 1), which included 39 studies reporting on outcomes assessed following new wheelchair and/or seating prescription and a service evaluation incorporating the perspectives of staff and clients. The systematic review was conducted using rigorous methods including a comprehensive search, two people independently assessing all full text reviews to determine eligibility using pre-determined inclusion criteria and assessment of the quality of all studies. While the review included a large number of studies, the variety of outcome measures reported means it remains difficult to make recommendations regarding the most appropriate outcome measure.

The aim of the service evaluation (Chapters 4 and 5, study 2) was to identify the strengths and weaknesses of a wheelchair and seating prescription service to provide recommendations about areas for service improvement. At a service level, the evaluated service provides services for approximately 65 people per year. To minimise recall bias, only people who had received services two years prior were contacted. Contacting people who had received services more than two years prior may have led to difficulties in recalling the events accurately. However, only people discharged for >1 year were contacted as they could reasonably be expected to have received their wheelchair. These potential funding delays highlight a key challenge in conducting an evaluation of a service and the need to balance recall of stakeholders with service delays in providing the prescribed equipment. This recruitment barrier thus affected the potential sample size for our evaluation. The smaller potential sample was further compounded by the use of only

one site. Since the data come from only one study site, results may also not be generalisable to other services even within Australia. The context description of the service outlined in Chapters 1 (Introduction) and 4 (Service Evaluation) may assist other services to make such decisions.

This series of studies did, wherever possible, seek to use well established data collection and analysis methods in an effort to maximise rigour. For example, the medical record audit was conducted systematically using a pre-determined data extraction form; however, as the audit was retrospective, the findings should still be interpreted with caution. In this population, auditing medical records may not be a good measure of actual practice, since it only reflects what was recorded and it is plausible that not all therapists may have documented their practices. Observation of prescription sessions would provide more detailed information but may result in change of practice by the therapist. Interviews with therapists would also provide more detail about practice, beliefs, and clinical reasoning; however, there may be discrepancies between self-reported practice and actual practice. In regards to the qualitative analysis, this was completed using strategies to ensure methodological rigour however member checking was not completed. The completion of member checking would have increased the rigour of the research.

The staff survey elicited a response rate of 52%. This response rate is quite high relative to other studies, suggesting that the staff were keen to provide feedback about the service. A limitation of the survey was that it focussed on staff awareness of clinical guidelines but it did not illicit information on staff attitudes or understanding of clinical guidelines, or their actual use. The staff survey was developed specifically for this study to address the research questions however as it is not a standardised assessment psychometric properties are not available and the validity and reliability are unknown.

7.2 Recommendations for Caulfield Hospital wheelchair and seating service

- Key stakeholders to identify an appropriate model of care that meets the complexity of wheelchair and seating prescription required, develop clear objectives for the wheelchair and seating service at Caulfield Hospital, identify outcomes for key objectives and select appropriate outcome measures to be used. The outcome measured used should be valid and reliable and used consistently during practice.
- It is widely acknowledged that it can be difficult to change clinical practice (Grol & Grimshaw, 2003) and that provision of recommendations alone is unlikely to result in change. Gaining further insight into staff attitudes and use of guidelines is warranted. It is recommended that someone who has a good working knowledge of the setting, has skills in service improvement or change management processes, and is well respected at the site lead the process, and that staff feel included in the process.
- Key stakeholders to review relevant guidelines in relation to wheelchair and seating prescription service delivery, identify barriers to implementation, and strategies to overcome these barriers.
- Key stakeholders to review documentation procedures and update accordingly; ensuring they reflect the model of practice and key objectives of the service.
- The results of the evaluation suggested that more professional development opportunities would be valuable, mentoring of junior clinicians should be established, and standardised processes and documentation would lead to more consistent service delivery.
- Key stakeholders to review the staff competency requirements to meet the model of care and implement strategies to build staff capacity and skills. Education regarding

goal setting should be targeted as the evaluation showed goal setting in relation to wheelchair and seating prescription was poor despite goal setting being an expectation of the service. Train the trainer models should be considered given the identified complexity of wheelchair and seating prescription.

- Select appropriate outcome measures to measure client-related outcomes. This may include a client centred outcome measure such as goal attainment.
- Re-evaluate the service post-implementation of recommendations.

7.3 Conclusion

Wheelchair and seating prescription has been identified as a complex intervention in which there are many factors that can influence the outcome. The research regarding wheelchair and seating prescription is variable in terms of quality and outcomes measured, and research is sparse specifically within the Australian sector. The results of the systematic review have highlighted issues with the use of multiple outcome measures and studies of low methodological quality. This is not the first study to report these findings and call for a consensus on outcomes and outcome measures, and an increase in the quality of research with well-designed studies that accommodate the heterogeneity of the wheelchair user population.

The service evaluation is the first important step in ensuring service development. Although the evaluation has highlighted clients are happy with the service they received, many areas for development were identified. In future, Caulfield Hospital should consider the results and implementation of the recommendations to improve the quality, efficiency, and effectiveness of the service, client outcomes and staff capacity. Further service evaluation should be completed following implementation of changes and results

published to increase the available evidence about the Australian wheelchair and seating service environment.

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Appendix A: Systematic Review Protocol

Review title

A Systematic review of outcomes measured following new wheelchair and seating-prescription interventions in adults

Reviewers

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Review question/objective

The objectives of this systematic review are:

1. Following new wheelchair prescriptions, what outcomes are being measured and what are the measurement tools used?

Background

Assistive devices are commonly used to support the independence of people living with disability by facilitating participation and enhancing overall wellbeing (World Health Organization, 2011). A wheelchair is one of the most commonly prescribed assistive devices for enhancing mobility (World Health Organization, 2008). Wheelchairs are considered a basic human right, because not only does a wheelchair provide mobility and postural support, but it also allows the user to have independence and participate in life roles and valued occupations, and supports health and wellbeing (Di Marco, Russell & Masters, 2003, p. 30; Kenny & Gowran, 2014, p. 67; Dolan, 2013, p. 363).

Adults who use a wheelchair as their primary means of mobility vary in terms of their capabilities and needs (Dolan 2013 and Dolan & Henderson 2014). Their impairments may be physical and/or neurological and their user needs are specific. Wheelchair users also have individual goals and expectations relating to their wheelchair needs. For these reasons, wheelchair and seating prescription is a complex, time consuming, costly but important intervention for people with mobility limitations. A successful prescription of a wheelchair and seating system can increase a person's participation and independence, and improve quality of life (EnableNSW & Lifetime Care & Support Authority, 2011, p. 15). In contrast, an inappropriate prescription can lead to negative consequences such as injury, feelings of abandonment and dissatisfaction, and limited activity and participation (Lukersmith, Radbron & Hopman, 2013, p. 378).

To achieve a successful prescription, the procurement process can involve the assessment of function, range of movement, user needs, environmental barriers or enablers, and roles and routines (Arledge et al., 2011, p. 4). The prescription process can be multidisciplinary including but not limited to occupational therapists, physiotherapists and rehabilitation engineers. Successful prescription depends on this thorough, and often multidisciplinary assessment through which outcomes are appropriately measured (Arledge et al., 2011, p. 12; EnableNSW & Lifetime Care & Support Authority, 2011, p. 22).

The use of outcome measures as part of any assessment process (e.g., in research studies, service improvement, clinical care or benchmarking activities) is essential to evaluate and demonstrate the effect of an intervention (Skinner & Turner-Stokes, 2006). Researchers and health professionals should use tools that meet their needs, are suitable for the target population, and are standardised to ensure reliability and validity data are

available—such data are essential for the correct interpretation of the results (Unsworth, 2000, p. 151). In addition, the use of commonly applied outcome measures facilitates the comparison of different studies and services. However, in the area of wheelchair prescription, it is unknown which measurement tools should be used by clinicians.

The aim of this review is to address this gap in knowledge and inform clinicians and health care providers of the outcomes measured and the outcome measures used following new wheelchair and seating prescription interventions.

Inclusion criteria

Types of participants

This review will consider studies that include participants of either gender, aged 18 years and over (or ≥75% aged 18 years and over), who are community living in private dwellings, group homes or residing in residential care. People with all health conditions will be included. This study will exclude prescriptions for short-term use; participants must be long-term users of a wheelchair. For the purpose of this review wheelchair use is defined as any use of a wheelchair regardless of number of hours used each day provided the wheelchair was provided on a permanent basis.

Types of intervention(s)/phenomena of interest

This review will consider studies that investigate outcomes following the prescription of a new manual or power wheelchair. Prescription of a seating system (postural supports in the form of backrest, seat base, cushion) together with a wheelchair or separately will also be included provided it is a new prescription prescribed on a long-term basis. Prescription of the wheelchair may have occurred in any setting (inpatient, outpatient, community) and via any service delivery model (single health professional, interdisciplinary team, vendor led).

Types of outcomes

This review will consider studies that include all outcome measures. Primary measures will be occupational performance, participation and quality of life. Secondary outcomes will include satisfaction (with both the device and service delivery) adverse events and improvements in physical, cognitive or psychosocial function. Other measure may include caregiver's perception, wheelchair skills, abandonment, pressure injuries, postural issues and cost.

Types of studies

This review will consider all study designs; randomised controlled trials, non-randomised controlled studies, before-and-after studies, interrupted time-series studies, observational studies (including cohort studies), case-control studies, case-series and qualitative studies.

Search strategy

The search strategy aims to find published studies.

A three-step search strategy will be used in this review.

1. An initial limited search of CINAHL and MEDLINE will be undertaken followed by analysis of the text words contained in the title and abstract and of the index terms used to describe article. The aim of this search will be to identify the most appropriate search terms to identify relevant literature.
2. A second search using all identified keywords and index terms will then be undertaken across Medline, CINHAL, EMBASE, PsycINFO and OT Seeker.
3. Thirdly, the reference list of all identified reports and articles will be searched for additional studies.
4. First author will search all citations and identify studies to be included in full text review. Second author to check 20% of citations.
5. First and second author will independently assess full text papers to determine eligibility against the inclusion criteria.

Studies published in English language will be considered for inclusion in this review.

The databases to be searched include:

Medline, CINHAL, EMBASE, PsycINFO and OT Seeker

Initial keywords to be used will be:

MeSH Search Terms

2. Wheelchair
3. Seating
4. Wheeled mobility (keyword)
5. Wheeled seating (keyword)
6. Assistive technology
7. Mobility device* (keyword)
8. Special Seating (keyword)
9. (#1 or #2 or #3 or #4 or #5 or #6 or #7)
10. Satisfaction (keyword)
11. User satisfaction (keyword)
12. Participation (keyword)
13. Patient participation
14. Social participation
15. Self efficacy
16. Independent living
17. Quality of life
18. Occupational performance (keyword)
19. Activities of Daily Living
20. (#9, or #10 or #11 or #12 or #13 or #15 or #16 or #17 or #18)
21. (#8 and #19)

Assessment of methodological quality

Quantitative papers selected for retrieval will be assessed by two independent reviewers for methodological validity prior to inclusion in the review using the PEDro scale (for randomised controlled trials) and the Newcastle–Ottawa Quality Assessment Scale (for non-randomised studies) (Wells et al., 2013); qualitative studies will be assessed using the Critical Appraisal Skills Programme (CASP) tool (CASP, 2014). Any disagreements that arise between the reviewers will be resolved through discussion, or with a third reviewer.

Data collection

Data extraction will be completed by the first author and the second author will check data for accuracy. Data will be collected from the eligible studies using a predetermined data collection form. The data extraction form will record information regarding study methodology, participant characteristics, intervention, types of outcomes and results.

Data synthesis

The findings will be presented in narrative form including tables and figures to aid in data interpretation where appropriate. It is anticipated that studies will be mostly descriptive in design and that meta-analysis will not be possible.

Conflicts of interest

At the beginning of the systematic review process the authors were required to declare any real or perceived conflict of interest. No conflicts of interest were declared.

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Nil

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Appendix B: Systematic Review Search Strategy

Search carried out in Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R) 1946 to 22.07.15

#	Searches	Results
1	wheelchairs.mp.	4185
2	(wheelchair* or wheel chair*).mp.	6426
3	mobility device*.mp.	204
4	powered indoor outdoor chair*.mp.	5
5	power* chair*.mp.	14
6	manual chair*.mp.	3
7	wheeled seat*.mp.	2
8	wheeled chair*.mp.	7
9	wheel* mobili*.mp.	183
10	EPIOC.mp.	13
11	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10	6539
12	patient participation.mp.	19954
13	consumer participation.mp.	14760
14	social partcipation.mp.	0
15	(self concept or self efficacy).mp.	68661
16	personal satisfaction.mp.	12558
17	occupational therapy.mp.	13339
18	"activities of daily living".mp.	60903
19	independent living.mp.	3108
20	"quality of life".mp.	219208
21	(participation or satisfaction or confidence or independence or independent or integration or interaction or self efficacy).mp.	1843975
22	(occupational therap* or daily living or daily life).mp.	85385
23	12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22	2106201
24	11 and 23	2042

Appendix C: Alfred Health Ethics Committee Certificate of Approval

TheAlfred

ETHICS COMMITTEE CERTIFICATE OF APPROVAL

This is to certify that

Project No: 127/15

Project Title: Evaluation of current wheelchair and seating prescription practices in a sub acute rehabilitation centre: are best practice and state funding guidelines being met?

Principal Researcher: A/Prof Natasha Lannin

was considered for Low Risk Review and ***APPROVED*** *on* **16/3/2015**

It is the Principal Researcher's responsibility to ensure that all researchers associated with this project are aware of the conditions of approval and which documents have been approved.

The Principal Researcher is required to notify the Secretary of the Ethics Committee, via amendment or report, of

- Any significant change to the project and the reason for that change, including an indication of ethical implications (if any);
- Serious adverse effects on participants and the action taken to address those effects;
- Any other unforeseen events or unexpected developments that merit notification;
- The inability of the Principal Researcher to continue in that role, or any other change in research personnel involved in the project;
- A delay of more than 12 months in the commencement of the project; and,
- Termination or closure of the project.

Additionally, the Principal Researcher is required to submit

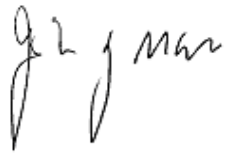
- A Final Report on completion of the project.

Approval covers the project as described in the application (including any modifications made prior to approval). Low Risk projects are subject to audit and ethical approval may be withdrawn if the project deviates from that proposed and approved.

SPECIAL CONDITIONS

None

SIGNED:



Professor John J. McNeil
Chair, Ethics Committee

Please quote project number and title in all correspondence

Appendix D: Southern Adelaide Clinical Human Research Ethics Committee Certificate of Approval

Southern Adelaide Clinical Human Research Ethics Committee

Government of South Australia
Southern Adelaide Health Service

Ethics application approval

15 June 2015

Dear Dr Laver

This is a formal correspondence from the Southern Adelaide Clinical Human Research Ethics Committee (SAC HREC EC00188). This committee operates in accordance with the "National Statement on Ethical Conduct in Human Research (2007)." No hard copy correspondence will be issued.

Application Number: 278.15 - HREC/15/SAC/235

Title: Evaluation of current wheelchair and seating prescription practices at Caulfield Hospital: are best practice and state funding guidelines being met?

Chief investigator: Dr Kate Laver

Public health sites approved:

The Issue: The Southern Adelaide Clinical Human Research Ethics Committee (SAC HREC) have reviewed and approved the above application. The approval extends to the following documents/changes:

- SA Health Low and Negligible Risk Application dated 09 June 2015
- The Alfred Ethics Committee Certificate of Approval
- Flinders University Indemnity email dated 01 June 2015
- Information Sheet/Consent form v1.0 dated 23 February 2015
- WHOQoL Survey
- Quebec – QUEST Questionnaire v2.0
- Telephone Interview Questions – Patient
- Data Collection Table
- Email to staff – invitation to participate
- Master Participant Information Sheet/Consent form – Healthcare Worker
- Staff Survey sheet
- Data Collection Table – Staff Survey

Approval Period: 15 June 2015 to 15 June 2018

Please read the terms and conditions of ethical approval below, as researchers have a significant responsibility to comply with reporting requirements and the other stated conditions.

For example, the implications of not providing annual reports and requesting an extension for research prior to approval expiring could lead to the suspension of the research, and has further serious consequences.

Please retain a copy of this approval for your records.

Flinders Medical Centre
The Flats G5 – Rooms 3 and 4
Flinders Drive, Bedford Park SA 5042
T: 08 8204 6453
F: 08 8204 4586
E:Research.ethics @health.sa.gov.au

TERMS AND CONDITIONS OF ETHICAL APPROVAL
Final ethical approval is granted subject to the researcher agreeing to meet the following terms and conditions.

As part of the Institution's responsibilities in monitoring research and complying with audit requirements, it is essential that researchers adhere to the conditions below.

Researchers have a significant responsibility to comply with the *National Statement 5.5.* in providing the SAC HREC with the required information and reporting as detailed below:

1. **The approval only covers the science and ethics component of the application**. A SSA will need to be submitted and authorised before this research project can commence at any of the approved sites identified in the application.
2. **It is the policy of the SAC HREC not to provide signed hardcopy or signed electronic approval letters**, as our office is moving to electronic documentation. The SAC HREC office provides an unsigned electronic PDF version of the study approval letter to the Chief Investigator/Study Manager via email. These email approvals are generated via the email address research.ethics@health.sa.gov.au which can be linked back to the SAC HREC.
3. **If University personnel are involved in this project**, the Principal Investigator should notify the University before commencing their research to ensure compliance with University requirements including any insurance and indemnification requirements.
4. **Compliance** with the *National Statement on Ethical Conduct in Human Research* (2007) & the *Australian Code for the Responsible Conduct of Research* (2007).
5. To **immediately report to SAC HREC** anything that may change the ethical or scientific integrity of the project.
6. **Report Significant Adverse events (SAE's)** as per SAE requirements available at our website.
7. **Submit an annual report on each anniversary of the date of final approval** and in the correct template from the SAC HREC website.
8. **Confidentiality** of research participants MUST be maintained at all times.
9. A copy of the **signed consent form** must be given to the participant unless the project is an audit.
10. Any **reports or publications derived from the research** should be submitted to the Committee at the completion of the project.
11. All requests for **access to medical records** at any SALHN site must be accompanied by this approval email.
12. To **regularly review the SAC HREC website** and comply with all submission requirements, as they change from time to time.
13. The researchers agree to use **electronic format** for all correspondence with this department.

Kind Regards

Anna Pantelidis
Administration Officer, SAC HREC

On behalf of
Professor David Gordon
Chair, SAC HREC

Appendix E: Staff Survey

1. Please select your age range

☐ 20-30yrs

☐ 31-40yrs

☐ 41-50yrs

☐ 51-60yrs

☐ 61yrs+

2. Please select your discipline?

☐ Physiotherapy

☐ Occupational therapy

☐ Physiotherapy Allied Health Assistant

☐ Occupational Therapy Allied Health Assistant

3. How many years experience do you have in your discipline identified in previous question?

☐ 1-3yrs

☐ 4-8yrs

☐ 9-12yrs

☐ 13-16yrs

☐ 16yrs+

4. How many years experience do you have in wheelchair prescription?

☐ Less than 1yr

☐ 2-4yrs

☐ 5-7yrs

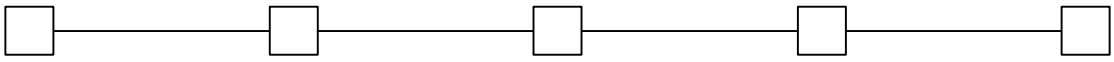
☐ 7yrs+

5. Have you attended any professional development/training in wheelchair and seating prescription?

If yes what?

6. I feel confident in wheelchair and seating prescription

Please indicate your response on the scale below.



Strongly Agree Neither Agree or Disagree Disagree Strongly

7. On average how much of your clinical time each week is spent on prescribing definitive wheelchairs for long-term use?

☐ None

☐ Less than 1 hour

☐ 1-2 hours

☐ 2-4 hours

☐ > 4 hours

8. What do you think are the strengths of our service?

9. If there was an opportunity to develop the wheelchair and seating prescription service what development/changes would you like to see happen?

10. Are there any guidelines/research articles/educational resources that you use to guide your practice in wheelchair and seating prescription? If yes please list.

Thank you for taking the time to complete this survey. Your responses will be kept private and confidential.

Appendix F: Staff Participant Information Form

AlfredHealth

Participant Information Sheet – Healthcare worker

Title	Evaluation of current wheelchair and seating prescription practices in a sub acute rehabilitation centre: are best practice and state funding guidelines being met?
Short Title	Evaluation of Wheelchair and Seating Prescription.
Protocol Number	127/15
Project Sponsor	Occupational Therapy Department, Caulfield
Coordinating Principal Investigator/ Principal Investigator	Belinda Robertson – Occupational Therapist
Associate Investigator(s)	Dr Natasha Lannin – Associate Professor in Occupational Therapy, Alfred Health Dr Kate Laver – Flinders University, South Australia
Study Location	Caulfield Hospital, Alfred Health

Part 1 What does my participation involve?

1 Introduction

You are invited to take part in this research project, titled; Evaluation of Wheelchair and Seating Prescription. You have been invited because as a staff member at Caulfield Hospital you may be involved with patients requiring a wheelchair and/or seating system prescription. Your contact details were obtained by the principle investigator from your manager at Caulfield Hospital, Alfred Health.

This Participant Information Sheet tells you about the research project. It explains the processes involved with taking part. Knowing what is involved will help you decide if you want to take part in the research.

Please read this information carefully. Ask questions about anything that you don't understand or want to know more about.

Participation in this research is voluntary. If you don't wish to take part, you don't have to.

If you decide you want to take part in the research project, please complete the survey by following the link in the email. By completing the survey you are telling us:
- Understand what you have read
- Consent to take part in the research project
- Consent to be involved in the research described
- Consent to the use of your personal and health information as described.

Please print or save a copy of this Participant Information Form to keep.

2 What is the purpose of this research?

The aim of this research is to determine if current wheelchair and seating prescription practices are meeting best practice and state funding guidelines, obtain consumers perspectives on the wheelchair and seating prescription process and outcomes and establish if there is a relationship between satisfaction with the wheelchair and seating prescription process and post-prescription quality of life, activity participation and meaningful occupational performance. We will collect important information from patients or family members, their medical records and staff involved in wheelchair prescription. Results of this project will assist us to understand current practice in wheelchair and seating prescription in the sub-acute setting and implement changes as required based on the results.

This project has been initiated by the investigator, Belinda Robertson, occupational therapist, Caulfield Hospital and will involve up to 30 adult patients who have had their wheelchair prescribed at Caulfield Hospital and approximately 35 healthcare workers involved in wheelchair and seating prescription.

The results of this research will also be used by one of the investigators, Ms Belinda Robertson, to obtain a Master of Clinical Rehabilitation by research degree.

3 What does participation in this research involve?

If you agree to participate in the project, the following will occur:

1) You will be asked to complete a survey using survey monkey. The survey will take no longer than 15mins. The link to this survey is in the email attached to this Participant Information Sheet. Please follow the link to complete the survey.

You will not be required to travel to participate in this study.

There are no costs associated with participating in this research project, nor will you be paid.

We appreciate the time and effort you will take to complete the survey.

4 Do I have to take part in this research project?

Participation in any research project is voluntary. If you do not wish to take part, you do not have to. If you decide to take part and later change your mind, you are free to withdraw from the project at any stage.

If you do decide to take part, please keep this Participant Information Form for your records.

Your decision whether to take part or not to take part, or to take part and then withdraw, will not affect your routine care, your relationship with professional staff or your relationship with Alfred Health.

5 What are the possible benefits of taking part?

There will be no clear benefit to you from your participation in this research. It is anticipated this study will benefit the wider community. The evaluation of the service will highlight the strengths and weaknesses of the service, assist in determining if the service is based on best practice guidelines and what the outcomes are. This evaluation will assist in ensuring the service meets the needs of the users and evidence-based practice is delivered.

6 What are the possible risks and disadvantages of taking part?

There are no known risks or disadvantages of taking part; risks are equivalent to those of usual service provision. This project will seek to identify the process staff are completing during wheelchair and seating prescription.

7 What if I withdraw from this research project?

If you do consent to participate, you may withdraw at any time. If you decide to withdraw from the project, please notify a member of the research team before you withdraw. A member of the research team will inform you if there are any special requirements linked to withdrawing. If you do withdraw, you will be asked to complete and sign a 'Withdrawal of Consent' form; this will be provided to you by the research team.

If you decide to leave the research project, the researchers will not collect additional personal information from you, although personal information already collected will be retained to ensure that the results of the research project can be measured properly and to comply with law. You should be aware that data collected up to the time you withdraw will form part of the research project results. If you do not want your data to be included, you must tell the researchers when you withdraw from the research project.

8 Could this research project be stopped unexpectedly?

Although unlikely, this research project may be stopped unexpectedly for a variety of reasons. These may include reasons such as low staffing numbers on the wards, which would make clinical care a priority over this quality assurance project.

9 What happens when the research project ends?

We expect that participants will receive a summary of the results of this research project after all components have been completed. We anticipate this to be the January 2016.

Part 2 How is the research project being conducted?

10 What will happen to information about me?

By completing the survey you consent to the research team collecting and using personal information about you for the research project. Any information obtained in connection with this research project that can identify you will remain confidential. Any information obtained in connection with this research project will be stored in a non-identifiable format. Only a small number of research staff can access the study data. The data is protected and maintained by Belinda Robertson, Occupational Therapist, Caulfield Hospital, Alfred Health.

Your information will only be used for the purpose of this research project and it will only be disclosed with your permission, except as required by law.
The personal information that the research team collect and use is information from the survey. By completing the survey you agree to the research team accessing this information.

It is anticipated that the results of this research project will be published and/or presented in a variety of forums. In any publication and/or presentation, information will be provided in such a way that you cannot be identified. Storage of research material will occur as per Alfred Health protocols.

In accordance with relevant Australian and/or Victorian privacy and other relevant laws, you have the right to request access to the information about you that is collected and stored by the research team. You also have the right to request that any information with which you disagree be corrected. Please inform the research team member named at the end of this document if you would like to access your information.

Any information obtained for the purpose of this research project that can identify you will be treated as confidential and securely stored. It will be disclosed only with your permission, or as required by law.

11 Complaints and compensation

If you suffer any distress as a result of this research project, you should contact the research team as soon as possible. You will be assisted with arranging appropriate treatment and support.

In the event of distress as a result of your participation in this research project, please contact the research staff – their details can be found on page 5 of this form. Hospital care and treatment will be provided by the public health care system (Medicare) at no cost to you if you are eligible for Medicare benefits and elect to be treated as a public patient.

12 Who is organising and funding the research?

This research project is being conducted and funded by the Occupational Therapy Department, Caulfield Hospital and led by Associate Professor Natasha Lannin (Occupational Therapist) along with the Grade 3 Occupational Therapist, Belinda Robertson.
No member of the research team will receive financial benefit from your involvement in this research project.

13 Who has reviewed the research project?

All research in Australia involving humans is reviewed by an independent group of people called a Human Research Ethics Committee (HREC).

The ethical aspects of this research project have been approved by the HREC of Alfred Health This project will be carried out according to the *National Statement on Ethical Conduct in Human Research (2007)*. This statement has been developed to protect the interests of people who agree to participate in human research studies.

14 Further information and who to contact

The person you may need to contact will depend on the nature of your query. If you want any further information concerning this project or if you have any problems, which may be related to your involvement in the project, you can contact the researcher on the details below.

Research contact person

Name	Belinda Robertson
Position	Occupational Therapist
Telephone	9076 6000 Pager 4621
Email	b.robertson@cgmc.org.au

If you have any complaints about any aspect of the project, the way it is being conducted or any questions about being a research participant in general, then you may contact Ms Emily Bingle (details below). You will need to tell Ms Bingle the following Alfred Health project number (insert number):

Complaints contact person

Name	Emily Bingle
Position	Ethics & Research Governance Office, Alfred Health
Telephone	9076 3619
Email	research@alfred.org.au

Appendix G: Semi-structured interview questions

1. In order to understand you a bit better, can you tell me how you spend your days?

2. As you know I am interested in finding out about the process of organising / being given / prescribed a wheelchair at Caulfield Hospital and understanding this a little more therefore can you tell me a bit about the process of organizing / being given / being prescribed your wheelchair at Caulfield Hospital?

3. What were the positive aspects of the service?

4. We know that our patients often have very valuable suggestions for ways that Caulfield Hospital could improve our services. And so we would like to ask you whether you have thought about anything that the hospital staff could have done better with organizing your wheelchair?

5. Now that you have your wheelchair, tell me about the things that work well? What does it allow you to do? [prompt/clarify: could you do these things before? Or is being able to do XXX a new thing for you?]

6. And what about the things that don't work so well?

If some questions remain unanswered

- *you earlier touched on…….can I go back to that and ask……*
- *There is just one or two final questions that I'd like to ask……*
- *Can I summarise what you have said…….. Is there anything else you would like to add on (a specific question)……..*

If the conversation is going off topic

- *I hear what you're saying in relation to……but is there anything that you can tell me about (for example) the organising of your wheelchair, did it meet your needs or is there something else the staff could have done differently?*
- *Can you tell me a little bit more about…….*
- *You mentioned…… I'm really interested to know more about this……*
- *Am I understanding you correctly that……..*
- *Can I clarify that what you mean…..*

Appendix H: QUEST 2.0

DO NOT COPY OR DISTRIBUTE

Quebec User Evaluation of Satisfaction with assistive Technology

QUEST (Version 2.0)

Technology device: _____

User name: _____

Date of assessment :_____

The purpose of the **QUEST** questionnaire is to evaluate how satisfied you are with your assistive device and the related services you experienced. The questionnaire consists of 12 satisfaction items.

- For each of the 12 items, rate your satisfaction with your assistive device and the related services you experienced by using the following scale of 1 to 5.

1	2	3	4	5
not satisfied at all	not very satisfied	more or less satisfied	quite satisfied	very satisfied

- Please circle or mark the **one number** that best describes your degree of satisfaction with each of the 12 items.
- D**o not** leave any question unanswered.
- For any item that you were not "very satisfied", please comment in the section ***comments***.

Thank you for completing the QUEST questionnaire.

1	2	3	4	5
not satisfied at all	not very satisfied	more or less satisfied	quite satisfied	very satisfied

ASSISTIVE DEVICE ***How satisfied are you with,***	
1. the **dimensions** (size, height, length, width) of your assistive device? *Comments*:	1 2 3 4 5
2. the **weight** of your assistive device? *Comments*:	1 2 3 4 5
3. the **ease in adjusting** (fixing, fastening) the parts of your assistive device? *Comments*:	1 2 3 4 5
4. how **safe and secure** your assistive device is? *Comments*:	1 2 3 4 5
5. the **durability** (endurance, resistance to wear) of your assistive device? *Comments*:	1 2 3 4 5
6. how **easy** it is to use your assistive device? *Comments*:	1 2 3 4 5
7. how **comfortable** your assistive device is? *Comments*:	1 2 3 4 5
8. how **effective** your assistive device is (the degree to which your device meets your needs)? *Comments*:	1 2 3 4 5

1	2	3	4	5
not satisfied at all	not very satisfied	more or less satisfied	quite satisfied	very satisfied

SERVICES ***How satisfied are you with,***	
9. the **service delivery** program (procedures, length of time) in which you obtained your assistive device? *Comments*:	1 2 3 4 5
10. the **repairs and servicing** (maintenance) provided for your assistive device? *Comments*:	1 2 3 4 5
11. the quality of the **professional services** (information, attention) you received for using your assistive device? *Comments*:	1 2 3 4 5
12. the **follow-up services** (continuing support services) received for your assistive device? *Comments*:	1 2 3 4 5

- Below is the list of the same 12 satisfaction items. PLEASE **SELECT THE THREE ITEMS** that you consider to be **the most important to you**. Please put an X in the **3 boxes** of your choice.

☐	1. Dimensions	☐	7. Comfort
☐	2. Weight	☐	8. Effectiveness
☐	3. Adjustments	☐	9. Service delivery
☐	4. Safety	☐	10. Repairs/servicing
☐	5. Durability	☐	11. Professional service
☐	6. Easy to use	☐	12. Follow-up services

QUEST
Scoring Sheet

This page is for scoring the answers to your questions.

DO NOT WRITE ON THIS PAGE.

- Number of non-valid responses _____ ☐

- **Device** subscale score _____ ☐

  For items 1 to 8, add the ratings of the valid responses and divide this sum by the number of valid items in this scale.

- **Services** subscale score _____ ☐

  For items 9 to 12, add the ratings of the valid responses and divide this sum by the number of valid items in this scale.

- Total QUEST score _____ ☐

  For items 1 to 12, add the ratings of the valid responses and divide this sum by the number of valid items.

- The 3 most important satisfaction items:

  _____

  _____

  _____

QUEST
(version 2.0)

1	2	3	4	5
not satisfied at all	not very satisfied	more or less satisfied	quite satisfied	very satisfied

WHOQOL-BREF

About You

Before you begin we would like to ask you to answer a few general questions about yourself by circling the correct answer or by filling in the space provided.

1. What is your gender — Male — Female

2. What is your date of birth? _____ / _____ / _____ (Day / Month / Year)

3. What is the highest education you received?
   - None at all
   - Elementary School
   - High School
   - College

4. What is your marital status?
   - Single
   - Married
   - Living as Married
   - Separated
   - Divorced
   - Widowed

5. Are you currently ill? — Yes — No

6. If something is wrong with your health, what do you think it is? _____ illness/problem

Instructions

This questionnaire asks how you feel about your quality of life, health, or other areas of your life. Please answer all the questions. If you are unsure about which response to give to a question, please choose the one that appears most appropriate. This can often be your first response.

Please keep in mind your standards, hopes, pleasures and concerns. We ask that you think about your life in the last two weeks. For example, thinking about the last two weeks, a question might ask:

For office use		*(Please circle the number)*				
		Not at all	A little	Moderately	Mostly	Completely
	Do you get the kind of support from others that you need?	1	2	3	4	5

You should circle the number that best fits how much support you got from others over the last two weeks. So you would circle the number 4 if you got a great deal of support from others. o

For office use		*(Please circle the number)*				
		Not at all	A little	Moderately	Mostly	Completely
	Do you get the kind of support from others that you need?	1	2	3	(4)	5

You would circle number 1 if you did not get any of the support that you needed from others in the last two weeks. o

For office use		*(Please circle the number)*				
		Not at all	A little	Moderately	Mostly	Completely
	Do you get the kind of support from others that you need?	(1)	2	3	4	5

Please read each question, assess your feelings, and circle the number on the scale that gives the best answer for you for each question.

For office use			*(Please circle the number)*				
			Very poor	Poor	Neither poor nor good	Good	Very Good
G1 / G1.1	1.	How would you rate your quality of life?	**1**	**2**	**3**	**4**	**5**

For office use			*(Please circle the number)*				
			Very dissatisfied	Dissatisfied	Neither satisfied nor dissatisfied	Satisfied	Very satisfied
G4 / G2.3	2.	How satisfied are you with your health?	**1**	**2**	**3**	**4**	**5**

The following questions ask about **how much** you have experienced certain things in the last two weeks.

For office use			*(Please circle the number)*				
			Not at all	A little	A moderate amount	Very much	An extreme amount
F1.4 / F1.2.5	3.	To what extent do you feel that physical pain prevents you from doing what you need to do?	**1**	**2**	**3**	**4**	**5**
F11.3 / F13.1.4	4.	How much do you need any medical treatment to function in your daily life?	**1**	**2**	**3**	**4**	**5**
F4.1 / F6.1.2	5.	How much do you enjoy life?	**1**	**2**	**3**	**4**	**5**

For office use			(Please circle the number)				
			Not at all	A little	A moderate amount	Very much	An extreme amount
F24.2 / F29.1.3	6.	To what extent do you feel your life to be meaningful?	1	2	3	4	5

For office use			(Please circle the number)				
			Not at all	Slightly	A Moderate amount	Very much	Extremely
F5.2 / F7.1.6	7.	How well are you able to concentrate?	1	2	3	4	5
F16.1 / F20.1.2	8.	How safe do you feel in your daily life?	1	2	3	4	5
F22.1 / F27.1.2	9.	How healthy is your physical environment?	1	2	3	4	5

The following questions ask about **how completely** you experience or were able to do certain things in the last two weeks.

For office use			(Please circle the number)				
			Not at all	A little	Moderately	Mostly	Completely
F2.1 / F2.1.1	10.	Do you have enough energy for everyday life?	1	2	3	4	5
F7.1 / F9.1.2	11.	Are you able to accept your bodily appearance?	1	2	3	4	5
F18.1 / F23.1.1	12.	Have you enough money to meet your needs?	1	2	3	4	5

For office use		(Please circle the number)				
		Not at all	A little	Moderately	Mostly	Completely
F20.1 / F25.1.1	13. How available to you is the information that you need in your day-to-day life?	1	2	3	4	5
F21.1 / F26.1.2	14. To what extent do you have the opportunity for leisure activities?	1	2	3	4	5

For office use		(Please circle the number)				
		Very poor	Poor	Neither poor nor well	Well	Very well
F9.1 / F11.1.1	15. How well are you able to get around?	1	2	3	4	5

The following questions ask you to say how **good** or **satisfied** you have felt about various aspects of your life over the last two weeks.

For office use		(Please circle the number)				
		Very dissatisfied	Dissatisfied	Neither satisfied nor dissatisfied	Satisfied	Very satisfied
F3.3 / F4.2.2	16. How satisfied are you with your sleep?	1	2	3	4	5
F10.3 / F12.2.3	17. How satisfied are you with your ability to perform your daily living activities?	1	2	3	4	5
F12.4 / F16.2.1	18. How satisfied are you with your capacity for work?	1	2	3	4	5

For office use		(Please circle the number)				
		Very dissatisfied	Dissatisfied	Neither satisfied nor dissatisfied	Satisfied	Very satisfied
F6.4 / F8.2.2	19. How satisfied are you with yourself?	1	2	3	4	5
F13.3 / F17.2.3	20. How satisfied are you with your personal relationships?	1	2	3	4	5
F15.3 / F3.2.1	21. How satisfied are you with your sex life?	1	2	3	4	5
F14.4 / F18.2.5	22. How satisfied are you with the support you get from your friends?	1	2	3	4	5
F17.3 / F21.2.2	23. How satisfied are you with the conditions of your living place?	1	2	3	4	5
F19.3 / F24.2.1	24. How satisfied are you with your access to health services?	1	2	3	4	5
F.23.3 / F28.2.2	25. How satisfied are you with your mode of transportation?	1	2	3	4	5

The follow question refers to **how often** you have felt or experienced certain things in the last two weeks.

For office use		*(Please circle the number)*				
		Never	Seldom	Quite often	Very often	Always
F8.1 / F10.1.2	26. How often do you have negative feelings, such as blue mood, despair, anxiety, depression?	**1**	**2**	**3**	**4**	**5**

Did someone help you to fill out this form? *(Please circle Yes or No)* Yes No

How long did it take to fill out this form? _____

THANK YOU FOR YOUR HELP

Appendix J: Retrospective notes audit data collection form

	Physical assessment									**Environmental Assessment**				**Outcome meausres and goal setting**		**Wheelchair selection / trials**						
Study ID	MAT Evaluation, Assessment of posture	Pressure Care	Mobility/ Transfers	Balance	Dimensions / seating measurements	Pain	Cognition	Vision	Communication / swallowing	Home assessment / Access visit details	Work/ voactional considerations	Recreation/ leisure considerations	Transport considerations	Standardised outcome measure	Goals documented	Wheelchair selection	Wheelchair trials	**Funding**	**Fitting / wheelchair set up**	**Training and delivery**	**Follow up**	**Repairs and maintenance**

Appendix K: Client Participant Information Form

AlfredHealth

Participant Information Form

Title	Evaluation of current wheelchair and seating prescription practices in a sub acute rehabilitation centre: are best practice and state funding guidelines being met?
Short Title	Evaluation of Wheelchair and Seating Prescription
Protocol Number	127/15
Project Sponsor	Occupational Therapy Department, Caulfield
Research Contact and Investigator	Belinda Robertson – Occupational Therapist
Co-Investigator(s)	Dr Natasha Lannin – Associate Professor in Occupational Therapy, Alfred Health Dr Kate Laver – Flinders University, South Australia
Study Location	Caulfield Hospital, Alfred Health

Part 1 What does my participation involve?

1 Introduction

You are invited to take part in this research project, 'Evaluation of Wheelchair and Seating Prescription' because you have recently had a wheelchair or seating system prescribed to you by a physiotherapist or occupational therapist at Caulfield Hospital. Your contact details were obtained from Caulfield Hospital Medical Records by the research team, who are employed there.

This Participant Information Sheet tells you about the research project. It explains the processes involved with taking part. Knowing what is involved will help you decide if you want to take part in the research.

Please read this information carefully. Ask questions about anything that you don't understand or want to know more about.

Participation in this research is voluntary. If you don't wish to take part, you don't have to.

If you decide you want to take part in the research project, please complete the enclosed surveys and return them using the stamped, self-addressed envelope. By completing and returning the surveys you are telling us that you:

- Understand what you have read
- Consent to take part in the research project
- Consent to be involved in the research described
- Consent to the use of your personal and health information as described.

Please retain this copy of the Participant Information Form for your records.

2 What is the purpose of this research project?

This project is part of the Occupational Therapy Department at Caulfield Hospital review of practices. The aim of this project is to determine if current wheelchair and seating prescription practices meet the needs of the person requiring the wheelchair. We also want to establish if those of you who have worked with our staff are satisfied with the wheelchair and the process of wheelchair prescription, and whether you can now manage more everyday activities because of your new wheelchair. We will collect important information from patients or family members, from the medical records held at Caulfield Hospital and from staff involved in wheelchair prescription. Results of this project will assist us to understand current practice in wheelchair and seating prescription in the hospital setting and make improvements to the service if required.

This project has been initiated by the Occupational Therapy Department at Caulfield Hospital and will involve up to 30 adult patients who have had their wheelchair prescribed at Caulfield Hospital plus approximately 35 healthcare workers involved in wheelchair and seating prescription.

The results of this research will also be used by one of the investigators, Ms Belinda Robertson, to obtain a Master of Clinical Rehabilitation by research degree.

3 What does participation in this research involve?

If you agree to participate in the project, the following will occur:

1) Enclosed with this Participant Information Form are two surveys. We ask that you complete these two surveys and return them via the enclosed stamped, self-addressed envelope. The completion of both surveys should take no longer than 20-30 minutes. If you have difficulty completing the surveys you can ask a family member or friend to help you.

2) Your medical records will be reviewed to gather information on the process that occurred during your wheelchair and/or seating prescription.

You will not be required to travel to participate in this study.

There are no costs associated with participating in this research project, nor will you be paid.

We appreciate the time and effort you will take to participate in this research study.

4 Do I have to take part in this research project?

Participation in any research project is voluntary. If you do not wish to take part, you do not have to. If you decide to take part and later change your mind, you are free to withdraw from the project at any stage.

If you do decide to take part, please keep this Participant Information Form for your records.

Your decision whether to take part or not to take part, or to take part and then withdraw, will not affect your routine care, your relationship with professional staff or your relationship with Alfred Health.

5 What are the possible benefits of taking part?
There will be no clear benefit to you from your participation in this research. It is anticipated this study will benefit future clients of the hospital. The evaluation of the service will highlight the strengths and weaknesses of the service and assist in determining if the service is effective.

6 What are the possible risks and disadvantages of taking part?
There are no known risks or disadvantages of taking part although it will take up a short amount of your time.

7 What if I withdraw from this research project?
If you do consent to participate, you may withdraw at any time. If you decide to withdraw from the project, please notify a member of the research team before you withdraw. A member of the research team will inform you if there are any special requirements linked to withdrawing. If you do withdraw, you will be asked to complete and sign a 'Withdrawal of Consent' form; this will be provided to you by the research team.

If you decide to leave the research project, the researchers will not collect additional personal information from you, although personal information already collected will be retained to ensure that the results of the research project can be measured properly and to comply with law. You should be aware that data collected up to the time you withdraw will form part of the research project results. If you do not want your data to be included, you must tell the researchers when you withdraw from the research project.

8 Could this research project be stopped unexpectedly?
Although unlikely, this research project may be stopped unexpectedly for a variety of reasons. These may include reasons such as low staffing numbers on the wards, which would make clinical care a priority over this quality assurance project.

9 What happens when the research project ends?
We expect that participants will receive a summary of the results of this research project after all components have been completed. We anticipate this to be the January 2016.

Part 2 How is the research project being conducted?

10 What will happen to information about me?
By completing the surveys and returning them you consent to the research team collecting and using personal information about you for the research project. Any information obtained in connection with this research project that can identify you will remain confidential. Any information obtained in connection with this research project will be stored without your name on it. Only a small number of research staff can access the study data; their names are written on the front of this Information Sheet. The data is protected and maintained by Belinda Robertson, Occupational Therapist, Caulfield Hospital, Alfred Health.

Your information will only be used for the purpose of this research project and it will only be disclosed with your permission, except as required by law.

The personal information that the research team collect and use is information from the surveys, and from your medical records. By completing the surveys and returning them you agree to the research team accessing this information.

It is anticipated that the results of this research project will be published and/or presented in a variety of forums. In any publication and/or presentation, information will be provided in such a way that your name will not be provided and you cannot be identified. Storage of research material will occur as per Alfred Health protocols.

In accordance with relevant Australian and/or Victorian privacy and other relevant laws, you have the right to request access to the information about you that is collected and stored by the research team. You also have the right to request that any information with which you disagree

be corrected. Please inform the research team member named at the end of this document if you would like to access your information.

Any information obtained for the purpose of this research project that can identify you will be treated as confidential and securely stored. It will be disclosed only with your permission, or as required by law.

11 Complaints and compensation

If you suffer any distress as a result of this research project, you should contact the research team as soon as possible. You will be assisted with arranging appropriate treatment and support.

In the event of distress as a result of your participation in this research project, please contact the research staff – their details can be found on page 5 of this form. Hospital care and treatment will be provided by the public health care system (Medicare) at no cost to you if you are eligible for Medicare benefits and elect to be treated as a public patient.

12 Who is organising and funding the research?

This research project is being conducted and funded by the Occupational Therapy Department, Caulfield Hospital and led by Associate Professor Natasha Lannin (Occupational Therapist) along with the Grade 3 Occupational Therapist, Belinda Robertson.
No member of the research team will receive financial benefit from your involvement in this research project.

13 Who has reviewed the research project?

All research in Australia involving humans is reviewed by an independent group of people called a Human Research Ethics Committee (HREC).
The ethical aspects of this research project have been approved by the HREC of Alfred Health
This project will be carried out according to the *National Statement on Ethical Conduct in Human Research (2007)*. This statement has been developed to protect the interests of people who agree to participate in human research studies.

14 Further information and who to contact

The person you may need to contact will depend on the nature of your query. If you want any further information concerning this project or if you have any problems, which may be related to your involvement in the project, you can contact the researcher on the details below.

Research contact person

Name	Belinda Robertson
Position	Occupational Therapist
Telephone	9076 6000 Pager 4621
Email	b.robertson@cgmc.org.au

If you have any complaints about any aspect of the project, the way it is being conducted or any questions about being a research participant in general, then you may contact Ms Emily Bingle (details below). You will need to tell Ms Bingle the following Alfred Health project number (insert number):

Complaints contact person

Name	Emily Bingle
Position	Ethics & Research Governance Office, Alfred Health
Telephone	9076 3619
Email	research@alfred.org.au

Form for Withdrawal of Participation - *Adult providing own consent*

Title	Evaluation of current wheelchair and seating prescription practices in a sub acute rehabilitation centre: are best practice and state funding guidelines being met?
Short Title	Evaluation of Wheelchair and Seating Prescription
Protocol Number	TBC
Project Sponsor	Occupational Therapy Department, Caulfield Hospital
Research Contact and Investigator	Belinda Robertson – Occupational Therapist
Co-Investigator(s)	Dr Natasha Lannin – Associate Professor in Occupational Therapy, Alfred Health Dr Kate Laver – Flinders University, South Australia
Study Location	Caulfield Hospital, Alfred Health

Declaration by Participant

I wish to withdraw from participation in the above research project and understand that such withdrawal will not affect my routine care, or my relationships with the researchers or Alfred Health.

Name of Participant (please print) _____

Signature _____ Date _____

In the event that the participant's decision to withdraw is communicated verbally, the Senior Researcher must provide a description of the circumstances below.

Declaration by Researcher[†]

I have given a verbal explanation of the implications of withdrawal from the research project and I believe that the participant has understood that explanation.

Name of Researcher (please print) _____

Signature _____ Date _____

[†] An appropriately qualified member of the research team must provide information concerning withdrawal from the research project.

Note: All parties signing the consent section must date their own signature.