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## A systematic review of the impact of powered mobility devices on older adults' activity engagement

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## **A systematic review of the impact of powered mobility devices on older adults' activity engagement.**

### **Abstract**

Purpose: To systematically review the impact powered mobility devices have on engagement in independent occupations for adults with acquired mobility limitations.

Method: Electronic search of CINAHL Plus, Medline, PsychInfo, OT Seeker, Joanna Briggs Institute and Physiotherapy Evidence Database. Search terms included combinations of words to encompass all terms most likely used for powered mobility.

Results: Eleven studies were eligible for inclusion. One study was a true experimental design; four studies were pre-experimental, and six were non-experimental. Studies indicated positive improvements to occupational engagement and independence while environmental barriers were identified as negatively impacting occupation and increasing risk of injury or accident.

Conclusions: Drawing conclusions from this research is problematic due to varying methodological quality. This review suggested two distinct themes: environmental barriers generate difficulties and challenges, which can subsequently result in accident or injury, and access to powered mobility impacts positively on areas of independence, quality of life, mobility and engagement.

Keywords: powered mobility device, occupational engagement, independence, adults, mobility limitations.

## **A systematic review of the impact of powered mobility devices on older adult activity engagement**

### **Introduction**

Freedom to participate without limitation of disability develops self-esteem and self-efficacy from engagement in meaningful and positive activities (Trombly Latham, 2008). Acquired mobility restriction may deprive people of the ability to participate in many activities of daily living, fulfilment of social desires and enablement of independence (Trombly Latham, 2008), however, use of powered mobility devices including powered wheelchairs and motorised scooters may result in empowerment and enablement. Scooters are designed for people with limited walking ability and substantial difficulty with body control, while powered wheelchairs are generally used by people with higher levels of limitation (Cooper, 1998). Scooters are power bases with a mounted seat and usually a tiller (e.g., handle bar) steering system (Cooper & Cooper, 2004), while powered wheelchairs are most commonly controlled by an arm rest mounted joystick. Use of the most appropriate mobility aid for the person and their environment can enhance their quality of life and may have the added benefit of enhancing the lives of other people such as the person's family, friends, and carers.

“Wheelchairs and mobility scooters not only remove physical and environmental barriers, but can assist with the user's activity and participation in many aspects of life.” (EnableNSW and Lifetime Care & Support Authority, 2011, p. 6).

Using a powered mobility device allows conservation of energy generally used for mobility such as walking and makes this energy accessible for use in activities of choice. In addition, the user of a powered mobility device has the ability to independently determine route, destination and time of travel (E. May, Garrett, & Ballantyne, 2010) to suit their needs.

The increasing population of aging people living with disability is reflected in the 2009 statistic where 6.5% of Australians over the age of 65 years reported arthritic or back conditions affecting mobility (Australian Bureau of Statistics, 2009) and one in five people requiring varying levels of assistance due to acquired or progressing disability, with the need for assistance significantly increasing after 70 years of age (Australian Bureau of Statistics, 2009). A recent report on mobility scooters (excluding powered wheelchairs) found that about half the users of these mobility devices were aged under 60 and that there were approximately 231 000 mobility scooter users Australia wide (Australian Competition and Consumer Commission, NRMA Motoring & Services, CHOICE, EnableNSW, & Flinders University, 2012). The increasing incidence of motorised mobility use brings with it a challenge as is reflected in a 2011 Monash University report “targeted at injuries related to motorised mobility devices (scooters) found that 62 Australians aged between 60 and 90 have died from collisions or falls since the year 2000, and hundreds more have been hospitalised as a result of falling or losing control of their motorised mobility device” (Mornington Peninsula Shire, 2012, p. 3). These statistics compel us to question why people with mobility restriction use motorised mobility devices; are users of motorised mobility devices aware of the potential dangers in using these devices or do people with restricted mobility perceive independence and increased mobility of greater value than the fear of possible injury resulting from the use of a motorised mobility device?

The objective of this systematic review was to analyse the impact of powered mobility device use, specifically powered wheelchairs and motorised scooters on independent engagement in activities for adults with acquired mobility limitations due to aging or progressive disability.

## **Methods**

### *Literature search*

A comprehensive systematic review and assessment of the literature was completed in accordance with the guidelines set by the Standard Quality Assessment Criteria for Evaluating Primary Research Papers (Kmet, Lee, & Cook, 2004). Full text articles published in English were identified through electronic searches of the databases CINAHL Plus, Medline, PsychInfo, OT Seeker, Joanna Briggs Institute and Physiotherapy Evidence Database. Each database was searched from their earliest record through to April 2012 (CINAHL Plus 1982 -2011, Medline 1966 – 2012, PsychInfo 1685-2011, Pedro 1929-2012, Joanna Briggs Institute 1998-2012, Physiotherapy Evidence Database 1929-2012). The main search term was motorised mobility and alternate terms which can define motorised mobility: motorised, electric, powered, mobility, scooter, wheelchair and device. Additional search terms were participation, enablement, engagement and occupation. Terms were combined in different sequences to generate combinations that encompass all terms which can be applied to motorised mobility and occupational performance. To improve search outcomes all terms were truncated to match specific databases. All reference lists were manually searched to identify any secondary sources which may be relevant to the objective of the systematic review.

A priori criteria for inclusion were created. Articles were included if they investigated the use of a motorised mobility device (powered wheelchair, motorised scooter), included adults, and the use of a powered mobility device as a prerequisite due to acquired mobility limitation. Articles which included individuals with both acquired and congenital conditions resulting in mobility limitations were included. Titles and abstracts of all searched articles were reviewed according to criteria. Full texts were reviewed when insufficient detail was available from titles and abstracts. Full text versions of articles were retrieved upon acceptance after completed screening of title and abstracts. Due to the scarcity of research within the area both

quantitative and qualitative papers were included. The outcomes of interest were independent engagement in occupations and increased mobility or participation in preferred occupations.

### *Exclusion criteria*

Articles focusing solely on individuals with congenital conditions or children were excluded. Studies researching other forms of mobility devices such as manual wheelchairs and walking aids, which are not motorised, were excluded from this review. Studies that lacked methodological substantiveness were also excluded.

[Insert Figure One here]

### *Assessment of methodological quality*

Four assessors reviewed the 15 selected articles; judgements were made on suitability for rejection or acceptance into the systematic review. Four articles were rejected for methodological flaws or irrelevant content, resulting in eleven articles being accepted into the systematic review. The methodological qualities of the accepted articles were assessed using the Standard Quality Assessment Criteria for Evaluating Primary Research Papers (SQAC) guidelines (Kmet et al., 2004) and the McMasters Guidelines for Critical Review Standards (Law et al., 1998; Letts et al., 2007). The SQAC were used to assess quality; data were extracted into a table before a design level was assigned using the McMasters guidelines for critical review standards. The SQAC were independently attained by two reviewers to determine the strengths and weakness of the studies and any discrepancies in opinion were resolved through discussion (Kmet et al., 2004).

### *Data extraction*

Using the SQAC (Kmet et al., 2004) checklists and further analyses of each article, a descriptive data analysis table was created (Table 1). Data extracted included study design,

subject description, intervention, outcome measure, results and methodological quality. The McMaster Qualitative (Letts et al., 2007) and Quantitative (Law et al., 1998) Guidelines for the Critical Review standards were used to establish a research design level (ranging from 1-5) for each article.

## Results

Electronic searches of databases using EBSCO host with CINAHL plus, Medline, and PsychInfo retrieved 104 results. OT Seeker established 790 articles, by using a less precise keyword matching search option (fuzzy logic). Joanna Briggs Institute and Pedro located zero results and a less precise keyword matching search option was unavailable. In total 894 articles were retrieved. Assessment of the titles of the retrieved articles resulted in 840 rejections for failure to meet the inclusion criteria. Assessment of the remaining 54 abstracts identified 8 articles which met the criteria. Reasons for exclusion were duplicates, non motorised mobility; population sample was children, and congenital mobility limitations. Reference searches of similar systematic reviews and included research resulted in a further 7 articles matching the inclusion criteria resulting in 15 full text articles for potential inclusion in the review. Four assessors reviewed the 15 articles in accordance with the inclusion criteria, accepting 11 articles (Figure 1).

### *Description of included studies*

There was a significant variation in design and outcome measure of articles (Table 1). Publication dates ranged from 1994 to 2012. The intervention in all studies was either a powered wheelchair, motorised scooter or both. One randomised control trial (Hoenig, Giacobbi, & Levy, 2007), four pre and post-test research design (Buning, Angelo, & Schmeler, 2001; Davies, Souza, & Frank, 2003; M. May & Rugg, 2010; Pettersson, Törnquist, & Ahlström, 2006) and six non-experimental design research reports were

included. Two non-experimental design studies utilised surveys (Edwards & McCluskey, 2010; E. May et al., 2010) and four utilised structured interviews (Brandt, Iwarsson, & Stahle, 2004; Evans, 2000; Lofqvist, Pettersson, Iwarsson, & Brant, 2012; Miles-Tapping & MacDonald, 1994).

### *Quality assessment of studies*

The methodological quality of the studies and research design level varied considerably (Table 1). Two articles had very strong methodological quality, but with different design levels (Hoenig, Pieper, Branch, & Cohen, 2007; Lofqvist et al., 2012). Nine articles scored evidence levels of either 4 or 5, with various methodological quality scores between low and strong. Methodological quality was assessed according to the description of sample characteristics, sample sizes, sample heterogeneity, connections to theoretical framework, verification of results, controlling for confounding variables and estimate of variance (Hoenig, Giacobbi, et al., 2007). Current research incorporated short follow up times for pre and post-test designs with the longest follow up identified in this review having a four month and one year re-evaluation (Lofqvist et al., 2012).

### *Outcome measures*

Different outcome measures were used in each study, and five studies conducted research without an outcome measure. Two outcome measure groups were identified; one measuring occupational performance and another assessing changes to quality of life. Three studies measured change in individual's occupational performance. The Individually Prioritised Problem Assessment (IPPA) and the World Health Organization Disability Assessment Schedule II (WHODAS II) was used to understand the effectiveness of assistive technology and activity limitations and participation restrictions (Pettersson et al., 2006). The Six Minute Walk Distance Assessment and a self-reporting questionnaire on mobility gauged



whether mobility devices maintain and/or improve walking capacities of individuals with arthritis of the knee (Hoenig, Pieper, et al., 2007). The context specific Nordic Mobility-related Participation Outcome Evaluation of assistive device intervention (NOMO 1.0) measured the outcomes associated with powered mobility device use (Lofqvist et al., 2012).

Other researchers investigated the impact of powered mobility devices on the individual's quality of life. The European Quality of Life Measure (EQ-5D) and the Visual Analogue Scale (VAS) gauged changes in the quality of life for people with severe disabilities using a powered mobility device (Davies et al., 2003). The Occupational Performance History Interview (OPHI) and the Psychosocial Impact of Assistive Device Scale (PIADS) were used in a pre- and post-test design to investigate the impact of powered mobility devices on users' lives, roles and quality of life (Buning et al., 2001). The Canadian Occupational Performance Measure (COPM) was the outcome measure to assess changes to quality of life and occupational performance (M. May & Rugg, 2010).

### *Engagement in occupations*

Five studies directly reported on the occupational performance of the power mobility device user: all articles reported a positive association or an increase in ability to engage in occupations. Use of a powered mobility device resulted in a statistically significant improvement (Wilcoxon Signed Rank Test  $p < 0.01$ ) in function and activity engagement in relation to occupational performance (M. May & Rugg, 2010). These results support Evans' (2000) study which indicated that participants value the greater control over their occupations with an enhanced opportunity to experience life gained through powered mobility use.

Another salient finding identified the ongoing involvement in new activities (Pettersson et al., 2006) with participants reporting engagement in 16 new activities at 4 to 5 month follow up. This high level of engagement confirmed research indicating participants perform new

activities following the provision of a powered mobility device (Davies et al., 2003).

Improvements in occupational performance were attributed to independence and the ability to engage in valued interests, roles and responsibilities by using the powered mobility device (Buning et al., 2001).

Independence is directly related to occupational engagement and enablement (American Occupational Therapy Association, 2008). The use of a powered mobility device was reported as having a positive impact on independence in four articles (Edwards & McCluskey, 2010; Evans, 2000; Lofqvist et al., 2012; E. May et al., 2010). Additionally, independence was indicated as an outcome of powered mobility use which resulted in increases in autonomy and self-sufficiency for participants (Buning et al., 2001). In contrast, Davies et al. (2003) identified no significant increase in participant's independence and social life. The short follow up time skewed these results as changes in independence and social life may require additional time to establish.

Closely linked to independence is the concept of role performance and expansion. May and Rugg (2010) found that powered mobility devices enabled people to engage in past roles while Evans (2000) suggested that powered mobility devices expand individual's roles, providing a new sense of purpose.

Environmental barriers limiting use of powered mobility devices prohibiting engagement in many community activities and desired occupations were frequently reported in the findings. The barriers commonly identified were narrow and uneven footpaths, lack of footpaths, stairs, kerbs, narrow doorways and aisles (Brandt et al., 2004; Edwards & McCluskey, 2010; Hoenig, Pieper, et al., 2007; E. May et al., 2010; M. May & Rugg, 2010; Pettersson et al., 2006). These barriers were also associated with accidents and injury for the powered mobility user (Edwards & McCluskey, 2010; Hoenig, Pieper, et al., 2007). Nine accidents were

reported in the study by Heonig et al. (2007) and Edwards and McCluskey (2010) demonstrate that in 2009 one in five users had been involved in an accident. Accidents included driving into doors/ walls/ objects, tipping over, incorrectly loading device onto car lift for transportation and colliding with motor vehicles, however this did not deter them from continuing to use the motorised mobility device.

The powered mobility device was consistently reported as facilitating engagement in activities which can be categorised under the broad domains of interpersonal interactions and relationships and community, social and civic life according to the International Classification of Functioning, Disability and Health (World Health Organization, 2003). The activities reported in the research included shopping, going for a ride, visiting family and friends, attending appointments and church (Brandt et al., 2004; Edwards & McCluskey, 2010; Hoenig, Pieper, et al., 2007; Lofqvist et al., 2012; M. May & Rugg, 2010).

Many results suggested that powered mobility devices can have a positive impact on well-being with ensuing improvements to self-confidence, self-esteem, freedom and quality of life. The implication that improvements in functioning effect changes in other domains of life is not necessarily linked to occupational engagement (Brandt et al., 2004; Buning et al., 2001; Edwards & McCluskey, 2010; Hoenig, Giacobbi, et al., 2007; Hoenig, Pieper, et al., 2007; E. May et al., 2010; M. May & Rugg, 2010; Pettersson et al., 2006; Trombly Latham, 2008).

## **Discussion**

The aim of this review was to determine whether there was evidence that powered mobility devices impact on an individual's participation and performance in occupations. The available research indicates that powered mobility devices are associated with increases in independence, quality of life, and mobility which lead to engagement in valued past and new occupations. The positive impact associated with powered mobility device use is consistently

reflected in the studies in the behaviour of the user as seen by the engagement and expansion of new roles and activities. Power mobility devices provide greater opportunity for individuals to experience life while maintaining independence and dignity. Difficulty with negotiating environmental barriers and risk of accidents were some of the negative aspects of using a powered mobility device that were highlighted. The literature suggests that the positive aspects of use outweighed the negative aspects. This was demonstrated by users confidently continuing to use the device when faced with challenges associated with powered mobility device use. This validates the importance of powered mobility devices, stressing their positive impact in improving users' mobility, confidence and quality of life.

The outcome measures used measured changes in occupational performance and/or quality of life. The relevance of certain measures can be debated due to their inherent context specific nature such as the NOMO 1.0 (Lofqvist et al., 2012) which limits the ability to transfer and interpret the results confidently. The outcome measures were consistent in reporting on the two outcomes: occupational performance and quality of life, which are most relevant to health professionals and users of powered mobility.

The concept of occupational engagement was not often directly measured within the research. Engagement is generally precipitated by core foundations skills such as mobility, leading to independence and enabling engagement (Trombly Latham, 2008), however definitions of engagement and understanding the precursor to engagement are subjective concepts and may differ substantially. Understanding the diverse way in which powered mobility impacts upon the individual and their occupational engagement was none the less a key concept in these studies.

## **Limitations**

The review conclusions must be interpreted with caution, considering the limitations of the research. The varying methodological quality of the research impacts the validity of the conclusions with limited high quality evidence to support the impact and use of powered mobility devices. Practical and ethical restraints prevent researchers employing techniques enhancing the strength of the research; for example blinding of participants and researcher to the intervention is not possible. Randomisation, use of comparative control groups and homogenous sampling is not ethical or possible in this population group (Hoenig, Giacobbi, et al., 2007).

The studies differ in focus, sample characteristics and outcome measures which impacts the ability to derive definitive conclusions for this review. The varying terms used throughout different countries and studies for powered wheelchairs and motorised scooters could potentially impact the search results. The research team attempted to conceptualise, include and cover all possible terms for powered mobility, but given the diverse terminology it is possible that relevant research may have gone unnoticed. Furthermore conference proceedings and grey literature were excluded and the material was limited to English language papers, potentially overlooking some research.

### **Future research**

Research attempting to control potential biases and improve quality will be of value for improving outcomes within this population. Long term follow up research studies would be beneficial in providing information regarding the long term consequences of powered mobility devices. Future research within this field should focus on utilising reliable and valid outcome measures to improve comparability of research outcomes and provide consistency in research. The use of surveys and/or structured interviews for individual research leads to a potential bias; improvements should be made in regards to standardising surveys and

interviews or employing other measures which withstand psychometric testing. Future research should aim at enhancing the evidence-based knowledge surrounding powered mobility to improve outcomes for the individual user.

### **Clinical implications**

Researching the way new technology facilitates mobility and community engagement will provide an evidence based understanding of the associated impact. This understanding is significant in enabling the health outcomes, independence and engagement for individuals with mobility limitations. Conducting evidence based practice directly facilitates health outcomes for individuals; the findings of this systematic review demonstrate that there is a need for improved quality of research by the health industry professionals. The available evidence is still applicable in the field of powered mobility, despite demonstrating low level methodological quality, as much of the research incorporates the user's perspective and opinion. Providing health professionals and the public with information on the experience and issues encountered as a powered mobility user, facilitates better knowledge and choices by professionals and consumers.

### **Declaration of interest**

The authors report no declaration of interest.

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