WHEELCHAIR ASSESSMENT SPECIFIC TO OCCUPATIONAL THERAPY AND

PERSON-ENVIRONMENT-OCCUPATION-PERFORMANCE FRAMEWORK: A

REFERENCE MANUAL

A Thesis submitted to the faculty at Stanbridge University in partial fulfillment of the

requirements for the degree of Master of Science in Occupational Therapy

By

Willand Patrick Floirendo, Hannah Nipp, Rochelle Vander Tuig, and Pauline Vu

Thesis Advisors: Annette Hatala OTD, OTL and Shain Davis OTD, OTR/L

October 15, 2023

Certification of Approval

I certify that I have read the *Wheelchair Assessment Specific to Occupational Therapy and Person-Enviornment-Occupation-Performance Framework: A Reference Manual* by Willand Patrick Floirendo, Hannah Nipp, Rochelle Vander Tuig, and Pauline Vu, and in my opinion, this work meets the criteria for approving a thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Occupational Therapy at Stanbridge University.

Annette Hatala, OTD, OTL

Instructor of Occupational Therapy

ACCEPTED

Myka Persson, OTD, OTR/L

Program Director, Master of Science in Occupational Therapy

Acknowledgments

We would like to thank our thesis advisors, Dr. Annette Hatala and Dr. Shain Davis for their continual guidance, support, encouragement, and knowledge in making this thesis project. We would also like to extend our gratitude to the Stanbridge University faculty, family, friends, and mentors for their constant support throughout.

Abstract

The *"Wheelchair Assessment Specific to Occupational Therapy and the Person-Environment-Occupation-Person Framework: A Reference Manual"* is a research project that critically reviews various evaluation tools available on the web and commonly used by physical and occupational therapists. These tools aim to assess cognitive, physical, and environmental factors that impact individuals' performance, participation, and safety using wheelchairs in various settings at present, these tools only cover a limited number of elements within the PEOP framework, with none entailing all the components of the person, environment, occupation, and performance as outlined in the PEOP framework. The primary goal of our research is to identify assessments that incorporate elements of the PEOP framework, demonstrating validity, reliability among different assessors, stability over time, and clarity and relevance in their questions. These assessments will be compiled into a manual, which will serve as a reference for a secondary group tasked with creating a comprehensive assessment that fully incorporates the PEOP framework. Such a tool could prove beneficial for wheelchair users and future therapists alike.

Table of Contents

Wheelchair Assessment Specific to Occupational Therapy and Person-

Environment-Occupation-Performance Framework: A Reference Manual

The National Center for Chronic Disease Prevention and Health Promotion (2022) notes a significant increase in the U.S. population aged 65 and older, rising from 39.6 million in 2009 to 54.1 million in 2019, marking a 39% increase. A 2019 report by the Centers for Disease Control and Prevention reveals that 19% of adults in this age group experienced significant difficulties in at least one of six functioning domains, and 40% encountered mobility issues such as walking or climbing stairs (Centers for Disease Control and Prevention, 2023). The U.S. Census Bureau projects a sustained upward trajectory, forecasting the population aged 65 and older to reach 94.7 million by 2060 (Vespa et al., 2018). This demographic shift has spurred a growing demand for mobility products like wheelchairs, aiming to enhance independence and mobility (Koontz et al., 2015).

To prioritize the well-being and quality of life of the growing wheelchair population, it is essential to address safety concerns and promote functional engagement in daily life with minimal injury and health setbacks (Koontz et al., 2015). Providing wheelchairs that are appropriately fitted and tailored to individual needs can significantly impact user satisfaction, mobility, and long-term health outcomes. Taking a proactive approach to implementing universally standardized wheelchair measures that promote functional engagement, prioritize safety, and ensure the comfort and proper fit of individuals is essential. This approach ensures that the ergonomic needs of wheelchair users are comprehensively addressed while optimizing functionality.

According to Sutton and McCormack (2019), approximately 60% of manual wheelchair users experience falls and face challenges in recovering independently or with assistance. These falls and injuries often occur while engaging in activities of daily living due to errors in judgment, accidental incidents, or insufficient motor planning during wheelchair use. Various factors contribute to these adverse events, including individual behavior, wheelchair type (powered or manual), inappropriate wheelchair prescription, lack of maintenance (e.g., broken brakes), environmental characteristics, and wheelchair-related activities or performance, such as transferring between surfaces (Gavin-Dreschnack et al., 2005). Understanding and addressing these factors is crucial for mitigating falls and injuries associated with wheelchair use.

Healthcare providers currently use various assessment tools to prescribe wheelchairs to individuals, including the Wheelchair Outcome Measure, Wheelchair Skills Test, Power Mobility Community Driving Assessment, and others (O'Sullivan et al., 2019). These evaluation tools assist in determining the most suitable wheelchair for each individual's needs. Despite the availability of these resources, Sprigle (2014) highlights a concerning issue, a significant percentage (68%) of wheelchair users lack appropriate cushioning and support for their trunk, posture, and pelvis. This deficiency often leads to pain, discomfort, and inefficient wheelchair propulsion. Furthermore, the study emphasized that these mismatches between wheelchairs and users result in skin breakdown (46%), faulty posture, reduced participation in activities, and diminished quality of life. Addressing these concerns and ensuring proper wheelchair fit is crucial for enhancing comfort, preventing complications, and promoting overall well-being.

Tu et al. (2017) conducted a systematic review underscoring the importance of manual wheelchair skills training. The findings strongly emphasized that incorporating wheelchair skills training into rehabilitation programs positively impacted the quality of life, safety, and ability to navigate the environment for manual wheelchair users, surpassing the outcomes of standard-of-care rehabilitation. As a result, a professional healthcare provider with proper licensing should consider implementing an assessment tool that evaluates the individual, their environment, their meaningful occupations, and their performance skills. The formulation of the tool, guided by the expertise and training of occupational therapists, has the potential to offer valuable insights in domains unfamiliar to those without specialized training. Such well-considered development could ultimately prove advantageous for both the patient and the administrator responsible for assessment.

This thesis project is guided by the American Occupational Therapy Foundation and the American Occupational Therapy Association principles. The American Occupational Therapy Foundation emphasizes the importance of vibrant science to support effective, evidence-based occupational therapy and to advance the science of occupational therapy in facilitating clients' meaningful participation in activities (AOTF, n.d.). Similarly, the American Occupational Therapy Association focuses on empowering occupational therapy practitioners to maximize clients' involvement in daily life (AOTF, n.d.; AOTA, n.d.). Compiling and assessing existing literature can play a crucial role in gathering comprehensive data that can be leveraged by future researchers to improve the wellbeing and quality of life for individuals who use wheelchairs.

Finally, it is crucial to understand which testing instruments are valid, reliable, and suitable for evaluating the current function of the wheelchair-user population (Robertson et al., 2022). Relying solely on a single assessment tool that focuses exclusively on physical, cognitive, or vision aspects to determine the overall scope of functional mobility capabilities for non-ambulatory individuals (permanent or temporary) can result in occupational injustice. It is essential because the Person-Environment-Occupation-Performance (PEOP) model influences functional mobility. Doing so can ensure a holistic understanding of the individual's abilities and needs rather than relying on a single aspect. (Mortenson et al., 2013).

Literature Review

Significance

Mobility is crucial for independence and quality of life, especially in the presence of a diagnosis or disorder, which can impact mobility and active participation (Cardol et al., 2002). Occupational therapists strive to promote functional mobility by conducting assessments and providing interventions tailored to the client's needs and preferences. However, determining the most effective assessment can be complex due to the diverse environments and transitions involved with assistive devices. It is essential to ensure the validity and reliability of assessment measures that align with specific devices, environments, and levels of physical, cognitive, and social independence (Mlinac & Feng, 2016; Auger et al., 2018; Manee et al., 2020; Pellichero et al., 2021).

However, no matter the complexity, assistive mobility devices are valuable to clients' needs and allow participation in essential roles and routines. Auger et al. (2018) conducted a study demonstrating the reliability, convergent validity, and applicability of

assistive technology. The study isolates the impact of mobility assistive technology on perceived difficulty with activity and participation in occupational roles, focusing on power wheelchair users who were predominantly middle-aged and older. The results demonstrate that mobility devices increase individuals' participation in daily activities when viewing task completion scores. Wheelchair users' task results indicate similar difficulties to those using other devices but display a significant difference from those not using devices. These findings highlight the importance of assessing both individuals and their environments to determine which assistive devices might be most efficient in maximizing task completion.

Theme 1: Effective Training of Power and Manual Wheelchair Users

The Centers for Disease Control and Prevention (2023) reports that up to one in four adults (27%) have some type of disability, with 12.1% having severe mobility difficulties with walking or climbing stairs. Powered and manual mobility are marketed globally, with the US being the largest regional market, which is projected to grow exponentially due to aging baby boomers and increasing longevity (Koontz et al., 2015). Choosing motorized or manual adaptive equipment for transportation depends on the individual's capability, environment, and level of assistance required to facilitate independence. However, factors such as the efficacy of clinician assessment, clinician training, the wheelchair, the environment, the user's profile (physical and cognitive ability), and the user's daily activities and social roles play a significant role in the appropriateness of measures (Routhier et al., 2003).

To assess effectiveness of proper wheelchair use, it is essential to provide individuals with appropriate wheelchairs and educate them about their functions.

However, Rushton et al. (2019) highlight a concerning gap in training provided by rehabilitation clinicians. Their study reveals that only 66% of Canadian clinicians offer basic manual wheelchair skills training, and 12% provide skills.

To potentially overcome this obstacle, Lersilp et al. (2022) identify six categories for an effective training program: acquiring sufficient knowledge, practical learning to build confidence, valuing fieldwork experiences, team and organizational support, exposure to various contexts, and maintaining connections and services after training. These findings suggest that future studies should focus on how clinicians can effectively educate and train wheelchair users in essential skills, ensuring their safety and sustained ability to participate in meaningful activities. This would contribute to optimizing the outcomes and overall well-being of wheelchair users.

Theme 2: Wheelchair Safety and Physical Capabilities

Self-sufficiency and safety come at risk when there is inconsistent training among clinicians, patients, and facilities (Rushton et al., 2019). Abou and Rice (2023) discovered no significant difference between transfers from both types of wheelchairs to another surface. About and Rice concluded that "power wheelchair users had higher body mass index, report being less valued, had less to the community participation, had worse control over their community participation, and had higher reports of fear of falling in comparison to those who use a manual wheelchair" (p. 1). Therefore, targeting interventions for power and manual wheelchairs addressing fear of falling and functional mobility quality should be further researched. Ambrosio et al. (2005) also suggest strength training for manual wheelchair propulsion and proper propulsion techniques to maximize the effectiveness of the task. The study advised that future research should seek

to identify the differences in the fatigue resistance of muscles used during wheelchair propulsion (Ambrosio et al., 2005). Wang et al. (2011) underscored the intricate nature of both manual and motorized wheelchairs, emphasizing that individuals receiving wheelchairs must possess the cognitive ability to comprehend the dynamics and safety protocols. The study mentions, that despite the apparent technological advancement of power wheelchairs with collision-avoidance features, the cognitive demands associated with consumer use are notably challenging.

Sakakibara et al. (2014) emphasize the importance of evaluating an individual's physical capabilities to determine safety and confidence levels while navigating a manual or power wheelchair, whether independently or with assistance, as a measure of self-efficacy. Sakakibara et al. further explain the low participation frequency of community-dwelling manual wheelchair users; however, older individuals lack independence when using a wheelchair compared to younger individuals. In addition, difficulties with wheelchairs increase as an individual ages. There is little research indicating the relationship between the participation frequency of community-dwelling manual wheelchair users, a positive association has been found between self-efficacy and participation frequency (Sakakibara et al., 2014).

The physical capabilities of wheelchair users should be assessed, and any issues addressed to encourage self-efficacy and confidence in community participation. Muscle Manual Testing (MMT) is the most used method for measuring impairments in muscle strength (Cuthbert & Goodheart, 2007). However, Baschung et al. (2018) identify the hand dynamometer as the best method to evaluate single muscle group strength, whereas the MMT is beneficial to ascertain general muscle weakness. Further, these researchers

discuss MMT reliability as dependent on total scoring and a time-efficient assessment. This assessment tool can be resourceful when considering general muscle weakness.

A study conducted by Seko et al. (2019) indicates that a seated position is not only highly reproducible but also as valid as prone and standing positions when assessing hip extensor strength through MMT, even among older adults. The use of alternative positions during MMT may enhance client comfort while upholding the assessment's validity. Further research needs to be conducted to confirm the reliability and validity of results when utilizing alternative positions. However, MMT retains its status as a firmly established clinical method for semi-quantifying muscle strength, with extensive use in daily practice and clinical trials. It stands as a representative tool for evaluating limb muscle strength, effectively delineating the natural progression of muscle strength decline and facilitating therapeutic interventions (Uchikawa et al., 2004).

Theme 3: Wheelchair Safety and Cognitive Function

Regarding wheelchairs, while acquiring one is readily accessible, it is imperative to consider the cognitive abilities of the individual when utilizing a power wheelchair, with due regard to safety. It's vital to determine whether they can effectively manage it independently or if opting for a manual wheelchair, with or without assistance, would be a more suitable choice. Pellichero et al. (2021) conclude that wheelchair users' cognitive level of functioning outside of gross or fine motor capabilities is vital. The study explains how cognitive functioning significantly correlates to confidence, wheelchair performance, and life-space mobility in users with mild to moderate cognitive impairment. Pellichero et al. further identify that the level of cognitive impairment correlates to how one manages one's wheelchair and suggest higher accident rates are

found in mildly cognitively impaired individuals. Evidence suggests that the level of cognitive function dictates the safety of wheelchair users, but further research is needed to target how to overcome these findings appropriately.

A study by Krayn-Deckel et al. (2022) concluded that manual wheelchair users have poor performance skills with deficits in visual attention and orientation, highlighting the importance of proper assessments for assistive devices. Common accidents associated with wheelchair use are attentional distractions, executive user dysfunction, and cognitive and visual impairment. Taken together, Pellichero et al. (2021) and Karyn-Deckel et al. demonstrate the need for dynamic assessments in which the individual is assessed on cognitive, visual, physical, and environmental factors inside and outside the home, such as transitioning and terrains.

When assessing an individual's cognitive performance, there is flexibility to choose either a bottom-up or top-down approach. The bottom-up approach, or the body structure and function, evaluates cognitive performance by examining memory, attention, information processing, and executive functions by utilizing an assessment such as the Mini-Mental Status Examination (MMSE) and Montreal Cognitive Assessment (MoCA; Manee et al., 2020). Yu et al. (2018) explained that the top-down approach, or activity and participation, considers how cognition enables an individual to successfully engage in activities of daily living and instrumental activities of daily living by using the Functional Independence Measure (FIM) assessment. When evaluating functional performance, Yu et al. discovered no statistical significance between the MMSE and FIM assessments or the MoCA and FIM assessments found in the geriatric population. As

such, it may be best to depend on multiple MMSE, MoCA, or FIM results for goal setting or intervention planning.

When choosing a standardized assessment, it is crucial to address the individual's cognitive function to use a manual or power wheelchair safely. According to Stigen et al. (2018), the MMSE may be beneficial in identifying impairment and disabilities but not describe occupational performance or predict performance levels. However, extensive literature acknowledges the validity and reliability of the Mini-Mental Status Examination-2 (MMSE-2; Baek et al., 2016; Lee et al., 2022; Sleutjes et al., 2020). Sleutjes et al. (2020) indicate the MMSE-2 to be a reliable measure in discriminating individuals without mild cognitive impairment or dementia compared to those with dementia but question its content validity for identifying individuals with mild cognitive impairment. However, Sleutjes et al. caution the MMSE-2 may not be the most reliable or valid for distinguishing an individual with mild cognitive impairment from a typical cognitive functioning individual. In addition, another precaution to note is that the MMSE-2 provides excellent test-retest reliability except in three subtests: visual-constructional ability, registration, and recall (Lee et al., 2022). The MMSE-2 is an innovative assessment tool to determine an individual's cognitive function overall, without a comparative analysis of other populations.

Theme 4: Accuracy of Self-Report Assessment

Using self-reported measures to understand the effectiveness and satisfaction levels of wheelchairs could be beneficial to improve proficiency and maximize functional mobility for community participation opportunities for wheeled mobility users (D'Souza et al., 2019). In exploring biases on the reliability and validity of the accuracy of self-

reporting measures, there are many circumstances where it is challenging to prove

effectiveness definitively for it to become relevant (Reimers et al., 2012). It is suggested

that more than one questionnaire is needed to accurately meet a particular population's

assessment and evaluation needs (Yang et al., 2014). Including a combination of existing

questionnaires may help provide a more comprehensive and accurate idea of a disability.

Spector (1994) explains that using self-reports reasonably depends on the purpose of the

study. Self-report assessments are strongly correlated to cross-sectional designs where the

data are collected at one point. In addition, conducting self-reports has demonstrated

efficacy in evaluating individuals' recognition of their dysfunction (Goodman et al.,

1998). However, caution should be taken when interpreting the information because there

is no current evidence regarding self-report assessments. To improve self-report

accuracy, multiple-informant versions that include self-reports from three perspectives:

self, parent/caretaker, and teacher/therapist, could be beneficial for screening.

A study by Vugteveen et al. (2019) explored the multiple-informant strengths and

difficulties self-report questionnaire on adolescents with autism spectrum disorder. This

questionnaire could be beneficial for measuring cognitive functioning. The study found

the parents reported and provided better results than adolescents when assessing social

problems. However, Conijn et al. (2020) raise the question of whether parents' reports

accurately represent the child's experiences, inaccurately assessing the child's autonomy

for that of the parent's perception. Nonetheless, this assessment measure can be

resourceful for cross-sectional study designs and may help bring awareness about a

specific condition, dynamic, or variable. The evidence further suggests that a self-report

assessment is reliable and valid in assessing physical activity in adolescents (Reimers et

al., 2012). Physical activity was evaluated in correlation with social support (parental and peer) and physical environmental components: convenience, public recreation facilities, safety, and private sports providers. It was found that both components had moderate test-retest reliability, with social supports having good internal consistency and predictive reliability. Since self-report assessments hold moderate reliability, construct validity, and predictive validity, this tool can be a resourceful measure of understanding the satisfaction levels or knowledge about wheelchairs of a wheelchair user, caregiver, and therapist (Reimers et al., 2012).

Remaining Gaps in Evidence

One gap we identified in the literature pertains to comparing assessments and exploring assessment methods beyond self-report measures. Kumar et al. (2012) examined the effectiveness of two sets of functional mobility assessment (FMA) questionnaires but did not reach a definitive recommendation on which one to use. While Paulisso et al. (2019) compare different assessments, their study solely relies on self-report questionnaires such as the Quebec User Evaluation of Satisfaction with Assistive Technology, FIM, and Wheelchair Skills Test Questionnaire for both powered and manual wheelchair users. The study did not address whether the questionnaires were subject to cognitive limitations and required completion with the assistance of a second party, whether they needed to be administered in a preferred environment, or whether self-reporting was used as a secondary measure.

A second gap we identified is the need for more current and comprehensive empirical research and quantitative studies on functional mobility. Previous research by Kumar et al. (2012) demonstrated the effectiveness of FMA for a wide range of wheel

mobility and seating devices. However, nearly a decade after that study, more research is needed on whether the FMA applies to emerging assistive devices. Rushton et al. (2019) highlighted the importance of improving wheelchair skills but did not explore approaches to enhance these skills or identify specific areas that need improvement. While Kumar et al. assessed the benefits of FMA for various devices, an updated evaluation is necessary. Moreover, Paulisso et al. (2019) recently evaluated the effectiveness of FMA within Brazilian culture, which provides valuable insights but may only partially apply to the United States context.

We also identified a gap in the literature around assessing individuals' ability to transition between assistive devices like canes and wheelchairs. Koontz et al. (2021) acknowledge that facilitators play a crucial role in wheelchair transfers within the community. However, while their study revealed that more than half of the participants find the facilitators helpful, the actual abilities and skill sets of these facilitators were not observed or assessed. Similarly, Barbareschi and Holloway (2020) conducted a study highlighting the lack of clear transfer guidelines and the challenges individuals face, such as skills and energy expenditure, when acquiring a wheelchair. The majority of individuals who receive wheelchairs have limited in-person training and often experiment with their devices to find strategies that align with their specific needs. Barbareschi and Holloway stated that skills in wheelchair transfers are essential for functional mobility. A proper transferring technique is crucial as it reduces the effort needed to complete a transfer and minimizes the risk of falls and upper limb injuries. Their research also indicated that difficulty with independently transferring can negatively impact how one perceives themselves and others. To ensure maneuverability, assessments should consider

those who can switch to another device, especially in environments with limited

accessibility (Barbareschi & Holloway, 2020).

Clinical Significance of Evidence

Kumar et al. (2012) stated that the FMA is relevant for wheeled and non-wheeled

mobility and seating. The study demonstrates that mobility is necessary for daily living

activities, and implementing assistive technology or devices increases independence and

enhances the quality of life by minimizing dependency on caretakers. The study also

pointed out that assessments promote a client-based intervention between the consumer

and the practitioner by allowing clients to understand their personal, health, and

functional needs within their environments. The FMA will allow for clarification and

easier understanding for the consumer while reducing the workload for the clinician. The

information presented by Kumar et al. provided additional mobility assessment tools by

assessing the total range of wheeled mobility devices. In addition, the barriers and

facilitators to wheelchair transfers must be evaluated for clients to participate optimally in

society. Rusek et al. (2021) discuss how wheelchair users can independently transfer by

making the environment more accessible and safer. It was concluded that adding more

grab bars, space, leg clearance, and seat area would increase the amount of participation

for non-level transfers. Allowing wheelchair users to become more independent and

adapt to their lifestyles decreases the risk of falls and injuries. Assessing their

environment and overcoming barriers enhance their quality of life and well-being (Cole

& Tufano, 2020).

Occupational therapists strive to positively influence the quality of life by using

assessments according to client's preferences and diagnoses, often within their homes,

and incorporating assistive devices. However, evaluating a person's assistive device concerning their environment may not accurately represent the lack of autonomy a client is experiencing outside the home. Khalili et al. (2021) reveal the importance of control among wheelchair users in their everyday environment. The quantitative and qualitative measures results showed that participants' overall satisfaction with autonomy and the outdoor natural environment was significantly lower than in other environments. Dissatisfaction resulted from negotiating with stairs, curbs, obstacles outside and inside buildings, and maneuvering various terrains. The study calls attention to the importance of functional community mobility and that overall perception of autonomy comes with limitations and challenges. Assessments of the contextual and societal factors do not factor in the reliability and validity of transitioning concerning one's independence and control within one's environment.

Conclusion

Autonomy is defined as the ability of an individual to recognize, execute, and have decisional factors to which they can control the most critical aspects of their life (Pizzi et al., 2018, p. 64). Factors coined as necessary are unique, vary among individuals, and are determined by personal values and preferences. Therefore, participation in identified meaningful occupations contributes to the quality of life. Among individuals with disabilities, it is recognized as one of the most influential aspects of their autonomy (Khalili et al., 2021). The foundation of occupational therapy is implementing assessments to evaluate an individual's safety and to effectively increase autonomy and self-sufficiency in one's environment. When there is a lack of empirical data on assessments, wheelchair accessibility and functionality, validity, and reliability of

measures, health professionals must work harder to meet clients' preferences. More importantly, the client's safety is at risk upon entering environments where participation, function, and security are not optimal.

Research Problem

Based on the literature review findings, the research problem is that there is a lack of a singular wheelchair assessment that encompasses the entirety of the PEOP framework in the field of occupational therapy. The need we identified is for a comprehensive and standardized assessment for wheelchair users. Our research question is, what valid and reliable assessments fitting within the PEOP framework effectively address the parameters associated with the multiple domains of functional mobility in wheelchair users? The purpose of the project is to continue to promote the participation of wheelchair users in their meaningful activities by providing optimal care, support, and safety through wheelchair assessments. The aim is to find research studies about wheelchair assessments and the domains associated with wheelchair users - cognitive, behavioral, social, psychological, physical, and emotional - to help preserve their autonomy, appropriately evaluating their current skill level through various collective assessments. To identify which assessments fall under the PEOP framework, we reviewed and compared existing wheelchair assessments to determine which combination of assessments is most effective for this population. The outcome of this project is to provide a manual comparing the similarities and differences between wheelchair assessments in occupational therapy.

The targeted population of the functional community mobility manual and power wheelchair users are ages fifty-five and older. Understanding which assessments are the

most valid and reliable is critical to evaluate the current function of the elderly wheelchair-user population. Relying solely on one assessment tool to provide the overall scope of functional mobility capabilities would be an occupational injustice because it would detract from their autonomy. Literature has suggested the implementation of self-reports from different perspectives - client, therapist, and caregiver - to understand better the barriers most wheelchair users experience with functional mobility (Reimers et al., 2012).

Theoretical Framework

The PEOP is the most compelling framework for the purpose of our research. The PEOP model views the system's function as a whole and considers the interaction among its components. The complexity of occupational performance is highlighted in the PEOP model and is based on four variables that configure the practitioner's comprehension: narrative story, person, occupational, and environmental factors (Cole & Tufano, 2020) We utilized the PEOP model to understand better the specific demographics in implementing and developing an assessment tool for community wheelchair users. According to Cole and Tufano (2020), occupation refers to one's choice of daily activities, tasks, or roles. The authors define occupational performance as meaningful engagement in activities that enhance participation, well-being, self-efficacy, and environmental interactions. Additionally, Sakakibara et al. (2014) found that self-efficacy is crucial in determining the consistency of personal and social participation among wheelchair users in the geriatric population. To effectively address the various components of the PEOP model, each will be individually examined.

The narrative factor involves wheelchair users and clinicians and the characteristics of the individual's various physical, cognitive, and physiological elements relative to the assessment (clinician) and safe usage (users) of wheelchairs or mobility devices in diverse environments. Both populations provided extensive information regarding the past, current, and future perceived barriers affecting their occupational performance, their goals and ability to perform meaningful daily occupations, and the role of occupational therapy practitioners in mitigating the detrimental effects of mobility restrictions. Koontz et al. (2021) identified that independent transfer capabilities on different surface levels are a common theme among wheelchair users, deterring them from successfully navigating multiple settings under various conditions, resulting in limited participation and reduced quality of life. A significant concern arises as many occupational therapy schools fail to deliver sufficient training in conducting wheelchair assessments, providing training, and developing wheelchair skills. Consequently, it becomes even more crucial for occupational therapy practitioners and students of occupational therapy to possess the essential skills, competence, and confidence required to offer training and education to prospective and current wheelchair users (Giesbrecht, 2021; Best et al., 2015).

For factors involving the person, the PEOP model indicates all the intrinsic factors, such as psychological (endurance), cognitive (language comprehension, task organization, reasoning, attention, and memory), neurobehavioral (sensory and motor systems), and spiritual aspects (meaning and purpose in everyday life), that enable or impede the occupational performance of wheelchair users and clinicians (Baum et al., 2015). Occupational therapy practitioners promote a holistic approach to providing

individualized client interventions. A study by Malone and Dadswell (2018) posited that the inclusion of religion, spirituality, or beliefs is correlated to a positive aging process, implying the need to incorporate non-tangible elements that could provide a source of strength, comfort and hope to allow clients to deal with their life's changes and challenges.

Regarding occupations and environmental domains, Cole and Tufano (2020) state that occupations are goal-directed, have temporal meaning, include activities, tasks, and steps to manage an individual's daily life, and are influenced by societal roles. Further, the environment is an external factor (built, natural, social, social support, assistive technology, and cultural) that directly affects occupational performance. Accordingly, the interplay between an individual and their environmental factors can either enhance or hinder occupational performance, much like the other domains when not properly addressed. Applying the PEOP model in practice requires a collaborative relationship between the client and practitioner. The practitioner understands the issues and options presented by the client's needs and goals by asking the appropriate questions to elicit the client's narrative.

According to Baum et al. (2015), the PEOP model identifies factors in the personal performance capabilities and constraints and the environmental performance enablers and barriers predominant to occupational performance, leading to developing a realistic and sequenced intervention plan. When there is a person-environment fit in supporting the valued occupation, success in occupational performance eventually leads to participation and well-being. When people perform occupations, they also interact with the environment. As such, there are mutual outcomes wherein the client's goals and

intentions influence their occupational performance, and the action simultaneously changes their environment and characteristics (Baum et al., 2015). Finally, the PEOP model is also client-centered and represents a system-based approach where all the variables impact one another within a transactional relationship, wherein the client must earnestly set objectives and create a plan that facilitates occupational performance (Baum et al., 2015).

Methodology

This thesis project is intended to be the first phase of a larger research project carried out by three groups. The second group is intended to develop a standardized assessment, while the third group develops an experimentation stage using human subjects. This project aims to gather and evaluate existing literature on wheelchair users to establish a strong foundation for subsequent groups (2 and 3). The goal is to develop a comprehensive and standardized assessment tool for this population, enabling future rehabilitation teams to promote efficiency, efficacy, and safety among wheelchair users.

The research is based on the PEOP model theoretical framework. According to Baum et al. (2015), the characteristics of the person, environmental features, and different features of the tasks interact together, which influence the occupational performance of the individual, wherein the interactions could result in a positive and successful or damaging and failing experience. Coincidentally, the clinician plays an essential role in this model by ensuring that barriers are identified and removed to enable the individual's participation in executing their choice of meaningful occupations.

To address the domains that affect the experience of wheelchair users, such as their navigation skills, knowledge, and skills of the prescriber, and the barriers that

influence a favorable outcome of using a wheelchair, an in-depth literature review is the study design. The design aims to deliver comprehensive information for the following thesis group (phase 2) to be utilized in developing an all-inclusive assessment tool for future wheelchair users.

The literature was collected utilizing CINAHL Ultimate, CINAHL Complete, Cochrane Library, MedLine Complete, PsycINFO, PubMed, and PEDro scale. Keywords to search and appraise literature consisted of "wheelchair," "wheelchair-user," "assessment tool," "activities of daily living," "wheelchair-mobility," "musculoskeletal, cognitive, cardiological, or neurological examinations," musculoskeletal, cardiological, cognitive, or neurological conditions," and "manual or powered-wheelchair."

The inclusion criteria for the article search were: the age of participants in each study (55 years and older); wheelchair users (temporarily and permanent); outcome measures (including self-report assessment tools) that test cognitive, physical, neurological, and emotional states; types of wheelchair; types of mobility impairment; short and long term wheelchair use; studies that include clinical trials (randomized and or controlled); comparison of wheelchair mobility in different environmental settings; self-efficacy among wheelchair users; diverse skills required for wheelchair use; training vs. non-training among users; the efficacy of wheelchair training skills programs for wheelchair users; and factors affecting accidental falls or injuries among non-ambulatory elderly (wheelchair use and non-use). The exclusion criteria were research studies whose participants are ages younger than 55 years old, condition or impairment-specific assessment tools, and literature without reliability and validity measurements.

Outcome measures were assessed for their validity and reliability to identify gaps in knowledge related to several aspects, including wheelchair technologies, the negative impacts of improperly fitted wheelchairs, autonomy, and housing accessibility for powered wheelchair users. Additionally, the focus on assessment tools addressed comfort, stability, and safety among wheelchair users. A compilation of various available assessment tools was created to help determine how each evaluation instrument affects wheelchair users. After filtering the studies, the data needed were collected to answer the research question by comparing various outcomes of different designs. We synthesized our data by categorizing the evaluation instruments according to the chosen PEOP theoretical framework, contingent on how each component interacts with the others. On data synthesis, the evaluation instruments were categorized according to the chosen PEOP theoretical framework and contingent on how each component interacts with the others. The influence of the PEOP framework on the person or their interactions (including their condition or impairment), environmental settings, occupations, and how it impacts the wheelchair user's performance and maneuverability were also considered. Moreover, being in a wheelchair affects their performance in engaging or increasing participation regarding their choice of meaningful activities in their daily lives.

Ethical Considerations

The research we collected provided an unbiased analysis of wheelchair assessments, with a focus on their validity and quality control measures. To ensure that our findings could be applied across a wide range of situations without being limited to specific diagnoses or groups, we intentionally selected a diverse set of assessments for our review. Our decision regarding which assessments to include was also influenced by

the availability of research that we could thoroughly evaluate. The assessments featured in our table were chosen because they align with the PEOP model, covering one or more of its components. Importantly, these selected assessments prioritize evaluating the patient or person, emphasizing a client-centered approach. Lastly, this thesis project does not include informed consent due to the absence of intervention and study participants.

Results

Cognitive Assessments

Our team selected the MoCA tool over the MMSE because it is considered a more reliable and valid option for identifying mild cognitive impairment in older adults. MMSE and MoCA are widely used in clinical practice and research due to their simplicity and proven ability to differentiate between individuals with dementia and those with normal cognitive function (Fasnacht et al., 2022).

According to a study by Jia et al. (2021), MoCA emerged as a superior measure of cognitive function because it does not exhibit a ceiling effect and effectively detects variations in cognitive abilities. Moreover, MoCA tends to identify a higher prevalence of mild cognitive impairment compared to MMSE. Similarly, a meta-analysis conducted by Ciesielska et al. (2016) found that MoCA, with a cut-off point of 24/25, achieved better results in detecting mild cognitive impairment with a sensitivity of 80.48% and specificity of 81.19%, as indicated by the ROC curve analysis. The corresponding area under the curve was 0.846 (95% CI 0.823–0.868). In contrast, MMSE had a more critical cut-off of 27/28, resulting in a sensitivity of 66.34% and specificity of 72.94%, with an AUC of 0.736 (95% CI 0.718–0.767). Therefore, MoCA is considered a more suitable screening test for detecting MCI in individuals over 60 compared to MMSE.

Tool for Assessing Wheelchair Discomfort

Tool for Assessing Wheelchair Discomfort is a three-part self-report tool designed to evaluate the levels of discomfort experienced by individuals using wheelchairs, focusing on their long-term comfort or discomfort (Crane et al., 2004). The first part of Tool for Assessing Wheelchair involves a survey collecting general information about individuals' activities on the first day of assessment. The second part, known as the General Discomfort Assessment, aims to gauge the overall discomfort experienced. The General Discomfort Assessment consists of two sub-scales: the Discomfort Rating Subscale, consisting of eight statements, and the Comfort Rating Subscale, containing five statements. Participants rate each of these 13 statements on a 7-point Likert scale (Hong et al., 2014). The combined scores from these statements contribute to the overall General Discomfort Assessment score, ranging from 13 to 91. Lower scores indicate higher comfort, while higher scores indicate significant discomfort. The final section of the tool is the Discomfort Intensity Rating, which focuses on identifying the specific areas of the body experiencing discomfort. Participants assign a numerical rating from zero to 10 to describe the level of discomfort for each of the eight body regions, along with any additional areas where they may feel discomfort. A rating of zero signifies no discomfort, while a rating of 10 indicates severe discomfort. It is essential to note some limitations of this tool. One limitation is that it primarily addresses overall discomfort without considering other potential reasons for discomfort. Additionally, it focuses solely on assessing comfort and discomfort, overlooking other potential symptoms that may arise during the assigned activities.

Functional Mobility Assessment

The FMA is a self-report questionnaire to evaluate satisfaction levels when using assistive devices for daily activities. It offers versatile applications, such as confirming an individual's satisfaction with their current device and shedding light on newer alternatives through a comparative analysis. This comparison aims to ensure that these devices meet the criteria of comfort and health necessary for enhancing client-centered outcomes.

Furthermore, the FMA can assess whether assistive device goals have been achieved (Paulisso et al., 2019). The FMA was established based on the individual's daily functional wheelchair use, expanding its applicability to assess a diverse array of mobility devices. The FMA considers an individual's performance in functional mobility and independent tasks, prioritizing safety and efficiency. Its client-centered approach fosters collaboration between users and practitioners, ultimately leading to improved outcomes (Kumar et al., 2012).

However, it is essential to note that the FMA relies on the user's subjective perception of their functional mobility (Sarsak, 2019). While it offers valuable insights, it may not provide an objective assessment of a wheelchair user's actual abilities. The research discovered that a high functional mobility assessment scale score does not always align with the user's practical skills in operating wheeled mobility and seating devices. Consequently, solely depending on the functional mobility assessment tool may not guarantee safety or proficiency in using these assistive devices.

Psychosocial Impact of Assistive Device Scale

The Psychosocial Impact of Assistive Devices Scale is a self-report questionnaire comprising 26 items designed to evaluate functional independence, well-being, and

quality of life concerning the use of assistive devices. This tool has the flexibility to be

applied across various assistive technologies, disabilities, and health conditions (Jiménez

et al., 2019). The self-report score is structured into three distinct subscales. The first of

these, consisting of 12 items, assesses an individual's competence. It focuses on how the

person personally perceives their functional capabilities, independence, and performance.

The second subscale, encompassing six items, explores adaptability. It delves into an

individual's motivation to engage in social settings and examines how this motivation

influences their life. This subscale also considers the person's readiness to take risks. The

final subscale, comprising eight items, evaluates self-esteem. Its purpose is to uncover

insights into the individual's emotional well-being, self-confidence, sense of

empowerment, and overall happiness. Scores on the self-report can range from a

maximum negative to a maximum positive impact. It is important to acknowledge certain

limitations of this tool. First, its validity when translated into languages other than the

original may be questionable. Additionally, it does not encompass the measurement of

psychosocial factors among long-term wheelchair users, which can significantly affect

their functional mobility (Jutai & Day, 2002).

Wheelchair Users Functional Assessment

The Wheelchair Users Functional Assessment is a tool comprising 13

performance-based items used to evaluate the functional abilities of individuals in their

home and community settings (Stanley et al., 2003). It serves the purpose of assessing

changes in their functional status and distinguishing different levels of independence.

This assessment involves observing users as they engage in everyday activities, providing

an accurate score. Some of the activities assessed include functional mobility, transfers,

and dressing. Scores on this assessment range from one, which signifies complete dependence, to seven, indicating complete independence. The scoring process also considers the time taken to complete each task. However, it's important to be aware of certain limitations associated with this assessment. First, it can be time-consuming to administer. Additionally, it requires sufficient space and specialized equipment, and practitioners may need training to use it effectively. Another important limitation to keep in mind is that an individual's performance may become standardized, meaning that the assigned score may not entirely reflect their actual level of independence.

Power-Mobility Indoor Driving Assessment

The Power-Mobility Indoor Driving Assessment describes and assesses a user's competence and safety while operating powered mobility devices within their home environment. This assessment comprises 30 specific tasks, categorized into seven areas: bedroom, bathroom, doors, elevators, parking, ramps, and driving skills (Routhier et al., 2003). Each task is evaluated using a four-point ordinal scale. A score of one indicates that the user is unable to complete the task without cues and physical assistance. A score of two suggests that the user may cause harm by bumping into objects during the task. A score of three reflects hesitation and the need for multiple attempts to complete the task. Finally, a score of four represents complete and optimal independence in performing the task. The assessment is rooted in several key principles, including focusing on skill improvement, measuring actual performance rather than capability, and recognizing the diverse requirements associated with operating a powered mobility device. It is worth noting that this tool has limitations. It cannot definitively determine who is safe to operate a powered mobility device and who is not. However, it can be valuable in

identifying the specific skills needed for effective use of such devices (Dawson et al., 1994).

Power-Mobility Community Driving Assessment

The Power-Mobility Community Driving Assessment evaluates the performance of individuals using powered mobility devices when they are not at home (Routhier et al., 2003). This assessment consists of three components. The initial part involves interviewing to create a user profile. The second part employs a checklist to uncover their experience with wheelchairs, and the final part assesses the person's overall mobility. Similarly, the Power-mobility Community Driving Assessment employs a four-point scale and adheres to the core principles of the Power-mobility Indoor Driving Assessment. Practitioners select tasks from six categories, including general driving skills, using wheelchairs on public and private transit, managing driving controls in different positions, navigating various surfaces, and accessing public places.

However, it is important to note that this tool has limitations. It solely measures a patient's capacity to use a mobility device in the community and doesn't consider the individual's visuoperceptual abilities (Letts et al., 2007). Furthermore, it does not assess the person's long-term quality of life in relation to their mobility device.

Wheelchair Skills Test

The Wheelchair Skills Test is designed to record the starting abilities and advancements of individuals who use wheelchairs. It comprises 33 tasks organized into 13 categories: brakes, footrests, armrests, transfers, wheelchair folding, reaching, maneuvering, dealing with doors, handling different surfaces, navigating inclines, handling curbs, and performing wheelies (Routhier et al., 2003). This assessment

employs a three-point ordinal scale, where zero indicates a failure to complete a task, one represents partial completion, and two signifies successful and safe completion. However, it is essential to acknowledge that this test has certain limitations. It necessitates the manipulation of the wheelchair, and the skills assessed primarily focus on fundamental wheelchair abilities rather than those required at home or in community settings (Stanley et al., 2003). Additionally, since it is an objective, performance-based evaluation, it may be constrained by the availability of environmental obstacles that exist in a person's home and require sufficient time, space, and equipment for testing (Rushton et al., 2012).

The Assistive Technology Outcome Profile for Mobility

The Assistive Technology Outcome Profile for Mobility is a self-report questionnaire comprising 68 items assessing the self-perceived difficulty an individual may face in activities and participation (Auger et al., 2018). Within this assessment, the activities domain examines how the use of a mobility device impacts physical performance and everyday instrumental tasks. Meanwhile, the participation domain explores the individual's societal role and voluntary engagement in social activities. Respondents provide scores on a five-point scale, ranging from one, signifying an inability to perform, to five, indicating completion without any difficulty. Nevertheless, there is a drawback associated with this tool. It is based on a theoretical framework known as Item Response Theory, which carries the potential of producing imprecise parameter estimates for particular groups.

Discussion

Assessing an individual's wheelchair requirements and how they use it within the occupational therapy's PEOP model is a comprehensive process. This method considers the person's abilities, their physical environment, and the meaningful activities that shape their life. However, it is essential to note that there is no single assessment tool currently available that can fully cover all aspects of the PEOP framework. Instead, occupational therapists must conduct multiple assessments to gain a complete understanding of each patient's unique needs. This approach requires a deep understanding of various assessment tools and a significant investment of time to ensure its effectiveness. Our research found that nine assessment tools encompassed one or more components of the PEOP framework, exhibiting high reliability, validity, sensitivity, or specificity.

The main goal of this study is to create a user-friendly manual that provides essential information on which assessments work best for specific demographics and environments. This manual will also serve as a reference for those interested in developing PEOP-based assessment tools, benefiting both clinical practitioners and their clients. Integrating these components into a single assessment will streamline the evaluation process, saving time and effort. This holistic approach aims not only to improve the assessment process by gaining a clear understanding of the patient's status, desires, and needs but also to enhance the safety of future wheelchair users, promote autonomy, support overall independence, and emphasize the ongoing significance of occupational therapy interventions in ensuring functional mobility, improved quality of life, and increased engagement in their chosen activities.

Furthermore, it's crucial to recognize occupational therapy practitioners' constraints when utilizing these assessment tools, primarily stemming from deficiencies in their educational curriculum. Proficiency in administering wheelchair assessments is developed through hands-on experience and collaboration with fellow practitioners. This conclusion is supported by Burrola-Mendez et al. (2022) regarding the global integration of the university occupational therapy program curriculum. The authors mentioned that only three out of twenty-five articles incorporated wheelchair skills into their program, and they are all from Canada.

Limitations

Despite the importance of incorporating a wide range of factors within the PEOP model, we identified a current lack in this area. When examining assessment tools for wheelchair functional mobility, the available research was outdated by more than five years and finding up-to-date research within the same context proved challenging. Furthermore, the existing literature only focused on specific aspects of the PEOP model, leaving many variables to be explored.

Although research was scarce on wheelchair assessments aligning with the PEOP theoretical framework, we conducted a comprehensive analysis of the empirical research. We aimed to provide valuable insights emphasizing the need for an assessment approach based on the PEOP model, advocating for its practical application in occupational settings.

The study acknowledged its limitations, such as the absence of assessment tool resources specifically designed for occupational therapy practice, outdated studies, and the lack of a single evaluation tool that aligns with the PEOP model. By recognizing

these constraints, future researchers and clinicians have the opportunity to explore and create new materials that fully embrace the principles of the PEOP model. The hope is to pave the path for future advancements by acknowledging these limitations in wheelchair functional mobility assessments, leading to a better understanding of wheelchair users' needs and an overall improvement in the quality of assessments and interventions in occupational therapy.

Conclusion

The research reviewed identified several critical gaps that must be addressed. First, there is a pressing need for currently available literature to provide the efficacy for assessing wheelchair performance and its use as an assistive mobility device. These studies are crucial in determining how wheelchairs meet the users' needs and improve their quality of life. Second, the evaluation of assistive device transitions is an area that demands attention. Transitioning between different assistive devices and surfaces, such as transferring from a wheelchair to a walker or different surface levels, can significantly affect the user's independence and safety due to the lack of standardized training in wheelchair skills. A thorough examination of this aspect is essential to ensure safety, seamless mobility, and user satisfaction. Third, incorporating feedback from clinicians and caregivers is vital for a holistic and comprehensive assessment process. Insights can provide valuable information about the user's specific needs, preferences, and challenges, which enables better customization and fitting of wheelchairs to an individual.

In addition to the above gaps, it has become evident that there is a lack of occupational therapy-specific assessment tools for wheelchairs. Moreover, to address this issue, it is imperative to create evaluation materials explicitly designed to align with the

PEOP model, which considers the Person (the user), Environment (where the wheelchair is used), Occupation (daily and preferred activities), and Performance (how well the user can perform those activities and how it affects their participation in doing their chosen occupation). The framework can account for the interplay between the individual user's needs, environment, performance, and level of participation in specific activities.

Ultimately, we aim to develop a comprehensive manual to guide future groups in developing a more thorough assessment utilizing the entirety of the PEOP model that is tailored to wheelchair users. The primary objective is to understand users' needs better and the various domains of functions for which they require support. By doing so, the goal is to enhance the validity and reliability of assessment measures, ultimately resulting in better-fitted wheelchair recommendations and improved outcomes for wheelchair users through occupational therapy.

References

Abou, L., & Rice, L. A. (2023). Influence of transfer quality and wheelchair type on fear

of falling among full-time wheelchair users. *Archives of Physical Medicine and*

Rehabilitation, *104*(4), 690–693. https://doi.org/10.1016/j.apmr.2022.09.002

Ambrosio, F., Boninger, M. L., Souza, A. L., Fitzgerald, S. G., Koontz, A. M., & Cooper,

R. A. (2005). Biomechanics and strength of manual wheelchair users. *The Journal*

of Spinal Cord Medicine, *28*(5), 407–414.

https://doi.org/10.1080/10790268.2005.11753840

American Occupational Therapy Association. (n.d). *What is occupational therapy?*

https://www.aota.org/about/what-is-ot

American Occupational Therapy Foundation. (n.d). *About AOTF*.

https://www.aotf.org/About-AOTF/About-AOTF

Auger, C., Rushton, P. W., Jutai, J. W., & Millter, W. C. (2018). Reliability, convergent

validity and applicability of the assistive technology outcome profile for mobility

for middle-aged and older power wheelchair users. *Australian Occupational*

Therapy Journal, *65*(5), 439-338. https://doi.org/10.1111/1440-1630.12515

Baek, M. J., Kim, K., Park, Y. H., & Kim, S. (2016). The validity and reliability of the

Mini-Mental State Examination-2 for detecting mild cognitive impairment and

Alzheimer's disease in a Korean population. *PLoS ONE, 11*(9), 1–19.

https://doi.org/10.1371/journal.pone.0163792

Barbareschi, G., & Holloway, C. (2020). Understanding independent wheelchair

transfers. Perspectives from stakeholders. *Disability and Rehabilitation: Assistive*

Technology, *15*(5), 545–552. https://doi.org/10.1080/17483107.2019.1594407

Baschung, P. P., de Bruin, E. D., Sterkele, I., Maurer, B., de Bie, R. A., & Knols, R. H. (2018). Manual muscle testing and hand-held dynamometry in people with inflammatory myopathy: An intra- and interrater reliability and validity study. *PLoS ONE, 13*(3), 1–22. https://doi.org/10.1371/journal.pone.0194531

Baum, C. S., Christiansen, C. H., & Bass, J. D. (2015). The Person-Environment-Occupation-Performance (PEOP) model. In C. M. Christianson, J. D. Bass, & C. S. Baum (Eds.), *Occupational therapy: Performance, participation, and well-being* (4th, pp. 49–56). SLACK incorporated.

Best, K. L., Routhier, F., & Miller, W. C. (2015). A description of manual wheelchair skills training: Current practices in Canadian rehabilitation centers. *Disability and Rehabilitation: Assistive Technology*, *10*, 393–400. https://doi.org/10.3109/17483107.2014.907367

Burrola-Mendez, Y., Kamalakannan, S., Rushton, P. W., Bouziane, S., Giesbrecht, E., Kirby, R. L., Gowran, R. J., Rusaw, D., Tasiemski, T., Goldberg, M., Tofani, M., Pedersen, J. P., & Pearlman, J. (2022). Wheelchair service provision education for healthcare professional students, healthcare personnel and educators across low-to high-resourced settings: A scoping review. *Disability and Rehabilitation: Assistive Technology*, *18*(1), 67–88. https://doi.org/10.1080/17483107.2022.2037757

Cardol, M., De Jong B. A., & Ward, C. D. (2002). Clinical commentary. On autonomy and participation in rehabilitation: A response. *Disability & Rehabilitation*, *24*(18), 1001–1004. https://doi.org/10.1080/09638280210152094

Centers for Disease Control and Prevention. (2023, May 15). *Disability impacts all of us* [Infographic]. U.S. Department of Health and Human Services. https://www.cdc.gov/ncbddd/disabilityandhealth/infographic-disability-impacts-all.html

Ciesielska, N., Sokołowski, R., Mazur, E., Podhorecka, M., Polak-Szabela, A., & Kędziora-Kornatowska, K. (2016). Is the Montreal Cognitive Assessment (MoCA) test better suited than the Mini-Mental State Examination (MMSE) in mild cognitive impairment (MCI) detection among people aged over 60? Meta-analysis. *Psychiatria Polska, 50*(5), 1039–1052. https://doi.org/10.12740/PP/45368

Cole, M. B., & Tufano, R. (2020). *Applied theories in occupational therapy: A practical approach* (2nd ed.). SLACK incorporated.

Conijn, J. M., Smits, N., & Hartman, E. E. (2020). Determining at what age children provide sound self-reports: An illustration of the validity-index approach. *Assessment, 27*(7), 1604–1618. https://doi.org/10.1177/1073191119832655

Crane, B., Holm, M. B., Hobson, D., Cooper, R. A., Reed, M. P., & Stadelmeier, S. (2004). Development of a consumer-driven Wheelchair Seating Discomfort Assessment Tool (WcS-DAT). *International Journal of Rehabilitation Research*, *27*(1), 85–90. https://doi.org/10.1097/00004356-200403000-00014

Cuthbert, S. C., & Goodheart, G. J., Jr. (2007). On the reliability and validity of manual muscle testing: A literature review. *Chiropractic & Osteopathy, 15*(4), 1–23. https://doi.org/10.1186/1746-1340-15-4

Dawson, D., Chan, R., & Kaiserman, E. (1994). Development of the power-mobility indoor driving assessment for residents of long-term care facilities: A preliminary report. *Canadian Journal of Occupational Therapy*, *61*(5), 269–276. https://doi.org/10.1177/000841749406100507

D'Souza, C., Paquet, V. L., Lenker, J. A., & Steinfeld, E. (2019). Self-reported difficulty and preferences of wheeled mobility device users for simulated low-floor bus boarding, interior circulation and disembarking. *Disability & Rehabilitation: Assistive Technology*, *14*(2), 109–121. https://doi.org/10.1080/17483107.2017.1401128

Fasnacht, J. S., Wueest, A. S., Berres, M., Thomann, A., Krumm, S., Gutbrod, K., Steiner, L. A., Goettel, N., & Monsch, A. U. (2022). Conversion between the Montreal Cognitive Assessment and the Mini-Mental Status Examination. *Journal of the American Geriatrics Society, 71*(3), 869–879. https://doi.org/10.1111/jgs.18124

Gavin-Dreschnack, D., Nelson, A., Fitzgerald, S. G., Harrow, J. J., Sanchez-Anguiano, A., Ahmed, S., & Powell-Cope, G. (2005). Wheelchair-related falls. *Journal of Nursing Care Quality*, *20*(2), 119–127. https://doi.org/10.1097/00001786-200504000-00006

Giesbrecht, E. (2021). Wheelchair skills test outcomes across multiple wheelchair skills training bootcamp cohorts. *International Journal of Environmental Research and Public Health, 19*(1), 1–10. https://doi.org/10.3390/ijerph19010021

Goodman, R., Meltzer, H., & Bailey, V. (1998). The strengths and difficulties questionnaire: A pilot study on the validity of the self-report version. *European*

Child & Adolescent Psychiatry, 7(3), 125–130.

https://doi.org/10.1007/s007870050057

Hong, E.-K., Dicianno, B. E., Pearlman, J., Cooper, R., & Cooper, R. A. (2014). Comfort

and stability of wheelchair backrests according to the TAWC (Tool for Assessing

Wheelchair Discomfort). *Disability and Rehabilitation: Assistive Technology,*

11(3), 223–227. https://doi.org/10.3109/17483107.2014.938365

Jia, X., Wang, Z., Huang, F., Su, C., Du, W., Jiang, H., Wang, H., Wang, J., Wang, F.,

Su, W., Xiao, H., Wang, Y., & Zhang, B. (2021). A comparison of the Mini-

Mental state examination (MMSE) with the Montreal Cognitive Assessment

(MoCA) for mild cognitive impairment screening in Chinese middle-aged and

older population: A cross-sectional study. *BMC Psychiatry, 21*(1), 1–13.

https://doi.org/10.1186/s12888-021-03495-6

Jiménez Arberas, E., Ordoñez Fernández, F. F., & Rodríguez Menéndez, S. (2019).

Psychosocial impact of mobility assistive technology on people with neurological

conditions. *Disability and Rehabilitation: Assistive Technology*, *16*(5), 465–471.

https://doi.org/10.1080/17483107.2019.1648571

Jutai, J., & Day, H. (2002). Psychosocial Impact of Assistive Devices Scale (PIADS).

Technology and Disability, 14(3), 107–111. https://doi.org/10.3233/tad-2002-

14305

Khalili, M., Jonathan, C., Hocking, N., Van der Loos, M., Mortenson, W. B., & Borisoff,

J. (2021). Perception of autonomy among people who use wheeled mobility

assistive devices: Dependence on environment and contextual factors. *Disability*

and Rehabilitation: Assistive Technology, *202*1, 1–8.

https://doi.org/10.1080/17483107.2021.1978565

Koontz, A. M., Bass, S. R., & Kulich, H. R. (2021). Accessibility facilitators and barriers

affecting independent wheelchair transfers in the community. *Disability and*

Rehabilitation: Assistive Technology, *16*(7), 741–748.

https://doi.org/10.1080/17483107.2019.1710771

Koontz, A. M., Ding, D., Jan, Y. K., de Groot, S., & Hansen, A. (2015). Wheeled

mobility. *BioMed Research International*, *2015*, Article e109273864.

https://doi.org/10.1155/2015/138176

Krayn-Deckel, N., Presaizen, K., & Kalron, A. (2022). Cognitive status is associated with

performance of manual wheelchair skills in hospitalized older adults. *Disability &*

Rehabilitation: Assistive Technology, *2022,* 1–6.

https://doi.org/10.1080/17483107.2022.2060353

Kumar, A., Schmeler, M. R., Karmarkar, A. M., Collins, D. M., Cooper, R., Cooper, R.

A., Shin, H., & Holm, M. B. (2012). Test-retest reliability of the Functional

Mobility Assessment (FMA): A pilot study. *Disability and Rehabilitation:*

Assistive Technology, *8*(3), 213–219.

https://doi.org/10.3109/17483107.2012.688240

Lee, Y.-C., Lee, S.-C., & Chiu, E.-C. (2022). Practice effect and test-retest reliability of

the Mini-Mental State Examination-2 in people with dementia. *BMC Geriatrics*,

22(1), 67-76. https://doi.org/10.1186/s12877-021-02732-7

Lersilp, S., Putthinoi, S., Lersilp, T., Panyo, K., & Punyakaew, A. (2022). Training

program to modify manual wheelchairs to simplified power wheelchairs for

community dwelling elderly people and caregivers. *Occupational Therapy International*, *2022*, Article e155699489. https://doi.org/10.1155/2022/5594598

Letts, L., Dawson, D., Bretholz, I., Kaiserman-Goldenstein, E., Gleason, J., McLellan, E., Norton, L., & Roth, C. (2007). Reliability and validity of the power-mobility community driving assessment. *Assistive Technology*, *19*(3), 154–163. https://doi.org/10.1080/10400435.2007.10131872

Malone, J., & Dadswell, A. (2018). The role of religion, spirituality and/or belief in positive aging for older adults. *Geriatrics*, *3*(2), 1–28. https://doi.org/10.3390/geriatrics3020028

Manee, F. S., Nadar, M. S., Alotaibi, N. M., & Rassafiani, M. (2020). Cognitive assessments used in occupational therapy practice: A global perspective. *Occupational Therapy International*, *2020,* 1–8. https://doi.org/10.1155/2020/8914372

Mlinac, M. E., & Feng, M. C. (2016). Assessment of activities of daily living, self-care, and independence. *Archives of Clinical Neuropsychology*, *31*(6), 506-516. https://doi.org/10.1093/arclin/acw049

Mortenson, W. B., Clarke, L., & Best, K. L. (2013). Prescribers' experiences with powered mobility prescription among older adults. *American Journal of Occupational Therapy, 67*(1), 100–107. https://doi.org/10.5014/ajot.2013.006122

National Center for Chronic Disease Prevention and Health Promotion. (2022, September 8). *Promoting health for older adults*. U.S. Department of Health and Human Services.

https://www.cdc.gov/chronicdisease/resources/publications/factsheets/promoting-health-for-older-adults.htm

O' Sullivan, S. B., Schmitz, T. J., & Full, G. (2019). *Physical rehabilitation* (7th ed.). F. A. Davis.

Paulisso, D. C., Schmeler, M. R., Schein, R. M., Allegretti, A. L., Campos, L. C., Costa, J. D., Fachin-Martins, E., & Cruz, D. M. (2019). Functional mobility assessment is reliable and correlated with satisfaction, independence and skills. *Assistive Technology*, *33*(5), 264–270. https://doi.org/10.1080/10400435.2019.1629125

Pellichero, A., Best, K., Leblond, J., Coignard, P., Sorita, E., & Routhier, F. (2021). Relationships between cognitive functioning and power wheelchair performance, confidence and life-space mobility among experienced power wheelchair users: An exploratory study. *Journal of Rehabilitation Medicine (Stiftelsen Rehabiliteringsinformation), 53*(9), 1–7. https://doi.org/10.2340/16501977-2869

Pizzi, M. A., Reitz, M., & Scaffa, M. E. (2018). Health promotion and well-being for people with physical disabilities. In H. M. Pendleton & W. Schultz-Krohn (Eds.), *Pedretti's occupational therapy: Practice skills for physical dysfunction* (8th ed., pp. 58–70). Elsevier.

Reimers, A. K., Jekauc, D., Mess, F., Mewes, N., & Woll, A. (2012). Validity and reliability of a self-report instrument to assess social support and physical environmental correlates of physical activity in adolescents. *BMC Public Health*, *12*, Article 705. https://doi.org/10.1186/1471-2458-12-705

Robertson, B., Lane, R., Lannin, N., Laver, K., & Barr, C. (2022). A systematic review of outcomes measured following new wheelchair and seating-prescription

interventions in adults. *Archives of Rehabilitation Research and Clinical Translation*, *5*(1), 1–20. https://doi.org/10.1016/j.arrct.2022.100249

Routhier, F., Vincent, C., Desrosiers, J., & Nadeau, S. (2003). Mobility of wheelchair users: A proposed performance assessment framework. *Disability and Rehabilitation, 25*(1), 19–34. https://doi.org/10.1080/dre.25.1.19.34

Rusek, C. T., Kleven, M., Walker, C., Walker, K., Heeb, R., & Morgan, K. A. (2021). Perspectives of inpatient rehabilitation clinicians on the state of manual wheelchair training: A qualitative analysis. *Disability and Rehabilitation: Assistive Technology, 18*(7), 1154-1162. https://doi.org/10.1080/17483107.2021.1993359

Rushton, P. W., Kirby, R. L., & Miller, W. C. (2012). Manual wheelchair skills: Objective testing versus subjective questionnaire. *Archives of Physical Medicine and Rehabilitation*, *93*(12), 2313–2318. https://doi.org/10.1016/j.apmr.2012.06.007

Rushton, P. W., Smith, E. M., Miller, W. C., Kirby, R. L., & Daoust, G. (2019). Reliability and responsiveness of the Self-Efficacy in Assessing, Training and Spotting Wheelchair Skills (SEATS) outcome measure. *Disability and Rehabilitation: Assistive Technology*, *14*(3), 250–254. https://doi.org/10.1080/17483107.2018.1428370

Sakakibara, B. M., Miller, W. C., Routhier, F., Backman, C. L., & Eng, J. J. (2014). Association between self-efficacy and participation in community-dwelling manual wheelchair users aged 50 years or older. *Physical Therapy*, *94*(5), 664–674. https://doi.org/10.2522/ptj.20130308

Sarsak, H. I., (2019). Association of self-report and performance-based instruments to measure functional performance among wheelchair users. *Journal of Physical Medicine, Rehabilitation and Disabilities, 5*, 1-11. http://doi.org/10.24966/PMRD-8670/100029

Seko, T., Mori, M., Ohnishi, H., Himuro, N., Takahashi, Y., Kumamoto, T., & Ito, T. (2019). Reliability and validity of seated hip extensor strength measurement by handheld dynamometer in older adults. *Journal of Geriatric Physical Therapy, 42*(4), 39–44. https://doi.org/10.1519/JPT.0000000000000207

Sleutjes, D. K. L., Harmsen, I. J., van Bergen, F. S., Oosterman, J. M., Dautzenberg, P. L. J., & Kessels, R. P. C. (2020). Validity of the Mini-Mental State Examination-2 in diagnosing mild cognitive impairment and dementia in patients visiting an outpatient clinic in the Netherlands. *Alzheimer Disease and Associated Disorders, 34*(3), 278–281. https://doi.org/10.1097/WAD.0000000000000403

Spector, P. E. (1994). Using self-report questionnaires in OB research: A comment on the use of a controversial method. *Journal of Organizational Behavior*, *15*(5), 385–392. https://doi.org/10.1002/job.4030150503

Sprigle, S. (2014). Measure it: Proper wheelchair fit is key to ensuring function while protecting skin integrity. *Advances in Skin & Wound Care, 27*(12), 561–572. https://doi.org/10.1097/01.asw.0000456446.43330.70

Stanley, R. K., Stafford, D. J., Rasch, E., & Rodgers, M. M. (2003). Development of a functional assessment measure for manual wheelchair users. *The Journal of Rehabilitation Research and Development*, *40*(4), 301-307. https://doi.org/10.1682/jrrd.2003.07.0301

Stigen, L., Bjørk, E., Lund, A., & Cvancarova Småstuen, M. (2018). Assessment of

　　　clients with cognitive impairments: A survey of Norwegian occupational

　　　therapists in municipal practice. *Scandinavian Journal of Occupational Therapy*,

　　　25(2), 88–98. https://doi.org/10.1080/11038128.2016.1272633

Sutton, D., & McCormack, S. (2019). *Fall prevention guidelines for patients in*

　　　wheelchairs or patients with delirium: A review of evidence-based guidelines.

　　　Canadian Agency for Drugs and Technologies in Health.

　　　https://www.ncbi.nlm.nih.gov/books/NBK546784/#

Tu, C., Liu, L., Wang, W., Du, H., Wang, Y., Xu, Y., & Li, P. (2017). Effectiveness and

　　　safety of wheelchair skills training program in improving the wheelchair skills

　　　capacity: A systematic review. *Clinical Rehabilitation, 31*(12), 1573–1582.

　　　https://doi.org/10.1177/0269215517712043

Uchikawa, K., Liu, M., Hanayama, K., Tsuji, T., Fujiwara, T., & Chino, N. (2004).

　　　Functional status and muscle strength in people with Duchenne muscular

　　　dystrophy living in the community. *Journal of Rehabilitation Medicine, 36*(3),

　　　124–129. https://doi.org/10.1080/16501970410023461

Vespa, J., Armstrong, D. M., & Medina, L. (2018). Demographic turning points for the

　　　United States: Population projections for 2020 to 2060.

　　　https://www.census.gov/content/dam/Census/library/publications/2020/demo/p25-

　　　1144.pdf

Vugteveen, J., De Bildt, A., Theunissen, M., Reijneveld, S. A., & Timmerman, M.

　　　(2019). Validity aspects of the Strengths and Difficulties Questionnaire (SDQ)

adolescent self-report and parent-report versions among Dutch adolescents. *Assessment, 28*(2), 601–616. https://doi.org/10.1177/1073191119858416

Wang, R. H., Mihailidis, A., Dutta, T., & Fernie, G. R. (2011). Usability testing of multimodal feedback interface and simulated collision-avoidance power wheelchair for long-term-care home residents with cognitive impairments. *Journal of Rehabilitation Research & Development*, *48*(7), 801–821. https://doi.org/10.1682/JRRD.2010.08.0147

Yang, M., Ding, X., & Dong, B. (2014). The measurement of disability in the elderly: A systematic review of self-reported questionnaires. *Journal of the American Medical Directors Association, 15*(2), 150.e1–150.e1509. https://doi.org/10.1016/j.jamda.2013.10.004

Yu, S. T. S., Yu, M., Brown, T., & Andrews, H. (2018). Association between older adults' functional performance and their scores on the Mini Mental State Examination (MMSE) and Montreal Cognitive Assessment (MoCA). *The Irish Journal of Occupational Therapy*, *46*(1), 4–23. https://doi.org/10.1108/ijot-07-2017-0020

Appendix A

Comparison of Wheelchair Assessments Under the PEOP Framework

Assessments	P *Person*	E *Environment*	O *Occupation*	P *Performance*
Tool for assessing wheelchair (TAWC)	X			
Functional mobility assessment (FMA)	X		X	X
Psychosocial Impact of Assistive Device Scale (PIADS)	X	X		X
Wheelchair Users Functional Assessment (WUFA)	X		X	X
Power-mobility indoor driving assessment (PIDA)		X		X
Power-mobility community driving assessment (PCDA)		X		X
Wheelchair Skills Test (WST)		X		X
The assistive technology outcome profile for mobility (ATOP/M)	X		X	X

Appendix B

Reliability and Validity Comparison of Each Wheelchair Assessment

Assessments	Inter-rater reliability	Intra-rater reliability	Test-retest reliability	Face Validity	Content Validity	Concurrent Validity
Tool for assessing wheelchair discomfort (TAWC)**						X
Functional mobility assessment (FMA)	X	X	X		X	
Psychosocial impact of assistive device (PIADS)**		X	X			X
Wheelchair users functional assessment (WUFA)**	X				X	
Power-mobility indoor driving assessment (PIDA)	X	X		X	X	
Power-mobility community driving assessment (PCDA)	X			X	X	X
Wheelchair Skills Test (WST)	X	X	X	X	X	X
The assistive technology outcome profile for mobility (ATOP/M)**			X			