

Role of Wheelchairs and Wheelchairs Assessments: A review

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Abstract

Wheelchairs are enablers of community participation and are used to enhance function, to improve independence, and to enable a person to successfully live at home and in the community. It is estimated that 70 million people require wheelchairs worldwide (World Health Organization [WHO], 2017) [1]. The most current available data on persons who use wheelchairs comes from the 2008 National Survey of Income and Program Participation, which indicated that there were about 56.7 million people with disabilities (number increased by 2.2 million since 2005) and 3.6 million wheelchair/scooter users in the United States (USA) in 2010 [2]. Despite the vital role of wheelchairs, the substantial number of wheelchair users and the increasing demand on providers to meet their needs, there is currently a lack of comprehensive outcome measures that focus on everyday functioning with a wheelchair. Therefore, appropriate outcome measurements are needed.

1. **Keywords:** Assessment; Assistive technology; Function; Outcome measure; Wheelchair; Wheelchair user

2. Introduction

Assistive Technology (AT) devices enable people with disabilities to function in multiple contexts and activities [3] and are used by people with disabilities to facilitate return to as many pre-injury activities as possible [4]. Although clinically, a significant increase in improvement associated with AT use exists, a lack of evidence remains on the quantitative benefit and efficacy of AT devices and service delivery [5]. The wheelchair is viewed as one of the most important AT devices used in rehabilitation for individuals who cannot ambulate or have difficulty with ambulation [6]. More recently, Wee and Lysaght (2009)[7] reported wheelchairs as one of the most influential factors that affect activity in persons with a mobility impairment. Wheelchairs, both manual and power, are enablers of community participation and are used to enhance function, to improve independence, and to enable a person to successfully live at home and in the community (**Figure 1**). In contrast, a wheelchair could be a limiting factor and restrict participation. Wheelchairs may create problems such as limiting destinations and creating increased dependence on others and can be perceived as negatively impacting a person's life if they do not enable persons to participate fully in social and community activities [4,8]. Additionally, powered mobility, for example, can have a

great impact on the lives of persons with mobility impairments. Some previous studies reported that such persons feel empowered, become more productive, enjoy more leisure, and enhance their functional performance in other areas such as self-care. However, other studies showed that powered wheelchair use may restrict accessibility (e.g., maneuverability in the home) and may have some limitations and implications for the safety of the user and of other people and objects in the environment. Therefore, and due to the high cost of powered wheelchairs, a comprehensive evaluation usually takes place of the physical and cognitive-perceptual abilities necessary for use of such a chair before one is prescribed for an individual. Factors including level of intellectual functioning, physical limitations, visual problems and seizure control are all reviewed [9]. Wheelchair evaluation is a continuous process requiring re-assessment of wheelchair fit as users age and their functional conditions change [10]. To make the best possible fit between the wheelchair and the clients' needs and goals, an expert clinician needs to take various factors into consideration. These factors include: (1) the client's profile (such as physical status), (2) the physical and socio-cultural environments, and (3) the daily activities and social roles that the client performs, and (4) wheelchair characteristics (such as type and design of wheelchair)[11](Figure 2).

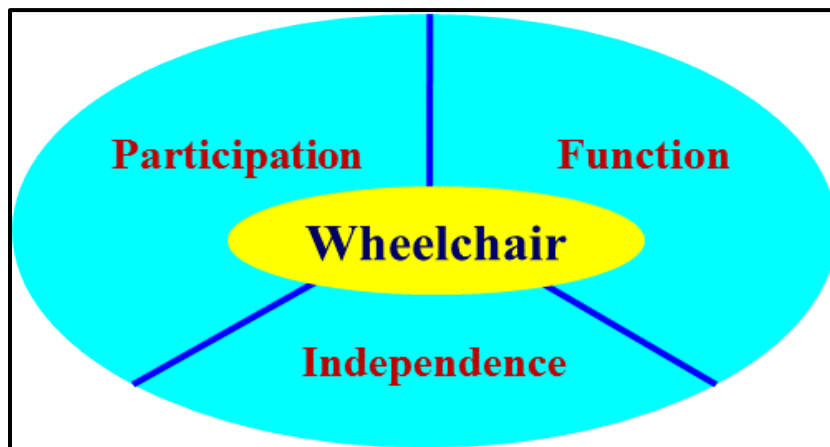


Figure 1: Effect of a wheelchair.



Figure 2: Factors included in the wheelchair evaluation process.

Wheelchair assessments can be done using subjective (self/proxy report) or objective (performance-based observation) methods. Although there are many outcome measures of global function in the rehabilitation field such as the Functional Independence Measure (FIM) [12,13] and the Barthel Index (BI)[14,15], few outcome measures, specifically consider the functional abilities of wheelchair users [16,17]. In this study, we hypothesized that despite

the important role of wheelchairs in the lives of wheelchair users that allow them to better perform their activities of daily living, there is currently a lack of comprehensive outcome measures that focus on everyday functioning with a wheelchair, hence, appropriate outcome measures are needed.

3. Methods

The following electronic databases were searched to identify literature relevant to this study: PubMed, Ovid (MEDLINE, PsychINFO, and Global Health), and Cumulative Index of Nursing and Allied Health Literature (CINAHL). Search terms (keywords) used were wheelchair combined with functional assessment, function, assistive technology, outcome, skill, performance, self-report, clinic, and home. One hundred eight potential relevant research studies were identified and screened for the literature review (**Figure 3**). Research studies were selected and included in the literature review if they were written in the English language and published between 1972 and 2013 in peer-reviewed journals. Based on these criteria, 81 studies out of the 108 were identified and reviewed and 27 studies were excluded. Furthermore, studies were screened again for more detailed evaluation and were included if they involved functional assessments, comparisons between subjective (self/proxy report) or objective (performance-based observation) methods and clinic and home assessments. Studies were excluded if they included one measurement method only and did not compare between different methods (e.g., studies which used self-reports only or assessments at home only were excluded), or because the dependent variables were not well defined in terms of functional capacity or performance based on the International Classification of Functioning, Disability and Health (ICF) (World Health Organization [WHO], 2001)[18]. Additionally, when the literature review on assessment of functioning with a wheelchair was conducted, studies related only to skills, not functioning in a wheelchair, were excluded. This yielded a total of 41 studies that were included in the literature review and 40 studies were excluded.

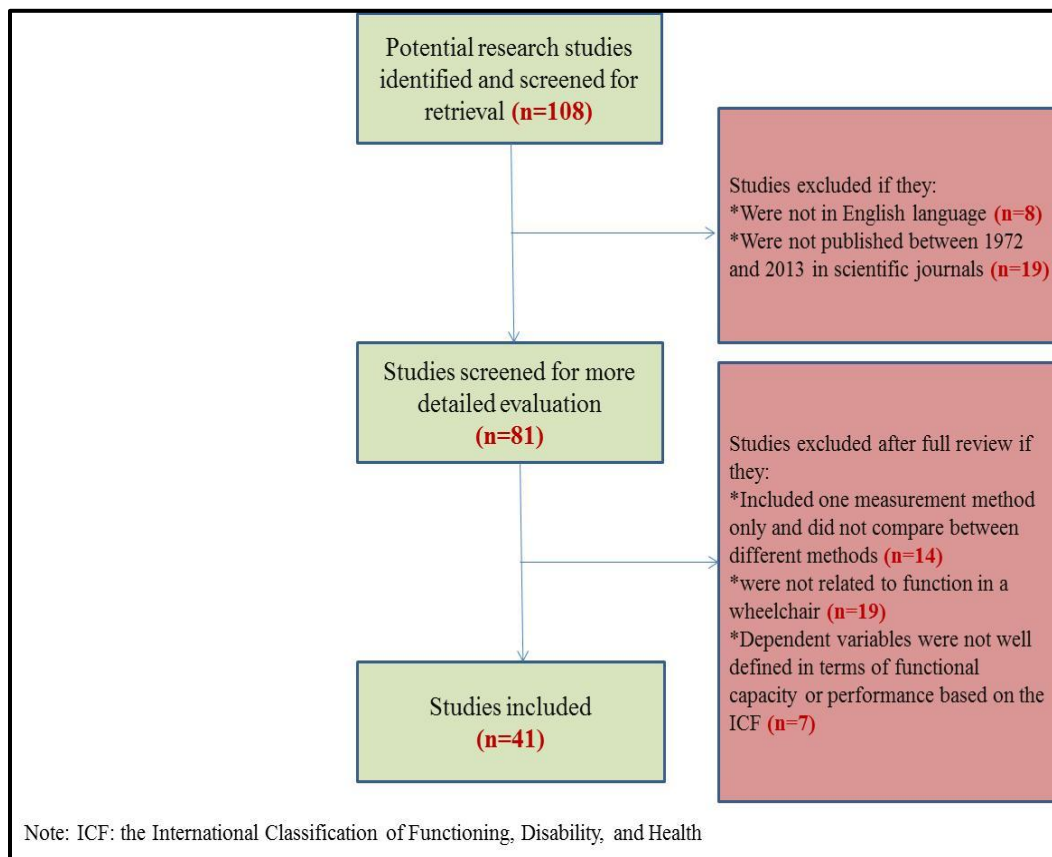


Figure 3: Flow diagram of the literature review.

4. Results

Wheelchair assessments can be done using subjective (self/proxy report) or objective (performance-based observation) methods. Subjective methods are the quickest methods of measurement, but they are highly vulnerable to subjective bias (over and/or underestimation of performance) and may be influenced by cognitive status and the perceived abilities of the reporters [19]. Objective performance methods have the potential advantage of minimizing subjective aspects associated with self/proxy reports by allowing clinicians to directly observe function across a range of basic to complex tasks in different settings (clinic or community setting). However, objective performance methods may be limited by: (a) their dependence on the client's motivation to perform, (b) the frequency of performance (administration at only one single time versus multiple times), and (c) the time, space, and equipment needed [20]. Both subjective and objective methods are useful and are complementary. Decisions on which of these assessment methods to use are based on the purpose of the evaluation and, clinically, a combination of methods is typically used [21]. Furthermore, wheelchair assessments can be categorized into three different settings: real (daily environments; home, workplace), controlled (clinical setting and obstacle course), or virtual environments (computerized driving simulators) [22]. Prior research on persons with disabilities and wheelchair users has documented that these different settings could be more or less realistic and could be more or less facilitative/challenging. They may lead to either better or worse performance depending on factors such as the nature and the requirements of the tasks being assessed, the nature of the impairments, the environment's characteristics, and the purpose of the assessment. For example, previous studies showed that when assessing Basic Activities of Daily Living (BADL) and Instrumental ADL (IADL), the familiarity of the home may facilitate overall functional performance. Nonetheless, the standardization of clinical settings may help clients to better perform some tasks. For example, those requiring better lighting and clutter-free spaces rather than environment familiarity to successfully perform the task [22,23]. As another example, simulated environments used for training purposes, when compared to the real (e.g., home) or the controlled (e.g., clinic) environment, represent a potentially useful means of assessing and training novice powered wheelchair users. Hence, they may prove more motivating, less challenging, and safer, and would reduce the danger of collisions during the training phase because the client would not actually be moving[9].

Little work has been done to assess the effects of wheelchair interventions on clients. Research has focused on a narrow range of activities and has ignored the role of wheelchairs for enabling activities and participation [18,19,24,25]. Most literature on wheelchairs is focused around issues of design, client preferences, use, disuse, abandonment, cost, and policy [26]. What needs further investigation is how wheelchairs prescribed for mobility impairments affect overall participation. Although some studies explored mobility characteristics and activity levels of wheelchair users, more research is needed to further assess the relationship between wheelchair mobility and demographics, type of wheelchair, and participation [11]. There is also a need for outcomes research in service provision and activities that support the wheelchairs service provision system. Therefore, the user's assessment of daily participation as well as wheelchair provision services need to be considered to identify gaps in activity involvement by wheelchair users. For example, older adults commonly use wheelchairs for mobility impairments regardless of their living situations. However, limited outcomes data are available to determine the quality of the wheelchairs that older Americans are receiving, as well as their satisfaction with wheelchair service delivery programs. Level of satisfaction has been identified as an additional outcome measure for evaluating wheelchair prescriptions and service delivery programs [10].

5. Discussion

Our hypothesis that despite the important role of wheelchairs in the lives of wheelchair users that allow them to better perform their activities of daily living, there is currently a lack of comprehensive outcome measures that focus on everyday functioning with a wheelchair, hence, appropriate outcome measures are needed was confirmed. Few outcome measures, specifically consider the functional abilities of wheelchair users [16,17]. The Wheelchair Physical Functional Performance (WC-PFP) is a valid and reliable performance-based tool used to measure the manual wheelchair users' physical function and the ability and the time required to perform important tasks for independent living. The WC-PFP includes 11 tasks in the domains of upper body strength, upper body flexibility, balance-coordination, and endurance (e.g., lift and transfer pan of weight, put on and remove a jacket, carry groceries 70 meters, transfer to a standard chair). However, the WC-PFP assesses these tasks based on time required

for task completion, distance travelled, and the amount of weight carried, not independence, safety or quality of performance [6]. The Wheelchair Skills Test (WST) is another valid and reliable tool that evaluates manual wheelchair skills and provides useful information about the ability of wheelchair users to perform skills relevant to their daily lives successfully and safely. The most recent version (4.1) has 32 individual skills and includes tasks, such as rolling, turning, reaching a high object, ascending and descending curbs, and ascending and descending stairs. The WST also rates safety, but not levels of independence or quality. A questionnaire version (WST-Q) is also available [20,27]. The Wheelchair Users Functional Assessment (WUFA) is another example of a valid and reliable tool that measures the wheelchair skills needed for independent living in the home and community. The WUFA consists of 13 performance-based items that measure level of independence in different skills such as, door management, street crossing, bed/toilet/floor transfer, reaching, and upper and lower body dressing [28]. The WUFA independence score is unique in that it includes a timing criterion for each task. However, the WUFA does not address safety and quality.

6. Conclusion

As one of the most representative AT devices, the wheelchairs play an important role in the lives of wheelchair users and allow them to better perform their activities of daily living. There is currently a lack of comprehensive outcome measures that focus on everyday functioning with a wheelchair. The WC-PFP, WST, and WUFA are valid and reliable performance measures used to assess client's skills or function while using a manual wheelchair[6,20,27,28]. None of these measures address the quality of functional performance or provide individual scores for independence and safety for both manual and power wheelchair users. Furthermore, these measures do not fully represent all the important tasks wheelchair users identified as important to perform in a seating-mobility device such as comfort needs, reach for multiple levels, transfers to/from multiple levels, and transportation [16,17,29]. Therefore, and given the substantial number of individuals in need of wheelchairs and the increasing demand on providers to meet client needs, there is a need for more comprehensive outcome measures.

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References

1. World Health Organization. Disability and Rehabilitation. Retrieved September 20, 2017.
2. Brault MW (2012) Americans with Disabilities: 2010.
3. Arthanat S1, Nochajski SM, Lenker JA, Bauer SM, Wu YW (2009) Measuring usability of assistive technology from a multicontextual perspective: The case of power wheelchairs. *American Journal of Occupational Therapy* 63: 751-764.
4. Chaves ES1, Boninger ML, Cooper R, Fitzgerald SG, Gray DB (2004) Assessing the influence of wheelchair technology on perception of participation in spinal cord injury. *Archives of Physical Medicine and Rehabilitation* 85: 1854-1858.
5. Mills TL, Holm MB, Schmeler M (2007) Test-retest reliability and cross validation of the Functioning Everyday with a Wheelchair instrument. *Assistive Technology* 19: 61-77.
6. Cress ME, Kinne S, Patrick DL, Maher E (2002) Physical functional performance in persons using a manual wheelchair. *Journal of Orthopedic and Sports Physical Therapy* 32: 104-113.
7. Wee J, Lysaght R (2009) Factors affecting measures of activities and participation in persons with mobility impairment. *Disability and Rehabilitation* 31: 1633-1642.
8. Barker DJ, Reid D, Cott C (2006) The experience of senior stroke survivors: Factors in community participation among wheelchair users. *Canadian Journal of Occupational Therapy* 73: 18-25.
9. Harrison A, Derwent G, Enticknap A, Rose FD, Attree EA (2002) The role of virtual reality technology in the assessment and training of inexperienced powered wheelchair users. *Disability & Rehabilitation* 24: 599-606.
10. Karmarkar AM, Collins DM, Kelleher A, Cooper RA (2009) Satisfaction related to wheelchair use in older adults in both nursing homes and community dwelling. *Disability and Rehabilitation: Assistive Technology* 4: 337-343.

11. Oyster ML, Karmarkar AM, Patrick M, Read MS, Nicolini L, et al. (2011) Investigation of factors associated with manual wheelchair mobility in persons with spinal cord injury. Archives of Physical Medicine and Rehabilitation 92: 484-490.
12. Hamilton BB, Laughlin JA, Fiedler RC, Granger CV (1994) Interrater reliability of the 7-level functional independence measure (FIM). Scandinavian Journal of Rehabilitation Medicine 26: 115-119.
13. Linacre JM, Heinemann AW, Wright BD, Granger CV, Hamilton BB (1994) The structure and stability of the functional independence measure. Archives of Physical Medicine and Rehabilitation 75: 127-132.
14. McGinnis GE, Seward ML, DeJong G, Osberg JS (1986) Program evaluation of physical medicine and rehabilitation departments using self-report Barthel. Archives of Physical Medicine and Rehabilitation 67: 123-125.
15. Shinar D, Gross CR, Bronstein KS, Licata-Gehr EE, Eden DT, Cabrera AR, Fishman IG, Roth AA, Barwick JA, Kunitz SC (1987). Reliability of the activities of daily living scale and its use in telephone interview. Archives of Physical Medicine and Rehabilitation 68: 723-728
16. Mills, T. L. (2003). Functioning EveryDay with a Wheelchair (FEW): Development and validation of self-report and performance-based observation instruments to measure functional outcomes of seating-mobility interventions (Doctoral Dissertation, University of Pittsburgh, 2003).
17. Schmeler MR, Margo B. Holm, Elaine Treffler, Shirley Fitzgerald, Michael Boninger (2005). Development and testing of a clinical outcome measurement tool to assess wheeled mobility and seating interventions (Doctoral Dissertation, University of Pittsburgh, 2005).
18. World Health Organization. International classification of functioning, disability, and health. Geneva, 2001
19. Hammel J, Lai J, Heller T (2002). The impact of assistive technology and environmental interventions on function and living situation status with people who are ageing with developmental disabilities. Disability and Rehabilitation 24: 93-105.
20. Rushton PW, Kirby RL, Miller WC (2012). Manual Wheelchair Skills: Objective testing versus subjective questionnaire. Archives of Physical Medicine and Rehabilitation.
21. Sarsak, H. I. (2013). Functional assessment of wheeled mobility and seating interventions: Relationship of self-report and performance-based assessments (Doctoral Dissertation, University of Pittsburgh, 2013).
22. Rogers H, Berman S, Fails D, Jaser, J (2003). A comparison of functional mobility in standard vs. ultralight wheelchairs as measured by performance on a community obstacle course. Disability and Rehabilitation 25: 1083-1088.
23. Hamed, R. (2008). Task performance of older women with major depression (Doctoral Dissertation, University of Pittsburgh, 2008).
24. Mann WC, Hurren D, Charvat B, Tomita M (1996). Problems with wheelchair experienced by frail elders. Technology and Disability, 5: 101-111.
25. Putzke JD, Richards JS, Hicken BL, DeVivo MJ (2002). Predictors of life satisfaction: A spinal cord injury cohort study. Archives of Physical Medicine and Rehabilitation 83: 555-561.
26. Kittel A, Marco A, Stewart H (2002). Factors influencing the decision to abandon manual wheelchairs for three individuals with a spinal cord injury. Disability and Rehabilitation 24: 106-114.
27. Stanley RK, Stafford DJ, Rasch E, Rodgers MM (2003). Development of a functional assessment measure for manual wheelchair users. Journal of Rehabilitation Research and Development 40: 301-308.
28. Kirby, R. L., Dupuis, D. J., MacPhee, A. H., Coolen, A. L., Smith, C., Best, K. L., et al. (2004). The Wheelchair Skills Test (version 2.4): Measurement properties. Archives of Physical Medicine and Rehabilitation, 85, 794-804. doi:10.1016/j.apmr.2003.07.007
29. Mills T, Holm MB, Treffler E, Schmeler M, Fitzgerald S, Boninger M (2002). Development and consumer validation of the Functional Evaluation in a Wheelchair (FEW) instrument. Disability and Rehabilitation 24: 38-46.

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