DEVELOPMENT AND TESTING OF A CLINICAL OUTCOME MEASUREMENT TOOL TO ASSESS WHEELED MOBILITY AND SEATING INTERVENTIONS

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The purpose of this study was to develop the Functioning Everyday with a Wheelchair – Capacity (FEW-C), a valid and reliable performance-based observation tool to measure the effects of wheeled mobility and seating interventions on functional capabilities specific to consumers needs. The tool was modeled after the Functioning Everyday with a Wheelchair (FEW), a companion self-report measure and characteristics of the capacity qualifier of the World Health Organization International Classification of Functioning, Disability, and Health. Prior to the development of the tool a systematic review of the scientific literature revealed limited availability of performance based measures of functional outcome that could be applied across the spectrum of wheeled mobility and seating devices or types of impairments. Excellent interrater reliability coefficients (ICC 2,k = 0.98) were established with 13 wheeled mobility and seating device users and 8 trained raters. Internal consistency of the FEW-C, based on a sample of 25 wheeled mobility and seating device users, yielded Cronbach's alphas ranging from 0.74 to 0.89 indicating good internal consistency without redundancy. Multitrait-multimethod matrix analyses, yielded fair to good convergent and discriminant validity when compared with other tools that were measuring similar traits by different methods. A non-randomized clinical trial was implemented to test the ability of the performance-based FEW-C to detect statistical and practical change over time, and to ascertain if the FEW-C results differed from the companion self-report tools. Findings indicated that the FEW-C and other self-report tools were able to measure practical changes in function over time with very large Cohen's d effect sizes (2.28 - 3.18) following the provision of a new wheeled mobility and seating device, however, each of the tools behaved differently. These findings further confirmed the effectiveness of the wheeled mobility and seating interventions provided by the clinicians. Our findings also indicated that the operationalization of the items of the reliable and valid FEW self-report tool into a performance-based observational tool yielded another reliable and valid tool for gathering data about functioning with a wheeled mobility and seating device, and that each tool contributed unique information to wheeled mobility and seating assessments.

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PREFACE

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Finally, I wish to dedicate the work of this dissertation to all those who have endured difficulties obtaining the appropriate wheeled mobility and seating interventions. You are the motivation behind all of this.

1. INTRODUCTION

The wheelchair is viewed as one of the most valued assistive technology devices in the field of rehabilitation (Kirby, Swuste, Dupuis, MacLeod, & Monroe, 2002). Studies have estimated there are approximately 1.7 million non-institutionalized people who use wheelchairs in the United States (Jones & Sanford, 1996, Kaye, Kang, & LaPlante, 2000). Other research has further reported limited mobility is becoming a problem in the United States where almost six million non-institutionalized adults report difficulty walking a quarter mile, climbing 10 steps, standing for 20 minutes, or report using a wheelchair or scooter (Iezzoni, 2003, Iezzoni, McCarthy, Davis, & Siebens, 2001).

The recent shift to evidence based practice has challenged the assistive technology community with the ethical obligation to be accountable and demonstrate the effectiveness of services and interventions (DeRuyter, 1995). However, documentation of such outcomes is dependent on the availability of appropriate measurement tools (Smith, 1996). According to a systematic review of outcome measures related to functional performance with the use of manual wheelchairs (Kilkens, Post, Dallmeijer, Seelen, & van der Woude, 2003) existing tools are limited in their scope and utility. Other commonly accepted tools used to assess global function if the field of rehabilitation such as the Functional Independence Measure (FIM™) (Granger, Hamilton, Linacre, Heinemann, & Wright, 1993) has been reported by others to not be sensitive in measuring functional change in users of wheeled mobility and seating devices (Harvey, Batty,

& Fahey, 1998, Marino et al., 1993, Ota et al., 1996, Yarkony, Roth, Heinemann, Lovell, & Wu, 1988).

Due to the lack of available outcome measures related to function with the use a wheelchair, a team of researchers at the University of Pittsburgh systematically developed a 10 item self-report outcome measurement tool, Functioning Everyday with a Wheelchair (FEW). Task items for the FEW were developed and validated based on structured interviews with wheelchair users and analysis of goals and items documented by consumers and clinicians in other sources including additional research studies related to wheeled mobility and seating as well as the review of health records related to the prescription of these devices. The FEW has also demonstrated good test-retest reliability (Mills, Holm, Schmeler et al., 2002, Mills, Holm, Trefler et al., 2002).

Given that the FEW is a self-report measure of functional performance and there is ongoing question as to the accuracy and reliability of self-report tools (Cress et al., 1995, Rogers et al., 2003)} the primary purpose of this study was to systematically develop a criterion-referenced, performance-based observation tool, for use by practitioners and researchers to measure functional outcomes of wheeled mobility and seating interventions in the clinical setting. The Functioning Everyday with a Wheelchair - Capacity (FEW-C) was developed using the same item content as the FEW self-report tool and modeled after the Performance Assessment of Self-Care Skills (PASS) (Rogers & Holm, 1989). The FEW-C was developed simultaneously with another performance-based version of the FEW, the Functioning Everyday with a Wheelchair – Performance (FEW-P) tool. Whereas the FEW-C was designed for use in the standardized clinical environment, the FEW-P was designed to quantify function with the use of a wheeled mobility and seating device within the “lived-in” environment (Mills, Holm, &

Schmeler, 2003). The FEW-C and FEW-P were developed to respond to the World Health Organization International Classification of Function, Disability, and Health (World Health Organization., 2001) capacity and performance qualifiers as well as complement one another. Both tools have identical items and scoring methods.

The first aim of this study was to conduct a systematic review of the literature, and this is included in Chapter 2. The review systematically identifies and describes items from other performance based measures of function for people who use manual or powered wheeled mobility and seating devices to determine the degree to which the 10 items of the FEW are represented in existing wheelchair functional outcomes measures and studies. A second purpose was to document the content, target populations, study participants, test feasibility, and clinometric properties of existing wheelchair functional performance measures. The review was further intended to build on the previous work of Kilkens et al (2003), and to also include studies of performance outcomes for users of powered mobility devices.

Chapter 3 describes the systematic development of the FEW-C including protocols for tool administration, testing materials, and procedures used to train test raters. Studies performed to measure the interrater reliability as well as tests for internal consistency, convergent validity, and discriminant validity of the FEW-C are also described and discussed in this chapter and compared with constructs in two other tools. This chapter further describes and discusses the use of a third tool, Functional Abilities in a Wheelchair (FAW), intended to measure a person's self-perceived level of independence performing the same 10 task items measured in the FEW and FEW-C in a wheeled mobility and seating device, however the FAW questions do not mention the mobility device.

Chapter 4 describes and discusses the study that investigated the ability of the FEW and the FAW to measure user perceived change in function and the FEW-C to measure observed change in function following the provision of a new wheeled mobility and seating device provided by a qualified interdisciplinary team of practitioners. This study specifically examined statistical and practical changes in function that were measured between the self-report tools and performance-based measure, as well as the magnitude of those changes. Finally, Chapter 5 provides a summary of all study objectives and results as well as implications for future outcomes research using the FEW, FAW, and FEW–C.

2. MEASURES OF FUNCTIONAL CAPACITY AND PERFORMANCE USING A WHEELCHAIR: A SYSTEMATIC REVIEW

2.1. INTRODUCTION

The wheelchair is viewed as one of the most important Assistive Technology (AT) devices used in rehabilitation for people who cannot ambulate or have difficulty with ambulation (Kirby et al., 2002). Almost 6 million non-institutionalized adults in the United States report difficulty walking a quarter mile, climbing 10 steps, standing for 20 minutes, or report using a wheelchair or scooter (Iezzoni, 2003, Iezzoni et al., 2001). Other research has estimated there are approximately 1.7 million non-institutionalized wheelchair users in the United States (Jones & Sanford, 1996, Kaye et al., 2000). The assessment of the user's needs and matching the user with appropriate wheelchair interventions as well as fitting and training the user for the device, is essential for successful outcomes (Rory A. Cooper, 1998). Consumer involvement in key decisions regarding the products and services they receive is important to identify interventions they will find personally appealing and useful (Marcia J. Scherer, 2000, M. J. Scherer & Lane, 1997). The functional effects of a wheelchair seating and mobility device cannot be understood without reference to the complex interplay of the technology with the user's specific needs and preferences (Samuelsson, Larsson, & Thyberg, 1999).

The Assistive Technology (AT) community has the ethical obligation to be accountable and demonstrate the effectiveness of services and interventions (DeRuyter, 1995). However,

documentation of such outcomes is dependent on the availability of appropriate measurement tools (Smith, 1996). Occupational therapy is well positioned to take a critical lead in improving the quality and accessibility of assistive technology services through the application of occupational therapy practice models and outcomes measurement tools (Jutai, 2002).

The new World Health Organization International Classification of Functioning, Disability, and Health (ICF) (World Health Organization., 2001) has been developed to provide a common language to define health and health-related domains from the perspective of the body, the individual, and society that has universal application to all people. These domains are described as (1) Body Functions (physiological) and Structures (anatomical); and (2) Activities (tasks or actions) and Participation (life situations). ICF defines Function from the perspective of all body functions, activities, and participation and Disability is used to define impairment, activity limitation, and restricted ability to participate in society. ICF also includes environmental factors (physical, social, and attitudinal environment at the level of the individual and society) or personal factors (person's background excluding health condition/state) that interact with these constructs. Capacity is used as a qualifier to measure a person's ability to carry out activities in a controlled environment and Performance is used to qualify a person's ability to carry out activities in their natural environments (World Health Organization., 2001).

The ICF (World Health Organization., 2001) has been recommended as a conceptual framework for outcome measures because it includes dimensions of social participation and factors in the environment that are important for understanding the complexity of disability (Gray & Hendershot, 2000). From ICF a new model of Human Environment Integration has been proposed to consider rehabilitation interventions and outcome measures that integrally include man-made and naturally occurring environmental barriers that impact capacity for and

participation in activities (Stineman, 2001). One environmental factor, assistive technology, has been identified as an important element in addressing the capacity for performance and participation in activities (Kirby, 2002). The ICF shift in focus from traditional health indicators provides a mechanism to document function, environmental impacts on function (social and physical), and the impact of assistive technology in performing functional activities within contexts that are meaningful to the consumer.

An outcomes measurement tool must be valid, reliable, and practical for implementation within the context of clinical or natural environments as well as capable of being administered within a reasonable amount of time with reasonable resources (Miller Polgar & Barlow, 2002). There are many assessments of global function in the rehabilitation field with the two most common being the Functional Independence Measure (FIM™) (Granger et al., 1993) and the Barthel Index (Collin, Wade, Davies, & Horne, 1988). Few, however, specifically consider functional abilities with the use of a wheelchair. The well recognized FIM™ , with well-established validity (Stineman et al., 1996) and reliability (Ottenbacher, Hsu, Granger, & Fiedler, 1996) actually penalizes a full function rating for an activity if it is performed while using an AT device (Kirby, 2002). Additionally, the sensitivity of the FIM™ scale does not distinguish levels of difference within activities common to wheelchair users, regardless of user competency (Harvey et al., 1998). The FIM's lack of sensitivity has been demonstrated by its inability to differentiate between functional levels of people with paraplegia and quadriplegia unlike the motor score of the American Spinal Injury Association (ASIA) (Ota et al., 1996). The scales also appear to have a ceiling effect as studies have shown no improvement in function on the FIM™ when clinical observations indicated otherwise (Marino et al., 1993, Yarkony et al., 1988).

Due to limited availability of functional outcome measures for wheelchair use, a team of researchers at the University of Pittsburgh systematically developed the Functioning Everyday with a Wheelchair (FEW) self-report outcome measurement tool based on consumer input and validation. Phase I of the FEW development consisted of structured interviews of 20 wheelchair users (10 manual and 10 power) conducted using the Canadian Occupational Performance Measure (Law et al., 1990, Law et al., 1994) as a guide. In this first phase of development, 154 functional items were identified based on consumer reported self-care, productivity, and leisure activities related to their current seating and mobility devices. From this initial item pool, 10 categories were developed related to transfers, reach, accessing task surfaces, transportability, human machine interface, architectural barriers, transportation accessibility, transportation securement, natural barriers, and accessories. From the 10 categories, 10 items were developed that focused on the consumer, the technology, and the milieu and how they interacted (Marcia J. Scherer, 2000). The first version of the FEW (see Appendix A) was administered to 17 of the original 20 participants for validation. Participants prioritized the importance of the 10 items differently based on their individual needs as compared to what they perceived as generally important for wheelchair users overall. The ability of consumers to differentiate these two approaches (content and construct validity), and rate them differently, also supported the validity of the tool as a dynamic indicator of function. Findings from this first phase also indicated wheelchair users had unmet needs that impacted their function and quality of life and supported the need for further development of a quantifiable outcome measurement tool (Mills, Holm, Trefler et al., 2002).

In Phase II of development, test-retest reliability of the FEW was examined. The FEW was administered to 40 participants with non-progressive medical conditions by trained

researchers. The participants were then asked to self-administer the FEW again 4 to 7 days later and return it by mail. Thirty five of the 40 participants completed and returned the self-administration. Results yielded an Intraclass Correlation Coefficient (2,*k*) of 0.93, [CI = .84, .97; p<.001] indicating the FEW is a highly stable measurement tool warranting further psychometric development (Mills, Holm, Schmeler et al., 2002).

In Phase III of development (concurrent validity), cross-validation of goals and outcome statements related wheelchair seating and mobility were identified from five different sources including (1) consumer reported goals and needs from an Internet-based study (Buning, 2002), (2) a telerehabilitation study (Shapcott, Boninger, Cooper, Cohen, & Fitzgerald, 2001), (3) goals stated by consumers during a clinical assessment at the Center for Assistive Technology at the University of Pittsburgh Medical Center (CAT), and (4) medical records reviewed from the CAT as well as (5) the Center for Assistive & Rehabilitative Technology at Hiram G. Andrews Center (CART). The goals and outcomes were cross validated with items from the FEW, based on the consensus of two practitioner researchers. The analysis revealed 15 new categories of goals not captured by the original FEW items. The FEW did however capture 80% of the goals identified in this analysis after rewording of the items. Beta Version 2.0 of the FEW (see Appendix B) was then developed with the 10 new items and it captured 98% of the consumer and practitioner goals identified across five samples that included 1900 goals documented by 221 consumers or their practitioners. The findings confirmed the concurrent validity of the FEW, and supported the need to continue with development of the FEW. Prior to Phase IV of development, changes were made to the format of the FEW Beta Version 2.0 items and the tool was renamed Functioning Everyday with a Wheelchair (FEW Beta Version 2.0) based on consensus of the

Rehabilitation Engineering & Research Center on Wheeled Mobility and Seating Advisory Board's feedback, to better reflect the underlying purpose of the measure.

In Phase IV test-retest reliability of the FEW Beta Version 2.0 was examined. The self-report measure was administered to 40 participants with non-progressive medical conditions by trained researchers. Participants were again asked to self-administer the FEW four to seven days later and return it by mail. Thirty seven of the 40 participants completed and returned the self-administration. Results yielded an Intraclass Correlation Coefficient (2,k) of 0.86 indicating the FEW Beta Version 2.0 is a stable self-report measurement tool of consumer-generated functional outcomes of seating and mobility interventions.

The FEW is a self-report tool and there are ongoing questions related to whether self reported measures correlate with performance-based measures. For example, good to excellent correlation was reported (r=.95) between manual wheelchair user self report of skills and scores on the Wheelchair Skills Tests, however, the authors reported that with self-report users tended to overestimate their abilities (Newton, Kirby, Macphee, Dupuis, & Macleod, 2002). Differences in self-report overestimation and underestimation when compared to performance-based assessment can also depend on the activity domain. Rogers, et al. (2001) found that for functional mobility, self-report underestimated ability compared to clinic performance ratings, whereas for personal care, physical instrumental activities of daily living (IADL) and cognitive IADL, self-report overestimated ability compared to performance assessment in the clinic among subjects with chronic arthritis. Just as ratings of activity domains can yield different outcomes, so can constructs such as independence, safety and adequacy of task performance. Rogers, Holm, Beach, Schulz, and Starz (2001) found that "independence is not always synonymous with safe and adequate performance" (p. 410). Similarly, one study suggested that there may also be

significant differences in perceived performance versus actual performance of certain activities of daily living among hospital-based older persons at discharge (Sager et al., 1992). However, others have reported that both self-reported and performance based measurement tools yield strong indicators of function in a variety of activities, but factors such as depression, cognitive function, and marital status affect self-perceived function in some populations such as community and nursing home residents (Cress et al., 1995).

Although comparisons have been made between tools and among methods of assessing functional outcomes of users of wheelchairs, few involved tools derived from items that wheelchair users perceived as being important for assessing functional outcomes. Therefore Routhier, Vincent, Desrosiers, and Nadeau (2003) proposed a systematic framework for the clinical assessment of functional performance of wheelchair users. Based on their review of existing measurement tools, it was suggested that few existing tools assess all variables that influence wheelchair mobility. They concluded that further development of tools for assessing functional outcomes of wheelchair users should consider all aspects of wheelchair mobility including the user's profile, the wheelchair device, environmental factors, activities of daily living, social roles, as well as assessment and training in use of the device.

A systematic review has been described and compared the content, feasibility, outcome parameters, and clinometric properties of performance based manual wheelchair tests of functional performance (Kilkens et al., 2003). Based on a search of common databases from 1966 to 2001, the authors described 24 unique manual wheelchair skills tests with propulsion, transfers, curb negotiation, ascending slopes, traversing tracks, sprinting, and performing wheelies as being the most frequently cited skills. Task performance time, task independence, and physical strain were the most commonly cited performance outcomes. Sensitivity to change,

validity, and reliability were not consistently measured for all tools and the authors concluded it is difficult to compare study results due to a lack of standardization in the use of measurement instruments.

Items in the FEW were systematically developed based on consumer input and validation, the primary purpose of this review is to identify and describe items from other performance based measures of function for people who use manual or powered wheeled mobility devices to determine the degree to which the 10 items of the FEW are represented in existing wheelchair functional outcomes measures and studies. A second purpose is to document the content, target populations, study participants, test feasibility, and clinometric properties of existing wheelchair functional performance measures.

Kilkens et al (2003) reviewed the literature from 1966 to 2001 related to observable capacity-based outcomes using manual wheelchairs only. Buning et al. (2001) investigated self-reported change in occupational performance following the transition from marginal ambulation or marginal use of a manual wheelchair to powered mobility, and their literature review beginning with the early 1980's found limited outcomes describing and quantifying the effects of powered mobility on function. The current review was intended to build on and extend these works, and was thus limited to studies published from 1994 to July 2004. Additionally, the current review includes more recent studies that focused on either the ICF constructs of capacity or performance (World Health Organization., 2001)and those that included outcomes associated with the use of manual wheelchairs, power wheelchairs, or scooters.

2.2. METHODS

2.2.1. Search Strategies

Research studies were initially identified through electronic database searches of MEDLINE, Cumulative Index of Nursing and Allied Health Literature (CINAHL), and PsychINFO. The keywords used were wheelchair combined with outcome, function, performance, and skill as well as each of the key words for the 10 FEW items as follows;

1. Wheelchair
2. #1 and Outcome
3. #1 and Function
4. #1 and Performance
5. #1 and Skill
6. #1 and Durability
7. #1 and Safety
8. #1 and Comfort
9. #1 and Health Needs
10. #1 and Operate
11. #1 and Reach
12. #1 and Transfers
13. #1 and Activities of Daily Living
14. #1 and Indoor Mobility
15. #1 and Outdoor Mobility
16. #1 and Transportation

The reference lists of relevant publications were also reviewed to identify further studies that met the inclusion criteria. Studies were included for review if they were (a) published between 1994 and July, 2004, (b) in referenced scientific journals, and (c) written in the English language.

2.2.2. Selection Criteria

An article was accepted for review if it involved observational performance using a manual or powered mobility device and focused on measurement of function at the level of activity, and addressed capacity or performance as described by the ICF (World Health Organization., 2001). Studies were excluded if: (a) physiologic body system functions were the only dependent variables, (b) the outcomes were self report in nature, (c) the variables were not well enough defined to determine whether they fell into the ICF domains of functional capacity or performance.

Articles were excluded if the study was not related to function in a wheelchair. When in doubt, abstracts and articles were retrieved and reviewed to determine whether the study might meet the inclusion criteria. Articles were then reviewed by two student research assistants for consensus as to whether they met the inclusion/exclusion criteria, and when there was doubt, a senior faculty member was consulted.

2.2.3. Assessment of Selected Studies

Articles were systematically assessed and described based on the following components;

- Number of subjects in the study
- Item content: specific tasks in the assessment and relationship to FEW items
- ICF Domain: assessment of task capacity or performance
- Target population: who the test is intended for
- Study population: subjects used in the study
- Test feasibility: resources, space, time, and apparatus necessary to administer test

- Measurement methods: scoring and scaling
- Clinometric properties: reliability, validity, and sensitivity

2.3. RESULTS

2.3.1. Studies Selected

From the initial review, 40 studies were identified for potential inclusion and all articles were reviewed. Twenty studies were rejected as they were either self-reports only, the dependent variables were related to physical capacity and physiologic body system functions only, or because the dependent variables were not well defined. This yielded a total of 20 studies that met the inclusion/exclusion criteria.

2.3.2. Descriptive Overview of Studies

For each study Table 2.1 provides general descriptions of each study, organized in alphabetical order of first author. Sixteen of the 20 studies assessed function at the activity/capacity level of the ICF domains whereas the other 4 assessed function at the activity/performance level. Seventeen were designed specifically to assess function in manual wheelchairs, 2 in powered mobility, and 1 for either manual or powered mobility. Sample sizes ranged from 4 to 298 subjects with a mean sample size of 50.9 ± 70.5 and median sample size of 25.5. In 7 studies the target population was described as manual wheelchair users; 7 as manual wheelchair users with spinal cord injuries; 3 as elderly manual wheelchair users who resided in long-term care facilities; 2 as people being considered for powered mobility; and 1 as residents of long-term care facilities being considered for powered mobility. In 8 studies the study population was

described as people with spinal cord injuries; 7 as manual wheelchair users, 4 as residents of long-term care facilities; 1 as power wheelchair users; and 2 studies included able-bodied subjects as part of their study population. Twelve studies described task independence using ordinal scaling methods as the outcome measure. Twelve studies described interval measures of outcome including 6 using task completion time, 3 using reach distance, 1 using distance traveled in the wheelchair, one using the angle to which a wheelchair tips, and 1 using a visual analog scale of safety. One study used a pass/fail categorical scoring method. Reliability was reported in only 12 of the studies including 6 that reported test-retest reliability, 5 that reported intra-rater reliability, 7 that reported interrater reliability, and 1 reported a test of internal consistency. Magnitude of reliability, as described by Portney and Watkins (2000), found

Table 2.1 Overview of Selected References

Reference	Capacity/ Performance Setting	Power Manual Either	[1] *N*	[2] Target Population	[3] Study Population	[4] Scoring	[5] Reliability	[6] Validity
Amos *et al*, 2001	Capacity/ Clinic	Manual	53	Long-term care residents who use standard wheelchairs	Long-term care residents who use standard wheelchairs	Interval; Reach distance	Reported elsewhere	Not reported
Bolin *et al*, 2000	Capacity/ Clinic	Manual	4	Tetraplegic manual wheelchair users	Complete C5-C6 spinal cord injury	Interval: Reach distance Interval: task time Ordinal: FIM transfer item	Not reported	Not reported
Cooper *et al*, 2003	Performance / Community	Either	4	Manual wheelchair users being considered for the IBOT	Manual wheelchair users with T7 to L! spinal cord injury	Ordinal: task independence (1 to 6)	Not reported	Not reported
Cress *et al*, 2002	Capacity/ Laboratory	Manual	18	Manual wheelchair users	Adult manual wheelchair users	Interval: time, distance, & weight (0 to 100)	Test-retest: ICC 0.87 to 0.96, *P*<0.01 Internal consistency: Cronbach's alpha 0.58 to 0.93, *P*<0.01	Construct: SIP scores and WC-PFP scores (Eta=.32-.45; *P*<.05) Concurrent: SIP scores and upper body domain of WC-PFP (*r*=-0.45)
Dawson *et al*, 1994	Performance/ Residence	Power	15	Long-term care residents being considered for a powered wheelchair or scooter	Male long-term care residents	Ordinal: task performance (1 to 4)	Intra-rater: ICC 0.67, *P*<0.001 Interrater: ICC 0.87, *P*<0.001	Content & face: national survey of expert clinicians and clinician/consumer focus groups
Dunkerly *et al*, 2000	Capacity/ Clinic	Manual	11	Person with tetraplegia who underwent deltoid tricep transfer surgery	Manual wheelchair users with C4-C6 spinal cord injury	Interval: task performance time	Not reported	Face: 10m push was felt to be equivalent to 10m Walk Test
Duran *et al*, 2001	Capacity/ Clinic	Manual	14	Manual wheelchair users with spinal cord injury	Manual wheelchair users with thoracic spinal cord injury	Ordinal: task performance wheelchair skills (1-4) 1= cannot perform 2= incomplete performance of the test 3= complete performance with greater mean time 4= complete performance with a lesser mean time	Not reported	Not reported

Table 2.1 (continued)

Reference	Capacity/ Performance Setting	Power Manual Either	[1] *N*	[2] Target Population	[3] Study Population	[4] Scoring	[5] Reliability	[6] Validity
Harvey *et al*, 1998	Capacity/ Clinic	Manual	20	Manual wheelchair users with paraplegia	Manual wheelchair users with paraplegia	Ordinal: task performance (1 to 6)	Interrater: Cohen's Weighted Kappas 0.82 to 0.96,	Face: based on expert opinion of clinicians
Kilkens *et al*, 2002	Capacity/ Clinic	Manual	27	Manual wheelchair users with spinal cord injuries	Manual wheelchair users with paraplegia and tetraplegia	Interval: task completion time	Intra-rater: ICC 0.71 to 0.99 Interrater: ICC 0.76 to 0.98	Not reported
Kilkens *et al*, 2004	Capacity/ Clinic	Manual	74	Manual wheelchair users with spinal cord injuries	Manual wheelchair users with paraplegia and tetraplegia	Ordinal: task performance (0 to 8) Interval: task completion time	Reported previously	Construct: functional status, physical capacity, lesion level, motor completeness, and age
Kirby *et al*, 1999	Capacity/ Clinic	Manual	97	Manual wheelchair users	Manual wheelchair users	Ordinal: ranges of degrees of wheelchair tip angle	Intra-rater: r=.94 - .98 Interrater: r=.97 -.99	Content: adapted from ISO test Construct: stability leaning forward, locking wheels, using anti-tippers (p<.0001) Concurrent: scores between static & dynamic stability (r=.29 - .65)
Kirby *et al*, 2001	Capacity/ Clinic	Manual	42	Manual wheelchair users	12 manual wheelchair users and 30 able-bodied participants	Interval: VAS of safety % of subjects able to learn skill Interval: task mastery time	Not reported	Content: clinical expertise (focus groups) and review of the literature
Kirby *et al*, 2002	Capacity/ Clinic	Manual	24	Manual wheelchair users	Manual wheelchair users	Ordinal: task performance (0 to 2) 0= Failure to complete test criteria safely 1=partial completion 2=successful and safe completion NA=not applicable	Test-retest: ICC .65 (P=.001) Intra-rater: ICC .96 (P<.001) Interrater: ICC .95 (P<.001)	Content: clinician endorsement of items Construct: clinician subjective assessment of change in performance from test 1 to test 2 Concurrent: WST score & clinician VAS score

Table 2.1 (continued)

Reference	Capacity/ Performance Setting	Power Manual Either	[1] *N*	[2] Target Population	[3] Study Population	[4] Scoring	[5] Reliability	[6] Validity
Kirby *et al*, 2004	Capacity/ Clinic	Manual	298	Manual wheelchair users	169 manual wheelchair users and 129 able-bodied participants	Categorical: pass or fail on task performance 0=Fail 1: Pass NA: Not applicable NG: not a goal	Test-retest: ICC .904 (*P*<.001) Intra-rater: ICC .959 (*P*<.001) Interrater: ICC .968 (*P*<.001)	Construct: correlation of total WST scores with age, gender, wheelchair experience, type of wheelchair, and diagnosis Concurrent: correlation between total WST scores and clinician subjective assessment of function and global assessments of FIM instrument scores
Letts *et al*, 1998	Performance/ Community	Power	4	People being considered for powered mobility	People who use powered mobility devices in the community	Ordinal: task performance (1 to 4) 1: unable to complete task independently 2: bumps objects and people in a way that could cause harm to driver and other people 3: completes tasks hesitantly 4: completely independent	Not reported	Content: expert opinions of clinicians and users of powered mobility based on focus groups
May *et al*, 2003	Capacity/ Clinic	Manual	20	Manual wheelchair users	Male manual wheelchair users with paraplegia or tetraplegia	Ordinal: task performance Scaling not reported	Test-retest: *r*=.99 *P*<.001 Interrater: ICC = .99 *P*<.001	Content: review of literature
Simmons *et al*, 1995	Performance / Residence	Manual	65	Non-ambulatory nursing home residents sitting in manual wheelchairs	Non-ambulatory nursing home residents sitting in manual wheelchairs	Ordinal: task performance (1 to 5 for wheel locks and footrest management) (0 to 3 to pick up sponge from floor), scoring criteria not reported.	Test-retest: distance propelled Day 1 and Day 2; *r*= .82 *P*=.000	Not reported

Table 2.1 (continued)

Reference	Capacity/ Performance Setting	Power Manual Either	[1] *N*	[2] Target Population	[3] Study Population	[4] Scoring	[5] Reliability	[6] Validity
Stanley *et al*, 2003	Capacity/ Clinic	Manual	101	Manual wheelchair users	Manual wheelchair users who use their devices both in the home and community	Ordinal: task performance scoring similar to FIM 1-7. 1= total dependence to 7=complete independence. On the WUFA a score of 6 or 7 includes specific time for task completion. Specific scaling criteria. Other details not reported.	Test-retest Spearman rho r= 0.95 p< 0.05 Interrater: ICC = 0.96 Stability: ICC = 0.78	Content: expert opinions of clinicians and manual wheelchair chair users.
Taricco *et al*, 2000	Capacity/ Clinic	Manual	100	Manual wheelchair users with spinal cord injury	67 manual wheelchair users with paraplegia and 23 with tetraplegia	Ordinal: task performance (1-5) 1=unable to carry out the task. Depends on others 2=needs major physical help by one or two people. 3=requires some supervision or very limited help 4=able to perform task independently even though with problems (hesitation, long time) 5=performs task independently without difficulties	Not reported	Content: measured and assessed against Barthel Index, QIF, and FIM Criterion: Having a concurrent and independent measure, the Barthel Index, convergent validity was evaluated by estimating strength and direction between the two scales; the VFM and Barthel Index.
Trefler *et al*, 2004	Capacity/ Clinic	Manual	30	Elderly nursing home residents who use manual wheelchairs	Elderly nursing home residents who use manual wheelchairs	Interval: task performance time Interval: reach distance	Not Reported	Not reported

moderate reliability (= 0.50 to 0.75) in 3 of the 12 studies and good reliability (> 0.75) in 9 of the 12 studies. Validity was reported in only 13 of the studies with 8 that reported content or face validity methods, 5 that reported construct validity, and 5 that reported concurrent validity.

2.3.3. FEW Items and Study Subtasks

Table 2.2 describes the match of FEW items to those in the reviewed studies. Indoor mobility tasks were the most frequently cited and included in 17 of the 20 studies. This was followed by items related to operating the wheelchair (15 studies), reaching tasks (11 studies), outdoor mobility tasks (11 studies), transfer tasks (8 studies), personal care tasks (3 studies), stability, durability, and dependability measures (2 studies), health needs tasks (2 studies), transportation tasks (2 studies), and comfort related tasks (1 study).

Table 2.3 outlines 160 unique observable subtasks described in the studies reviewed. Each subtask is sorted based on its match to the FEW items. Operate wheelchair had the largest number of distinct subtasks (44 subtasks). This was followed by outdoor mobility (36 subtasks), indoor mobility (26 subtasks), reach (22 subtasks), personal care (15 subtasks), transfers (9 subtasks), stability, durability and dependability (4 subtasks), transportation (2 subtasks), comfort (1 subtask), and health needs (1 subtask). When analyzing subtasks within each FEW item operate wheelchair had 22 subtasks related to maneuvering the wheelchair forwards, backwards, and making turns followed by 6 subtasks related to performing a wheelie in a manual wheelchair, and 5 subtasks related to wheelchair components such as armrest/footrest management, applying wheel locks, folding the wheelchair, and adjusting the speed control. Within the outdoor mobility item there were 12 subtasks related to curb negotiation; 11 subtasks

Table 2.2 Inclusion of FEW Items or Constructs in the Reviewed Studies

Reference	Indepen-dence (I) Safety (S) Quality (Q)	[1] Stability Durability Depend-ability	[2] Comfort	[3] Health Needs	[4] Operate	[5] Reach	[6] Transfers	[7] Personal Care	[8] Indoor Mobility	[9] Outdoor Mobility	[10] Transportation
Amos *et al*, 2001	_ _ _					X					
Bolin *et al*, 2000	I				X	X	X		X	X	
Cooper *et al*, 2003	I					X			X	X	
Cress *et al*, 2002	I					X		X	X		
Dawson *et al*, 1994	I, S				X				X		
Dunkerly *et al*, 2000	I				X						
Duran *et al*, 2001	I				X	X			X		
Harvey *et al*, 1998	I						X		X	X	
Kilkens *et al*, 2002	I				X		X		X	X	
Kilkens *et al*, 2004	I				X		X		X	X	
Kirby *et al*, 1999	I, S	X									
Kirby *et al*, 2001	I, S	X	X	X	X				X	X	
Kirby *et al*, 2002	I				X	X	X		X	X	
Kirby *et al*, 2004	I				X	X	X		X	X	
Letts *et al*, 1998	I, S, Q				X	X			X	X	X
May *et al*, 2003	I				X	X			X		
Simmons *et al*, 1995	I				X				X		

Table 2.2 (continued)

Reference	Indepen-dence (I) Safety (S) Quality (Q)	[1] Stability Durability Depend-ability	[2] Comfort	[3] Health Needs	[4] Operate	[5] Reach	[6] Transfers	[7] Personal Care	[8] Indoor Mobility	[9] Outdoor Mobility	[10] Transportation
Stanley *et al*, 2003	I				X	X	X	X	X	X	
Taricco *et al*, 2000	I			X	X		X	X	X	X	X
Trefler *et al*, 2004	I				X	X			X		
TOTAL		2	1	2	15	11	8	3	17	11	2

related to negotiating ramps, inclines, and slopes; and 4 subtasks related to negotiating soft of uneven terrain. Within the indoor mobility item there were 12 subtasks related to negotiating the wheelchair to objects and places such as tables, bed, toilet, and sink; 8 subtasks related to negotiating doors and doorways; and 4 items related to elevator management. Within the reach item 9 subtasks involved vertical reaching or accessing objects and places that tend to be higher such as counters and shelves; 5 subtasks that involve reaching to the floor, 4 subtasks that involved forward, left, and right horizontal reaching; and 4 subtasks that were included as part of

Table 2.3 Subtasks Described in Reviewed Studies Matched to FEW Items

	Few Item	Subtasks	Reference
1.	Durability, Stability, Dependability	Static rear stability with brakes locked	9
		Static rear stability with brakes locked and user leaning forward	9
		Static rear stability with brakes locked and anti-tip device in place	9
		Static rear stability with brakes unlocked	9
2.	Comfort	Wheelie rest; user pushes or pulls against surface to rest at angle against wall	10
3.	Health Needs	Wheelchair push-up	17
4.	Operate	Negotiate one step entrance	3
		Carry groceries 70m	4
		Turn right at intersection	5
		Turn left at intersection	5
		180 degree turn	5
		Drive backwards	5
		Control in congested area	5
		Maneuver between chairs	5
		Avoid unexpected obstacles	5
		Speed selection	5
		Share public space	5
		10m push	6
		Figure 8 maneuver	6, 8
		Push on flat (50m)	7
		Ascend/descend 1:12 ramp 15m in length	7

Table 2.3 (continued)

Few Item	Subtasks	Reference
	Crossing doorstep / threshold	8, 10, 11
	15m sprint	8
	Stationary wheelie	10, 11, 14
	Move forward in a wheelie	10, 11, 14
	Turn tight space in a wheelie	10, 11
	Turn corner in a wheelie	10, 11
	Move backwards in a wheelie	10, 11
	Wheelie (unspecified)	17
	Release brakes / Apply brakes	10, 17
	Move armrests / restore armrests	11, 17
	Move footrests / restore footrests	11
	Level propulsion forward and backward	11, 17
	Turn in space	11, 17
	Three point turn	11
	Parallel parking	11
	Open / fold wheelchair	11
	Time forward 23m	11
	One stroke push	13
	Forward propulsion receiving and throwing a ball	14
	backward propulsion receiving and throwing a ball	14
	Forward propulsion doing a circle while turning right	14
	Backward propulsion doing a circle turning right	14
	Forward propulsion doing a circle while turning left	14
	Backward propulsion doing a circle while turning left	14
	Forward propulsion between obstacles	14
	Backward propulsion between obstacles	14
	Turn in tight spaces	16
	Move forward 25ft	18
	Move forward 10ft turn right 15ft	18
5. Reach	Forward reach	1, 18
	Reach to the left	1
	Reach to the right	1
	Retrieve book off shelf	3
	Access counter-height computer	3
	Make a purchase from a top shelf in store	3
	Place purchased item on high shelf	3

Table 2.3 (continued)

	Few Item	Subtasks	Reference
		Lift and transfer a pan of weight (2m)	4
		Transfer and pour from jug into a cup	4
		Place and remove a sponge from an adjustable shelf	4
		Transfer 7.27 kg laundry from washer to dryer and from dryer to counter	4
		Pick up 4 scarves from the floor	4
		Reach High object	11
		Take /remove object from knapsack	11
		Pick object off floor	11
		Access teller counter at bank	12
		Access ATM machine	12
		Forward vertical reach	13
		Propulsion while picking up objects from the floor	14
		Reaching function (unspecified)	16
		Picking up objects / sweeping	16
		Lateral reach	18
6.	Transfers	Access bed from right	5
		Access bed from left	5
		Vertical transfer	7
		Horizontal transfer	7, 8
		Transfer into / out of wheelchair	11
		Bed transfers	16, 17
		Toilet transfer	16, 17
		Floor transfer	16, 17
		Transfer to / from bathtub / shower	17
7.	Personal Care	Put on and remove a jacket	4
		Put a Velcro-closed strap over shoe	4
		Bathing	16
		Upper / lower dressing	16
		Washed hands	17
		Washes face	17
		Dries hands / face	17
		Brushes teeth	17
		Shaves / make-up	17
		Combs hair	17
		Dressing	17
		Puts on / takes off sweater / t-shirt	17
		Puts on / takes off jacket / dress shirt	17
		Puts on / takes off pants	17

Table 2.3 (continued)

	Few Item	Subtasks	Reference
		Puts on / takes off shoes	17
8.	Indoor Mobility	Negotiate elevator	3
		Pull open/pass through a door	4
		Approach dresser	5
		Approach closet	5
		Through bathroom doorway	5
		Approach sink	5
		Approach toilet	5
		Exit bathroom	5
		Doors sliding – mat trigger	5
		Doors swing open – mat trigger	5
		Doors swing open – button trigger	5
		Doors regular	5
		Enter elevator	5
		Spacing in elevator	5
		Exit elevator	5
		Park under table	5
		Park beside table	5
		Back in parking	5
		Parallel park	5
		Up ramp	5
		Down ramp	5
		Door opens toward	11, 14, 16, 17
		Door opens away	11, 14, 16, 17
		Maneuver wheelchair inside (unspecified)	17
		Maneuver in a teller line at a bank	12
		Maneuver between shelves and display in a store	12
9.	Outdoor Mobility	Negotiate 4 degree incline for 7.5m	2
		Negotiate a 4 degree incline for 21m	2
		Negotiate ramp/incline	3
		Cross street with curb cut	3
		Cross street without curb cut	3
		Negotiate uneven terrain	3
		Negotiate soft terrain	3
		Negotiate trail incline	3
		Drive along sidewalk with pedestrians	3
		Negotiate up 2.5cm curb	7
		Negotiate up 15cm curb	7

Table 2.3 (continued)

Few Item	Subtasks	Reference
	Negotiating 1.5” curb	11
	Negotiating 4” curb	8, 10, 11
	Negotiating 7” curb	11
	Negotiate 3% slope	8
	Negotiate 6% slope	8
	Ramp ascend forward wheeling 1:13 slope	13
	Negotiate soft / irregular surface	10, 11, 16, 17
	Negotiate gravel	10, 11, 16, 17
	Ascend 5 degree slope	11
	Descend 5 degree slope	10, 11
	Negotiate 3 degree cross slope	11
	Ascend / descend a 4.7” curb	14
	Ascend / descend a 3.1” curb	14
	Ascend / descend a 2.4” curb	14
	Ascend / descend ramp (unspecified slope)	14, 16
	Ascend / descend unspecified curb	16
	Street crossing	16
	Outdoor turn (unspecified)	17
	Uphill / downhill (unspecified)	17
	Up / down curb (unspecified)	17
	Driving in crowds	12
	Approach entrance to bank	12
	Approach entrance with automatic doors	12
	Enter and negotiate a non-automatic door	12
	Approach entrance to a store with a slight slope	12
10. Transportation	Load / download wheelchair to / from car	17
	Getting on ramp to accessible public transit	12

N. B. *Primary author, year of publication/ Name of tool (if applicable)*
1. Amos *et al*, 2001 / Functional Reach; 2. Bolin *et al*, 2000 / Posture and Performance;
3. Cooper *et al*, 2003 / IBOT Study; 4. Cress *et al*, 2002 / WC-PFP;
5. Dawson *et al*, 1994 / PIDA; 6. Dunkerly *et al*, 2000 / Deltoid, Tricep Study;
7. Harvey *et al*, 1998 8. Kilkens *et al*, 2004 / Wheelchair Circuit;
9. Kirby *et al*, 1999 / Static Rear Stability; 10. Kirby *et al*, 2001 / Wheelie Aid;
11. Kirby *et al*, 2004 / Wheelchair Skills Test Version 2.4; 12. Letts *et al*, 1998 / PCDA
13. May *et al*, 2003; 14. Salinas Duran *et al*, 2001; 15. Simmons *et al*, 1995;
16. Stanley *et al*, 2003 / WUFA; 17. Taricco *et al*, 2000 / VFM; 18. Trefler *et al*, 2004

a functional task such as lifting and pouring a jug of water and reaching laundry in a washer and dryer. Within the personal care item 8 subtasks were related to dressing and 7 to hygiene. Within the transfer item 5 subtasks involved transferring to a bed, toilet, bathtub, or shower; 2 items related to a vertical transfer; and 1 to a horizontal transfer.

2.3.4. Results of Specific Studies

Within the 20 studies included in the review, 18 different methods of measuring observable functional outcomes in a wheelchair were described. Two sets of authors reported different stages of development of the same tool in more than one publication, and therefore only 18 of the articles are cited. The following are results of each study as described in Table 2.1, Table 2.2, and Table 2.3 in order of first author.

2.3.4.1. Amos et al. (2001) / Functional Reach

A study by Amos et al. (2001) investigated goal- directed functional reach of 53 elderly nursing home residents who use manual wheelchairs. The purpose of the study was to determine if the application of a wedged cushion with a solid base insert improved reach as compared to sitting on the standard sling seat and back upholstery of the wheelchair. Using a modified version of the Functional Reach Test (MFRT) (Lynch, Leahy, & Barker, 1998), the authors found statistically significant improvements in forward reach (T=-2.43, p=.015) but no significant improvement in right/left reach (T=-0.106., p=.915) using the wedged cushion and solid insert compared to the sling seat. The time to complete the test was not reported but test apparatus was simple requiring the wedged cushion and solid seat insert, tape measure, and standardized dexterity test apparatus. The outcomes were measured using interval data, measuring reach

distance, and compared using Wilcoxon matched-pairs signed-rank tests. Neither tests of reliability nor validity were reported in this study, however, they were reported by the authors of the Functional Reach Test (Weiner, Duncan, Chandler, & Studenski, 1992) and MFRT (Lynch et al., 1998). This study addresses the capacity qualifier of the ICF activity domain and the reach item within the FEW.

2.3.4.2. Bolin, Bodin, and Kreuter (2000)

A study by Bolin, Bodin, and Kreuter (2000) investigated how wheelchair seating and postural interventions affected functional performance in transfers, wheelchair skills, balance, and propulsion as well as on body systems including spasticity, physical strain, and respiration in four manual wheelchair users with complete C5-C6 tetraplegia. Baseline measures were taken prior to the provision of seating interventions that were intended to address issues of kyphotic postures and pelvic obliquities. Pre and post photographic imaging of sitting postures in the wheelchair showed reduction in postural deformities, however, their impact on other functional and physiological variables varied among participants. Functional measures used in this study included the MFRT (Lynch et al., 1998) for balance and the transfer item from the FIM™ (Granger et al., 1993). The authors also mentioned using a series of timed wheelchair propulsion tasks known as "Cooper's test" however the specific tasks were not described and were referenced to a Swedish language publication that could not be identified or retrieved. Participants were also timed propelling their wheelchairs forward for 20m and backwards for 10m, negotiating a 7.5m and 21m incline of 4 degrees, and maneuvering on a slalom course. They were also tested on their ability to climb 5, 7, and 11 cm curbs. The MFRT did not show any change in balance for three out of the four subjects. The FIM™ transfer item did not yield a

functional change in any of the four participants nor was any obvious change in wheelchair propulsion noted in the four subjects. Improvement in wheelchair skills was only noted in one participant although two perceived improvement. The authors concluded that although positioning interventions can result in an improved posture, they are not always accepted by wheelchair users and may not always result in improved functional capacity. It is also possible the tools selected lack the sensitivity to measure functional change following the provision of postural interventions. No clinometric properties were described related to the non-standardized assessments used. Time to complete the assessment was not reported and it appears reasonable resources and apparatus are required to conduct these assessments in a clinical setting. This study addresses the capacity qualifier of the ICF activity domain and 5 out of 10 items in the FEW including operate wheelchair, reach, transfers, indoor mobility, and outdoor mobility.

2.3.4.3. Cooper et al. (2003)

A study conducted by Cooper et al. (2003) measured changes in functional performance in the home and community using the Independence 3000 IBOT Transporter (power wheelchair) by four expert manual wheelchair users with spinal cord injury ranging from T7 to L1. The experts were asked to perform a series of activities of daily living in both the IBOT and their own manual wheelchairs while being observed by a trained clinician who scored their performance for each activity on an ordinal scale ranging from one (unable to perform) to six (independent). Specific task items included; negotiate elevator, negotiate ramp/incline, cross street with curb cut, cross street without curb cut, negotiate uneven terrain, negotiate soft terrain, negotiate trail incline, retrieve book off shelf, access counter height computer, make a purchase from a top shelf in a store, drive along sidewalk with pedestrians, negotiate 1-step entrance, and place purchased

item on high shelf. No significant differences in function were noted between use of the IBOT and the participants' own manual wheelchair as they were all almost completely independent with each task using either device. The lack of difference can be attributed to the tool's lack of sensitivity for measuring change or the fact that the participants were expert manual wheelchair users. No clinometric properties were reported related to the tool. The tool used ordinal scales, however, the criteria for scoring were not reported. Time to complete the assessment was not reported and it appears reasonable resources and apparatus are required to conduct this assessment in a community setting. This study addresses the performance qualifier of the ICF activity domain and 3 of the 10 FEW items including reach, indoor mobility, and outdoor mobility.

2.3.4.4. Cress, Kinne, Patrick, and Maher (2002): Wheelchair Physical Function Performance (WC-PFP)

Cress et al. (2002) reported on a focused outcome tool for manual wheelchair users titled Wheelchair Physical Function Performance (WC-PFP) test. The WC-PFP was developed to assess manual wheelchair skills based on a modified version of the Continuous Scale Physical Functional Performance (CS-PFP) test (Cress et al., 1996). Tasks include lifting and transferring weighted objects, reaching objects at various surface heights, donning and doffing clothing, carrying objects, and negotiating doors and doorways. The authors reported the WC-PFP had construct validity when compared to scores on the Sickness Impact Profile (SIP) for 18 study participants. Difficulties in bathing, dressing, and transfers on the SIP correlated significantly with lower WC-PFP scores (Eta^2 = 0.45, p = .01; Eta^2 = 0.32, p = .03; Eta^2 = 0..39, p = .05, respectively). There was no significant relationship between scores on the WC-PFP and the

physical domains on the SIP related to ambulation and mobility domains. Good test-retest reliability was reported (ICC=0.87-0.96) after three of the original eleven tasks with coefficients below 0.66 were eliminated from the analyses. Limitations to the study were acknowledged including a small sample size which may have necessitated the elimination of items with low reproducibility coefficients and the authors believed a larger sample might have allowed for greater confidence in their evaluation of specific domains of the WC-PFP. The authors further cautioned that study participants were community-based manual wheelchair users therefore the results of the study might not be transferable to institution-based wheelchair users. A visual analog scale was used to measure task performance (0 = dependent, 100 = independent). Time, distance, and weight were also used to measure outcome. The test was reported to take about 40 minutes to administer and utilizes resources and apparatus common to most rehabilitation clinics. This study and assessment tool addresses the capacity qualifier of the ICF activity domain and 3 of the 10 FEW items including reach, personal care, and indoor mobility.

2.3.4.5. Dawson, Chan, and Kaiserman (1994): Power-mobility Indoor Driving Assessment (PIDA)

Dawson et al. (1994) developed the Power-mobility Indoor Driving Assessment (PIDA) as an assessment tool to determine persons' candidacy for safe and competent use of a powered mobility devices in long-term care facilities. The content of the assessment was validated based on a national survey of occupational therapists with expertise in the area of powered mobility as well as consumers who used powered mobility. The tool has 30 items which are reported in Table 2.3. The assessment was piloted on 15 male residents of a long-term care facility and yielded moderate intra-rater reliability coefficients (ICC=0.67) and good interrater coefficients

(ICC=0.87). The assessment uses an ordinal scale of functional performance (1 = dependent, 4 = independent). The time to complete the assessment was not reported and it appears to use resources and apparatus typically available in long-term care facilities. This study and assessment tool address the performance qualifier of the ICF activity domain and 2 of the 10 FEW items including operate wheelchair and indoor mobility.

2.3.4.6. Dunkerley, Ashburn, and Stack (2000)

Dunkerley et al. (2000) measured the functional independence of five people with tetraplegia who underwent surgical transfer of the deltoid to the triceps muscles and compared them to a matched group of six people with tetraplegia who did not receive the surgical procedure. All participants completed a modified self-report version of the FIM™ (Grey & Kennedy, 1993) as well as two observable manual wheelchair performance tasks that included a timed 10m push and a figure-of-8 push. The 10m push was considered to be equivalent to the standardized 10m walk (Wade, Wood, Heller, Maggs, & Langton Hewer, 1987). No functional difference was measured between the 2 groups on either the self-reported FIM™ or observational performance tests citing the measures were not sensitive to change even though participants who underwent the surgical procedure anecdotally reported improvements in function and recommended the procedure. No clinometric properties were reported on the observable tests of function. The amount of time required to complete the assessments was not reported and the amount of resources and apparatus necessary to complete the assessments appears reasonable and typical of what is available in a rehabilitation clinic. The observable components of this assessment address the capacity qualifier of the ICF activity domain and the operate wheelchair item of the FEW.

2.3.4.7. Duran, Lugo, Ramirez, and Eusse (2001)

Functional independence was measured to assess the impact of a directed physical exercise program in people with spinal cord injuries who used manual wheelchairs (Duran et al., 2001). Thirteen people with thoracic level spinal cord injuries participated in a 16 week exercise program that included mobility, strength, coordination, aerobic resistance, and relaxation activities. Pre and post outcomes included measures of strength, body composition, and lipid levels, however, functional outcomes included scores on the FIM™ instrument and observable wheelchair skills. The wheelchair skills were developed by the investigators and included items related to forward and backward propulsion, turns, obstacle negotiation, and picking up objects (see Table 2.3). No tests of validity or reliability were reported related to these wheelchair skill task items. Using Wilcoxon signed-rank tests there was a noted significant improvement in average FIM™ scores following the exercise program (106 ± 6.8, 113 ± 7.1; $p < .001$) and the time required to complete all the wheelchair skills (only reported descriptively in a table within the publication). The amount of time to complete the wheelchair skills was not reported and the apparatus necessary appears reasonable and can be found in most rehabilitation clinics. The reported study addresses the capacity qualifier of the ICF activity domain and 3 of the 10 items of the FEW including reach, operate wheelchair, and indoor mobility.

2.3.4.8. Harvey, Batty, and Fahey (1998)

Harvey et al. (1998) developed a measurement tool to assess the mobility skills of people with paraplegia who use manual wheelchairs. The tool consists of six items, each with a six point ordinal scale designed to measure transfers and mobility on various surfaces and obstacles (see

Table 2.3 for specific tasks). The scoring criteria were different for each task and considered the complexity, time, and assistance required for each of the tasks. The tool was piloted on 20 people with paraplegia and independently scored by two therapy practitioners. Good interrater reliability was reported across all items ranging between r = 0.82-0.96. The authors further reported the tool is reliable and simple to implement (no special apparatus or resources) in a short period of time (less than 15 minutes) and is more sensitive in identifying differences within mobility tasks as compared to commonly used scales of global function. The assessment tool addresses the capacity qualifier of the ICF activity domain and 3 of the 10 items of the FEW including transfers, indoor mobility, and outdoor mobility.

2.3.4.9. Kilkens, Post, van der Woude, Dallmeijer, and van den Heuvel (2002) & Kilkens, Dallmeijer, de Witte, van der Woude, & Post (2004): Wheelchair Circuit

The "Wheelchair Circuit" was systematically developed with good clinometric properties to assess manual wheelchair mobility in persons with spinal cord injury (Kilkens et al., 2004, Kilkens et al., 2002). The tool consists of eight wheelchair skills resulting in three different test scores related to functional ability, task performance time, and peak heart rates. The functional capacity items of the tool include performing a figure-of-8 maneuver, traversing a .04m doorstep, mounting a .10m platform, 15m sprint, transfer to a mat table at a height level with the wheelchair seat, and propelling on a level wheelchair-adjusted treadmill as well as with inclines of 3 and 6%. Moderate to good intra-rater reliability (ICC=.71 to .97) and good interrater reliability (ICC= .76 to .98) was reported on a convenience sample of 27 manual wheelchair users with spinal cord injuries in the final stages of their clinical rehabilitation program (Kilkens et al., 2002). Tests for validity and sensitivity to change were completed on 74 manual

wheelchair users with spinal cord injuries during their rehabilitation programs. Construct validity was assessed by determining whether the Wheelchair Circuit scores were significantly related to the subjects' functional ability, physical capacity, level of lesion, motor completeness of lesion, and age. At admission and discharge from inpatient rehabilitation, results indicated significantly different functional ability scores among people with paraplegia and tetraplegia. Those with paraplegia scored significantly better than those with tetraplegia ($\underline{p} < .001$; $\underline{p} < .004$). No significant difference in functional ability was noted between subjects with complete versus incomplete lesions. Functional ability scores were inversely related to age as older subjects scored lower than younger subjects ($r = -0.32$, $p < .01$). The functional ability scores on the wheelchair circuit also correlated positively with a FIM™ mobility score $r = 0.52$, $p < .01$). Subjects with paraplegia had significantly higher performance time scores than subjects with tetraplegia ($p < .001$), and performance time scores were also positively correlated with the FIM™ mobility score ($r = -0.47$, $\underline{p} < .01$ (admission); $r = -0.40$, $\underline{p} < .01$ (discharge)). Responsiveness was assessed by determining whether scores changed significantly over time during the clinical rehabilitation program. Significant improvements were measured on all three scores of the Wheelchair Circuit from initial to final stages of the rehabilitation program (Kilkens et al., 2004). The time to complete all items of the Wheelchair Circuit was not reported and it does require access certain complex apparatus including a wheelchair-adjusted treadmill. The assessment tool addresses the capacity qualifier of the activity domain of the ICF and 4 of the 10 items of the FEW including operate wheelchair, transfers, indoor mobility, and outdoor mobility.

2.3.4.10. Kirby and Dupuis (1999)

Kirby and Dupuis (1999) tested the static rear stability of user occupied wheelchairs. The test was adapted from the standardized methods of the International Organization for Standardization (ISO) from the perspective of its measurement properties, safety, and comfort. Ninety-seven wheelchair users were tested in their own wheelchairs on a wheelchair-stability-testing platform whereby the platform was incrementally inclined to the point where the front casters lost contact with the platform. Static rear stability was measured with the wheel locks engaged and disengaged, the occupant leaning forward and backward, and with the rear anti-tip devices in place. Test-retest reliabilities were all >.93. Content validity was established based on using the ISO methods which were developed by an international panel of experts. Construct validity was demonstrated by finding that static stability was appropriately affected by engaging or disengaging the wheel locks, leaning forward or backward, and using rear anti-tip devices. No adverse events were noted during the testing and participants tolerated the tests. No amount of time to complete the test was reported and administration requires a testing platform and inclinometer. The assessment tool addresses the capacity qualifier of the activity domain of the ICF and stability item of the FEW as well as the construct of safety, which is considered across all 10 items of the FEW.

2.3.4.11. Kirby, Lugar, and Breckenridge (2001)

Kirby et al. (2001) measured and reported the safety and efficiency of learning to perform aided wheelies with a new self-deploying wheelie aid device. Participants in the study included 12 wheelchair users and 30 able-bodied people who were randomly assigned to a group that was taught aided wheelies with the self-deploying device or a group that was taught wheelies using

conventional methods. The objective of the study was to determine if the group using the wheelie aid was safer, more successful at learning the skills, able to learn more quickly, and found such skills less difficult. The outcome measures included safety in 14 wheelie related skills that were scored using a visual analogue scale, percentage of participants who were able to learn the skills, time required to learn the skills, and subjective difficulty scores. The group that was taught aided wheelies reported significantly greater safety scores ($p < .0001$) and was able to learn the skills in a shorter period of time as compared to the group that learned the skills under conventional methods. No significant difference was noted between the two groups in the percentage of people able to learn the skills. Perceived mean difficulty scores were significantly lower in the aided wheelie group. The content validity of the wheelie related skills was established as they were developed based on a review of the literature, the authors' clinical experience, and the results of two focus groups that comprised wheelchair users, clinicians, and researchers. The 14 wheelie related skills are reported specifically in Table 2.3. No tests of reliability were reported. No amount of time for completing the tests was reported. Administration of the tests requires access to curbs, soft terrain, and gravel surface. The assessment tool addresses the capacity qualifier of the activity domain of the ICF and 5 of the 10 items of the FEW including comfort needs and health needs (wheelie rest), operate wheelchair, indoor mobility, and outdoor mobility as well as the construct of safety which is considered across all 10 items of the FEW.

2.3.4.12. Kirby et al. (2004) and Kirby, Swuste, Dupuis, MacLeod, & Monroe (2002): Wheelchair Skills Test (WST)

The "Wheelchair Skills Test" (WST) is a tool developed to be a practical, safe, reliable, valid, and useful measure of a person's ability to perform skills necessary for using a manual wheelchair (Kirby, 2002, Kirby et al., 2004). The first version of the tool included 33 items scored on a 3-point ordinal scale and was piloted on 24 manual wheelchair users. Items on the test where specific to the user's ability to manage the components of the wheelchair, reach various surface heights, propel the device, and negotiate various surfaces and obstacles (see Table 2.3). The authors reported moderate to good reliability (test-retest 0.65, intra-rater 0.96, and interrater 0.95) and good content validity as determined by unanimous endorsement of 91% of the items by nine therapists who administered the test. The authors reported moderate usefulness of the tool. Lower validity scores were attributed to the fact that not all users had wheelchairs equipped with the same features or components indicating that the test should be more specific to individual features. Low concurrent validity was noted when total WST scores were correlated with therapists' global rating scores of user skills (*r*, ranging between .40-.56), however no explanations were offered (Kirby et al., 2002). In a second publication the measurement properties of the WST version 2.4 were reported (Kirby et al., 2004). This version of the test was administered to 169 wheelchair users and 129 able-bodied subjects. The test took 27.0 $\pm$ 9.3 minutes to administer and was well tolerated with no reports of adverse incidents. Reliabilities were measured on a subset of 20 wheelchair users and yielded ICC's of .904 for test-retest reliability, .959 for intra-rater reliability, and .968 for interrater reliability. Construct validity was established with a slightly negative Pearson correlation (-.434) between total WST scores and age. Females showed significantly lower total WST scores than males on multiple

regression analysis (P<.001), and wheelchair users with more than 21 days experience using a wheelchair had higher total WST scores than subjects with less experience (65.0% vs. 59.6%; P=.01). Participants with stroke and other related conditions had significantly lower mean WST scores compared to participants in other diagnostic categories (55.0% $\pm$ 13.9%; P<.05), and participants using standard manual wheelchairs had significantly lower WST scores than those using lightweight wheelchairs (66.4% vs. 75.1%; P<.001). Concurrent validity was established using Spearman rank correlations between total WST scores with the score of global function as subjectively measured by the participant's therapist using the VAS (.394), admission FIM™ scores (.38), and discharge FIM™ scores (.31). A pass-fail method is used to score the WST version 2.4. Items can also be eliminated from the scoring if that item is not a goal of the participant. WST version 2.4 consists of 50 separately scored skills compared to the 33 in version 1.0 as new items were added, others deleted, and others combined. The skills of version 2.4 relate to performing wheelies, negotiating obstacles, opening and folding a wheelchair, transfers, reach in, turning, rolling, and managing wheelchair components (see Table 2.3). The WST version 2.4 addresses the capacity qualifier of the activity domain of the ICF and 5 of the 10 items of the FEW including reach, transfers, operate wheelchair, indoor mobility, and outdoor mobility.

2.3.4.13. Letts, Dawson, and Kaiserman-Goldenstein (1998): Powered Mobility Community Driving Assessment (PCDA)

The Powered Mobility Community Driving Assessment (PCDA) was developed to assess driving performance of adults living in the community (Letts et al., 1998). To establish face validity, the test was developed using a modified nominal group consensus method with a group

of 10 participants that included 5 users of powered mobility devices and 5 occupational therapy practitioners experienced in the prescription or training of people to use powered mobility devices. The test is performance-based and administered in the user's natural environment. Items on the assessment are divided into six categories; general driving skills, wheelchair accessible public transit, wheelchair accessible private transit, driving with controls in different positions, driving on varied surfaces, and accessing public places. In each location the driver's ability to approach the site, access the entrance, and maneuver within the site is assessed. Prior to administering the test, the user and therapists discuss which items of the PCDA are appropriate, feasible, and relevant. Only a sample of items were provided in the publication (see Table 2.3). To determine clinical utility, the PCDA was piloted on four experienced powered mobility device users and it was found the test takes between one and two hours to administer and the instrument provided flexibility to evaluate driving skills in a variety of settings as well as to select environments based on specific needs of the driver. No other tests of validity or reliability were reported. This study and assessment tool address the performance qualifier of the activity domain of the ICF and 5 of the 10 FEW items including reach, operate wheelchair, indoor mobility, outdoor mobility, and transportation, and includes measures of independence, safety and quality.

2.3.4.14. May, Butt, Minor, Kolbinson, and Tulloch (2003)

This study evaluated the reliability of four functional tasks relevant to wheelchair seating (May et al., 2003). Specific task items included timed forward wheeling (23m), time to ascend a 1:13 ramp 10.3m in length, distance traveled following a one stroke push on a carpeted surface, and forward vertical reach distance. Content validity was established by reporting these items were

developed based on a review of the literature as well as consultation with physical therapists with expertise in spinal cord injury, people who use wheelchairs, and a clinical researcher. Ten males with spinal cord injuries participated in the test-retest and interrater reliability evaluation of the four tasks. Another group of 10 males participated in the test-retest reliability evaluation of the one stroke push task. Four of the participants in the first group and six of the participants in the second group had tetraplegia while the others all had paraplegia. Time to complete all tasks took less than 45 minutes including allowing for a rest and there were no reported adverse incidents. Test-retest reliability for all four tasks was good (r = .99). Interrater reliability was found to be good for all tasks except the one stroke push item (ICC=.99). No other tests of validity were reported. This study and the four tasks address the capacity qualifier of the activity domain of the ICF and 3 of the 10 items of the FEW including reach, operate wheelchair, and indoor mobility.

2.3.4.15. Simmons, Schnelle, MacRae, and Ouslander (1995)

This descriptive study used observable wheelchair propulsion activity to describe factors affecting wheelchair mobility in nonambulatory nursing home residents (Simmons et al., 1995). One-minute timed-sampled observations of 65 nonambulatory residents were made every 15 minutes for 8 to 11 hours across 2 days to determine wheelchair propulsion activity. The study also described barriers that affect wheelchair activity in this population. Observations of residents' level of activity were coded as either lying, sitting, standing, or propelling a manual wheelchair. Percentage of time spent in each activity was calculated. The percentage of time spent propelling a wheelchair between day one and two was compared for test-retest reliability yielding good correlation (Pearson r = .82, P = .000). Residents were asked to pick up a sponge

from the floor while seated in their wheelchairs and evaluated on a 0 to 3-point ordinal scale. Wheelchair ability also involved evaluation of whether the resident could lock or unlock the wheelchair and ability to move the foot pedals. Amount of prompting required to complete the tasks was also assessed. Residents were timed over a 6m course and asked to propel as long as they could. Results indicated that 44.6% of residents were able to propel their wheelchairs independently upon verbal instructions. An additional 26.2% of residents required physical guidance and could propel their wheelchairs if their hands were correctly placed for them on the pushrims. Another 23.1% were completely unable to propel their wheelchairs. Although 70.8% of residents had some capacity for wheelchair propulsion, the percentage of time directly observed performing wheelchair propulsion was extremely low (mean = 4.0% $\pm$ 8.1). Other barriers to wheelchair propulsion activity were reported as residents' inability to unlock the wheelchair or move the foot pedals, wheelchair maintenance issues, and poor fit of wheelchairs. The study addresses the performance qualifier of the activity domain of the ICF and 3 of the 10 items of the FEW including reach, operate wheelchair, and indoor mobility.

2.3.4.16. Stanley, Stafford, Rasch, and Rodgers (2003): Wheelchair Users Functional Assessment (WUFA)

The Wheelchair Users Functional Assessment (WUFA) is another measurement tool for manual wheelchair users that underwent systematic development (Stanley et al., 2003). Both basic and community activities of daily living were included in this tool. Content validity of the instrument was established as the items were developed by a panel of six rehabilitation experts with input from manual wheelchair users. The test includes 13 manual wheelchair skills related to maneuvering in tight spaces, negotiating uneven terrain, door management, street crossing,

negotiating ramps, negotiating curbs, bed transfers, toilet transfers, transfers to the floor, bathing, upper and lower body dressing, reaching functions, and picking up objects/sweeping (see Table 2.3). Individual task performance was measured on an ordinal scale similar to that of the FIM™ instrument ranging from 1 (total dependence) to 7 (completely independent). Interrater reliability and stability was measured using six raters observing five subjects on videotape performing WUFA tasks yielding moderate to good ICCs of 0.96 and 0.78 respectively. Internal consistency of the 13 items was measured using Cronbach's Alpha with a sample of 101 tested subjects and yielded excellent internal consistency (alpha=0.96). It was reported that it takes 1 to 1.5 hours to complete all items and the apparatus necessary to administer the WUFA is reasonable and typically found in rehabilitation clinics. This study and the WUFA tool address the capacity qualifier the activity domain of the ICF and 6 of the 10 items of the FEW including operate wheelchair, reach, transfer, personal care, indoor mobility, and outdoor mobility.

2.3.4.17. Taricco, Apolone, Colombo, Filardo, Telaro, and Liberati (2000): Valuatizione Funzionale Mielolesi (VFM)

The VFM is a standardized measurement scale of people with spinal cord injuries who use manual wheelchairs (Taricco et al., 2000). Details related to specific VFM task items were not reported, however, the tool addresses the domains of bed mobility, eating, transfers, wheelchair use, grooming/bathing, dressing, and social skills. All tasks are observable and scored on an ordinal scale ranging from one (patient is unable to carry out task and completely depends on other people) to five (patient able to perform the assigned task without difficulties, modification or slowing down, he/she does not require any help). The VFM was administered to 100 people with spinal cord injuries and repeated on follow-up after 18 months. Interrater reliability was

assessed in a previous phase of the project and reported elsewhere in a non-English language journal. Content validity of the VFM was measured against the Barthel Index, QIF, and FIM™ instruments and includes all basic ADL domains. Estimates of construct and criterion validity indicate the VFM met all psychometric criteria usually recommended using the current sample. Task scores on the VFM differentiated among subjects based on level of spinal cord lesion, for example, quadriplegia versus paraplegia (T1 - T5) versus paraplegia (T6 – S5). Task score on the VFM were also significantly correlated with scores on the Barthel Index (r = 0.67 – 0.88, $p < .001$). Most VFM domains were also able to document large and significant changes over time (e.g., ES = 0.72 – 1.40 for individuals with quadriplegia*)* It was reported to take between 30 and 50 minutes to complete all of items of the VFM using typical apparatus found in a clinic or home/community environment. This study and the VFM tool address the capacity qualifier of the activity domain of the ICF and 7 of the 10 items of the FEW including health needs, operate wheelchair, transfer, personal care, indoor mobility, outdoor mobility, and transportation.

2.3.4.18. Trefler, Fitzgerald, Hobson, Bursick, and Joseph (2004)

Trefler et al. (2004) reported a pilot study designed to measure the effects of individually prescribed manual wheelchair systems for elderly long-term care residents. The study specifically investigated the effect of wheelchair interventions on reach and wheelchair mobility as well as self-reported quality of life and satisfaction with the technology by comparing two groups; one that was provided with an individually prescribed manual wheelchair seating and mobility system (group A) and another that used standard equipment typically issued in a long-term care facility (group B). Participants initially recruited in the study included 34 people (19 group A, 15 group B) who were over the age of 60, were permanent residents of a long-term care

facility, and used manual wheelchairs as their primary means of mobility. There was significant attrition due to death and loss to follow-up resulting in both groups losing 12 participants, however, all available data were included in the analyses. Specific observable wheelchair skills included timed independent mobility in a forward direction for 25 feet on a flat tile surface followed by timed independent mobility in a forward direction on a flat tile surface for 10 feet followed by making a 90° right turn and propelling for another 15 feet. The reach tasks involved asking participants to reach as far forward and laterally as possible with their dominant arm with distance measured using a specially constructed reference bar. Group A initially performed these tasks in a standard manual wheelchair, a second time immediately after provision of an individually prescribed wheelchair system, and a third time three months post provision of the new wheelchair system. Group B performed these tasks initially in their standard manual wheelchair, again three months later in the same standard manual wheelchair as well as immediately following provision of an individually prescribed manual wheelchair system, and finally three months following provision of the individually fitted system. Results indicated participants had less difficulty with propulsion and increased ability to reach forward in an individually fitted wheelchair system. No tests of reliability or validity were reported for either of these skills. The necessary time to administer the tests was also not reported. The apparatus needed to conduct the assessments are reasonable except for the need for a specially constructed portable horizontal reference bar for the reach tasks. This study and the derived wheelchair skills address the capacity qualifier of the activity domain of the ICF and 3 of the 10 items of the FEW including operate wheelchair, reach, and indoor mobility.

2.4. DISCUSSION

This systematic review focused on existing performance based observational studies and measurement tools related to functioning in a wheeled mobility and seating device as reported in the English language scientific literature over the last 10 years. It was found that the studies or developed tools primarily measure function within the capacity domain of the ICF, are designed for manual wheelchair users, use a broad range of scoring methods, and have minimal item overlap across tools. Slightly more than half the measurement methods underwent tests of reliability or validity. Sample sizes used in the studies were also very broad. Therefore, this makes it difficult to conduct comparisons of outcomes across studies or tools. These findings are similar to those of a previous review (Kilkens et al., 2003). Another previously described systematic review by Routhier et al. (2003) concluded with a proposed a framework for the clinical assessment of functional performance of wheelchair users. The authors concluded that further development of tools should consider all aspects of wheelchair mobility including the user's profile, the wheelchair device, environmental factors, activities of daily living, social roles, as well as assessment and training in use of the device. Systematic development of the FEW version 2.0 self report tool determined that users of wheeled mobility and seating devices and clinicians who typically assess and recommend these devices were seeking a tool that would measure

- stability, durability and dependability needs
- comfort needs
- health needs
- ability to operate the device
- ability to reach and carry out tasks at different surface heights

- ability to transfer from one surface to another surface
- ability to carry out personal care tasks
- ability to get around indoors
- ability to get around outdoors, and
- ability to use personal and public transportation

The following sections discuss the degree to which the 10 items of the FEW version 2.0 are represented in the reviewed literature.

2.4.1. Stability, Durability, and Dependability

This item was only represented in 2 of 20 studies and by the same group of researchers (Kirby & Dupuis, 1999, Kirby et al., 2001) and basically looked at rear stability in manual wheelchair use. Nothing related to observable durability and dependability has been reported in the literature. Standardized laboratory testing of various types of manual and power wheelchairs has however been reported and the authors state in their conclusions that additional research and outcomes measures are needed to determine whether laboratory findings reflect the stability, durability, and dependability findings actually encountered by people using wheelchairs in their homes and communities (Fass et al., 2004, Fitzgerald, Cooper, Boninger, & Rentschler, 2001).

2.4.2. Comfort Needs

Wheelchair comfort, including heat and moisture issues, sitting tolerance, pain, and stability, although viewed as important by both users of wheelchairs and clinicians who prescribe wheeled mobility and seating interventions was only cited in one study and related to being able to lean back in a manual wheelchair and rest against a wall in a stable position with the front casters off

the ground (Kirby et al., 2001). This could be because comfort is a subjective measure usually assessed with self-reported pain scales. It could also be that researchers and practitioners have been reluctant to measure comfort as it may imply to third party payers the intervention is a convenience solely for the comfort of the wheelchair user. Therefore this item warrants further investigation of observable methods for measuring comfort outcomes.

2.4.3. Health Needs

Health needs while sitting in and using a wheelchair (e.g., reducing the potential for pressure sores, being able to breath, edema control, and compatibility with medical equipment) was only reported as an observable outcome in two of the studies (Kirby et al., 2001, Taricco et al., 2000) and was related to being able to tilt back and perform a push-up in a manual wheelchair for pressure relief to reduce the potential for pressure sores. There is therefore a need for more observable outcome measures to determine whether wheeled mobility and seating interventions address health needs beyond just being able to perform pressure releases as well as measuring the effectiveness of other features available in on powered systems including tilt in space, reclining backrests, and elevating leg rests.

2.4.4. Operate Wheelchair

Ability to operate the wheelchair (the user's ability to do what they want the wheelchair to do when and where they want to do it) was reported in 15 of the 20 studies and a large number of subtasks (22 of 160 as per Table 2.3). These included maneuvering the wheelchair forwards, backwards, and making turns; performing wheelies in a manual wheelchair; and managing wheelchair components such as armrest/footrests, applying wheel locks, folding the wheelchair,

and adjusting the speed control. There was very little overlap in specific task items except for being able to perform wheelies which was cited in three studies. This indicates a need for consistent operationalization of observable tasks related to a user's ability to operate a wheelchair as well as the safety and quality of task performance.

2.4.5. Reach

Ability to reach and carry out tasks at different surface heights from a wheeled mobility and seating device was cited in 11 of the 20 studies. Subtasks included vertical reaching or accessing objects and places that tend to be higher such as counters and shelves; reaching to the floor; forward, left, and right horizontal reaching; and subtasks that were included as part of a functional task such as lifting and pouring a jug of water and doing laundry. Only two of the studies used the existing standardized MFRT. Others developed their own operational measurement techniques for reaching of which only three reported clinometric properties of the measurement methods. The MFRT was shown to be sensitive in measuring change in reach distance in one of the studies however it does not specifically consider safety and quality of reach capacity or performance related to functional tasks therefore, there is a need to further investigate the development of observable methods to measure reaching and carrying out tasks at different surface heights.

2.4.6. Transfer

Ability to transfer to and from a wheeled mobility and seating device and another surface was reported as an observable task in 8 of the 20 studies. Subtasks involved transferring to a bed, toilet, bathtub, or shower as well as horizontal and vertical transfers including transferring to and

from the floor. Two studies used modified criterion from the FIM™ transfer item to assess and measure transfer capacity whereas the others developed their own specific operational methods and scoring system with not all reporting clinometric properties. The FIM™ transfer item may have potential as a sensitive and observable measure of a wheelchair user's ability to transfer to and from various surfaces however does not necessarily address the safety and quality of a person's capacity to transfer or their ability to perform transfers in a natural environment. There is therefore a need to further investigate the development of observable methods to measure a wheelchair user's ability to perform transfers.

2.4.7. Personal Care

Ability to carry out personal care tasks in a wheeled mobility and seating device was reported in only three of the 20 studies. Within this item subtasks were related to dressing and hygiene. The measures were all capacity based and intended for manual wheelchair users. Two of the studies reported they developed their own scoring methods and one used a modified version of the FIM™ scoring system. All reported some degree of clinometric testing properties. Capacity and performance based measures of self-care in wheelchair users is lacking as well as any observable measure of self-care for powered mobility users. The FIM™ items also do not necessarily consider the safety and quality of performing self-care tasks therefore warranting further investigation into the development of observable methods of assessing self-care tasks in wheelchair users.

2.4.8. Indoor Mobility

Ability to get around indoors in a wheeled mobility and seating device was reported the most of any item (17 of 20 studies) and included 26 subtasks. Subtasks included negotiating the wheelchair to objects and places such as tables, bed, toilet, and sink; negotiating doorways and door management. Subtasks included both tasks of capacity and performance for both powered and manual wheelchair users. About half the studies reported clinometric property testing of the measures used. There was almost no overlap in subtasks across the studies except doorway management was reported consistently in four studies therefore a need does exist to develop operational and observable measures of indoor mobility for both manual and powered mobility users. Safety and quality of task capacity was also not necessarily considered in any of the reported studies or tools.

2.4.9. Outdoor Mobility

Ability to get around outdoors in a wheeled mobility and seating device was included in 11 of the 20 studies with 27 different subtasks reported related to negotiating curbs, ramps, inclines, and slopes as well as negotiating soft and uneven terrain. Like indoor mobility, outdoor subtasks included both tasks of capacity and performance for both powered and manual wheelchair users. Eight of the studies reported some level of clinometric property testing of the measures used. Again, there was almost no overlap in the 27 subtasks across the studies except negotiating a 4" curb was cited in 3 studies and negotiating gravel or irregular surfaces was reported in 4 studies. There is therefore also a need to develop operational and observable measures of outdoor mobility for both manual and powered mobility users that also consider safety and quality in performing the tasks.

2.4.10. Transportation

Ability to use personal and public transportation with a wheeled mobility and seating device was only reported in 2 of the 20 studies including being able to load/unload a manual wheelchair from a car (Taricco et al., 2000) and ability to get on a ramp to access public transportation with a powered mobility device. Both used an ordinal scale of functional independence to measure task capacity or performance. Limited representation of the transportation item in this review might be because wheelchairs have not typically been designed to serve as passenger seats in a motor vehicle (Bertocci, Manary, & Ha, 2001), however, many wheelchair users need to transport their mobility devices and many others need to sit in them when being transported as they cannot transfer to a typical vehicle seat. This item was found to be of importance by both users of wheeled mobility and seating devices as well as clinicians who recommend them and therefore warrants further investigation and development of methods to observe how users are able to perform transportation related tasks.

2.5. CONCLUSION

A systematic review of the scientific literature from 1994 through July 2004 revealed 20 studies that developed and/or utilized observable measures of functional outcome in the use of wheeled mobility and seating devices. The majority of study populations were manual wheelchair users with spinal cord injuries and the majority of studies cited measured the capacity qualifier of the activity domain of the ICF. Eighteen different outcome measures were cited in the 20 studies. There was minimal consistency in the methods used to score task performance and minimal overlap in specific task items which made it difficult to

compare outcomes across measures. Not all studies reported or measured the clinometric properties of the tools. Content of the reported measures and subtasks were compared to the 10 items of the FEW version 2.0 and half of the consumer reported items were somewhat well represented and the other half were minimally represented. Thus, existing measures are not fully representative of what wheelchair users identified as being important tasks to be able to perform in a wheeled mobility and seating device (Mills, Holm, Trefler et al., 2002). There are, however, advantages to having tools that are not necessarily all inclusive as specific tools developed to measure specific outcomes may be more sensitive in measuring change. For example, the use of a pressure mapping device may more accurately reflect improved magnitude of pressure redistribution than an observed ability to perform a weight shift. This review though indicates the need for the development of a tool that quantifies functional activity at both the capacity and performance qualifier levels of the ICF activity domain. This tool should also operationalize the functions described in the FEW Beta Version 2.0 self report tool.

3. DEVELOPMENT, RELIABILITY AND VALIDITY OF THE FUNCTIONING EVERYDAY WITH A WHEELCHAIR–CAPACITY (FEW-C) TOOL

3.1. INTRODUCTION

The findings of a recent systematic literature review (see Chapter 2) identified the need for an observation-based tool to measure everyday functioning with a wheeled mobility and seating device based on items with consumer and clinician validation. The Functioning Everyday with a Wheelchair, version 2.0 (FEW) is a consumer-generated, valid and reliable self-report tool that measures the perceived functioning of wheeled mobility seating device users (Mills, Holm, Schmeler et al., 2002, Mills, Holm, Trefler et al., 2002). The service delivery process for these devices typically begins in a clinic setting where practitioners first determine the needs and goals of consumers as well as the context for the use of the technology. Portions of this information are gathered through interview and self-report by the user or a proxy, however functional capabilities and limitations require direct observation. Although the FEW version 2.0 proved useful for documenting perceived changes in the ability to carry out functional activities following a wheeled mobility intervention, the International Classification of Function, Disability, and Health (ICF) (WHO, 2001) has introduced new constructs for measuring everyday activity, namely, activity qualifiers, which promote observation of actions or tasks. The ICF has defined an activity "performance" qualifier, as the construct to be used when observing a person's ability to carry out tasks in the lived-in environment. The ICF activity

"capacity" qualifier is the construct to be used when observing a person's ability to execute a task or action in a "standardized environment" such as a clinic or a laboratory (p. 15). The FEW-C was developed to measure the capacity of persons to function everyday with their wheeled mobility devices. This chapter will specifically describe the systematic development of the Functioning Everyday with a Wheelchair-Capacity (FEW-C) tool and its reliability and validity.

3.2. METHODS

3.2.1. Overview of the Development of the FEW-C

The FEW–C was designed to be a criterion-referenced, performance-based observation tool, for use by practitioners and researchers to measure functional outcomes of wheeled mobility and seating interventions in the clinical setting. It was developed simultaneously with another performance-based version of the FEW, the Functioning Everyday with a Wheelchair – Performance (FEW-P) tool. Whereas the FEW-C was designed for use in the standardized clinical environment, the FEW-P was designed to quantifying consumer function within the “lived-in” environment (Mills et al., 2003). The FEW-C and FEW-P were developed to respond to the ICF capacity and performance qualifiers as well as complement one another. Both tools have identical items and scoring methods.

The FEW-C and FEW-P were modeled after the Performance Assessment of Self-Care Skills (PASS) Version 3.1 (Holm & Rogers, 1999) because of its measurement parameters (independence, safety, adequacy), and its focus on four domains of functioning: functional mobility (FM), activities of daily living (ADL) including self-care, instrumental activities of daily living (IADL) with a physical emphasis (PIADL), and IADL with a cognitive emphasis

(CIADL). The PASS is criterion-referenced, and therefore can be administered in its entirety or in a combination of items based on consumer-specific issues. It has two versions (Clinic and Home; Capacity and Performance), and has demonstrated good validity and reliability with adult populations from a variety of diagnostic groups. There is an operationally defined hierarchy for scoring PASS items based on level of task independence, task safety, and task adequacy (see Table 3.1 for the task independence hierarchy), and there are item construction guidelines for the development of new PASS items (Rogers & Holm, 1989, 2000, Rogers et al., 2003, Rogers, Holm, Beach, Schulz, & Starz, 2001).

Table 3.1 PASS Hierarchy of Assistance for Independence Data

Level	Type of Assistance	Definition and Example(s)
Level 1	Verbal Supportive	Encouragement to initiate, continue, or complete a task (e.g., "you are moving right along", "keep at it", and great").
Level 2	Verbal Non-directive	Cues to facilitate task initiation, continuance, or completion without telling the client exactly what to do (e.g., "is there anything missing", try another way").
Level 3	Verbal Directive	Verbal statements to initiate, continue, or complete a task (e.g., "check the recipe again", "the date needs to be filled in on the check").
Level 4	Gesture	Nonverbal communication including tactile cues to inform the client how to initiate, continue, or complete a task (e.g., pointing at an item, tapping an undone button).
Level 5	Task Object/Environ-mental Rearrangement	Manipulation of task objects or task environment to facilitate task initiation, continuation, or completion (e.g., raising chair height with a cushion, placing a stool under the client's foot when donning shoes, removing task objects that are distracting and then presenting them as needed).
Level 6	Demonstration	Modeling with verbal statements if appropriate to illustrate how to initiate, continue, or complete a task (e.g., wiping part of counter and then handing the sponge to the client, and lifting the garbage sack, heading to the door, and then coming back and replacing it for the client to proceed).
Level 7	Physical Guidance	Movement of the client's body or extremity as needed to facilitate an action to promote task initiation, continuation, or completion, which may be accompanied with verbal statements (e.g., positioning hand over a knife or button, guiding a leg out of the tub, and positioning a hand on the bathtub edge).

Table 3.1 (continued)

Level 8	Physical Support	Physical contact with the client to support the body or an extremity to promote task initiation, continuation, or completion, which may be accompanied with verbal statements (e.g., physical support of an arm when the client is getting out of the bathtub or supporting the weight of the soup pan
Level 9	Total Assist	Total assist- Examiner does the task for the client by compensating for the client's disability as appropriate for the underlying impairment (e.g., reading the directions on the soup can or muffin box, filling in the date on the check, and balancing the checkbook ledger).

Adapted from the Performance Assessment of Self-Care Skills (PASS), Clinic Version 3.1 (Rogers & Holm, © 1989, 1994)

The 10 items of the FEW-C were derived from the FEW, developed using the PASS guidelines for item development (see Table 3.2), and scaled using an ordinal scaling system similar to that of the PASS. Once items were developed and operationally defined based on the ICF construct of capacity, testing protocols were developed. This included a written manual for test protocols, and delineation of test materials and equipment, test administration length, test procedures and set-up, item scales, scoring interpretation, training protocols for test administrators, video examples of how to administer test items, and other miscellaneous information necessary for the administration of the FEW-C.

Table 3.2 Item Construction Mechanics for PASS Item Development

1		Identify a task
2		Identify critical task actions (subcomponents that are necessary for task safety and/or adequacy) in the sequence in which they typically occur during the task
3		Begin each subcomponent with an action verb followed by the objects and modifiers. Double underline the critical observable behaviors. For example Opens second pill bottle. These become the INDEPENDENCE DATA.

Table 3.2 (continued)

4		Identify the QUALITY outcome modifier. Use a single underline to note it. For example, correctly or appropriately or legibly. These modifiers become the referents for the QUALITY OUTCOME DATA.
5		If "correctly" or "appropriately" are not obvious based on the task, then specific examples are given in parentheses. For example, for appropriately (good bye, thank you); for correct time (all pills & all slots indicated; days indicated
6		The PROCESS outcome modifier is the double underlined verb (action) in the subtask. For example, Lowers self unto bed in a controlled manner. In this instance, the precision and efficiency of the action "lowers" is really the "process". In the PASS 3.1, an 8 is entered under quality (see Task #1, Subtask #1), when the "process" and quality are difficult to distinguish.
7		If the immediate physical safety of a patient cannot be at risk during the assessment, then under the SAFETY DATA column, a number 8 is entered. For example, if the patient is verbally reporting the next time the medication is to be taken, there is no immediate risk to safety in that task subcomponent.
8		Have several people review the sequence of the task subcomponents, and rate their concurrence with the sequence, whether each subcomponent is "critical" or not for community living, and whether the behaviors are observable for level of independence. Also have them rate whether the outcome modifiers are appropriate, meaning that quality and/or process are applicable and observable.
9		Identify the CONDITIONS that must be present. Include (a) task items that the assessor will provide (b) task items that the patient needs to provide (c) set up (table layout, etc.) (d) starting position of patient (e) verbal instructions to be given. When sequential instructions are given, place in brackets what the assessor is to be doing --- for example [select 2 medications to use…], [wait for response], [point to the refrigerator]. When there are several mini-tasks involved (See Task 21, Environmental Awareness), outline each new scenario that requires a change in position for the assessor and the patient. For example: Pt facing the rolled up scatter rug.
10		Observe peers or volunteers perform the task and subtasks and attempt to rate them. If necessary, modify what is "critical" as well as the conditions and directions.
11		Reference the PASS, and identify the adaptation source. For example: Performance Assessment of Self-Care Skills (PASS-Home) - Rogers, JC, & Holm, MB, © 1989, 1994 Version 3.1 - with Revisions for the Aging in Manitoba 2001 Study, Item adapted by T. Van Denend.

Margo B. Holm, 2002.

3.2.1.1. Target Population for the FEW-C

The FEW–C was designed to assess the functional performance of adults with disabilities who use a wheelchair or scooter as their primary seating and mobility device. For the purpose of the FEW-C tool development, wheeled mobility and seating devices were defined as any manual wheelchair, power wheelchair, or scooter whose features (e.g., frame dimensions, weight, maneuverability, controller, accessories) and seating components (e.g., seat cushion, back support, seat elevator, or tilt in space) contribute to the function of the user in actions, tasks, activities, and/or roles they want to, need to, or are required to do in an environmental context.

3.2.2. FEW-C Development Process

The initial starting point for developing the FEW-C and FEW-P items was to operationalize FEW items. Specific subtasks and critical behaviors to be included in the FEW-C and FEW–P were derived from consumer goals/outcomes generated during the development of the FEW, Beta Version 1.0 (Mills, Holm, Trefler et al., 2002), and the FEW, Version 2.0 (Mills et al., 2003). Once the critical behaviors to be observed were operationalized, the team used the PASS item development guide to help standardize item construction mechanics (see Table 3.2).

The 10 items of the FEW Version 2.0 were matched to the 26 items of the PASS Version 3.1 to determine which items were most concordant. For example, FEW Item 4, Operate best matched PASS Item 20, Indoor Walking (see Table 3.3, and also Appendix C: Example of PASS-Home Functional Mobility Item: Indoor Walking. By matching the content and the structure of the PASS, it was possible to determine which components could become a template for the FEW-C and FEW-P, and which aspects were not appropriate, and therefore required further development.. For example, on the FEW-C and FEW–P data collection forms, columns

were added to document any wheelchair/scooter stability, durability, and dependability issues that were observed during task performance because these were high priorities generated by consumers and they were applicable across all items (Mills et al., 2003, Mills, Holm, Trefler et al., 2002). Changes to wording of instructions were made, as appropriate, based on feedback received from initial participants, practitioners, and raters. All revisions of the FEW-C and FEW–P items were discussed by members of the research team, and decisions were made using a consensus approach.

Table 3.3 Concordance of FEW and PASS Items

FEW item	PASS item(s)
1. Stability, durability, dependability	None applicable
2. Comfort needs	None applicable
3. Health Needs	Medication management
4. Operate	Indoor walking
5. Reach/task surface heights	Stovetop cooking, oven use, meal cleanup
6. Transfer	Toilet transfers, tub transfers
7. Personal care	Dressing, oral hygiene
8. Indoor mobility	Indoor walking
9. Outdoor mobility	None applicable
10. Transportation	None applicable

The first FEW–C and FEW-P item developed was Item 5, reach and carry out tasks at different surface heights. The original reach item related closely to the PASS meal preparation items, and involved retrieving a can of soup, a bowl/cooking pot, and a spoon, and then placing these items on a table/counter, positioning self at the table/counter, and retrieving a small towel on the floor from the right and left side of the wheelchair/scooter. In a subsequent revision, the item required consumers to fill a cup with water and place it on a table/counter, and retrieve objects at, below, or above their shoulder height from the preferred side of their wheelchair/ scooter based on a specified position of vertical or horizontal displacement. This version of the item was practitioner tested. Based on actual observation of task performance and essential feedback, reach and carry out tasks at different surface heights underwent several iterations of revisions to achieve its final format (see Appendix D, FEW-C Task #5).

For the initial pilot testing, an occupational therapist and physical therapist with seating-mobility experience were asked to administer and score the final version of the reach item in an ADL laboratory environment. The purpose of the initial pilot testing was to guide further item revision and development of future items by gathering feedback on the practitioner interpretation of task conditions, instructions, and scoring. Over the course of the FEW–C and FEW-P development, three beta versions were created with the following items undergoing the most extensive content changes: reach and carry out tasks at different surface heights (Item 5) , personal care tasks (Item 7), operate wheelchair/scooter (Item 4), and health needs (Item 3).

Next, the FEW-C and FEW–P testing protocol was developed, and included (a) an instrument manual (see Appendix E for Table of Contents); (b) training videos; (c) testing materials and equipment; (d) instructions and conditions for task set-up and task performance; (e) scoring system and interpretation; and (f) training procedures for test administration. The

FEW-C and FEW–P scoring system was modeled after the PASS hierarchy of task assistance, and a predefined 4-point ordinal scale, which yields distinct independence, safety, and quality category scores (see Appendix C for the PASS summary score guideline). The final step was designing the final data collection forms into an understandable, practical, and useful format for practitioners and researchers (see Appendix D).

3.3. FEW-C Reliability and Validity Studies

The clinical utility of a measurement tool is dependent on its reliability and validity. The measurement reliability of a tool speaks to its ability to yield consistent responses under given conditions (Portney & Watkins, 2000). Realibility of clinical tools is usually measured using interrater reliability, test-retest reliability, and internal consistency. For the current study, the more clinically relevant interrater reliability was examined first. According to Portney and Watkins (2000), "interrater reliability is best assessed when all raters are able to measure a response during a single trial, where they can observe a subject simultaneously and independently..." (p. 69). The current study followed the method suggested by Portney and Watkins. Because the test-retest reliability of the parent tool, the FEW was good to excellent (ICC = 0.86, $p < .001$), and test-retest reliability would have added to subject burden, test-retest reliability was not conducted with the FEW-C for the current study. Finally, the internal consistency of the total FEW-C tool was examined using Cronhach's coefficient alpha. An alpha greater that 0.70 but less than 0.95 was set as the standard because this would indicate good to excellent homogeneity of the total FEW-C, without unnecessary redundancy of items (Portney & Watkins, 2000).

The measurement validity of a tool concerns its ability to measure what it is supposed to measure. Validity is also concerned with whether the results from the tool allow the user to distinguish among individuals with specific traits, evaluate change, or perhaps predict future performance (Portney & Watkins, 2000). The content validity (the tool adequately samples the universe being tested) of the FEW-C is based on its parent tool, the FEW, and is reported elsewhere (Mills, Holm, Trefler et al., 2002). Likewise, in a cross-validation study, the concurrent criterion-related validity (the tool items match a gold standard or target) was also established. Based on the seating and mobility goals identified by five clinical and research samples, the FEW (and FEW-C) would have captured 98.45% of the 1900 unique goals identified by the study participants (Mills et al., 2003). The current validity study, using the multitrait-multimethod matrix approach will examine the convergent and divergent validity of the FEW-C in conjunction with the FEW and a tool developed as an adjunct to the current study, the Functional Abilities in a Wheelchair (FAW).

3.3.1. FEW-C Reliability Study

The interrater reliability study involved five objectives:

1. Conduct training sessions for administering and scoring the FEW–C.
2. Implement FEW–C interrater reliability testing.
3. Establish $\geq$ 0.80 interrater reliability using the intraclass correlation coefficient (ICC, 2*k*).
4. Document potential changes to the FEW–C based on consumer and professional feedback during the reliability study.
5. Establish the internal consistency of the FEW-C

3.3.1.1. Reliability Study Raters

Three members of the research team, and six additional raters were involved in the collection of FEW–C reliability data. All except one rater were occupational therapy practitioners employed as research associates or graduate student researchers on studies pertaining to rehabilitation research, and were pursuing advanced degrees in the School of Health and Rehabilitation Sciences (SHRS) at the University of Pittsburgh. Of the 6 additional raters, four raters participated in the study as part of their work responsibilities and interest in outcomes measurement, one rater was enrolled in a specialized preceptorship course focusing on outcomes research with the principal investigator, and the other rater was an undergraduate student volunteer interested in a health-related profession. The level of clinical experience varied, and included two recent occupational therapy graduates, three practitioners with 1-3 years of neurorehabilitation experience, two practitioners who specialized in seating-mobility assessment and intervention and had five and 16 years of experience, and one practitioner with 37 years of experience.

3.3.1.2. Reliability Study Participants

For the reliability study, participants were recruited from the University of Pittsburgh Medical Center, Center for Assistive Technology (CAT) in Pittsburgh, Pennsylvania, and the Hiram G. Andrews Center (HGAC), Center for Assistive and Rehabilitative Technology (CART) in Johnstown, Pennsylvania. All participants were new or existing clients seen at the CAT or CART for provision of a wheeled mobility and seating device, or HGAC students. The inclusion criteria for participants recruited as part of the reliability study were (a) existing manual/power wheelchair or scooter user, who had experienced a change(s) in functional status (e.g.,

transitioning from a manual wheelchair to a power wheelchair, decline in function, going from home/community use to work) that required a new wheeled mobility and seating intervention (i.e., receipt of a new wheelchair or scooter); (b) 18 years of age and older; and (c) adequate cognitive and language status, meaning participants were able to cognitively and orally respond to questions and tasks posed in the FEW–C. Cognition and language status were determined by information provided by a CAT or CART team member.

As part of the initial FEW–C training, raters had the opportunity to first observe and score a FEW–C assessment administered by an instrument developer with an expert seating-mobility practitioner (research team member), who simulated symptoms and functional abilities of a person with multiple sclerosis using a manual wheelchair. The FEW–C was administered in a well-equipped ADL laboratory in the Department of Occupational Therapy at the University of Pittsburgh. Demographic data for this simulated FEW-C test participant was excluded when describing all participants however the data obtained from this session was included in the interrater reliability data analysis.

The reliability study sample consisted of 13 subjects: 11 were manual wheelchair users (including the simulated case) and two power wheelchair users. Two of the participants were observed in a manual wheelchair and again following the delivery of a power wheelchair. The average participant was a 48 year old (range 22–68) Caucasian (83%) male (75%). Primary diagnoses were multiple sclerosis (n = 3), spina bifida (n = 3), cerebral palsy (n = 2), spinal cord injury (n = 2), above knee amputation (n = 1), and Parkinson disease (n = 1). Participants had typically used a wheelchair or scooter for 12.1 years (range 2–45) (see Table 3.4).

3.3.1.3. Reliability Study Instrument

The FEW–C consists of 10 criterion-referenced, performance-based tasks that can be administered in total or selected tasks can be individually administered or combined (see Appendix D). The FEW–C is designed to be administered in a rehabilitation clinic setting by a trained assessor (e.g., practitioner, researcher) with background experience or training in wheeled mobility and seating evaluation and intervention. Although clinical settings may vary, the apparatus and environmental features necessary to carry out the FEW-C are typically available in most clinic facilities including flat surface, carpeted surface, outdoor surfaces, door, doorway, counter, shelf, adjustable height mat table, and sink. Criteria for standardized administration are included.

Of the 10 tasks, operate wheelchair/scooter, reach and carry out tasks at different surface heights, transfers, personal care tasks, indoor mobility, and outdoor mobility are tested strictly by

Table 3.4 FEW-C Reliability Study Subject Characteristics

Subject	Gender	Age	Race	Condition	Wheelchair Type
1	Male		C	Simulated multiple sclerosis	Manual
2	Male	29	A	Spinal Cord Injury	Manual
3	Male	22	A	Cerebral Palsy	Power
4	Female	40	C	Spina Bifida	Manual
5	Male	42	C	Spina Bifida	Manual
6	Female	60	C	Multiple Sclerosis	Manual/Power
7	Male	58	C	Cerebral Palsy	Manual
8	Female	57	C	Spina Bifida	Power
9	Male	52	C	Spinal Cord Injury	Manual
10	Male	46	C	Above Knee Amputation	Manual

Table 3.4 (continued)

11	Male	51	C	Multiple Sclerosis	Manual
12	Male	52	C	Multiple Sclerosis	Manual
13	Male	68	C	Parkinson Disease	Manual / Power

C = Caucasian, A = African American

performance-based observation. Three tasks (comfort needs, health needs, and personal/public transportation) include both performance-based and self-report components because of the complexity (i.e., subjectivity, feasibility) associated with task measurement, and the need to measure meaningful subtasks for each participant. Stability, durability, and dependability is a self-report item that was also subsequently measured, as observed, during performance of all other tasks. The following definitions apply to this item:

(1) Stability- an unintentional, non-preventable, or unexpected force or motion (e.g., generated by consumer, an external force, contact with object, person, or surface) that causes the wheel/tire/caster components of a seating-mobility system to become unbalanced, resulting in one or more wheels/tires/casters losing contact with the ground or floor.

(2) Durability- any aspect of a seating-mobility system that is considered (by consumers, caregivers, practitioners, etc.,) inoperable or unable to withstand reasonable use over a length of time, and affects or limits consumer function or quality of life.

(3) Dependability- any aspect of a seating-mobility system that is not considered (by consumers, caregivers, practitioners, etc.,) to operate or perform an intended function consistently under reasonable use, and affects or limits consumer function or quality of life.

The FEW–C items yield independence, safety, and quality data, independence summary scores for each subtask, and safety and quality summary scores for the total task based on a predefined 4-point ordinal scale. All rating criteria are defined on the data collection form (see

Appendix D). Additionally, the instrument manual provides detailed information on FEW–C administration, scoring, and interpretation.

3.3.1.4. Reliability Study Procedures: Rater Training

Members of the research team and all raters participated in training sessions conducted by the primary developers of the instrument. After all raters reviewed the FEW–C instrument and testing manual, a 5-hour group training session was conducted. An in-depth review of the FEW–C instrument protocol was provided, and a training video was shown of the FEW–C being administered by an instrument developer to a power wheelchair user with a disability located in the Center for Assistive Technology. Once an item was shown on the video (excluding stability, durability, and dependability), raters were asked to score it, and a discussion then followed to ensure group consensus, accuracy of item scores, and their understanding of the scoring and interpretation process. Some raters required more individualized training sessions to increase their familiarity and accuracy with scoring the FEW–C.

3.3.1.5. Reliability Study Procedures: Participants

The reliability study was conducted over 12 months. The FEW–C was administered to participants by one of the instrument developers in a clinical setting. Some participants were assessed with their current wheeled mobility and seating device. Other participants were also assessed initially with their current seating-mobility device, and later when they received their new wheeled mobility and seating device. Raters observed and simultaneously but independently, rated participant task performance during the FEW–C administration. The scores

assigned to a single participant by the instrument developer served as the anchor for assessing interrater reliability of the ratings given to that participant by the rater who observed. In this study, the same raters were not present at each FEW–C administration, even if the participant was one that was seen on two occasions. Participants were observed completing functional tasks using their wheelchairs in the clinic at a single point to establish the reliability of ratings among all observing raters (including instrument developers).

The FEW–C took approximately 1-2 hours to complete depending on the impairment status of the participant as well as the need for the participant to take rest breaks. Participants were asked to select convenient times for each visit to the CAT or CART. Following each FEW-C administration, participants and raters were asked to provide feedback on the FEW–C content, testing materials, administration protocol, and scoring system.

3.3.1.6. Reliability Study Internal Consistency

Cronbach's coefficient alphas were used to evaluate the internal consistency of the FEW-C among individual items and for the total tool. Because each of the items measured a unique trait, we expected lower inter-item correlations, but a good to excellent ($\geq$ 0.70) coefficient alpha.

3.3.2. FEW-C Validity Study

The validity study involved one objective:

1. Examine the convergent and divergent validity among methods of tool administration and the traits the tools measure.

3.3.2.1. Validity Study Participants

Data collected on the FEW, FAW, and FEW-C used for the validity study included participants who were recruited primarily from the University of Pittsburgh Medical Center, Center for Assistive Technology (CAT) in Pittsburgh, Pennsylvania, and one participant from the Hiram G. Andrews Center (HGAC), Center for Assistive and Rehabilitative Technology (CART) in Johnstown, Pennsylvania. All participants were new or existing clients seen at the CAT for provision of a wheeled mobility and seating device and one was an HGAC student. The inclusion criteria for participants recruited as part of the study were (a) existing manual/power wheelchair or scooter user, who had experienced a change(s) in functional status (e.g., transitioning from a manual wheelchair to a power wheelchair, decline in function, going from home/community use to work) that required a new wheeled mobility and seating intervention (i.e., receipt of a new wheelchair or scooter); (b) 18 years of age and older; and (c) adequate cognitive and language status, meaning participants were able to cognitively and orally respond to questions and tasks posed in the FEW–C. Cognition and language status were determined by information provided by a CAT or CART team member.

The study sample consisted of 25 participants. Thirteen were male and 12 female. The average participant was a 52 years old Caucasian, and had used a wheelchair for about 10 years. People with multiple sclerosis comprised over one third of the study population and the other

participants experienced impairments related to either progressive or non-progressive medical condition (see Table 3.5). The typical wheelchair used at the time of pre-test was a 3.6 year old manual wheelchair with no seat functions other than manual elevating legrests. At post-test, all wheelchairs used by the participants were power chairs except for one ultralight manual wheelchair user. These power wheelchairs tended to be equipped with multiple power seat functions such a tilt in space, recline, elevating leg rests, seat elevator, or passive standing (see Table 3.6 for detailed characteristics of the wheelchairs).

Table 3.5 Validity Study Participant Characteristics (n=25)

Descriptors	Parameters
Age (mean, SD)	52.3 ±10.5 (range 34 to 72)
Gender	
Male (%)	52.0
Female (%)	48.0
Race	
Caucasian (%)	84.0
African American (%)	16.0
Years using a wheelchair (mean, SD)	09.4 ± 10.5 (range 1 to 45)
Age of wheelchair at pre-test (mean, SD)	03.6 ± 2.5 (range 1 to 9)
Primary medical condition	
Multiple Sclerosis (%)	36.0
Spina Bifida (%)	12.0
Parkinson Disease (%)	08.0
Cerebral Vascular Accident (%)	08.0
Above Knee Amputation (%)	04.0
Cardiac Disease (%)	04.0
Cerebral Palsy (%)	04.0

Table 3.5 (continued)

Lupus (%)	04.0
Mitochondrial Disease (%)	04.0
Orthopedic Disorder (%)	04.0
Paraplegia (%)	04.0
Tetraplegia (%)	04.0
Traumatic Brain Injury (%)	04.0

Table 3.6 Characteristics of Study Participants' Wheelchairs, at Pretest and Posttest

Characteristics	Pre-test (n=25)	Posttest (n=22)
Type of wheelchair		
Manual (%)	80.0	04.5
Power (%)	16.0	95.5
Scooter (%)	04.0	00.0
Weight of manual wheelchairs		
Standard (%)	24.0	00.0
Highstrength lightweight (%)	40.0	00.0
Ultralight (%)	12.0	04.5
Seat functions		
Manual elevating legrests (%)	24.0	04.5
Power tilt in space only (%)	08.0	13.6
Power reclining backrest only (%)	00.0	00.0
Power elevating leg rests only (%)	00.0	04.5
Power seat elevator only (%)	04.0	04.5
All of the above (%)	00.0	45.5
All of the above plus passive standing (%)	00.0	09.1
No seat functions (%)	60.0	22.7

3.3.2.2. Validity Study Instruments

Data from the FEW-C, FEW self-report tool, and an additional self-report tool, Functional Abilities in a Wheelchair (FAW) (see Appendix F) were used in the validity study. The FAW was developed by the research team following the development of the FEW, FEW-C, and FEW-P. Items for the FAW are matched to those of the FEW however the focus of each tool differs. Items of the FEW focus on the level of support the wheeled mobility device features provide during functional tasks, whereas items in the FAW focus on the independence of the person during functional tasks performed in the wheeled mobility and seating device. For example, for the FEW, Item 4, Operate, consumers are asked to rate their level of agreement with the following statement: "The size, fit, postural support and functional features of my wheelchair/scooter allow me to operate it as independently, safely, and efficiently as possible." The same item on the FAW is worded: "While in my wheelchair/scooter and without assistance from others, I can operate it." The inclusion of the FAW in the current study occurred because the research team was interested in knowing whether participant self-reported perception of functional independence would differ based on wording directed to the support provided by the device versus wording that was directed specifically to perceived functional independence only.

3.3.2.3. Validity Study Procedures

A multitrait-multimethod matrix was developed to examine if the FEW-C, the FEW and the FAW (methods) yielded convergent or divergent information about the same traits (independence, safety, quality) in our participants (Campbell & Fiske, 1959).

3.3.3. Data Analysis: FEW-C Reliability and Validity

3.3.3.1. Interrater reliability

Descriptive statistics related to participant demographics and their types of wheeled mobility devices were calculated. Data collection for the interrater reliability study consisted of the FEW–C ratings of all reliability ratings from raters who observed each participant. Descriptive statistics and frequencies are reported for all variables of interest. Interrater reliability was established using ICC Model (2,*k*). This model was selected to examine the reliability of the average scores assigned by a rater from a fixed set of raters, for each participant, but not all raters rated each participant. The use of the ICC has several advantages, including (a) it reflects the degree of correlation and agreement, (b) it assesses reliability among two or more ratings, (c) it does not assume equal number of raters for each subject, and (d) it can be applied to ordinal data when intervals between measurements are assumed to be equal (Huck & Cormier, 1996, Lahey, Downey, & Saal, 1983, Portney & Watkins, 2000). Interrater reliability data analysis was conducted using SPSS, version 12.01.

3.3.3.2. Multitrait-Multimethod (MTMM) Matrix (reliability and validity)

An MTMM matrix was developed to examine the relationship between methods of tool administration and the traits the tools measure. The MTMM matrix is an approach assessing the construct validity of a set of measures in a study (Campbell & Fiske, 1959). The MTMM is simply a matrix or table of correlations arranged to facilitate the interpretation of the assessment of construct validity.. The MTMM assumes that one measures each of several concepts called traits by each of several methods. The strength of the relationships between methods and traits

was categorized as poor (0.00 to 0.25), fair (0.26 to 0.50), moderate (0.51 to 0.75), and good to excellent (0.76 to 1.00) (Portney & Watkins, 2000).

For the MTMM in the current study, the performance-based observational tool, the FEW-C, was compared with the FEW and the FAW self-report tools that were part of a larger study of outcome measures funded by the National Institute for Disability and Rehabilitation Research (H133E990001). The tools each measured the same traits or combinations of the same traits, and only the total mean ratings of each tool were included in the MTMM analysis.

3.4. RESULTS

The reliability study consisted of 15 FEW–C administrations with 13 participants who used their current manual or power wheelchair and two participants who repeated the FEW-C following the provision of a new power wheelchair (see Table 3.7). Eight of the 13 reliability participants were also in a non-randomized clinical trial and were receiving new power wheelchairs. Forty-nine discrete FEW–C ratings were collected with nine raters across the 12 participants, but one rater only rated the first training participant. On average, there were three raters present at a single FEW–C administration.

Table 3.7 Number of FEW–C Interrater Reliability Raters, by Subject, Condition and Type of Wheelchair

Subject	*Number of raters	Condition	Type of wheelchair
Subject 1	6	Training	Manual
Subject 2	6	Training	Manual
Subject 3	4	Training	Power
Subject 4	4	Training	Manual
Subject 5	4	Training	Manual
Subject 6	2	Pretest	Manual
Subject 6	3	Posttest	Power
Subject 7	3	Pretest	Manual
Subject 8	3	Pretest	Power
Subject 9	2	Pretest	Manual
Subject 9	2	Posttest	Power
Subject 10	2	Pretest	Manual
Subject 11	2	Pretest	Power
Subject 12	3	Pretest	Manual
Subject 13	3	Pretest	Manual
Subject 13		Posttest	Power

Note. Subjects 1-5 were training subjects for the reliability team (including Subject 1 who was a simulated case); subjects 6-13 were enrolled in the study; subjects 6 and 9 were observed twice for reliability under different conditions.

3.4.1. Interrater reliability

The FEW–C demonstrated excellent interrater reliability with an ICC = 0.99 [95% CI = 0.98–0.99, $p < 0.001$]. This finding was also consistent for each item, in which all combined ICCs for independence, safety, and quality data and summary scores were > 0.80 [range, 95% CI = 0.84–1.00] (see Table 3.8). Both of these primary findings were above the acceptable value $\geq$ 0.80, and all reliability coefficients had small to moderate confidence intervals, meaning the FEW–C

had good precision. With all ICCs > 0.80, the ratings indicated that the clarity of the FEW–C tool allowed multiple observers to rate individual items and the total tool consistently.

3.4.2. Internal consistency

Internal consistency of the total FEW-C tool, for all independence, safety and quality ratings achieved a standardized alpha of 0.97. Internal consistency for each scale was also good, with standardized alphas of 0.89 for independence, 0.81 for safety, and 0.74 for quality (see Tables 3.9, 3.10, and 3.11).

Table 3.8 FEW–C Interrater Reliability for Independence, Safety, and Quality (ISQ) Scores

	ISQ	Independence (I)	Safety (S)	Quality (Q)
	$^{**}ICC_2$ [CI]	$^{**}ICC_2$ [CI]	$^{**}ICC_2$ [CI]	$^{**}ICC_2$ [CI]
Comfort Needs	0.98 [0.97–0.99]	0.99 [0.99–1.00]	0.98 [0.96–0.99]	0.98 [0.97–0.99]
Health Needs	0.98 [0.97–0.99]	0.98 [0.96–0.99]	0.99 [0.97–0.99]	0.98 [0.96–0.99]
Operate WC/Scooter	0.98 [0.97–0.99]	0.99 [0.97–0.99]	0.99 [0.97–0.99]	0.98 [0.97–0.99]
Reach/Task Surface Height	0.99 [0.98–0.99]	0.99 [0.98–0.99]	0.99 [0.98–0.99]	0.98 [0.98–0.99]
Transfer	0.97 [0.94–0.98]	0.95 [0.84–0.99]	0.97 [0.93–0.99]	0.97 [0.93–0.99]
Personal Care Tasks	0.99 [0.98–0.99]	0.99 [0.97–0.99]	0.99 [0.98–0.99]	0.99 [0.97–0.99]
Indoor Mobility	0.99 [0.98–0.99]	0.99 [0.98–0.99]	0.99 [0.98–0.99]	0.99 [0.98–0.99]
Outdoor Mobility	0.97 [0.95–0.98]	0.97 [0.95–0.99]	0.97 [0.95–0.99]	0.97 [0.95–0.99]
Personal/Public Transportation	0.92 [0.85–0.96]	0.92 [0.85–0.96]	0.92 [0.85–0.96]	0.92 [0.85–0.96]
Total	0.99 [0.98–0.99]	0.98 [0.98–0.99]	0.98 [0.98–0.99]	0.98 [0.98–0.99]

Key. $^{**}p < 0.001$, unless, ICC_2 = intraclass correlation coefficient Model (2,*k*). ISQ ratings include all subtask data and summary scores.

Table 3.9 Internal Consistency of FEW-C Construct of Independence

	COM	HN	OWC	RCH	TRN	PC	IM	OM	PT
Comfort (COM)	1.00	0.63	0.42	0.76	0.63	0.68	0.64	0.23	0.04
Health needs (HN)		1.00	0.32	0.62	0.80	0.64	0.55	0.36	0.25
Operate wc/scooter (OWC)			1.00	0.41	0.26	0.67	0.88	0.40	0.47
Reach/ surface height access (RCH)				1.00	0.61	0.62	0.64	-0.01	-0.02
Transfers (TRN)					1.00	0.60	0.50	0.46	0.27
Personal care tasks (PC)						1.00	0.72	0.43	0.30
Indoor mobility (IM)							1.00	0.45	0.45
Outdoor mobility (OM)								1.00	0.38
Personal/ public transportation (PT)									1.00
Overall internal consistency									0.89

Table 3.10 Internal Consistency of FEW-C Construct of Safety

	COM	HN	OWC	RCH	TRN	PC	IM	OM	PT
Comfort (COM)	1.00	0.34	0.38	0.30	0.38	0.71	0.38	0.11	0.29
Health needs (HN)		1.00	0.13	0.02	0.32	0.39	0.04	0.31	0.48
Operate wc/scooter (OWC)			1.00	0.19	0.03	0.51	0.76	0.45	0.16
Reach/ surface height access (RCH)				1.00	0.09	0.47	0.55	0.06	0.47
Transfers (TRN)					1.00	0.43	0.13	-0.02	0.41
Personal care tasks (PC)						1.00	0.44	0.26	0.58
Indoor mobility (IM)							1.00	0.20	0.33
Outdoor mobility (OM)								1.00	0.30
Personal/ public transportation (PT)									1.00
Overall internal consistency									0.81

Table 3.11 Internal Consistency of FEW-C Construct of Quality

	COM	HN	OWC	RCH	TRN	PC	IM	OM	PT
Comfort (COM)	1.00	-0.11	-0.07	0.07	0.41	0.29	-0.06	-0.92	0.06
Health needs (HN)		1.00	0.23	0.56	0.28	0.21	0.39	-0.15	0.36
Operate wc/scooter (OWC)			1.00	0.20	0.03	0.36	0.69	0.36	0.16
Reach/ surface height access (RCH)				1.00	0.41	0.65	0.60	-0.12	0.33
Transfers (TRN)					1.00	0.66	0.11	-0.15	0.41
Personal care tasks (PC)						1.00	0.45	-0.05	0.37
Indoor mobility (IM)							1.00	0.24	0.16
Outdoor mobility (OM)								1.00	0.18
Personal/ public transportation (PT)									1.00
Overall internal consistency									0.74

3.4.3. Multitrait-Multimethod (MTMM) Matrix (reliability and validity)

For the validity study, two of the tools used a self-report method (FEW and FAW). However, the focus of the FEW and the FAW differ. Items in the FEW focus on the level of support the wheeled mobility device features provide during functional tasks, whereas items in the FAW focus on the independence of the person during functional tasks performed in the wheeled mobility device. The method used with the FEW-C is performance-based observation in a standardized clinic setting.

The traits being measured in the current study include independence, safety, and quality of performance. In the FEW, the three traits are rated together and the consumer has the option of identifying specific difficulties with a particular trait in the narrative part of the tool. In the FAW, the only trait rated is independence. In the FEW-C, each of the traits are rated separately for each item, and uniform rating criteria are provided for each trait that are applied to all items. The MTMM matrix in Table 3.12 includes both reliability and validity data.

3.4.3.1. MTMM Reliability.

The reliability diagonal of the MTMM matrix is highlighted in green. It represents the correlation of each trait with itself. Ideally it should be 1.00. However estimates of true reliability are included instead. For the FEW (self-report), this is the test-retest intraclass correlation (3, *k*) reliability coefficient (0.86). Because the FAW was added to the study after the other tools were developed, no reliability data are available for the FAW. For the FEW-C, the inter-observer

intraclass correlation (2, *k*) reliability coefficients are included (I, S, Q each are 0.98). The strength of these correlations should be greatest in the matrix, and that is the case (0.86 to 0.98) (Campbell & Fiske, 1959).

Table 3.12 Multitrait-multimethod matrix for the FEW, FAW, and FEW-C tools*

METHODS		FEW	FAW	FEW-C		
	TRAITS	I, S,Q	I	I	S	Q
FEW	I, S, Q	0.86				
FAW	I	0.84	--.--			
FEW-C	I	0.43	0.58	0.98		
	S	0.48	0.71	0.81	0.98	
	Q	0.63	0.65	0.67	0.74	0.98

*FEW = Functioning Everyday with a Wheelchair, FAW = Functional Abilities in a Wheelchair, FEW-C = Functioning Everyday with a Wheelchair - Capacity.
Note: I = independence, S = safety, Q = quality

3.4.3.2. MTMM Validity

Although the content and criterion-related validity of the FEW-C is based on the FEW (Mills et al., 2003), the convergent and discriminant validity is derived from an MTMM analysis. There are three validity indicators (1) monotrait-heteromethod, (2) heterotrait-heteromethod, and (3) heterotrait-monomethod. Each provides unique information. The monotrait-heteromethod data are highlighted in gray and yellow in Table 3.12 and represent the correlations between measures of the same trait, using different methods (FEW-C Independence and FAW). These data provide

information about the concordance between the different methods of measurement (convergent validity). The FEW requires the rating of the three traits in combination (I, S, and Q; (0.43, 0.48, 0.63, respectively) so because they are not an exact match of traits, they are highlighted in gray. The concordance between the methods for the traits of independence and safety is fair, and for quality it is moderate. Because the FAW measures the trait of independence only, the match with the FEW-C trait of independence is highlighted in yellow (0.58), and is moderately strong. Thus, when measuring the exact same trait using different methods there was moderate convergent validity between methods. However, when the traits being rated were combined, the convergent validity of the different methods was only fair.

Heterotrait-heteromethod validty data are highlighted in pink in Table 3.12. These represent the concordance of results when both traits and methods differ. Because these correlations share neither trait nor method (discriminant validity) they are expected to be the lowest in the matrix. However, that is not the case. The FAW (self-report method) independence trait is moderately correlated with the FEW-C (performance-based observation method) safety (0.71) and quality traits (0.65). Although the FAW emphasizes independence in its item wording, the relationship of the FAW independence trait and the FEW-C independence trait was not as strong as for the traits of safety and quality.

Heterotrait-monomethod validity data are highlighted in blue. These are correlations among measures that share the same method of measurement (discriminant validity). For instance, correlation between the traits of independence and safety measured with the FEW-C. If these correlations are high, it is because measuring different traits with the same method results in highly correlated (moderate to good) measures. Thus, even though each of the traits had separate rating criteria, the method effect may not have teased out the uniqueness of the three

traits (discriminant validity). This is understandable, because when observing a person transfer, a physical assist (independence scale) can be given to prevent a fall (safety scale), and multiple attempts with needs for assistance are reflected on the quality scale and the independence scale.

3.5. DISCUSSION

The purpose of this study was to develop a reliable and valid capacity-based version of the FEW self-report tool for use in the clinic or laboratory setting to measure functional outcomes of wheeled mobility and seating device interventions. Raters were able to establish excellent interrater reliability using the FEW-C, and the tool yielded good to excellent internal consistency without redundancy. Moderate to strong convergent and discriminant validity were also established when the FEW-C was compared with the FEW and the FAW self-report tools, indicating that the performance-based FEW-C adds unique and sometimes overlapping data to a wheeled mobility and seating device clinical evaluation.

The development of a reliable and valid clinical tool for measuring progress and outcomes of wheeled mobility interventions did not happen by chance. One primary method for improving reliability and validity is to model the tool after another reliable and valid tool. Items for the FEW-C were developed using the PASS as a model, including use of the PASS guidelines for item development and its hierarchical ordinal scaling protocol. Items for the FEW-C were also operationally defined, using PASS items as guides, and refined using the ICF activity capacity qualifier for guidance. Thus the specific testing conditions and target behaviors to be observed were clearly delineated and relevant to a standardized clinical or laboratory setting. Likewise, scoring methods for the FEW-C were operationally defined for task independence as well as for task safety and task quality. This left less ambiguity for scoring

compared to other tools that often combine safety and quality with independence and thereby may affect reliability in scoring across raters. The FEW-C interrater reliability study yielded almost identical finding to the FEW-P tool, which was developed simultaneously, and which yielded an interrater reliability intraclass correlation coefficient of 0.98 (Mills et al., 2003).

3.5.1. Reliability and Validity of Comparable Tools

As identified and discussed in the systematic review of Chapter 2, only a small number of observational tools related to wheeled mobility and seating functional outcomes have reported findings related to reliability and validity. Cress et al (2002) reported good test-retest reliability, internal consistency, as well as construct and content validity for the WC-PFP tool, however, this tool is limited for use with users of manual wheelchairs. Dawson et al (1994) established moderate intrarater reliability and good interrater reliability as well as content validity for the PIDA, however this tool is specifically designed to assess a user's ability to operate a powered mobility device. Harvey et al (1998) reported good interrater reliability and face validity, based only the opinions of clinicians, for their tool that is designed to measure functional performance of people with paraplegia using a manual wheelchair. The Wheelchair Circuit (Kilkens et al., 2004, Kilkens et al., 2002) has moderate to good interrater and intrarater reliability as well as good construct validity, however is only applicable to manual wheelchair users with spinal cord injuries. The Wheelchair Skills Test (Kirby et al., 2004, Kirby et al., 2002) has reported excellent test-retest, intrarater, and interrater reliability as well as measures of content, construct, and concurrent validity, however this tool is also specific to manual wheelchair users. May et al (2003) reported excellent test-retest and interrater reliability as well as content validity of their tool which is also limited in application to manual wheelchair users.

Based on this review, there do exist reliable and valid observational tools for measuring functional capacity with a wheelchair, however they are limited in scope to specific populations, or to manual wheelchair users or powered mobility device users, but not both. When compared to the 10 items of the FEW, the item content of the measures and subtasks of the tools reviewed indicated they were only minimally or somewhat representative of what is reported by wheelchair users or clinicians as being important tasks to be able to perform in a wheeled mobility and seating device (Mills, Holm, Schmeler et al., 2002). Furthermore, none of these tools provide separate scores for independence, safety, and quality. An advantage of the FEW-C is that it can be used with all adult populations across a variety of disability types as well as for both manual wheelchair and power mobility device users and it has content that is reflective of what is perceived as being important and necessary by wheeled mobility device users and clinicians.

3.5.2. Factors Contributing to the Reliability of the FEW-C

A possible factor that resulted in a high consistency of scoring across raters was related to the training protocol developed for the raters. This included providing copies of the FEW-C and a detailed test manual that was reviewed by the raters, and then followed by comprehensive in-person training sessions related to implementation and scoring of the FEW-C items. Training involved the use of videotape case examples and live test subjects as well as discussions and clarifications related to inconsistencies in scoring. Therefore, practitioners and researchers interested in the implementation of the FEW-C as an outcome measure in future activities will need to undergo similar levels of training which could potentially make the application of the tool burdensome. Future studies may be warranted to determine the interrater reliability of the

FEW-C following other means of rater training such as half or full day hands-on workshops, online training protocols, or a combination of both.

The raters in the study are another factor that may have contributed to high interrater reliability coefficients. All raters (except one) were occupational therapy practitioners, and therefore knowledgeable about methods of assessing a person's capacity to engage in functional tasks. These occupational therapy practitioners were also pursuing post-professional advanced degrees in the field of the rehabilitation science, and were also familiar with the need to adhere to research protocols and standardized test procedures. Some raters were also involved in the development of the FEW-C, and most also had exposure to wheeled mobility and seating interventions as part of their clinical internships. Further investigation is needed to determine whether the FEW-C would yield good interrater reliability coefficients among other practitioners such as physical therapists, rehabilitation engineering technologists, assistive technology suppliers, or nurses. The same would be the case for practitioners not involved in the development of the tool or generalist practitioners in the field of occupational or physical therapy with limited exposure to wheeled mobility and seating interventions as compared to the raters in this study.

The high internal consistency alpha of the total FEW-C indicates that there may be redundancy in some of the items (Portney & Watkins, 2000). However, the independence, safety and quality alphas were lower, indicating good internal consistency without redundancy within each scale. This finding suggests that further investigation into item redundancy between scales may be necessary. This finding is also mirrored in one of the MTMM analyses.

3.5.3. Factors Contributing to the Validity of the FEW-C

The MTMM analysis showed that there was only a fair to moderate relationship of data for the traits of independence, safety and quality when gathered with the FEW-C versus the FEW, indicating good discriminant validity for the FEW-C. In other words, the FEW-C and the FEW yield unique, rather than overlapping information when measuring the same traits. In contrast, because they use the same method of gathering data, even though the focus is different, data gathered about the same traits when using the FEW and the FAW are highly convergent. Although the FAW was designed to gather information about the trait of independence, there is a moderate overlap, but not duplication of the data on the traits of safety and quality gathered with the FEW-C, again indicating fair discriminant validity of the FEW-C.. Finally, the FEW-C data gathered for the traits of independence, safety and quality are strongly correlated among themselves, reducing its discriminant validity when measuring the separate traits, and indicating that the FEW-C may not totally distinguish the unique features of each of these traits within each scale. Larger samples may help to differentiate the unique contributions of the independence, safety and quality scales, as well as their overlap.

3.5.4. Limitations of the Study

One primary limitation to the interrater reliability study was that there were only 13 unique participants for the raters to observe and rate. Data were also included for one training participants who was an able-bodied researcher who simulated the functional abilities of a known person with multiple sclerosis. Future investigation of FEW-C interrater reliability should involve administering the tool to a larger sample of wheeled mobility and seating device users. Another potential weakness to the reliability study is that test-retest reliability was not

performed on the FEW-C. The rationale for not performing this was that it would pose a potential burden to the study participants as it would have required them to come into the clinic several days after the initial assessment to complete the FEW-C a second time. Many of the study participants had busy routines, limited transportation resources, or a fragile health status that would have made a return visit difficult and burdensome. At the same time, there was limited concern with what happened over time (even though this is a potential threat to sensitivity) and more concern whether task performance could be consistently observed and scored across observers at a given time.

3.6. CONCLUSIONS

The FEW-C has excellent interrater reliability, good to excellent internal consistency, and fair to good convergent and discriminant validity when compared with tools measuring similar traits by different methods. These findings indicate that operationalizing the items of a reliable and valid self-report tool into a performance-based observational tool yielded another reliable and valid tool for gathering data about functioning with a wheeled mobility and seating device. Future studies might consider test-retest reliability of the tool provided it can be conducted in a clinical or laboratory setting that does not pose a significant burden to study participants. At this point studies are warranted to investigate whether the FEW-C is valid for measuring change in function following the provision of a properly fitted wheeled mobility and seating device provided by a qualified practitioner with expertise in this area.

4. COMPARISON OF SELF-REPORT AND PERFORMANCE-BASED INSTRUMENTS TO MEASURE CHANGE IN FUNCTION FOLLOWING THE PROVISION OF WHEELED MOBILITY AND SEATING INTERVENTIONS

4.1. BACKGROUND

Research has estimated there are approximately 1.7 million non-institutionalized wheelchair users in the United States (Jones & Sanford, 1996, Kaye et al., 2000). Other research has further reported limited mobility is becoming a problem in the United States where almost six million non-institutionalized adults report difficulty walking a quarter mile, climbing 10 steps, standing for 20 minutes, or report using a wheelchair or scooter (Iezzoni, 2003, Iezzoni et al., 2001). The functional effects of a wheelchair seating and mobility device cannot be understood without reference to the complex interplay of the technology with the user's specific needs and preferences (Samuelsson et al., 1999).

With the shift to evidence based practice, the assistive technology community has the ethical obligation to be accountable and demonstrate the effectiveness of services and interventions (DeRuyter, 1995). However, documentation of such outcomes is dependent on the availability of appropriate measurement tools (Smith, 1996). In Chapter 2 a systematic review of performance based measures related wheeled mobility and seating interventions revealed there were only a limited number of valid and reliable tools to measure functional outcomes and the application of these tools were limited to specific type of device utilization and disability populations. Other tools used to assess global function such as the Functional Independence

Measure (FIM™) (Granger et al., 1993) has been reported by others to not be sensitive in measuring functional change in users of wheeled mobility and seating devices (Harvey et al., 1998, Marino et al., 1993, Ota et al., 1996, Yarkony et al., 1988).

There are ongoing questions related to whether self reported measures correlate with performance-based measures. For example, good to excellent correlation was reported (r=.95) between manual wheelchair user self report of skills and scores on the Wheelchair Skills Tests, however, the authors reported that with self-report users tended to overestimate their abilities (Newton et al., 2002). Differences in self-report overestimation and underestimation when compared to performance-based assessment can also depend on the activity domain. Rogers, et al. (2003) found that for functional mobility, self-report underestimated ability compared to clinic performance ratings, whereas for personal care, physical instrumental activities of daily living (IADL) and cognitive IADL, self-report overestimated ability compared to performance assessment in the clinic among subjects with chronic arthritis. Just as ratings of activity domains can yield different outcomes, so can constructs such as independence, safety and adequacy of task performance. Rogers, Holm, Beach, Schulz, and Starz (2001) found that "independence is not always synonymous with safe and adequate performance" (p. 410). Similarly, one study suggested that there may also be significant differences in perceived performance versus actual performance of certain activities of daily living among hospital-based older persons at discharge (Sager et al., 1992). However, others have reported that both self-reported and performance based measurement tools yield strong indicators of function in a variety of activities, but factors such as depression, cognitive function, and marital status affect self-perceived function in some populations such as community and nursing home residents (Cress et al., 1995).

Given concerns with the accuracy of self-reported measures of function, there is an inherent need to compare their scores to those of performance-based measures. Likewise there is also need to investigate the differences and magnitudes of change in function that can be measured between self-report and performance-based measures. The specific aim of this study was to establish the ability of the Functioning Everyday with a Wheelchair Beta Version 2.0 (FEW) (Mills et al., 2003) and the Functional Abilities with a Wheelchair (FAW) to measure user perceived change in function and the Functioning Everyday with a Wheelchair – Capacity (FEW-C) (see Chapter 3) to measure observed change in function following the provision of a new wheeled mobility and seating device provided by a qualified interdisciplinary team of practitioners. The sample was drawn from a population of wheeled mobility and seating device users with progressive conditions or those undergoing a significant change in lifestyle that warranted a new type a wheeled mobility and seating device (e.g., loss of strength, new living environment, chronic shoulder pain). The foci of three tools used in this study differ. The FEW is a self-report tool of a person's perceived ability to function using a wheeled mobility and seating intervention whereas the FAW is a self-report tool that measures perception of ability to perform without mention of the device. The FEW-C is to observe and measure functional capacity using a wheeled mobility and seating device.

4.1.1.1. Hypotheses

The specific hypotheses tested were:

i. There will be no significant difference in the ability of the total scores of the FEW, FAW, or FEW-C to detect significant changes in function after the provision of wheeled

mobility and seating interventions, for participants with a progressive condition or participants undergoing a significant change in lifestyle that warrants a new type seating and mobility device (e.g., loss of strength, new living environment, chronic shoulder pain).

ii. There will be no difference in the ability of specific item scores of the FEW, FAW, or FEW-C to detect significant changes in function after the provision of wheeled mobility and seating interventions, for participants with a progressive condition or participants undergoing a significant change in lifestyle that warrants a new type seating and mobility device (e.g., loss of strength, new living environment, chronic shoulder pain).

iii. There will be no difference in the ability of the total scores of FEW, FAW, or FEW-C to measure the magnitude of change in function after the provision of wheeled mobility and seating interventions, for participants with a progressive condition or participants undergoing a significant change in lifestyle that warrants a new type seating and mobility device (e.g., loss of strength, new living environment, chronic shoulder pain).

4.2. METHODS

4.2.1. Design

This was a repeated measures cohort design study. Twenty-five users of wheeled mobility and seating devices who met the inclusion criteria were recruited for this study. The FEW and FAW self-report as well as the FEW-C observational assessments were administered at Time 1 and again at Time 2 (eliminated 2-8 weeks) after receiving their new wheeled mobility device. On average, time lapse from Time 1 to Time 2 administrations of the tools was 57 days (SD $\pm$ 46)

with a median of 44 days and a range from 9 to 189 days. Time between Time 1 and Time 2 assessments varied based on insurance funding and in some cases transportation resources to the clinic. All assessments occurred in the clinic, with participants using their existing wheeled mobility and seating device at Time 1 and their new device at Time 2.

4.2.2. Participants

Participants were recruited primarily from the University of Pittsburgh Medical Center, Center for Assistive Technology (CAT) in Pittsburgh, Pennsylvania, and one participant from the Hiram G. Andrews Center (HGAC), Center for Assistive and Rehabilitative Technology (CART) in Johnstown, Pennsylvania. All participants were new or existing clients seen at the CAT for provision of a wheeled mobility and seating device and one was an HGAC student. The inclusion criteria for participants recruited as part of the study were (a) existing manual/power wheelchair or scooter user, who had experienced a change(s) in functional status (e.g., transitioning from a manual wheelchair to a power wheelchair, decline in function, going from home/community use to work) that required a new wheeled mobility and seating intervention (i.e., receipt of a new wheelchair or scooter); (b) 18 years of age and older; and (c) adequate cognitive and language status, meaning participants were able to cognitively and orally respond to questions and tasks posed in the FEW–C. Cognition and language status were determined by information provided by a CAT or CART team member.

The study sample consisted of 25 participants. Thirteen were male and 12 female. The average participant was a 52 years old Caucasian, and had used a wheelchair for about 10 years. People with multiple sclerosis comprised over one third of the study population and the other

participants experienced impairments related to either progressive or non-progressive medical condition (see Table 4.1). The typical wheelchair used at the time of pre-test was a 3.6 year old manual wheelchair with no seat functions other than manual elevating legrests. At post-test, all wheelchairs used by the participants were power chairs except for one ultralight manual wheelchair user. These power wheelchairs tended to be equipped with multiple power seat functions such a tilt in space, recline, elevating leg rests, seat elevator, or passive standing (see Table 4.2 for detailed characteristics of the wheelchairs).

Table 4.1 Study Participant Characteristics (n=25)

Descriptors	Parameters
Age (mean, SD)	52.3 ±10.5 (range 34 to 72)
Gender	
Male (%)	52.0
Female (%)	48.0
Race	
Caucasian (%)	84.0
African American (%)	16.0
Years using a wheelchair (mean, SD)	09.4 ± 10.5 (range 1 to 45)
Age of wheelchair at pre-test (mean, SD)	03.6 ± 2.5 (range 1 to 9)
Primary medical condition	
Multiple Sclerosis (%)	36.0
Spina Bifida (%)	12.0
Parkinson Disease (%)	08.0
Cerebral Vascular Accident (%)	08.0
Above Knee Amputation (%)	04.0
Cardiac Disease (%)	04.0
Cerebral Palsy (%)	04.0

Table 4.1 (continued)

Lupus (%)	04.0
Mitochondrial Disease (%)	04.0
Orthopedic Disorder (%)	04.0
Paraplegia (%)	04.0
Tetraplegia (%)	04.0
Traumatic Brain Injury (%)	04.0

Table 4.2 Characteristics of Study Participants' Wheelchairs, at Time 1 and Time 2

Characteristics	Time 1 (n=25)	Time 2 (n=22)
Type of wheelchair		
Manual (%)	80.0	04.5
Power (%)	16.0	95.5
Scooter (%)	04.0	00.0
Weight of manual wheelchairs		
Standard (%)	24.0	00.0
Highstrength lightweight (%)	40.0	00.0
Ultralight (%)	12.0	04.5
Seat functions		
Manual elevating legrests (%)	24.0	04.5
Power tilt in space only (%)	08.0	13.6
Power reclining backrest only (%)	00.0	00.0
Power elevating leg rests only (%)	00.0	04.5
Power seat elevator only (%)	04.0	04.5
All of the above (%)	00.0	45.5
All of the above plus passive standing (%)	00.0	09.1
No seat functions (%)	60.0	22.7

4.2.3. Instruments

Three instruments were utilized in this study. The Functioning Everyday with a Wheelchair, version 2.0 (FEW) (see Appendix B) is a 10 item self-report outcome measurement tool that was systematically developed based on consumer input and validation that included structured interviews with wheelchair users. The FEW has also undergone concurrent validation whereby items were further developed by comparing goals and items documented in other sources (see Chapter 2). The FEW has demonstrated good test-retest reliability (Mills, Holm, Schmeler et al., 2002, Mills, Holm, Trefler et al., 2002).

The FAW (see Appendix F) was developed by the research team following the development of the FEW, FEW-C, and FEW-P. Items for the FAW are matched to the 10 items of the FEW however the focus of each tool differs. Items of the FEW focus on the level of support the wheeled mobility device features provide during functional tasks, whereas items in the FAW focus on the independence of the person during functional tasks performed in the wheeled mobility and seating device. For example, for the FEW, Item 4, Operate, consumers are asked to rate their level of agreement with the following statement: "The size, fit, postural support and functional features of my wheelchair/scooter allow me to operate it as independently, safely, and efficiently as possible." The same item on the FAW is worded: "While in my wheelchair/scooter and without assistance from other, I can operate it." The inclusion of the FAW in the current study occurred because the research team was interested in knowing whether participant self-reported perception of functional independence would differ based on wording directed to the support provided by the device versus wording that was directed specifically to perceived functional independence only. Because the FAW was

developed after the other tools, no test-retest reliability of the tool was performed however content is mirrored after the FEW.

The FEW–C (see Appendix D) is a criterion-referenced, performance-based observation tool, for use by practitioners and researchers to measure functional outcomes of wheeled mobility and seating interventions in the clinical setting and modeled after the Performance Assessment of Self-Care Skills (PASS) Version 3.1 (Holm & Rogers, 1999). The FEW-C has 10 items which were derived from the FEW, developed using the PASS guidelines for item development, and scaled using an ordinal scaling system similar to that of the PASS. The FEW-C has demonstrated good to excellent internal consistency, moderate to strong convergent and discriminant validity as well as excellent interrater reliability with a sample of adult manual and power wheelchair users (see Chapter 3).

4.2.4. Procedures

Prior to the start of this study, University of Pittsburgh Institutional Review Board approval was obtained. Potential participants were recruited from the CAT by means of their attending physiatrist who sent letters to potential candidates advising them to return an enclosed addressed stamped post-card by mail back to the investigators advising them of their interest and permission to contact them. Clinicians in the CAT and CART were also made aware of the study and directed their clients to contact to investigators if they were interested in participating in the study. Once recruited, study requirements were explained and informed consent was obtained from those willing to participate.

Prior to each Time 1 or Time 2 assessment, participants were asked two questions regarding their current health status, and about being able to function and carry out their daily

routines. The first question addressed the participants' views of their health status on an average day over the last 3 months. The second question asked participants to rate how they felt they were able to function and carry out their daily routines on the day of the study. Both questions were scored using a vertical visual analog scale of 0-100, with 0 representing the worst participants felt over the last 3 months, and 100 indicating the best they felt over the last 3 months.

Time 1 assessment occurred on a regularly scheduled clinic visit for a seating evaluation. Following collection of demographic data, the FEW was administered first followed by the FAW and the FEW-C. The Time 2 assessment also occurred on a regularly schedule clinic visit --- the first follow-up clinic session after receiving their new wheeled mobility device.

4.2.5. Data Analysis

Descriptive statistics related to participants' perceived health status, and their responses to the FEW and the FAW and their performance ratings on the FEW-C were calculated. Paired t-tests were used to examine differences between participants' health status over the past 3 months versus day of testing, as well as from Time 1 to Time 2. Wilxon signed ranks were used to analyze the self-report responses for the FEW-C item on stability, durability and dependability.

Because the FAW was not completed by the time the first 3 participants entered the study, missing values for these subjects were replaced using the SPSS "median of nearby points" replacement method. Likewise, the same method was used to replace missing values for three subjects with missing data at Time 2 (SPSS, version 12.01). To examine the impact of replacing missing values, the general linear model repeated measures analyses were run with and without the replaced missing values. The replacement data set yielded lower mean change values, and

equal significance levels, but the additional power enabled all items to run for all subjects. Therefore, the replacement data set was chosen for all data analyses. Additionally, because the FEW and the FAW ratings are on a 6-point ordinal scale, and the FEW-C uses a 4-point ordinal scale, the extreme ratings of the FEW and FAW (1 and 6) were retained, and the middle ratings were collapsed to match the FEW-C for comparison (1=0, mean of 2/3 =2, mean of 4/5 =3, and 6=4).

General linear model (GLM) repeated measures analysis of variance (ANOVA) statistics were used to examine the effect of time (Time 1, Time 2) and tool (FEW, FAW, FEW-C) on functioning everyday with a wheelchair. With multivariate analysis there is an assumption that the variance-covariance matrix of dependent measures is circular in form if the F statistic is valid. Mauchly's test of sphericity tests this assumption, and if the assumption is not met (Mauchly's test is significant), then the conservative Greenhouse-Geisser epsilon adjusted data will be reported. In other words, all data reported will have met the GLM statistical assumptions. If interactions between the main effects (time and tools) for an item are significant, paired t tests using the ANOVA estimated marginal means will be used for post-hoc analyses and the main effects will not be interpreted (Huck, 2004). Because the use of repeated t tests increases the chance of a Type I error (finding significance differences by chance alone), a Bonferroni correction was also used [desired alpha/number of comparisons = alpha needed for desired alpha, or .05/4 = p. = .013] (Huck, 2004, Portney & Watkins, 2000).

Finally, to examine the clinical or practical significance of the wheeled mobility device interventions provided, effect sizes for the total tool grand means (FEW, FAW, FEW-C) as well as individual item grand means were calculated using Cohen's *d* [$d = 2t / \sqrt{df}$]. Cohen's *d* was chosen because it is appropriate for pre-post studies and does not require experimental and

control groups (Rosenthal & Rosnow, 1991). One-way analysis of variance was used to determine differences in effect size among the three tools.

4.3. RESULTS

Health status data (perception of health status over past 3 months and day of testing) for the pre-test averaged 55.8 out of 100 for the past 3 months, and 58.6 on the day of Time 1 testing. For Time 2 testing, the 3 month average was 60.6 and 68.0 on the day of the posttest. Paired t-tests, with Bonferroni corrections (0.05/4 = 0.013) indicated no significant differences at Time 1 or Time 2 for the past 3 months versus testing day (pre-test; t = - 0.84, df = 24, p. = 0.41; posttest, t = - 2.13, df = 24, p. = 0.04). Findings were similar for the Time 1 to Time 2 comparisons (past 3 months, t = - 1.18, df = 24, p. = .25; testing day, t = - 1.76, df = 24, p. = .09).

Table 4.3 Rank of FEW-C Items at Time 1 and Time 2

Item	Time 1 mean (SD)	Time 1 rank	Time 2 mean (SD)	Time 2 rank
Comfort	2.16 (0.75)	3	2.87 (0.21)	1
Health Needs	2.07 (0.70)	4	2.81 (0.37)	2
Operate	2.21 (1.02)	2	2.50 (0.76)	7
Reach	1.91 (1.08)	5	2.50 (0.76)	7
Transfer	1.59 (1.08)	8	2.71 (0.33)	5
Personal Care	2.39 (0.79)	1	2.71 (0.33)	5
Indoor Mobility	1.90 (1.02)	6	2.76 (0.37)	3
Outdoor Mobility	0.96 (1.10)	9	2.75 (0.36)	4
Transportation	1.61 (0.95)	7	1.89 (0.87)	9

As shown in Table 4.3, the wheeled mobility intervention resulted in changes in performance rank for several items. Comfort, health needs, transfers, indoor mobility, and outdoor mobility all improved in rank, whereas operate, reach, personal care, and transportation decreased in rank. Outdoor mobility and operate changed the most ranks; outdoor mobility to the positive, and operate to the negative. However, performance on all tasks improved from Time 1 to Time 2, based on the FEW-C.

The item on stability, durability and dependability was self-report, and differed from all other items of the FEW-C. The assessor asked "The stability, durability and dependability features of a wheelchair/scooter can affect how you carry out your daily routines. I will ask you to respond to various question regarding how stable, durable, and dependable your wheelchair/scooter is." Subjects were then asked to identify how many times their wheelchair had tipped or its wheels had lost contact with the ground in the last month (stability). No significant differences were found from pretest to posttest ($T = -1.72$, $p = .08$). Likewise, subjects were asked how many times they could not accomplish daily activities in the last month because their wheelchairs had broken down (durability) or because their wheelchairs were not dependable (dependability). No significant differences were found from pretest to posttest for either durability or dependability ($T = -0.69$, $p = .49$; $T = 0.38$, $p = .71$, respectively).

4.3.1. Null hypothesis 1

The 2 (Time 1, Time 2) X 3 (Tools: FEW, FAW, FEW-C) repeated measures analysis of variance (ANOVA) for the total tools indicated a significant interaction for the main effects of time and tools. When the interaction was followed, it indicated that participants improved

significantly for function on all three tools from Time 1 to Time 2, with the FEW and the FAW differing significantly from the FEW-C (see Table 4.4, Figure 4.1 and Tables 4.5, 4.6).

Table 4.4 Analysis of variance for effects of time and tools on functioning everyday with a wheelchair (Tool Totals)

Source	*df*	SS	MS	*F*	*p*
Time	1.00	31.75	31.75	52.37	.001
Error (Time)	24.00	14.55	0.61		
Tools	2.00	2.05	1.03	11.19	.001
Error (Tools)	48.00	4.39	0.09		
Time X Tools	2.00	0.84	0.42	5.23	.009
Error (Time X Tools)	48.00	3.85	0.08		

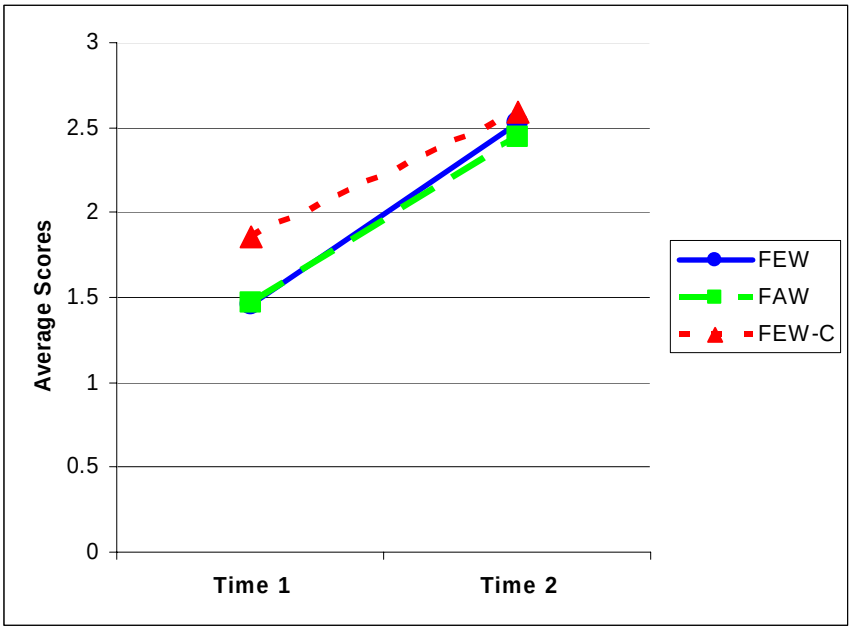


Figure 4.1 Interaction of FEW, FAW, and FEW-C Total Scores at Time 1 and Time 2

ANOVAs for the 9 rated items (stability, durability and dependability is not rated) yielded significant interactions of the main effects for the health needs, operate, reach, transfers, and transportation items. Post-hoc analyses indicated that for health needs and operate, all tools captured the significant changes in function from Time 1 to Time 2 following the provision of a wheeled mobility and seating device except for the FEW-C for operate (see Table 4.5). When following tools, the FEW and FAW measures yielded similar results as did the FEW and the FEW-C, whereas the FAW and the FEW-C yielded significantly different results (see Tables 4.6 to 4.8 and Figure 4.2 and 4.3). The interactions for the remaining items showed no commonalities. For reach the FEW and FAW measured significant changes in function over time, but the FEW-C did not (see Table 4.5). Furthermore, the FEW and the FAW did not differ significantly from each other, regardless of time, but they both differed significantly from the FEW-C (see Tables 4.6, and 4.9 and Figure 4.4). For transfers, in contrast to operate, the FEW and the FEW-C measured significant changes in function over time, but the FAW did not (see Table 4.5). Unlike previous items, for transfers, the FEW, FAW and FEW-C did not differ significantly from each other in how they measured function, regardless of time (see Table 4.6, 4.10 and Figure 4.5). For transportation, the FEW and the FEW-C did not show significant changes in function over time, but the FAW did (see Table 4.5). As with transfers, the FEW, FAW and FEW-C did not differ significantly from each other in how they measured function, regardless of time (see Table 4.6, 4.11 and Figure 4.6).

Table 4.5 Post-hoc t-tests for the Main Effect of Time, by Tool and Item

FEW			
Item	(t)	df	p value
Total tool	-7.79	24	.01
Comfort	-6.49	24	.01
Health needs	-6.21	24	.01
Operate	-5.44	24	.01
Reach	-5.58	24	.01
Transfer	-2.89	24	.05
Personal care	-3.00	24	.05
Indoor mobility	-4.63	24	.01
Outdoor mobility	-10.97	24	.01
Transportation	-1.88	24	.NS

FAW			
Item	(t)	df	p value
Total tool	-6.03	24	.01
Comfort	-4.79	24	.01
Health needs	-2.91	24	.05
Operate	-5.42	24	.01
Reach	-3.95	24	.01
Transfer	-0.96	24	.NS
Personal care	-3.45	24	.01
Indoor mobility	-3.66	24	.01
Outdoor mobility	-8.79	24	.01
Transportation	-5.51	24	.01

FEW-C			
Item	(t)	df	p value
Total tool	-5.59	24	.01
Comfort	-4.75	24	.01
Health needs	-5.25	24	.01
Operate	-1.03	24	.NS
Reach	-2.55	24	.NS
Transfer	-5.31	24	.01
Personal care	-2.09	24	.NS
Indoor mobility	-4.02	24	.01
Outdoor mobility	-7.48	24	.01
Transportation	-1.43	24	.NS

Note: p values are with Bonferroni correction already computed;
NS = Not significant after Bonferroni correction

Table 4.6 Pairwise Comparison of the FEW, FAW, and FEW-C for the Main Effect of Tools

	FEW	FAW	FEW-C
Total tools	a	a	b
Comfort **	a	a	b
Health needs*	ab	a	b
Operate*	ab	a	b
Reach**	a	a	b
Transfers	a	a	a
Personal care**	a	a	b
Indoor mobility	a	a	a
Outdoor mobility	a	a	a
Transportation	a	a	a

FEW = Functioning Everyday with a Wheelchair; FAW = Functional Abilities in a Wheelchair; FEW-C = Functioning Everyday with a Wheelchair - Capacity; * = $p \leq .05$; ** = $p \leq .01$; Cells with shared letters indicate tools did not differ significantly in how they measured function, and items with asterisks indicate significance of differences that existed

Table 4.7 ANOVA for Effects of Time and Tools on Functioning Everyday with a Wheelchair for Health Needs Item

Health Needs Source	*df*	SS	MS	*F*	*p*
Time	1.00	29.01	29.01	36.31	.001
Error (Time)	24.00	19.18	0.80		
Tools	2.00	4.17	2.08	4.25	.020
Error (Tools)	48.00	23.52	.49		
Time X Tools	2.00	2.30	1.15	3.81	.029
Error (Time X Tools)	48.00	14.49	0.30		

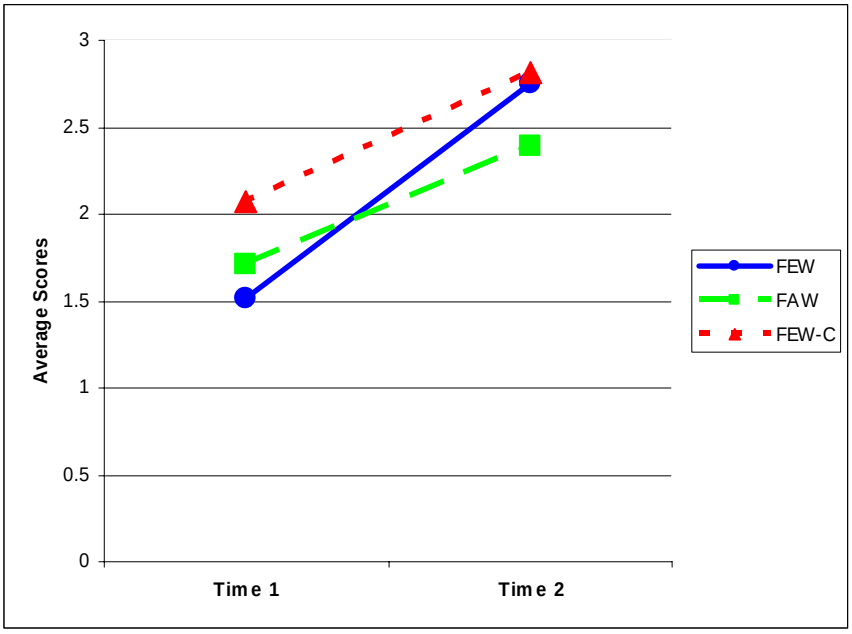


Figure 4.2 Interaction of FEW, FAW, and FEW-C Health Needs Scores at Time 1 and Time 2

Table 4.8 ANOVA for effects of Time and Tools on Functioning Everyday with a Wheelchair for Operate Item

Operate Source	*df*	SS	MS	*F*	*p*
Time	1.00	30.24	30.24	21.52	.001
Error (Time)	24.00	33.72	1.41		
Tools	2.00	3.67	1.84	5.01	.010
Error (Tools)	48.00	17.27	0.36		
Time X Tools	2.00	6.85	3.43	8.14	.001
Error (Time X Tools)	48.00	20.19	0.42		

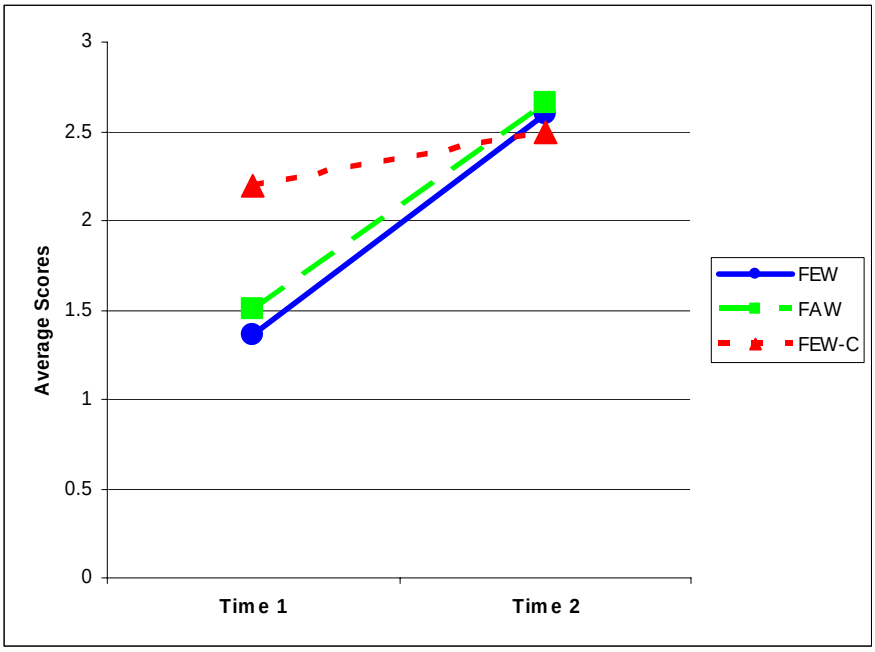


Figure 4.3 Interaction of FEW, FAW, and FEW-C Operate Scores at Time 1 and Time 2

Table 4.9 ANOVA for Effects of Time and Tools on Functioning Everyday with a Wheelchair for Reach Item

Reach Source	*df*	SS	MS	*F*	*p*
Time	1.00	28.70	28.70	23.39	.001
Error (Time)	24.00	29.44	1.23		
Tools	1.45	9.36	6.47	9.46	.002
Error (Tools)	34.73	23.75	0.68		
Time X Tools	1.33	2.34	1.76	4.04	.042
Error (Time X Tools)	31.94	13.88	0.43		

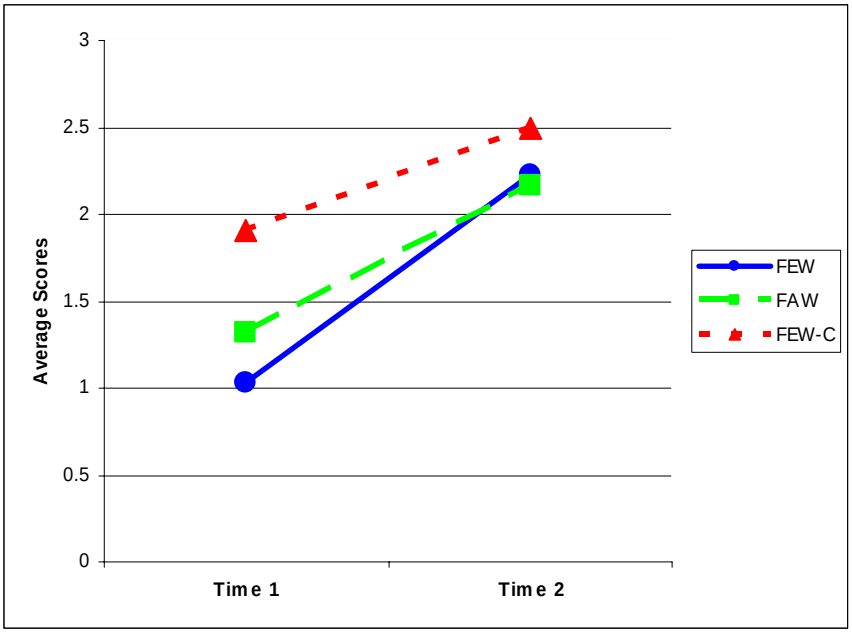


Figure 4.4 Interaction of FEW, FAW, and FEW-C Reach Scores at Time 1 and Time 2

Table 4.10 ANOVA for Effects of Time and Tools on Functioning Everyday with a Wheelchair for Transfers Item

Transfers Source	*df*	SS	MS	*F*	*p*
Time	1.00	16.64	16.64	15.32	.001
Error (Time)	24.00	26.06	1.09		
Tools	1.57	0.94	0.60	0.95	.377
Error (Tools)	37.76	23.73	0.63		
Time X Tools	1.98	4.91	2.48	5.81	.006
Error (Time X Tools)	47.57	20.31	0.43		

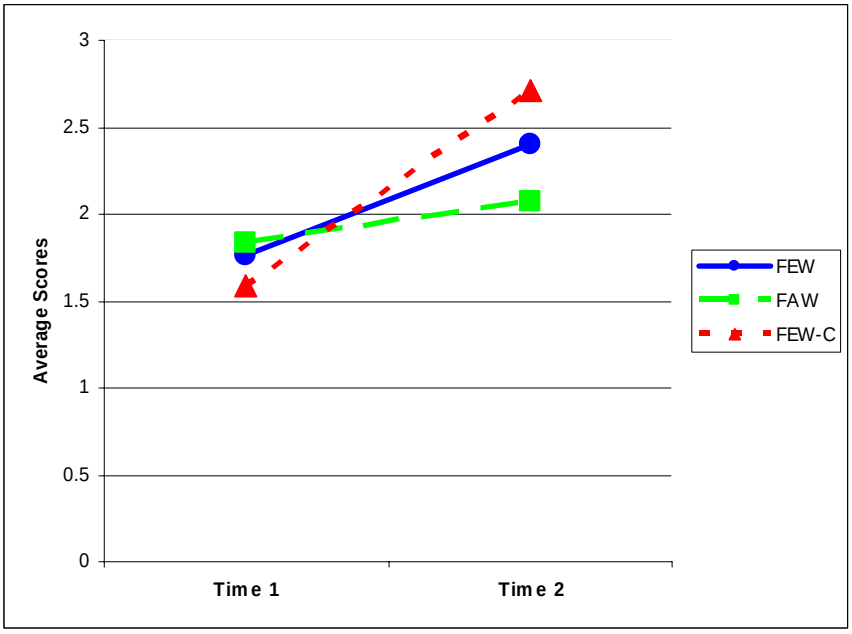


Figure 4.5 Interaction of FEW, FAW, and FEW-C Transfer Scores at Time 1 and Time 2

Table 4.11 ANOVA for Effects of Time and Tools on Functioning Everyday with a Wheelchair for Transportation Item

Transportation Source	*df*	SS	MS	*F*	*p*
Time	1.00	19.73	19.73	16.48	.001
Error (Time)	24.00	28.74	1.20		
Tools	1.56	1.75	1.12	1.66	.207
Error (Tools)	37.35	25.30	0.68		
Time X Tools	2.00	8.40	4.21	8.30	.001
Error (Time X Tools)	47.91	24.30	0.51		

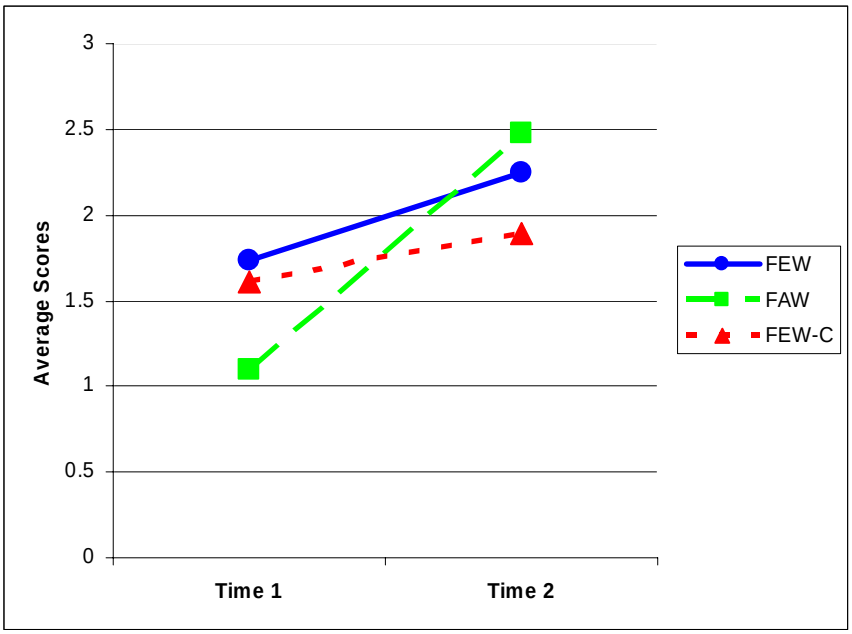


Figure 4.6 Interaction of FEW, FAW, and FEW-C Transportation Scores at Time 1 and Time 2

The comfort, personal care, indoor mobility and outdoor mobility ANOVAs were significant for the main effect of time. Comfort and personal care ANOVAs were also significant for the main effect of tools, however that was not the case for indoor mobility and outdoor mobility.

The comfort item analyses for the main effect of time indicated that all tools captured the significant changes in function from Time 1 to Time 2 following the provision of a wheeled mobility and seating device (see Table 4.5). Analyses for tools main effect indicated that the FEW and the FAW did not differ in how they measured comfort, and that they were significantly different from the FEW-C (see Table 4.6, 4.12 and Figure 4.7. Unlike the comfort item, analyses for the main effect of time showed that the FEW and FAW measured a significant change in personal care function over time, but that the FEW-C did not (see Table 4.5). Like the comfort item, analyses for the tools main effect for personal care indicated that the FEW and the FAW did not differ in how they measured comfort, and that they were significantly different from the FEW-C (see Table 4.6, 4.13 and Figure 4.8). For indoor mobility and outdoor mobility items, the main effect of time analyses indicated that all tools captured the significant changes in function from Time 1 to Time 2 following the provision of a wheeled mobility and seating device (see Table 4.5). Likewise, the tools main effect indicated that the tools did not differ in their measure of function for these two items, regardless of time (see Table 4.6, Tables 4.14 to 4.15, and Figures 4.9 to 4.10).

Table 4.12 ANOVA for Effects of Time and Tools on Functioning Everyday with a Wheelchair for Comfort Item

Comfort Source	*df*	SS	MS	*F*	*p*
Time	1.00	35.38	35.38	49.07	.001
Error (Time)	24.00	17.31	0.72		
Tools	2.00	7.60	3.80	10.83	.001
Error (Tools)	48.00	16.85	0.35		
Time X Tools	2.00	1.47	0.74	2.75	.074
Error (Time X Tools)	48.00	12.86	0.27		

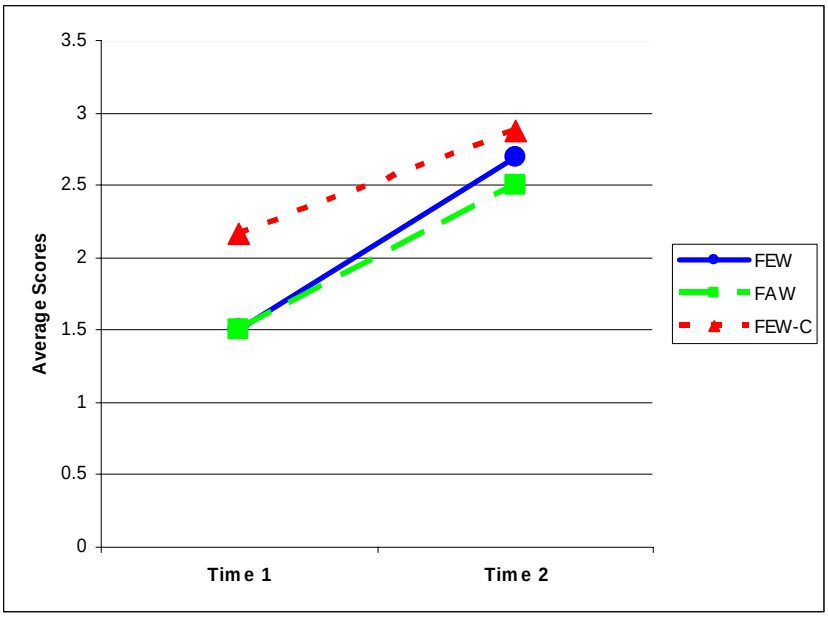


Figure 4.7 FEW, FAW, and FEW-C Comfort Scores at Time 1 and Time 2

Table 4.13 ANOVA for Effects of Time and Tools on Functioning Everyday with a Wheelchair for Personal Care Item

Personal Care Source	*df*	SS	MS	*F*	*p*
Time	1.00	14.06	14.06	14.44	.001
Error (Time)	24.00	23.36	0.97		
Tools	2.00	8.47	4.24	13.66	.001
Error (Tools)	48.00	14.89	0.31		
Time X Tools	2.00	1.90	0.95	2.74	.075
Error (Time X Tools)	48.00	16.63	0.35		

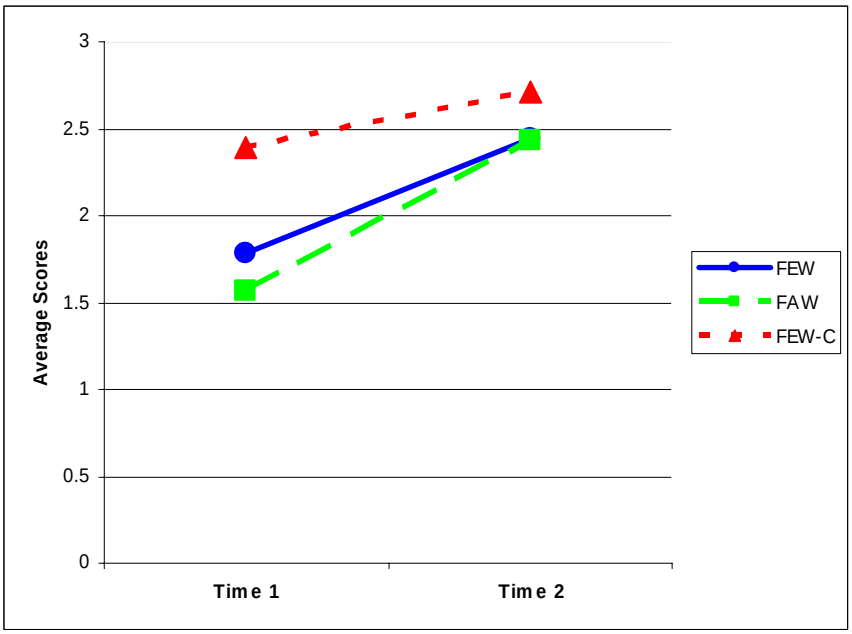


Figure 4.8 FEW, FAW, and FEW-C Personal Care Scores at Time 1 and Time 2

Table 4.14 ANOVA for Effects of Time and Tools on Functioning Everyday with a Wheelchair for Indoor Mobility Item

Indoor Mobility Source	*df*	SS	MS	*F*	*p*
Time	1.00	29.51	29.51	24.41	.001
Error (Time)	24.00	29.02	1.21		
Tools	2.00	1.08	0.54	2.50	.093
Error (Tools)	48.00	10.39	0.22		
Time X Tools	2.00	0.15	0.08	0.27	.760
Error (Time X Tools)	48.00	13.38	0.28		

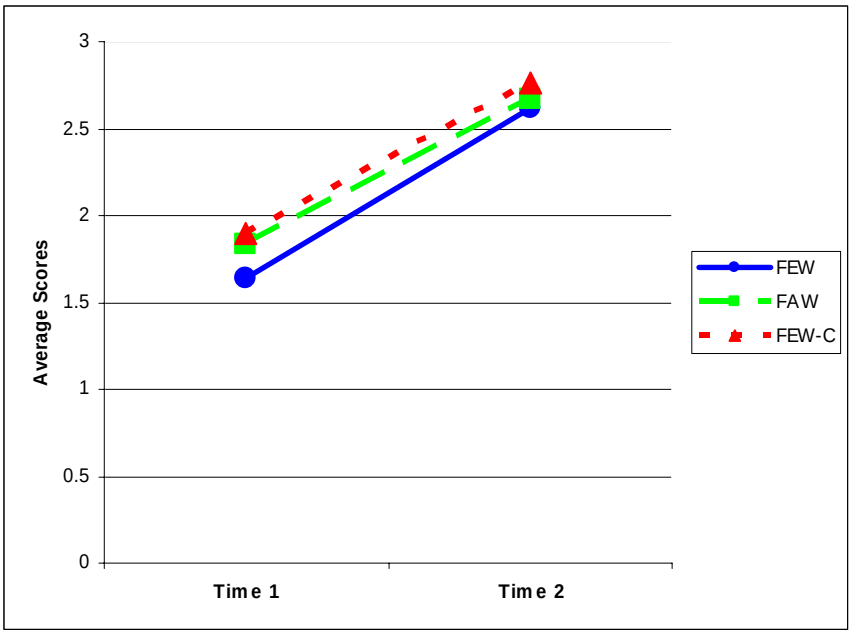


Figure 4.9 FEW, FAW, and FEW-C Indoor Mobility Scores at Time 1 and Time 2

Table 4.15 ANOVA for Effects of Time and Tools on Functioning Everyday with a Wheelchair for Outdoor Mobility Item

Outdoor Mobility Source	*df*	SS	MS	*F*	*p*
Time	1.00	127.26	127.26	109.04	.001
Error (Time)	24.00	28.01	1.17		
Tools	1.56	0.20	0.13	0.55	.540
Error (Tools)	37.44	8.78	0.24		
Time X Tools	1.63	0.71	0.43	1.57	.220
Error (Time X Tools)	39.20	10.74	0.27		

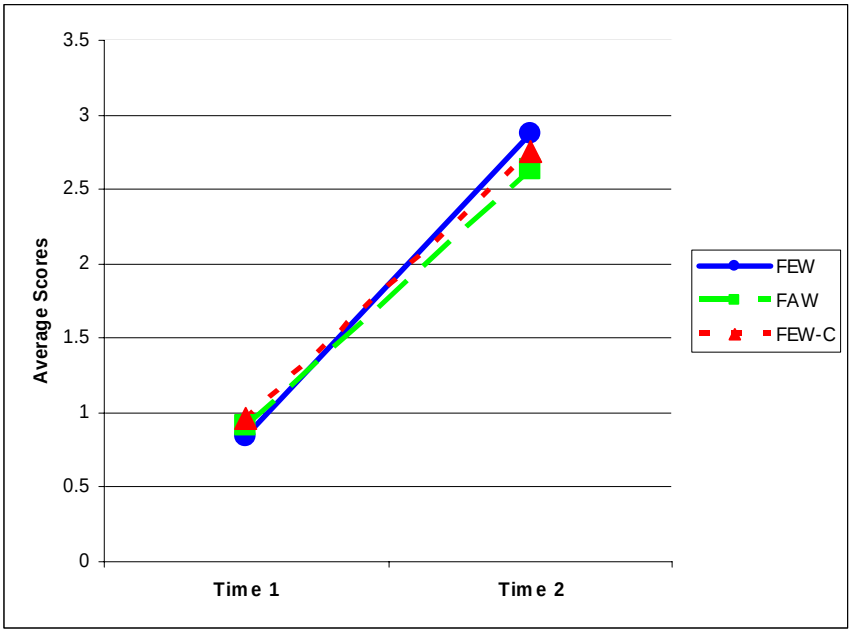


Figure 4.10 FEW, FAW, and FEW-C Outdoor Mobility scores at Time 1 and Time 2

Effect size calculations, using Cohen's *d* indicated that all three tools had very large effect sizes, as did most of the single items within each tool. Cohen's *d*, a standardized measure of change, indicates the magnitude of the difference between the pretest and posttest means. The effect size was greatest for the FEW, followed by the FAW, and then the FEW-C. Because of the large t values, the effect sizes for all three tools are also larger than usual, indicating the effectiveness of the wheeled mobility and seating device intervention for improving function (Huck, 2004).

Table 4.16 FEW, FAW and FEW-C Effect Size Estimations of the Wheeled Mobility Intervention Using Cohen's *d*

FEW					
Item	(t)	2*(t)	df	(sqrt)df	*d*
Total tool	-7.79	15.58	24	4.90	3.18
Comfort	-6.49	12.98	24	4.90	2.65
Health needs	-6.21	12.42	24	4.90	2.53
Operate	-5.44	10.88	24	4.90	2.22
Reach	-5.58	11.16	24	4.90	2.28
Transfer	-2.89	5.78	24	4.90	1.18
Personal care	-3.00	6.00	24	4.90	1.22
Indoor mobility	-4.63	9.26	24	4.90	1.89
Outdoor mobility	-10.97	21.94	24	4.90	4.48
Transportation	-1.88	3.76	24	4.90	0.77

Table 4.16 (continued)

FAW					
Item	(t)	2*(t)	df	(sqrt)df	*d*
Total tool	-6.03	12.06	24	4.90	2.46
Comfort	-4.79	9.58	24	4.90	1.96
Health needs	-2.91	5.82	24	4.90	1.19
Operate	-5.42	10.84	24	4.90	2.21
Reach	-3.95	7.90	24	4.90	1.61
Transfer	-0.96	1.92	24	4.90	0.39
Personal care	-3.45	6.90	24	4.90	1.41
Indoor mobility	-3.66	7.32	24	4.90	1.49
Outdoor mobility	-8.79	17.58	24	4.90	3.59
Transportation	-5.51	11.02	24	4.90	2.25

FEW-C					
Item	(t)	2*(t)	df	(sqrt)df	*d*
Total tool	-5.59	11.18	24	4.90	2.28
Comfort	-4.75	9.50	24	4.90	1.94
Health needs	-5.25	10.50	24	4.90	2.14
Operate	-1.03	2.06	24	4.90	0.42
Reach	-2.55	5.10	24	4.90	1.04
Transfer	-5.31	10.62	24	4.90	2.17
Personal care	-2.09	4.18	24	4.90	0.85
Indoor mobility	-4.02	8.04	24	4.90	1.64
Outdoor mobility	-7.48	14.96	24	4.90	3.05
Transportation	-1.43	2.86	24	4.90	0.58

4.4. DISCUSSION

When the non-randomized clinical trial was undertaken it was done to test the ability of the performance-based FEW-C to detect statistical and practical change over time, and to ascertain if the FEW-C results differed from two companion self-report tools, the FEW and the FAW. Three

null hypotheses were tested: (Null hypothesis 1) there will be no significant difference in the ability of the FEW, FAW, or FEW-C to detect significant changes in function over time, (Null hypothesis 2) there will be no significant difference in the ability of specific item scores of the FEW, FAW. or FEW-C to detect significant changes over time, and (Null hypothesis 3) there will be no difference in the ability of the total scores of the FEW, FAW, or FEW-C to measure the magnitude of change over time. Null hypotheses 1 and 2 were partially rejected and null hypothesis 3 was accepted. There were no statistically significant differences noted in perceived health status on the day of assessment or over the last 90 days at either pre or post-test administration of the tools. One might expect significant improved perceived health status following the provision of a new wheeled mobility and seating intervention, however the lack of significance might have been the result of low statistical power and the inclusion of a Bonferonni correction in the analysis. Also, consistent with our findings, this may suggest that subjects were able to differentiate between their medical health condition status and their improved ability to function following the provision of a wheeled mobility and seating device. The discussion will focus on the significance of our findings: first the statistical significance, followed by the practical significance.

4.4.1. Null Hypothesis 1

Although all three total tools did not differ significantly in their ability to measure changes in function over time following the provision of a new wheeled mobility and seating device, the self-report FEW and FAW tools differed significantly in how they measured function when compared to the performance-based FEW-C. At Time 1, the FEW and FAW documented lower levels of function compared to the performance-based FEW-C, whereas at Time 2 the tools were

similar. Thus the FEW and FAW documented greater changes in function over time than did the FEW-C. Because all study participants were recruited from a clinical setting where they had come to be evaluated for a new wheeled mobility and seating device, their perceptions of their function may have been worse than their performance indicated on the FEW-C. It is not unusual for individuals who are seeking interventions to underestimate their capabilities in order to obtain services or products (Cress et al., 1995).

4.4.2. Null Hypothesis 2

Nine individual items were rated on all tools, and all tools measured significant changes in function over time for 4 items, namely comfort, health needs, indoor mobility, and outdoor mobility. Five items (operate, reach, transfers, personal care, transportation) did not measure significant changes in function over time, but this varied based on the tool. For the global self-report FEW, transportation did not measure significant change from Time 1 to Time 2, nor did the performance-based FEW-C, however, the FAW, a self-report tool focusing only on independence did measure significant change, In contrast, the FAW did not measure significant change for transfers, whereas the FEW and the FEW-C did. The FEW-C also did not measure significant changes in function at the item level for operate, reach and personal care items, for which the FEW and the FAW showed significant change.

Regardless of time, the self-report tools, the FEW and the FAW, did not differ significantly in how they measured function for any item, even though the FEW was more global (i.e., focused on independence, safety and quality), and the FAW was more singular in focus (i.e., independence only). The self-report FEW and FAW differed from the performance-based

FEW-C on 3 common items, namely comfort, reach, and personal care. In a pattern similar to that of the total tools, the FEW and FAW measured function at a lower level at Time 1 and Time 2, with both tools therefore showing greater changes in function than the FEW-C. The FAW also differed significantly from the FEW-C on two additional items, health needs and operate. In both instances the FAW measured function at a lower level than the FEW-C at Time 1, and for health needs at Time 2, but for operate at Time 2 the FAW measured function at a higher level than the FEW-C.

Overall, the performance-based FEW-C measured function at a higher level than the self-report FEW and FAW tools 7/9 times at Time 1 and 6/9 times at Time 2. This indicates that subjective perceptions of performance with a wheeled mobility and seating device do not always agree with, and are often significantly different from, objective measures of the same performance. These finding are consistent with the multitrait-multimethod (MTMM) matrix analyses in Chapter 3, indicating that the self-report and performance-based tools bring unique information to a wheeled mobility and seating device assessment. This is also consistent with related literature (Rogers et al., 2003, Rogers et al., 2001). For four items, namely transfers, indoor mobility, outdoor mobility, and transportation, the self-report and performance-based tools are synoptic in how they measure function, but they still yield different information because of their different methods, indicating that they are not necessarily interchangeable in a clinical setting.

4.4.3. Null Hypothesis 3

When a tool does not document significant changes in function over time, there can be many reasons, including inadequate statistical power (small sample size), low sensitivity, or inappropriate design (Ottenbacher & Maas, 1999). Although all three tools measured significant changes in function over time, they differed in the degree of significant change measured for the total tool as well as for individual items. Inadequate statistical power is the most likely explanation. Effect sizes rather than alpha levels are used to answer the practical question: did the intervention make a real difference? (Huck, 2004), (Rosenthal & Rosnow, 1991). While effect sizes are usually referred to as small ($\leq$ .2), medium (.5) or large ($\geq$ .8), they can, in fact be much larger (Huck, 2004), as was the case for all three tools in the current study. Of the studies reviewed in Chapter 2, only two measured the effect sizes of their interventions. Taricco et al., (2000) also reported large effect sizes with their tool, the Valutazione Funzionale Mielolesi (VFM), when measuring the effect of rehabilitation for individuals with quadriplegia (.72 to 1.40) and paraplegia (.08 to 1.11). Kilkens and colleagues (2004) reported medium to large effect sizes (.6 to .9) for The Wheelchair Circuit test for a longitudinal study of individuals with spinal cord injury undergoing rehabilitation.

The magnitude of change measured by the FEW was greatest (3.18), followed by the FAW (2.46), and then the FEW-C (2.28). None of the tools demonstrated a floor or ceiling effect that could have influenced the effect size. Eighty percent of the participants at Time 1 were using a manual wheelchair with limited seat functions, and the impairments associated with their diagnoses compromised their function. The magnitude of the change in their perceptions on the FEW and FAW from Time 1 to Time 2 most likely reflect the real changes in function they

experienced associated with their new power chair with seat functions. Although to a lesser degree, the magnitude of change measured by the FEW-C was also very large, indicating that it captured performance changes resulting from effective wheeled mobility and seating device interventions.

4.4.4. Limitations of the Study and Future Directions

A major limitation in the clinical trial was the small sample size. Because of subject burden associated with returning to the clinical setting, even though data collection spanned a 2 year period, only 22 of 25 participants completed all components of the study. Also, because participants completed study items following, or interspersed with, a regular clinic visit, fatigue could have impacted data collection for some participants. Another limitation is that the FAW was added after data collection began, and no test-retest reliability data are available, and its measurement properties are unknown. Although the two self-report tools behaved similarly in the way they measured function at both pre and post-test, the FAW was administered immediately following the FEW and the bias of presenting two tools with similar wording is unknown. Another potential limitation of the study is the lack of masking of the raters to the pre-post status of the subjects. Attempts were made to reduce this bias by having different assessors, which included the primary author, at the pretest and posttest, but this was not always possible. The primary author was the assessor for 4/25 subjects at the pretest and for 8/22 subjects at the posttest. Assessors could also tell the difference between an older model wheelchair and a newer, less used wheelchair. The interventions for most subjects might also be considered a limitation, because of the drastic nature of the interventions -- from manual to power chairs with seat functions, which in turn influenced the magnitude of change. Future

studies should examine the properties of the FAW, and include a larger sample size. Future studies might also consider the use of the FEW and FEW-C to evaluate the magnitude of change for specific products and services, as well as the effectiveness of interventions provided by specific service delivery models and personnel. Because the changes from the interventions in the current study included mostly manual wheelchair to powered mobility, further studies are need to examine the utility of the FEW-C for detecting changes in function following manual wheechair to manual wheelchair interventions (e.g., standard weight to ultralight) and powered mobility to powered mobility interventions (e.g., standard use to specific use). In particular, the utility of the total tool versus items related to the desired functional changes should be examined.

4.5. CONCLUSIONS

Our first null hypotheses about the equivalence of the FEW, FAW, and FEW-C total tools for measuring change over time and at the same level was accepted for time and rejected for level. Our second null hypotheses about the equivalence of individual items for measuring change over time and at the same level was partially rejected for time and level, depending on the item. Finally, our third null hypothesis about the equivalence of the tools for measuring the magnitude of change following a wheeled mobility and seating device intervention was accepted. All three of the tools showed extremely large effect sizes for changes caused by the interventions, with the perceived changes measured on the FEW and FAW self-report tools being greater than the changes in performance measured on the FEW-C. These findings also confirm the effectiveness of the wheeled mobility and seating device interventions prescribed by the clinical setting practitioners.

5. SUMMARY

The purpose of this study was to develop a valid and reliable performance-based observation tool to measure the effects of wheeled mobility and seating interventions on functional capabilities specific to consumers needs. The tool, Functioning Everyday with a Wheelchair – Capacity (FEW-C), was designed to reflect the International Classification of Functioning, Disability, and Health (ICF) qualifier of capacity and modeled after the Functioning Everyday with a Wheelchair (FEW) self-report tool. The study objectives were to:

1. Systematically review the scientific literature to identify and describe items from other performance based measures of function for people who use manual or powered wheeled mobility and seating devices to determine the degree to which the 10 items of the FEW are represented in existing wheelchair functional outcomes measures and studies.
2. Systematically review the scientific literature to document the content, target populations, study participants, test feasibility, and clinometric properties of existing wheelchair functional performance measures.
3. Develop the FEW-C tool, a criterion-referenced, performance-based observation tool, matched to the FEW, Version 2.0 and designed to reflect the ICF capacity qualifier.
4. Establish the interrater reliability of the FEW-C.

5. Determine the internal consistency, convergent validity, and discriminant validity of the FEW-C.
6. Develop a third tool, Functional Abilities in a Wheelchair (FAW), intended to measure a person's self-perceived level of independence performing the same 10 task items measured in with the FEW and FEW-C in a wheeled mobility and seating device, however, without mention of the device in item questions.
7. Investigate the ability of the FEW and the FAW to measure the difference and magnitude of user perceived change in function and the FEW-C to measure observed change in function following the provision of a new wheeled mobility and seating device.
8. Discuss the results of the studies and future implications.

The systematic review of the scientific literature from 1994 through July 2004 revealed 20 studies that developed and/or utilized observable measures of functional outcome with the use of wheeled mobility and seating devices. The majority of study populations were manual wheelchair users with spinal cord injuries and the majority of studies cited measured the capacity qualifier of the activity domain of the ICF. Eighteen different outcome measures were cited in the 20 studies. There was minimal consistency in the methods used to score task performance and minimal overlap in specific task items which made it difficult to compare outcomes across measures. Not all studies reported or measured the clinometric properties of the tools. Content of the reported measures and subtasks were compared to the 10 items of the FEW version 2.0 and half of the consumer reported items were somewhat well represented and the other half were minimally represented. Thus, existing measures were not fully representative of what wheelchair

users identified as being important tasks to be able to perform in a wheeled mobility and seating device (Mills, Holm, Trefler et al., 2002). This review indicated the need for the development of a tool that quantifies functional activity at both the capacity and performance qualifier levels of the ICF activity domain and that such a tool should also operationalize the consumer-generated functions described in the FEW Beta Version 2.0 self report tool.

Following the development of the FEW-C, excellent interrater reliability coefficients were established upon administering the tool to a sample of wheeled mobility and seating device users and having multiple trained observers rate performance simultaneously. This indicated that the clarity of the tool allowed multiple observers to rate individual items and the total tool consistently. Analysis of another set of data collected on a larger sample of wheeled mobility and seating device users the FEW-C demonstrated good to excellent internal consistency, and fair to good convergent and discriminant validity when compared with the FEW and the FAW tools that were measuring similar traits by different methods. These findings indicated that the operationalization of the items of the reliable and valid FEW self-report tool into a performance-based observational tool yielded another reliable and valid tool for gathering data about functioning with a wheeled mobility and seating device.

For the final study, a non-randomized clinical trial was undertaken to test the ability of the performance-based FEW-C to detect statistical and practical change over time, and to ascertain if the FEW-C results differed from the FEW and FAW companion self-report tools. The first null hypothesis about the equivalence of the FEW, FAW, and FEW-C total tools for measuring change over time and at the same level was accepted for time and rejected for level as all tools were effective in the measurement of change in function over time (i.e. following the provision of a new wheeled mobility and seating intervention) however, each tool measured this

at different levels. The second null hypotheses about the equivalence of individual items for measuring change over time and at the same level was partially rejected for time and level, depending on the item. Not all individual items across the three tools measured a similar magnitude or change in function over time. Finally, the third null hypothesis about the equivalence of the tools for measuring the magnitude of change following a wheeled mobility and seating device intervention was accepted. All three of the tools showed extremely large effect sizes for changes caused by the interventions, with the perceived changes measured on the FEW and FAW self-report tools being greater than the changes in performance measured on the FEW-C. Although all three total tools did not differ in their ability to measure significant changes in function over time following the provision of a new wheeled mobility and seating device, the self-report FEW and FAW tools often significantly underestimated function when compared to the performance-based FEW-C. The magnitude of change documented my all three tools also confirm the effectiveness of the wheeled mobility and seating device interventions prescribed by the clinical setting practitioners.

APPENDIX A

Functional Evaluation in a Wheelchair (FEW) Beta Version 1.0

FEW (Functional Evaluation in a Wheelchair), Beta Version 1.0

DIRECTIONS:
Please answer the following 10 questions by **placing an 'X' in the box under the response** (completely agree, mostly agree, slightly agree, etc.,) that best matches your opinion of the tasks performed while in your wheelchair/scooter. All examples may not apply to you, and there may be tasks you perform that are not listed. **Mark each question only one time.** Thank you for helping us!

Question 1	Completely Agree	Mostly Agree	Slightly Agree	Slightly Disagree	Mostly Disagree	Completely Disagree	Does not apply to me
My wheelchair/scooter allows me to operate it easily: (e.g., do what I want it to do)							
Question 2	Completely Agree	Mostly Agree	Slightly Agree	Slightly Disagree	Mostly Disagree	Completely Disagree	Does not apply to me
My wheelchair/scooter allows me to transfer from one surface to another surface easily: (e.g., transfer to various surfaces)							
Question 3	Completely Agree	Mostly Agree	Slightly Agree	Slightly Disagree	Mostly Disagree	Completely Disagree	Does not apply to me
My wheelchair/scooter accessories are easy to use: (e.g., carry items- backpacks, drink holders)							
Question 4	Completely Agree	Mostly Agree	Slightly Agree	Slightly Disagree	Mostly Disagree	Completely Disagree	Does not apply to me
My wheelchair/scooter allows me to do tasks at different surface heights easily: (e.g., table/desk/counter height)							
Question 5	Completely Agree	Mostly Agree	Slightly Agree	Slightly Disagree	Mostly Disagree	Completely Disagree	Does not apply to me
My wheelchair/scooter allows me to reach easily: (e.g., ATM machines, back of cupboard)							

Question 6	Completely Agree	Mostly Agree	Slightly Agree	Slightly Disagree	Mostly Disagree	Completely Disagree	Does not apply to me
My wheelchair/scooter allows me to <u>get around indoors</u> easily: (e.g., in my home, in the mall)							
Question 7	**Completely Agree**	**Mostly Agree**	**Slightly Agree**	**Slightly Disagree**	**Mostly Disagree**	**Completely Disagree**	**Does not apply to me**
My wheelchair/scooter allows me to <u>get around outdoors</u> easily: (e.g., uneven ground, curbs)							
Question 8	**Completely Agree**	**Mostly Agree**	**Slightly Agree**	**Slightly Disagree**	**Mostly Disagree**	**Completely Disagree**	**Does not apply to me**
My wheelchair/scooter allows me to <u>ride public transportation</u> easily: (e.g., ride a bus, train, or other transportation vehicles)							
Question 9	**Completely Agree**	**Mostly Agree**	**Slightly Agree**	**Slightly Disagree**	**Mostly Disagree**	**Completely Disagree**	**Does not apply to me**
My wheelchair/scooter can be <u>secured</u> easily during <u>transportation</u>: (e.g., my van, bus, train, or other public transportation)							
Question 10	**Completely Agree**	**Mostly Agree**	**Slightly Agree**	**Slightly Disagree**	**Mostly Disagree**	**Completely Disagree**	**Does not apply to me**
My wheelchair/scooter can be <u>stowed</u> in a vehicle easily: (e.g., car, van)							

APPENDIX B

Functioning Everyday with a Wheelchair (FEW) Beta Version 2.0

Functioning Everyday with a Wheelchair (FEW)

DIRECTIONS: Please answer the following 10 questions by **placing an 'X' in the box under the response** (completely agree, mostly agree, slightly agree, etc.) that best matches your ability to function while in your wheelchair/scooter. All examples may not apply to you, and there may be tasks you perform that are not listed. **Mark each question only one time.** If you answer, ***slightly, *mostly, or *completely disagree for any question,** please **circle the feature(s) (i.e., size, fit, postural support, functional) contributing to your disagreement, and write the reason for your disagreement in the *Comments* section.**

	Completely Agree	Mostly Agree	Slightly Agree	*Slightly Disagree	*Mostly Disagree	*Completely Disagree	Does not apply
1. **The stability, durability and dependability features of my wheelchair/scooter <u>contribute to my ability</u> to <u>carry out my daily routines</u> as independently, safely and efficiently as possible:** *(e.g., tasks I want to do, need to do, am required to do- when and where needed)*							
Comments:							
2. **The <u>size</u>, <u>fit</u>, <u>postural support</u> and <u>functional</u> features of my wheelchair/scooter <u>match my comfort needs</u> as I carry out my daily routines:** *(e.g., heat/moisture, sitting tolerance, pain, stability)*							
Comments:							
3. **The <u>size</u>, <u>fit</u>, <u>postural support</u> and <u>functional</u> features of my wheelchair/scooter <u>match my health needs</u>:** *(e.g., pressure sores, breathing, edema control, medical equipment)*							
Comments:							
4. **The <u>size</u>, <u>fit</u>, <u>postural support</u> and <u>functional</u> features of my wheelchair/scooter allow me to <u>operate</u> it as independently, safely, and efficiently as possible:** *(e.g., do what I want it to do when and where I want to do it)*							
Comments:							
5. **The <u>size</u>, <u>fit</u>, <u>postural support</u> and <u>functional</u> features of my wheelchair/scooter allow me to <u>reach and carry out tasks at different surface heights</u> as independently, safely, and efficiently as possible:** *(e.g., table, counters, floors, shelves)*							
Comments:							

For questions #2 thru #10:
<u>size</u> *(e.g., wheelchair and seating frame- width, length, height)*
<u>fit</u> *(e.g., not too large, not too small, allows desired movement)*
<u>postural support</u> *(e.g., provides support, stability, and control for the body- bones, muscles, and tissues)*
<u>functional</u> *(e.g., speed, wheels, cushion, controller, backrest, legrests, seat belt, tilt/recline system, seat elevator, laptray, basket, cane holder, horn, lights)*

Subject Code: _____

	Completely Agree	Mostly Agree	Slightly Agree	*Slightly Disagree	*Mostly Disagree	*Completely Disagree	Does not apply
6. The size, fit, postural support and functional features of my wheelchair/scooter allow me to transfer from one surface to another surface as independently, safely, and efficiently as possible: *(e.g., bed, toilet, chair)*							
Comments:							
7. The size, fit, postural support and functional features of my wheelchair/scooter allow me to carry out personal care tasks as independently, safely, and efficiently as possible: *(e.g., dressing, bowel/bladder care, eating, hygiene)*							
Comments:							
8. The size, fit, postural support and functional features of my wheelchair/scooter allow me to get around indoors as independently, safely, and efficiently as possible: *(e.g., home, work, mall, restaurants, ramps, obstacles)*							
Comments:							
9. The size, fit, postural support and functional features of my wheelchair/scooter allow me to get around outdoors as independently, safely, and efficiently as possible: *(e.g., uneven surfaces, dirt, grass, gravel, ramps, obstacles)*							
Comments:							
10. The size, fit, postural support and functional features of my wheelchair/scooter allow me to use personal or public transportation as independently, safely, and efficiently as possible: *(e.g., secure, stow, ride)*							
Comments:							

For questions #2 thru #10:
size *(e.g., wheelchair and seating frame- width, length, height)*
fit *(e.g., not too large, not too small, allows desired movement)*
postural support *(e.g., provides support, stability, and control for the body- bones, muscles, and tissues)*
functional *(e.g., speed, wheels, cushion, controller, backrest, legrests, seat belt, tilt/recline system, seat elevator, laptray, basket, cane holder, horn, lights)*

APPENDIX C

Performance Assessment of Self-Care Skills (PASS) Indoor Walking Item

Task #H20: Functional Mobility: Indoor Walking

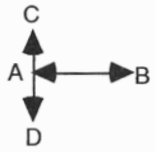
HOME CONDITIONS: Total apartment or first floor of home, and

1. Use of walking aid if normally used
2. Pt standing next to therapist on one side of room at center of home

HOME INSTRUCTIONS:

"The next task is walking. For this task you need to criss-cross your home. Start here (at point A) next to me. First walk across this room to [Point to B and name an object] and come back to me. [Wait for response]

Now walk to [Point to C and name an object], turn around and walk past me to [Point to D and name an object] and then return to me." [Wait for response]



SCORE	*INDEPENDENCE*	SAFETY	OUTCOME	
			QUALITY	PROCESS
3	*No assists given for task initiation, continuation, or completion*	Safe practices were observed	Acceptable (Standards met)	Subtasks performed with precision & economy of effort & action
2	*No Level 7-9 assists given, but occasional Level 1-6 assists given*	Minor risks were evident but no assistance provided	Acceptable (Standards met, but improvement possible)	Subtasks generally performed w/ precision & economy of effort & action; occasional lack of efficiency, redundant or extraneous actions; no missing steps
1	*No Level 9 assists given; occasional Level 7 or 8 assists given, or continuous Level 1-6 assists given*	Risks to safety were observed and assistance given to prevent potential harm	Marginal (Standards partially met)	Subtasks generally performed w/ lack of precision and/or economy of effort & action; consistent extraneous or redundant actions; steps may be missing
0	*Level 9 assists given, or continuous Level 7 or 8 assists given; or Unable to initiate, continue, or complete subtask or task*	Risks to safety of such severity were observed that task was stopped or taken over by therapist to prevent harm	Unacceptable (Standards not met)	Subtasks are consistently performed w/ lack of precision and/or economy of effort & action so that task progress is unattainable

TASK#H20: Functional Mobility: Indoor Walking

Assistive Technology Devices (ATDs) used during task: 1. 2. 3. Total # of ATDs used:_____	INDEPENDENCE DATA									SAFETY DATA	OUTCOME DATA		SUMMARY SCORES		
	Verbal Supportive (Encouragement) 1	Verbal Non-Directive 2	Verbal Directive 3	Gestures 4	Task or Environment Rearrangement 5	Demonstration 6	Physical Guidance 7	Physical Support 8	Total Assist 9	Unsafe Observations	QUALITY: Standards not met/ improvement needed	PROCESS: Imprecision, lack of economy, missing steps	INDEPENDENCE	SAFETY	OUTCOME
Subtasks	MOBILITY/ADL/IADL SUBTASKS														
1 A to B and back	Walks across area, turns, & walks back & maintains balance (no loss of balance; no reliance on furniture or walls for stabilization; no bumping into/stumbling over furniture)										8				
2 A to C and back	Walks across area, turns, & walks back & maintains balance (no loss of balance; no reliance on furniture or walls for stabilization; no bumping into/stumbling over furniture)										8				
3 A to D and back	Walks across area, turns, & walks back & maintains balance (no loss of balance; no reliance on furniture or walls for stabilization; no bumping into/stumbling over furniture)										8				
4															
5															
6															
7															
8															
9															
10															
11															
12															

APPENDIX D

Functioning Everyday with a Wheelchair - Capacity (FEW-C)

Task # 1: FEW–C : Wheelchair/Scooter Stability, Durability, and Dependability

Task Conditions: Clinic/laboratory area
Consumer seated in wheelchair/scooter, and positioned next to therapist.

Instructions: "The stability, durability, and dependability features of a wheelchair/scooter can affect how you carry out your daily routines. I will ask you to respond to various questions regarding how stable, durable, and dependable your wheelchair/scooter is".

Type of mobility device: ☐ **Manual** ☐ **Power** ☐ **Scooter** ☐ **Had current wheelchair/scooter for less than 1 month**

Task Instructions & Therapist Task Guide		
1. Stability	**(a) Using this table, in the last month, how many times while seated or moving to or from your wheelchair/scooter has it tipped, or the wheels lost contact with the ground/floor? For example, your wheelchair tipped to one side, tipped to the front or back, or completely tipped over.** ____ 0 **[Proceed to #2 Durability]** ____ 1 – 5 ____ 6 – 10 ____ 11 – 15 ____ 16 – 20 ____ ≥ 20 **(b) Using this list, tell me the reason why your wheelchair/scooter tipped. You can select as many as apply. If your reason is not listed here, please describe.** ____ **Contact with an obstacle, barrier, or object in environment** ____ **Human error (e.g., physical, cognitive)** ____ **Unstable ground/floor/terrain** ____ **Level or height of incline (ground/floor/terrain)** ____ **Weather condition** ____ **Transferring with or without assistance** ____ **Positioning in wheelchair/scooter with or without assistance** ____ **Other:** _____ _____ **(c) Were you or anyone else injured as a result of your wheelchair/scooter being tipped?** ☐ **Yes** ☐ **No** **(d) Who was injured?** ☐ **User** ☐ **Other person** ☐ **Both** **(e) Severity of injury?** ☐ **Minimal** ☐ **Moderate** ☐ **Severe**	**Using this table/list** *[Hand stability item sheet to consumer -- point to respective tables on sheet for items 1a, b, & e]* **(a) Number of times consumer tipped** *[Indicate by marking provided space]* **(b) Tell me the reason why wheelchair/scooter tipped** *[Indicate by marking provided space(s) -- if consumer's reason is not listed, write cause or reason in provided space]* **(c) Were you or anyone else injured as a result of wheelchair/scooter tipping** *[Mark 'Yes' or 'No']* **(d) Who was injured** *[Mark 'User', 'Other person', or 'Both']* **(e) Severity of injury?** *[Mark 'Minimal', 'Moderate', or 'Severe']*

Task # 1: FEW–C : Wheelchair/Scooter Stability, Durability, and Dependability

Task Instructions & Therapist Task Guide		
2. Durability	**(a) Using this table, in the last month, how many times have you *not* been able to do the tasks you wanted to do, needed to do, or are required to do because of the durability features of your wheelchair/scooter? For example, your wheelchair/scooter features had broken down, or were not able to withstand/hold up against daily use?** **____ 0 [Proceed to #3 Dependability]** **____ 1 – 5** **____ 6 – 10** **____ 11 – 15** **____ 16 – 20** **____ ≥ 20** **(b) Using this list, tell me the reason why your wheelchair/scooter became inoperable or broke down. You can select as many as apply. If your reason is not listed here, please describe.** **____ Wheelchair/scooter frame or hardware** **____ Hardware or electronic problem with the controller** **____ Motor/gear/brake problem** **____ Wheel/caster/tire components** **____ Seating system/positioning devices** **____ Accessories** **____ Upper/lower body supports** **____ Other:** _____ _____	**Using this table/list** *[Hand durability item sheet to consumer -- point to respective tables on sheet]* **(a) Number of times consumer has not been able to perform a task because of a wheelchair/scooter durability feature** *[Indicate by marking provided space]* **(b) Tell me the reason why wheelchair/scooter became inoperable or broke down** *[Indicate by marking provided space(s) -- if consumer's reason is not listed, write cause or reason in provided space]*

Task # 1: FEW–C : Wheelchair/Scooter Stability, Durability, and Dependability

Task Instructions & Therapist Task Guide		
3. Dependability	**(a) Using this table, in the last month, how many times have you *not* been able to do the tasks you wanted to do, needed to do, or are required to do because you could *not* depend on your wheelchair/scooter? For example, your wheelchair/scooter was *not* dependable because it was in for repairs or performed inconsistently from day-to-day or over a period of time?** ____ 0 ____ 1 – 5 ____ 6 – 10 ____ 11 – 15 ____ 16 – 20 ____ ≥ 20 **(b) Using this list, tell me the reason why you could not depend on your wheelchair/scooter. You can select as many as apply. If your reason is not listed here, please describe.** ____ New wheelchair/scooter service call/adjustment ____ Repairs for unexpected problems ____ Maintenance problems ____ Problems with charging/maintaining needed charge life ____ Wheelchair/scooter frame or hardware ____ Hardware or electronic problem with the controller ____ Motor/gear/brake problem ____ Wheel/caster/tire components ____ Seating system/positioning devices ____ Accessories ____ Upper/lower body supports ____ Other: _____ _____	**Using this table/list** *[Hand dependability item sheet to consumer -- point to respective tables on sheet]* (a) **Number of times consumer has not been able to perform a task because of a wheelchair/scooter dependability feature** *[Indicate by marking provided space]* (b) **Tell me the reason why you could not depend on your wheelchair/scooter** *[Indicate by marking provided space(s) -- if consumer's reason is not listed, write cause or reason in provided space]*

STABILITY

(1a.) In the last month, how many times while seated or moving to or from your wheelchair/scooter has it tipped, or the wheels lost contact with the ground/floor?

0 times	1 – 5 times	6 – 10 times	11 – 15 times	16 – 20 times	≥ 20 times

(1b.) Why did you your wheelchair/scooter tip? Select as many as apply. If your reason is not listed here, please describe.

Contact with an obstacle, barrier, or object in environment	Weather condition
Human error	Transferring with or without assistance
Unstable ground/floor/terrain	Positioning in wheelchair/scooter with or without assistance
Level or height of incline (ground/floor/terrain)	Other

(1e.) Severity of injury?

Minimal: No medical attention necessary	Moderate: Some attention required to care for injury	Severe: Medical attention necessary

DURABILITY

(2a.) In the last month, how many times have you *not* been able to do the tasks you wanted to do, needed to do, or are required to do because of the durability features of your wheelchair/scooter?

0 times	1 – 5 times	6 – 10 times	11 – 15 times	16 – 20 times	≥ 20 times

(2b.) Why did your wheelchair/scooter became inoperable or break down? Select as many as apply. If your reason is not listed here, please describe.

New wheelchair/scooter service call/adjustment	Seating system/positioning devices
Wheelchair/scooter frame or hardware	Accessories
Hardware or electronic problem with the controller	Upper/lower body supports
Motor/gear/brake problem	Other
Wheel/caster/tire components	

DEPENDABILITY

(3a.) In the last month, how many times have you *not* been able to do the tasks you wanted to do, needed to do, or are required to do because you could not depend on your wheelchair/scooter?

0 times	1 – 5 times	6 – 10 times	11 – 15 times	16 – 20 times	≥ 20 times

(3b.) Why could you not depend on your wheelchair/scooter? Select as many as apply. If your reason is not listed here, please describe.

New wheelchair/scooter service call/adjustment	Motor/gear/brake problem
Repairs for unexpected problems	Wheel/caster/tire components
Maintenance problems	Seating system/positioning devices
Problems with charging/maintaining needed charge life	Accessories
Wheelchair/scooter frame or hardware	Upper/lower body supports
Hardware or electronic problem with the controller	Other

Task # 2: FEW–C : Comfort Needs

Task Conditions:	Clinic/laboratory area Consumer seated in wheelchair/scooter typically used for tasks, and positioned next to therapist.
Instructions:	"Your comfort while seated in your wheelchair/scooter is important. I am going to ask you to show me how you improve comfort in your wheelchair/scooter. I will provide you with instructions before each question. Please wait until I say ***READY*** before you begin a task. If there are assistive devices you usually use to improve your comfort, feel free to use them". *[Wait for response]*

	Task Instructions
1. **Comfort: Method I**	**I need you to show me two methods or things you do to improve your comfort while seated in your wheelchair/scooter. You can show me the best or most often used method that works for you.** **Please describe one method you use to improve your comfort** *[Wait for response].* **Now, show me how you do it. Ready?** *[Wait for response]* **Method/Feature(s) Used:** _____
2. **Comfort: Method II**	**Describe another method you use to improve your comfort** *[Wait for response].* **Now, show me how you do it. Ready?** *[Wait for response]* **Method/Feature(s) Used:** _____

SCORE	INDEPENDENCE DATA	SAFETY DATA	QUALITY DATA
3	No assists given for task initiation, continuation, or completion	**SP** = Safe practices observed	**SM** = Acceptable (Standards met)
2	**VA** = No physical assists given, **but ≤ 2** verbal assists or **≤ 2** visual assists; **or ≤ 4** verbal and visual assists given	**MR** = Minor risks evident – no assistance provided	**IP** = Acceptable (Standards met – improvement possible)
1	**V^SA** = **≤ 2** physical assists given, **but no** total assistance; or **3** verbal assists or **3** visual assists, **or ≥ 5** verbal and visual assists given	**PH** = Risks to safety evident – assistance provided to prevent potential harm	**PM** = Marginal (Standards partially met)
0	**PA** = **3** physical assists given; **or** total assistance required for task initiation, continuation, or completion	**SR** = Severe risks evident – assistance provided to prevent harm	**NM** = Unacceptable (Standards not met)

Task # 2: FEW–C : Comfort Needs

	*Based on the **size, fit, postural support, and functional features** of the wheelchair/scooter:* **Mobility Device used during task:** ☐ Manual ☐ Power ☐ Scooter **Assistive Technology Devices (ATDs) used during task:** 1. 2. **Total # of ATDs used:** _____	**INDEPENDENCE DATA**			**SAFETY DATA**				**QUALITY DATA**				**SUMMARY SCORES**			**FEATURES**		
		Verbal Assist	Visual Assist	Physical Assist	Safe practices	Minor risk- no ass st	Risk- potential harm	Severe risk- prevent harm	Standards met	SM. Improvement possible	Standards partially met	Standards not met	INDEPENDENCE	SAFETY	QUALITY	STABILITY	DURABILLITY	DEPENDABILITY
		VA	V^{S}A	PA	SP	MR	PH	SR	SM	IP	PM	NM						
Subtasks	**FEW–C Subtasks**																	
1. **Comfort: Method I**	Adjusts comfort level in wheelchair/scooter adequately (achieves perceived improvement in comfort, does not lose balance) and efficiently (within 1 try, does not struggle)	VA	V^{S}A	PA									3					
		VA	V^{S}A	PA	SP	MR	PH	SR	SM	IP	PM	NM	2					
		VA	V^{S}A	PA									1					
													0					
2. **Comfort: Method II**	Adjusts comfort level in wheelchair/scooter adequately (achieves perceived improvement in comfort, does not lose balance) and efficiently (within 1 try, does not struggle)	VA	V^{S}A	PA									3					
		VA	V^{S}A	PA	SP	MR	PH	SR	SM	IP	PM	NM	2					
		VA	V^{S}A	PA									1					
													0					

Adapted from the Performance Assessment of Self-Care Skills (PASS), Home, Version 3.1 (Rogers & Holm, © 1989, 1994); (Holm, 2001)

Task # 3: FEW–C : Health Needs

Task Conditions:	Clinic/laboratory area. Consumer seated in wheelchair/scooter typically used to perform tasks, and positioned next to therapist.
Instructions:	"A wheelchair/scooter can support various health functions, and allow you to perform necessary health maintenance tasks. This task involves demonstrating how you carry out health-related functions, such as pressure relief, while seated in your wheelchair/scooter". I will provide you with instructions before each task. Please wait until I say ***READY*** before you begin a task. If there are assistive devices you usually use to perform these tasks, feel free to use them". *[Wait for response]*

**Use provided form to write responses*	**Task Instructions**
1. **Weight Shift**	**I need you to show me one method you use to shift your weight off your bottom, or re-distribute/relieve pressure from your sitting surface while seated in your wheelchair/ scooter. You can show me the best or most often used method that works for you.** **Please *describe one method you use to shift your weight. Now show me how you do it. Ready?** *[Wait for response]*
2. **Leg Elevation**	**Elevating your legs, particularly above heart level can be an important function for health, for example, improving circulation or reducing edema/swelling.** **Do you typically elevate your legs while seated in your wheelchair/scooter?** ☐ **Yes** ☐ **No** ☐ **Not applicable** **If No, please *describe why** *[Wait for response]*. **If you were to elevate your legs, describe what you would do** *[Wait for response]*. **Now, show me. Ready?** *[Wait for response]* **If Yes, *describe one method you use** *[Wait for response]*. **Please show me how you elevate your legs. Ready?** *[Wait for response]*
3. **Medical/ Health-related (MHR) Function**	**The next item is about performing medical/health-related functions, which may be important to maintain or improve your health.** **Do you have any medical/health-related functions you usually perform or need to perform while seated in your wheelchair/scooter?** For example, wound care, using respiratory-related equipment or implanted medical device, administering medications or injections, or taking your temperature, blood pressure, oxygen, or sugar/glucose level. ☐ **Yes** ☐ **No** ☐ **Not applicable** **Do you carry/stow any medication or medical equipment/devices with you when using your wheelchair/scooter?** ☐ **Yes** ☐ **No** ☐ **Not applicable** **If yes, *describe what it is or what you do** *[Wait for response]*. **Now, show me how you perform this function, and/or retrieve, use, and stow your medicine/medical equipment-devices while seated in your wheelchair/scooter. Ready?** *[Wait for response]*

SCORE	INDEPENDENCE DATA	SAFETY DATA	QUALITY DATA
3	No assists given for task initiation, continuation, or completion	**SP** = Safe practices observed	**SM** = Acceptable (Standards met)
2	**VA** = No physical assists given, but ≤ **2** verbal assists or ≤ **2** visual assists; or ≤ **4** verbal and visual assists given	**MR** = Minor risks evident – no assistance provided	**IP** = Acceptable (Standards met – improvement possible)
1	V^SA = ≤ **2** physical assists given, but no total assistance; or **3** verbal assists or **3** visual assists, or ≥ **5** verbal and visual assists given	**PH** = Risks to safety evident – assistance provided to prevent potential harm	**PM** = Marginal (Standards partially met)
0	**PA** = **3** physical assists given; or total assistance required for task initiation, continuation, or completion	**SR** = Severe risks evident – assistance provided to prevent harm	**NM** = Unacceptable (Standards not met)

	*Based on the **size, fit, postural support, and functional features** of the wheelchair/scooter:* **Mobility Device used during task:** ☐ Manual ☐ Power ☐ Scooter **Assistive Technology Devices (ATDs) used during task:** 1. 2. **Total # of ATDs used:** _____	**INDEPENDENCE DATA**			**SAFETY DATA**				**QUALITY DATA**				**SUMMARY SCORES**			**FEATURES**		
		Verbal Assist	Visual Assist	Physical Assist	Safe practices	Minor risk- no assist	Risk- potential harm	Severe risk- prevent harm	Standards met	SM, Improvement possible	Standards partially met	Standards not met	INDEPENDENCE	SAFETY	QUALITY	STABILITY	DURABILLITY	DEPENDABILITY
		VA	V^{S}A	PA	SP	MR	PH	SR	SM	IP	PM	NM						
Subtasks	**FEW–C Subtasks**																	
1. **Weight Shift**	Shifts or redistributes weight off sitting surface while seated in wheelchair/scooter adequately (achieves complete pressure distribution of sitting surface, able to maintain/hold position to achieve effective weight shift, does not lose balance) and efficiently (within 1 try, does not struggle)	VA VA VA	V^{S}A V^{S}A V^{S}A	PA PA PA	SP	MR	PH	SR	SM	IP	PM	NM	3 2 1 0					
2. **Leg Elevation**	Elevates legs while seated in wheelchair/ scooter adequately (legs are elevated at appropriate height/level to meet health needs, does not lose balance, bump into or scrape body parts on surrounding surfaces) and efficiently (within 1 try, does not struggle)	VA VA VA	V^{S}A V^{S}A V^{S}A	PA PA PA	SP	MR	PH	SR	SM	IP	PM	NM	3 2 1 0					
3. **MHR Function**	Demonstrates medical/health-related function(s) and/or retrieval, use, and stowing of medicine/ medical equipment-devices while seated in wheelchair/ scooter adequately (achieve desired health needs, carries out steps necessary to achieve health needs, does not lose balance) and efficiently (controlled manner, does not over-reach or drop items, no missing steps)	VA VA VA	V^{S}A V^{S}A V^{S}A	PA PA PA	SP	MR	PH	SR	SM	IP	PM	NM	3 2 1 0					

Adapted from the Performance Assessment of Self-Care Skills (PASS), Home, Version 3.1 (Rogers & Holm, © 1989, 1994); (Holm, 2001)

1. Weight Shift	Method and Feature(s) Used: _____
2. Leg Elevation ☐ Does elevate ☐ Does not elevate	If No or Not applicable, describe why: _____ Method and Feature(s) Used: _____
3. MHR Function	If yes, write description of what it is or method of how it is performed, and/or feature(s) used: _____

Task # 3: FEW–C : Health Needs

Task # 4: FEW–C : Operate Wheelchair/Scooter

Task Conditions: Clinic/laboratory area.
Consumer seated in wheelchair/scooter typically used to perform tasks, and positioned next to therapist.
*Prior to starting, therapist will identify an area that is 8 ft in length with a 90° turn to the L or R and a 6 ft long path [all having a minimum of 36" width (e.g., a hallway with a turn; an unobstructed open clinic/laboratory space)] -- see Task #4 Diagram.

Instructions: "The next task is about how your wheelchair/scooter operates, meaning it does the things you want it to do, when and where you want it to do it. I will ask you to perform common operations using your wheelchair/scooter, such as moving forward and backward. I will provide you with instructions for each task. Please wait until I say ***READY*** before you begin a task". *[Wait for response]*

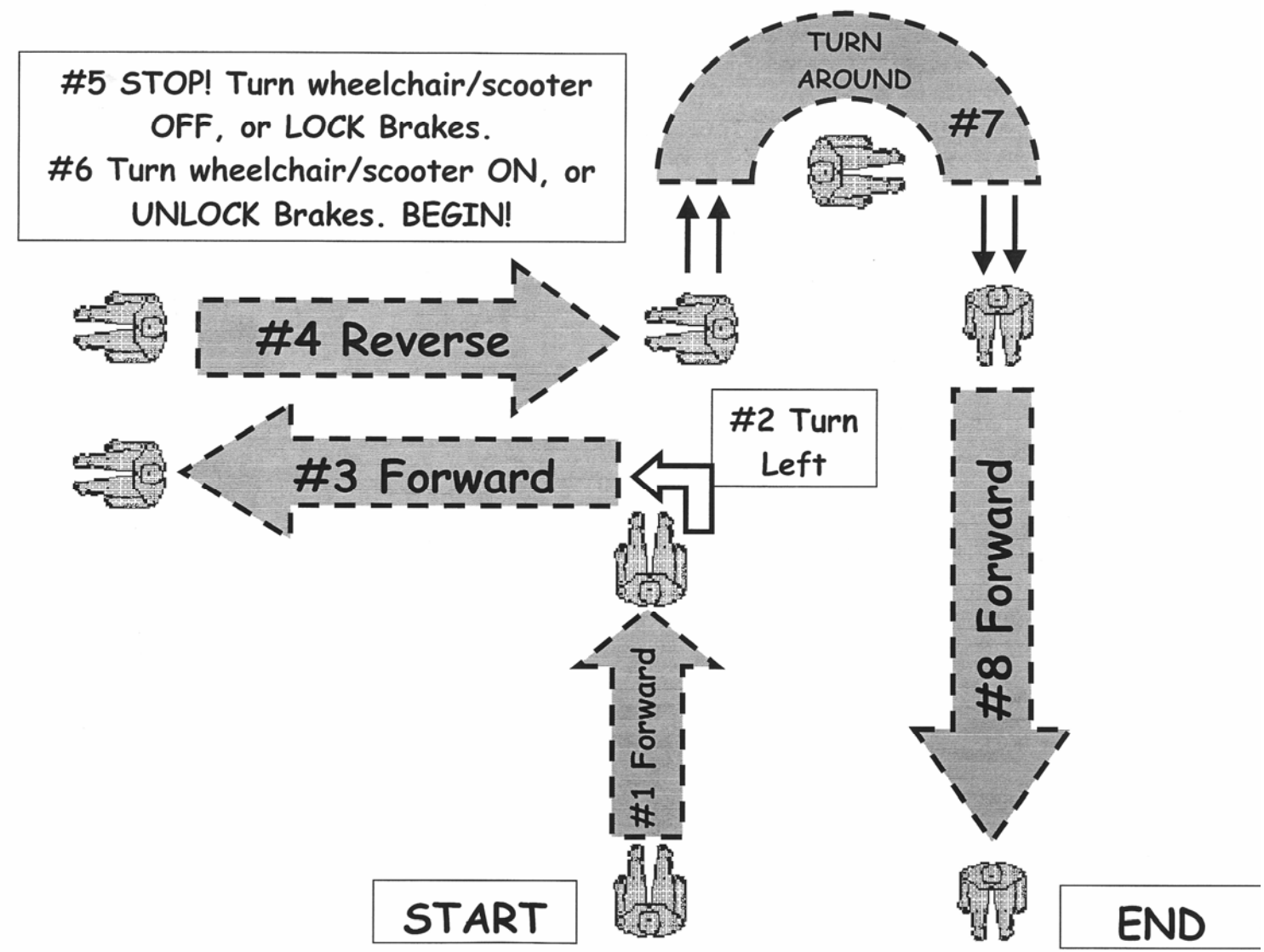
Common Operations:	**Task Instructions**
	Starting from *this location, I want you to travel this route as outlined on the diagram. You can carry it with you, but I will provide step-by-step directions along the way.
	First, please position your wheelchair/scooter facing *this direction. [WAIT]
1. Forward/ Reverse	**Now, travel forward to that corner [*this point/location] and make a [*right turn or left turn]. Ready?** *[Wait for response]*
2. Turns	**Continue traveling forward until you get to *this point/location and stop -- then without turning your wheelchair/scooter around, travel in reverse back to *here and stop [WAIT]. Now, turn off your wheelchair/scooter or lock your brakes.**
3. Stops	**Turn your wheelchair/scooter back on, or unlock your brakes. [WAIT]**
4. On/Off and Brakes	**Now, turning in *this direction [right turners = counter clockwise direction; left turners = clockwise direction], turn around and return to *where we started and then stop. Ready?** *[Wait for response]* **[WAIT]**
	Location/Route/Feature(s) Used: _____

SCORE	INDEPENDENCE DATA	SAFETY DATA	QUALITY DATA
3	No assists given for task initiation, continuation, or completion	**SP** = Safe practices observed	**SM** = Acceptable (Standards met)
2	**VA** = No physical assists given, **but ≤ 2** verbal assists or **≤ 2** visual assists; or **≤ 4** verbal and visual assists given	**MR** = Minor risks evident – no assistance provided	**IP** = Acceptable (Standards met – improvement possible)
1	**V^SA** = **≤ 2** physical assists given, **but no total assistance**; or **3** verbal assists or **3** visual assists, **or ≥ 5** verbal and visual assists given	**PH** = Risks to safety evident – assistance provided to prevent potential harm	**PM** = Marginal (Standards partially met)
0	**PA** = **3** physical assists given; **or** total **assistance** required for task initiation, continuation, or completion	**SR** = Severe risks evident – assistance provided to prevent harm	**NM** = Unacceptable (Standards not met)

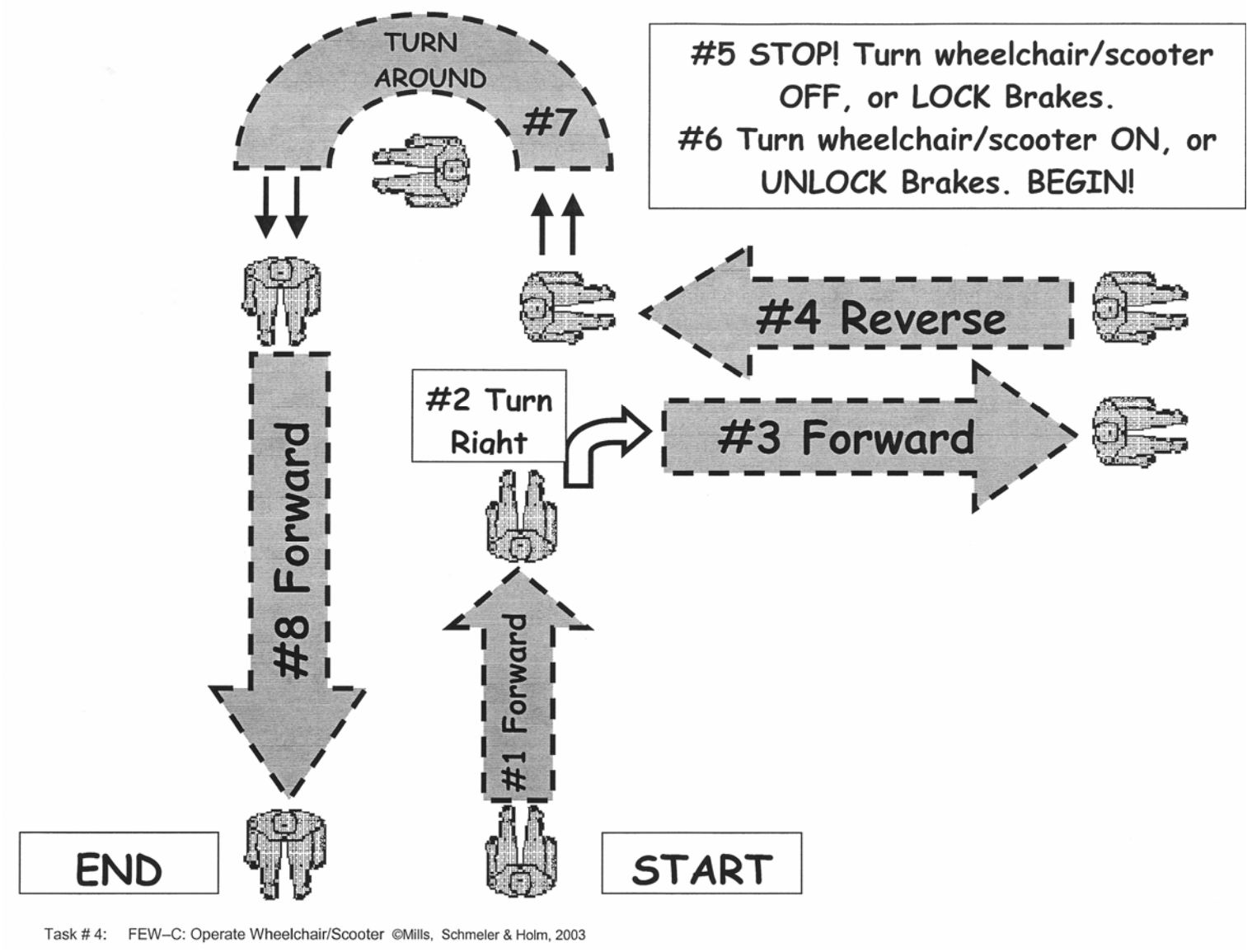
Task # 4: FEW–C : Operate Wheelchair/Scooter

	*Based on the **size, fit, postural support, and functional features** of the wheelchair/scooter:* **Mobility Device used during task:** ☐ Manual ☐ Power ☐ Scooter **Assistive Technology Devices (ATDs) used during task:** 1. 2. **Total # of ATDs used:** _____	**INDEPENDENCE DATA**			**SAFETY DATA**				**QUALITY DATA**				**SUMMARY SCORES**			**FEATURES**		
		Verbal Assist	Visual Assist	Physical Assist	Safe practices	Minor risk- no assist	Risk- potential harm	Severe risk- prevent harm	Standards met	SM, Improvement possible	Standards partially met	Standards not met	INDEPENDENCE	SAFETY	QUALITY	STABILITY	DURABILITY	DEPENDABILITY
		VA	V^{S}A	PA	SP	MR	PH	SR	SM	IP	PM	NM						
Subtasks	**FEW–C Subtasks**																	
1. Forward/ Reverse	Moves wheelchair/scooter into position and in forward and reverse directions as indicated on course diagram adequately (does not bump into or scrape body parts on surrounding surfaces, maintains balance, maintains appropriate speed/propulsion for terrain) and efficiently (does not need to stop, back up, etc., straight trajectory, controlled manner)	VA VA VA	V^{S}A V^{S}A V^{S}A	PA PA PA	SP	MR	PH	SR	SM	IP	PM	NM	3 2 1 0					
2. Turns	Moves wheelchair/scooter into position and demonstrates a right or left turn and a 180° turn adequately (does not bump into or scrape body parts on surrounding surfaces, maintains balance, maintains appropriate speed/ propulsion for terrain) and efficiently (does not need to stop, back up, etc., controlled manner)	VA VA VA	V^{S}A V^{S}A V^{S}A	PA PA PA	SP	MR	PH	SR	SM	IP	PM	NM	3 2 1 0					
3. Stops	Brings wheelchair/scooter to stop position after traveling in forward/reverse directions as indicated by therapist adequately (does not travel beyond indicated stopping point, maintains balance) and efficiently (within 1 try, does not struggle, controlled manner)	VA VA VA	V^{S}A V^{S}A V^{S}A	PA PA PA	SP	MR	RI	SR	SM	IP	PM	NM	3 2 1 0					
4. On/Off and Brakes	Turns wheelchair/scooter on and off or locks and unlocks brakes on wheelchair adequately (does not bump into or scrape body parts on surrounding surfaces, maintains balance, no unplanned movements) and efficiently (within 1 try, does not struggle, controlled manner)	VA VA VA	V^{S}A V^{S}A V^{S}A	PA PA PA	SP	MR	RI	SR	SM	IP	PM	NM	3 2 1 0					

Adapted from the Performance Assessment of Self-Care Skills (PASS), Home, Version 3.1 (Rogers & Holm, © 1989, 1994); (Holm, 2001)



Task # 4: FEW–C: Operate Wheelchair/Scooter ©Mills, Schmeler & Holm, 2003



Task # 4: FEW–C: Operate Wheelchair/Scooter ©Mills, Schmeler & Holm, 2003

Task # 5: FEW–C : Reach and Carry Out Tasks at Different Surface Heights

Task Conditions: Clinic/laboratory area, table/counter/desk, and drawer/cupboard nearby.
Consumer seated in wheelchair/scooter typically used to perform task, and positioned next to therapist.
Common items in the clinic/ laboratory will be used for this task.
*Each item must not exceed a maximum weight of 2 pounds (e.g. bag of beans, stapler), and a maximum size of 12" x 12" inches (e.g. box of cereal, 3-ring binder).
Prior to starting, therapist will survey the area, and identify locations and items for each subtask.

Instructions: "Certain features of a wheelchair/scooter can be useful in allowing a person to reach items and carry out tasks at different surface heights. I will ask you to demonstrate these tasks.
There are a total of three tasks and I will provide you with instructions before each one. Please wait until I say ***READY*** before you begin a task.
If there are assistive devices you usually use when you reach for items, feel free to use them." *[Wait for response]*

	Task Instructions & Therapist Task Guide
1. **High** ↓ **Mid-Level**	**Please describe how you would retrieve _*_ from here** *[Point to item on surface above Ss shoulder height -- within Ss arm's length]* **and then place it here** *[Point to surface at Ss shoulder level -- directly below area where item was retrieved] [Wait for response].* **Now show me. Ready?** *[Wait for response]* **Item/Location/Feature(s) Used:** _____
2. **Mid-Level** **Side → Side**	**Please describe how you would retrieve the _*_ from here** *[Point to item far back in drawer/on countertop -- at Ss shoulder level]* **and then hand it to me** *[Wait for response].* **Now show me. Ready?** *[Therapist holds out hand, palm up, approximately arm's length away from Ss -- at the same height as the drawer/ countertop, but on opposite side Ss used to retrieve item]* **Item/Location/Feature(s) Used:** _____
3. **Deep** **Mid-Level** ↑ **Floor**	**Please describe how you would retrieve the _*_** *[Point to item on floor]* **and then place it here** *[Point to nearby counter/table surface at Ss shoulder level -- just beyond Ss arm length] [Wait for response].* **Now show me. Ready?** *[Wait for response]* **Item/Location/Feature(s) Used:** _____

*Retrieve _*_ = Item identified by therapist; Ss = Subject/Subject's

SCORE	INDEPENDENCE DATA	SAFETY DATA	
3	No assists given for task initiation, continuation, or completion	**SP** = Safe practices observed	**SM** = Acceptable (Standards met)
2	**VA** = No physical assists given, **but ≤ 2** verbal assists or **≤ 2** visual assists; **or ≤ 4** verbal and visual assists given	**MR** = Minor risks evident – no assistance provided	**IP** = Acceptable (Standards met – improvement possible)
1	**V^SA** = **≤ 2** physical assists given, **but no total assistance**; or **3** verbal assists or **3** visual assists, **or ≥ 5** verbal and visual assists given	**PH** = Risks to safety evident – assistance provided to prevent potential harm	**PM** = Marginal (Standards partially met)
0	**PA = 3** physical assists given; **or** total assistance required for task initiation, continuation, or completion	**SR** = Severe risks evident – assistance provided to prevent harm	**NM** = Unacceptable (Standards not met)

Task # 5: FEW–C : Reach and Carry Out Tasks at Different Surface Heights

	*Based on the **size, fit, postural support, and functional features** of the wheelchair/scooter:* **Mobility Device used during task:** ☐ Manual ☐ Power ☐ Scooter **Assistive Technology Devices (ATDs) used during task:** 1. 2. **Total # of ATDs used:** _____	**INDEPENDENCE DATA**			**SAFETY DATA**				**QUALITY DATA**				**SUMMARY SCORES**			**FEATURES**		
		Verbal Assist	Visua Assist	Physical Assist	Safe practices	Minor risk- no assist	Risk- potential harm	Severe risk- prevent harm	Standards met	SM, Improvement possible	Standards partially met	Standards not met	INDEPENDENCE	SAFETY	QUALITY	STABILITY	DURABILITY	DEPENDABILITY
		VA	V^{S}A	PA	SP	MR	PH	SR	SM	IP	PM	NM						
Subtasks	**FEW–C Subtasks**																	
1. **High** ↓ **Mid-Level**	Retrieves item from high surface and places it on mid-level surface adequately (holds and places securely, does not over-reach) and efficiently (without dropping, within 1 try, does not struggle) --- Ss position during item retrieval **[CHECK ONE]:** ___ **Right side of Ss wheelchair/scooter closest to item** ___ **Left side** ___ **Front** **Draw line (→) for angle of item retrieval.**	VA VA VA	V^{S}A V^{S}A V^{S}A	PA PA PA	SP	MR	PH	SR	SM	IP	PM	NM	**3** **2** **1** **0**					
2. **Mid-Level** **S → S**	Retrieves item from drawer/countertop and hands it to therapist adequately (holds and places securely, does not over-reach) and efficiently (without dropping, within 1 try, does not struggle) --- Ss position during item retrieval **[CHECK ONE]:** ___ **Right side of Ss wheelchair/scooter closest to item** ___ **Left side** ___ **Front** **Draw line (→) for angle of item retrieval.**	VA VA VA	V^{S}A V^{S}A V^{S}A	PA PA PA	SP	MR	PH	SR	SM	IP	PM	NM	**3** **2** **1** **0**					
3. **Deep Mid-Level** ↑ **Floor**	Retrieves item from floor and places it deep on mid-level surface adequately (holds and places securely, does not over-reach) and efficiently (without dropping, within 1 try, does not struggle) --- Ss position during item retrieval **[CHECK ONE]:** ___ **Right side of Ss wheelchair/scooter closest to item** ___ **Left side** ___ **Front** **Draw line (→) for angle of item retrieval.**	VA VA VA	V^{S}A V^{S}A V^{S}A	PA PA PA	SP	MR	PH	SR	SM	IP	PM	NM	**3** **2** **1** **0**					

Adapted from the Performance Assessment of Self-Care Skills (PASS), Home, Version 3.1 (Rogers & Holm, © 1989, 1994); (Holm, 2001);

Task # 6: FEW–C : Transfers

Task Conditions:	Clinic/laboratory area. Consumer seated in wheelchair/scooter typically used to perform task, and positioned next to therapist. Two transfer surfaces will be used for this task: **easy transfer = same level as consumer's seated surface* and ***complex transfer = 3" above or 3" below consumer's seated surface.* Prior to starting, therapist will survey the area, and identify locations for each transfer surface. [N.B. Adjustable height exam/mat tables can be used for both tasks]
Instructions:	"This task involves transferring from your wheelchair/scooter to a same level surface and a high or low surface. I will provide you with instructions for each transfer. Please wait until I say ***READY*** before you begin a task. If there are assistive devices you usually use when you transfer, feel free to use them." *[Wait for response]*

Task Instructions	
1–2. ***easy**	**The first transfer is from your wheelchair/scooter to ___. Please describe how you would perform this transfer** *[Wait for response].* **Now, place your wheelchair/scooter in the position you would typically use for this transfer, and transfer from your wheelchair/scooter to ___. Ready?** *[Wait for response]* **[WAIT]. Now, transfer back to your wheelchair/scooter.** ***Transfer Surface/Location/Feature(s) Used:** _____
3–4. ****complex** ☐ 3" above ☐ 3" below	**The next transfer is from your wheelchair/scooter to ___. Please describe how you would perform this transfer** *[Wait for response].* **Now, place your wheelchair/scooter in the position you would typically use for this transfer, and transfer from your wheelchair/scooter to ___. Ready?** *[Wait for response]* **[WAIT]. Now, transfer back to your wheelchair/scooter.** ****Transfer Surface/Location/Feature(s) Used:** _____

SCORE	INDEPENDENCE DATA	SAFETY DATA	QUALITY DATA
3	No assists given for task initiation, continuation, or completion	**SP** = Safe practices observed	**SM** = Acceptable (Standards met)
2	**VA** = No physical assists given, but ≤ **2** verbal assists or ≤ **2** visual assists; or ≤ **4** verbal and visual assists given	**MR** = Minor risks evident – no assistance provided	**IP** = Acceptable (Standards met – improvement possible)
1	**V^SA** = ≤ **2** physical assists given, but no total assistance; or **3** verbal assists or **3** visual assists, or ≥ **5** verbal and visual assists given	**PH** = Risks to safety evident – assistance provided to prevent potential harm	**PM** = Marginal (Standards partially met)
0	**PA** = **3** physical assists given; or total assistance required for task initiation, continuation, or completion	**SR** = Severe risks evident – assistance provided to prevent harm	**NM** = Unacceptable (Standards not met)

Task # 6: FEW–C : Transfers

	*Based on the **size, fit, postural support, and functional features** of the wheelchair/scooter:* **Mobility Device used during task:** ☐ Manual ☐ Power ☐ Scooter **Assistive Technology Devices (ATDs) used during task:** 1. 2. **Total # of ATDs used:** _____	**INDEPENDENCE DATA**			**SAFETY DATA**				**QUALITY DATA**				**SUMMARY SCORES**			**FEATURES**		
		Verbal Assist	Visual Assist	Physical Assist	Safe practices	Minor risk- no assist	Risk- potential harm	Severe risk- prevent harm	Standards met	SM, Improvement possible	Standards partially met	Standards not met	INDEPENDENCE	SAFETY	QUALITY	STABILITY	DURABILITY	DEPENDABILITY
		VA	V^{S}A	PA	SP	MR	PH	SR	SM	IP	PM	NM						
Subtasks	**FEW–C Subtasks**																	
1. **easy*	Positions wheelchair/scooter adequately (secures wheelchair/scooter for transfer) and with ease (does not struggle, within 1 try, controlled manner) and transfers from wheelchair/scooter to identified surface adequately (does not bump into or scrape body parts on surrounding surfaces, does not plop down onto surface) and efficiently (does not struggle, within 1 try, controlled manner, no unplanned stops)	VA VA VA	V^{S}A V^{S}A V^{S}A	PA PA PA	SP	MR	PH	SR	SM	IP	PM	NM	3 2 1 0					
2. **easy*	Repositions wheelchair/scooter (as needed) with ease (does not struggle, within 1 try, controlled manner) and transfers from identified surface to wheelchair/scooter adequately (does not bump into or scrape body parts on surrounding surfaces, does not plop down onto surface) and efficiently (does not struggle, within 1 try, controlled manner, no unplanned stops)	VA VA VA	V^{S}A V^{S}A V^{S}A	PA PA PA	SP	MR	PH	SR	SM	IP	PM	NM	3 2 1 0					
3. ***complex* ☐ 3" above ☐ 3" below	Positions wheelchair/scooter adequately (secures wheelchair/scooter for transfer) and with ease (does not struggle, within 1 try, controlled manner) and transfers from wheelchair/scooter to identified surface adequately (does not bump into or scrape body parts on surrounding surfaces, does not plop down onto surface) and efficiently (does not struggle, within 1 try, controlled manner, no unplanned stops)	VA VA VA	V^{S}A V^{S}A V^{S}A	PA PA PA	SP	MR	PH	SR	SM	IP	PM	NM	3 2 1 0					
4. ***complex*	Repositions wheelchair/scooter (as needed) with ease (does not struggle, within 1 try, controlled manner) and transfers from identified surface to wheelchair/scooter adequately (does not bump into or scrape body parts on surrounding surfaces, does not plop down onto surface) and efficiently (does not struggle, within 1 try, controlled manner, no unplanned stops)	VA VA VA	V^{S}A V^{S}A V^{S}A	PA PA PA	SP	MR	PH	SR	SM	IP	PM	NM	3 2 1 0					

Adapted from the Performance Assessment of Self-Care Skills (PASS), Home, Version 3.1 (Rogers & Holm, © 1989, 1994); (Holm, 2001)

Task # 7: FEW–C : Personal Care Tasks

Task Conditions: Clinic/laboratory area, sink nearby.
Consumer seated in wheelchair/scooter typically used to perform tasks, and positioned next to therapist.
Shirt/coat/jacket (open front or pull-over) will be available for consumer use or consumer can use own clothing. The hand washing items available in the clinic/laboratory area will be used, but therapist will also have items available for consumer use.

Instructions: "As a wheelchair/scooter user, you may perform certain personal care tasks while seated in your wheelchair/scooter. We have selected upper body dressing and hand washing as two common personal care tasks.
I will provide you with instructions for each task. Please wait until I say ***READY*** before you begin a task.
If there are assistive devices you usually use when performing these personal care tasks, feel free to use them". *[Wait for response]*

	Task Instructions
1a–b. **Upper Body Dressing**	**First, I would like to see you put on a shirt/coat/jacket. You can use your own, or we have one that you can use** *[Wait for response].* **Please describe how you would put on this shirt/coat/jacket** *[Wait for response].* *[Therapist hands consumer a shirt/coat/jacket if necessary]* **Now, put it on and [zip, button, or fasten it] the way you would typically wear it. Ready?** *[Wait for response]* **[WAIT] Now take it off.** ☐ **Shirt/coat/jacket provided by therapist** ☐ **Type of shirt/coat/jacket:** _____ **Location/Feature(s) Used:** _____ _____
2. **Personal Hygiene**	**The next task involves personal hygiene. Please follow me to the sink.** **Describe how you would wash your hands with soap, and then rinse and dry your hands** *[Wait for response].* **Now, show me how you do it. Ready?** *[Wait for response]* ☐ **Hygiene products provided by therapist** **Location/Feature(s) Used:** _____ _____

SCORE	INDEPENDENCE DATA	SAFETY DATA	QUALITY DATA
3	No assists given for task initiation, continuation, or completion	**SP** = Safe practices observed	**SM** = Acceptable (Standards met)
2	**VA** = No physical assists given, **but** ≤ **2** verbal assists or ≤ **2** visual assists; **or** ≤ **4** verbal and visual assists given	**MR** = Minor risks evident – no assistance provided	**IP** = Acceptable (Standards met – improvement possible)
1	**V^{S}A** = ≤ **2** physical assists given, **but no** total assistance; **or 3** verbal assists or **3** visual assists, **or** ≥ **5** verbal and visual assists given	**PH** = Risks to safety evident – assistance provided to prevent potential harm	**PM** = Marginal (Standards partially met)
0	**PA** = **3** physical assists given; **or** total assistance required for task initiation, continuation, or completion	**SR** = Severe risks evident – assistance provided to prevent harm	**NM** = Unacceptable (Standards not met)

Task # 7: FEW–C : Personal Care Tasks

	*Based on the **size, fit, postural support, and functional features** of the wheelchair/scooter:* **Mobility Device used during task:** ☐ Manual ☐ Power ☐ Scooter **Assistive Technology Devices (ATDs) used during task:** 1. 2. **Total # of ATDs used:** _____	**INDEPENDENCE DATA**			**SAFETY DATA**				**QUALITY DATA**				**SUMMARY SCORES**			**FEATURES**		
		Verbal Assist	Visual Assist	Physical Assist	Safe practices	Minor risk- no assist	Risk- potential harm	Severe risk- prevent harm	Standards met	SM, improvement possible	Standards partially met	Standards not met	INDEPENDENCE	SAFETY	QUALITY	STABILITY	DURABILLITY	DEPENDABILITY
		VA	V^{S}A	PA	SP	MR	PH	SR	SM	IP	PM	NM						
Subtasks	**FEW–C Subtasks**																	
1a. Upper Body Dressing	Donns shirt/coat/jacket while seated in wheelchair/ scooter adequately (maintains balance) and efficiently (does not struggle, controlled manner)	VA VA VA	V^{S}A V^{S}A V^{S}A	PA PA PA	SP	MR	PH	SR	SM	IP	PM	NM	3 2 1 0					
1b. Upper Body Dressing	Doffs shirt/coat/jacket while seated in wheelchair/ scooter adequately (maintains balance) and efficiently (does not struggle, controlled manner)	VA VA VA	V^{S}A V^{S}A V^{S}A	PA PA PA	SP	MR	PH	SR	SM	IP	PM	NM	3 2 1 0					
2. Personal Hygiene	Positions wheelchair/scooter and retrieves and applies soap to hands, rinses hands with water, and dries hands while seated in wheelchair/ scooter adequately (reaches all items, does not spill on self/floor, does not bump into or scrape body parts on surrounding surfaces, maintains balance) and efficiently (does not drop items, does not struggle, controlled manner)	VA VA VA	V^{S}A V^{S}A V^{S}A	PA PA PA	SP	MR	PH	SR	SM	IP	PM	NM	3 2 1 0					

Adapted from the Performance Assessment of Self-Care Skills (PASS), Home, Version 3.1 (Rogers & Holm, © 1989, 1994); (Holm, 2001)

Task # 8: FEW–C : Indoor Mobility

Task Conditions:	Clinic/laboratory area. Consumer seated in wheelchair/scooter typically used to perform task, and positioned next to therapist. *Prior to starting, therapist will survey the area, and identify locations for each subtask -- including carpeted and non-carpeted surfaces large enough to make a 90^0 turn (minimum), and a doorway wide enough to accommodate a wheelchair -- and a door equipped with a lever handle or knob.
Instructions:	"The next task involves showing me how you get around within an indoor environment while seated in your wheelchair/scooter. I will provide you with instructions before each task. Please wait until I say ***READY*** before you begin a task. If there are assistive devices you usually use for indoor mobility, feel free to use them". *[Wait for response]*

Use provided form for additional space	**Task Instructions**
1. ****Carpeted Surface**	**First, starting from here travel in *this direction, make a turn at *this point/location, and then open and go through *that door and close it behind you. Ready?** *[Wait for response]* **[WAIT]** **Now, open the door, come out, and close the door behind you. Ready?** *[Wait for response]* **[WAIT]. Then return to *where you started following the same course and then stop.** **Location/Route/Door/Feature(s) Used:** _____ _____
2. ****Non-Carpeted Surface**	**Next, we will move onto a non-carpeted surface.** **First, starting from here travel in *this direction, make a turn at *this point/location, and then open and go through *that door and close it behind you. Ready?** *[Wait for response]* **[WAIT]** **Now, open the door, come out, and close the door behind you. Ready?** *[Wait for response]* **[WAIT]. Then return to *where you started following the same course and then stop.** **Location/Route/Door/Feature(s) Used:** _____ _____

**Provide a cumulative score for opening/closing door on a carpeted and non-carpeted surface, and entering/exiting door on a carpeted and non-carpeted surface.

SCORE	INDEPENDENCE DATA	SAFETY DATA	QUALITY DATA
3	No assists given for task initiation, continuation, or completion	**SP** = Safe practices observed	**SM** = Acceptable (Standards met)
2	**VA** = No physical assists given, **but ≤ 2** verbal assists or **≤ 2** visual assists; **or ≤ 4** verbal and visual assists given	**MR** = Minor risks evident – no assistance provided	**IP** = Acceptable (Standards met – improvement possible)
1	**V^SA** = **≤ 2** physical assists given, **but no** total assistance; **or 3** verbal assists or **3** visual assists, **or ≥ 5** verbal and visual assists given	**PH** = Risks to safety evident – assistance provided to prevent potential harm	**PM** = Marginal (Standards partially met)
0	**PA = 3** physical assists given; **or** total assistance required for task initiation, continuation, or completion	**SR** = Severe risks evident – assistance provided to prevent harm	**NM** = Unacceptable (Standards not met)

Task # 8: FEW–C : Indoor Mobility

	*Based on the **size, fit, postural support, and functional features** of the wheelchair/scooter:* **Mobility Device used during task:** ☐ Manual ☐ Power ☐ Scooter **Assistive Technology Devices (ATDs) used during task:** 1. 2. **Total # of ATDs used:** _____	**INDEPENDENCE DATA**			**SAFETY DATA**				**QUALITY DATA**				**SUMMARY SCORES**			**FEATURES**		
		Verbal Assist	Visual Assist	Physical Assist	Safe practices	Minor risk- no assist	Risk- potential harm	Severe risk- prevent harm	Standards met	SM, Improvement possible	Standards partially met:	Standards not me:	INDEPENDENCE	SAFETY	QUALITY	STABILITY	DURABILITY	DEPENDABILITY
		VA	V^{S}A	PA	SP	MR	PH	SR	SM	IP	PM	NM						
Subtasks	**FEW–C Subtasks**																	
1. **Carpeted Surface**	Travels from and returns to starting location following course identified by therapist adequately (maintains appropriate speed/propulsion for terrain, does not bump into or scrape body parts on surrounding surfaces, maintains balance, avoids obstacles) and efficiently (does not need to stop, back up, etc., controlled manner)	VA VA VA	V^{S}A V^{S}A V^{S}A	PA PA PA	SP	MR	PH	SR	SM	IP	PM	NM	3 2 1 0					
2. **Non-Carpeted Surface**	Travels from and returns to starting location following course identified by therapist adequately (maintains appropriate speed/propulsion for terrain, does not bump into or scrape body parts on surrounding surfaces, maintains balance, avoids obstacles) and efficiently (does not need to stop, back up, etc., controlled manner)	VA VA VA	V^{S}A V^{S}A V^{S}A	PA PA PA	SP	MR	PH	SR	SM	IP	PM	NM	3 2 1 0					
3. **Open/Close Door	Opens and closes door adequately (does not scrape body parts on surrounding surfaces, no damage/harm to wheelchair/scooter or surrounding surfaces, maintains balance) and efficiently (does not need to stop, back up, etc., within 1 try, controlled manner)	VA VA VA	V^{S}A V^{S}A V^{S}A	PA PA PA	SP	MR	PH	SR	SM	IP	PM	NM	3 2 1 0					
4. **Enter/Exit Door	Enters and exits door adequately (does not scrape body parts on surrounding surfaces, no damage/harm to wheelchair/scooter or surrounding surfaces, maintains balance) and efficiently (does not need to stop, back up, etc., within 1 try, controlled manner)	VA VA VA	V^{S}A V^{S}A V^{S}A	PA PA PA	SP	MR	PH	SR	SM	IP	PM	NM	3 2 1 0					

Adapted from the Performance Assessment of Self-Care Skills (PASS), Home, Version 3.1 (Rogers & Holm, © 1989, 1994); (Holm, 2001)

Additional Space for Location/Route/Door/Feature(s) Used Description:

1. **Carpeted Surface	
2. **Non-Carpeted Surface	

Task # 8: FEW–C : Indoor Mobility

Task # 9: FEW–C : Outdoor Mobility

Task Conditions:	Outdoor clinic/laboratory area. Consumer seated in wheelchair/scooter typically used to perform task, and positioned next to therapist. *Prior to starting, therapist will have identified a 3 block (1/4 mile) route that includes flat easy terrain, an inclined terrain, curb cuts/sidewalks, and flat difficult (uneven) terrain.
Instructions:	"The next task involves showing me how you get around outside while seated in your wheelchair/scooter. I will provide you with instructions before each task. Please wait until I say ***READY*** before you begin a task. If there are assistive devices you usually use for outdoor mobility, feel free to use them". *[Wait for response]*

Use provided form for additional space	**Task Instructions**
1. **Flat Easy Terrain**	**First, I want to see how you get around on a flat surface. Starting from here travel to *this point/location, and then turn around and return to where you started. Ready?** *[Wait for response]* **Location/Terrain/Feature(s) Used:** _____
2. **Inclined Easy Terrain**	**Now, show me how you move on an inclined surface (e.g., ADA compliant ramp -- 1:12 ratio -- at least 6 feet long). Starting from here travel to *this point/location, and then turn around and return to where you started. Ready?** *[Wait for response]* **Location/Terrain/Feature(s) Used:** _____
3. **Curb Cut/ Sidewalk/ Terrain Transition**	**Next, I would like to see how you negotiate a curb cut or sidewalk. Starting from here, please go down *this curb cut/sidewalk, and then turn around and come back up the curb cut/sidewalk. Ready?** *[Wait for response]* **Location/Terrain/Feature(s) Used:** _____ ☐ **Curb Cut** ☐ **Sidewalk** ☐ **Terrain Transition (e.g., even to uneven ground, grass to sidewalk)**
4. **Flat Difficult Terrain**	**The final task involves getting around on more complex terrain, such as grass, dirt, gravel, uneven sidewalk, or snow/ice lumps. Starting from here, travel to *this point/location, and then turn around and return to where you started. Ready?** *[Wait for response]* **Location/Terrain/Feature(s) Used:** _____

SCORE	INDEPENDENCE DATA	SAFETY DATA	QUALITY DATA
3	No assists given for task initiation, continuation, or completion	**SP** = Safe practices observed	**SM** = Acceptable (Standards met)
2	**VA** = No physical assists given, **but ≤ 2** verbal assists or **≤ 2** visual assists; **or ≤ 4** verbal and visual assists given	**MR** = Minor risks evident – no assistance provided	**IP** = Acceptable (Standards met – improvement possible)
1	**V^SA** = **≤ 2** physical assists given, **but no total assistance**; or **3** verbal assists **or 3** visual assists, **or ≥ 5** verbal and visual assists given	**PH** = Risks to safety evident – assistance provided to prevent potential harm	**PM** = Marginal (Standards partially met)
0	**PA = 3** physical assists given; **or** total assistance required for task initiation, continuation, or completion	**SR** = Severe risks evident – assistance provided to prevent harm	**NM** = Unacceptable (Standards not met)

Task # 9: FEW–C : Outdoor Mobility

	*Based on the **size, fit, postural support, and functional features** of the wheelchair/scooter:* **Mobility Device used during task:** ☐ Manual ☐ Power ☐ Scooter **Assistive Technology Devices (ATDs) used during task:** 1. 2. **Total # of ATDs used:** _____	**INDEPENDENCE DATA**			**SAFETY DATA**				**QUALITY DATA**				**SUMMARY SCORES**			**FEATURES**		
		Verbal Assist	Visual Assist	Physical Assist	Safe practices	Minor risk- no assist	Risk- potential harm	Severe risk- prevent harm	Standards met	SM, Improvement possible	Standards partially met	Standards not met	INDEPENDENCE	SAFETY	QUALITY	STABILITY	DURABILITY	DEPENDABILITY
		VA	V^{S}A	PA	SP	MR	PH	SR	SM	IP	PM	NM						
Subtasks	**FEW–C Subtasks**																	
1. **Flat Easy Terrain**	Travels to location identified by therapist, turns around, and returns to starting location adequately (maintains appropriate speed/ propulsion for terrain, does not bump into surrounding surfaces, maintains balance, avoids obstacles) and efficiently (does not need to stop, back up, etc., straight trajectory)	VA VA VA	V^{S}A V^{S}A V^{S}A	PA PA PA	SP	MR	PH	SR	SM	IP	PM	NM	3 2 1 0					
2. **Inclined Easy Terrain**	Travels to location identified by therapist, turns around, and returns to starting location adequately (maintains appropriate speed/ propulsion for terrain, does not bump into surrounding surfaces, maintains balance, avoids obstacles) and efficiently (does not need to stop, back up, etc., straight trajectory)	VA VA VA	V^{S}A V^{S}A V^{S}A	PA PA PA	SP	MR	PH	SR	SM	IP	PM	NM	3 2 1 0					
3. ☐ Curb Cut ☐ Sidewalk ☐ Terrain Transition	Negotiates up and down curb cut/sidewalk or over terrain transition adequately (uses enough speed/propulsion, does not bump into surrounding surfaces, maintains balance, avoids obstacles) and efficiently (does not need to stop, back up, etc., straight trajectory, controlled manner, within 1 try)	VA VA VA	V^{S}A V^{S}A V^{S}A	PA PA PA	SP	MR	PH	SR	SM	IP	PM	NM	3 2 1 0					
4. **Flat Difficult Terrain**	Travels to location identified by therapist and returns to starting location adequately (maintains appropriate speed/propulsion for terrain, does not bump into surrounding surfaces or get stopped/stuck by terrain, maintains balance, avoids obstacles) and efficiently (does not struggle excessively, controlled manner)	VA VA VA	V^{S}A V^{S}A V^{S}A	PA PA PA	SP	MR	PH	SR	SM	IP	PM	NM	3 2 1 0					

Adapted from the Performance Assessment of Self-Care Skills (PASS), Home, Version 3.1 (Rogers & Holm, © 1989, 1994); (Holm, 2001)

Additional Space for Location/Terrain:

1. Flat Easy Terrain	
2. Inclined Easy Terrain	
3. Curb Cut/ Sidewalk/ Terrain Transition	
4. Flat Difficult Terrain	

Task # 10: FEW-C: Personal/Public Transportation

Task Conditions: Begin in clinic/laboratory area.
Consumer seated in wheelchair/scooter typically used to perform task, and positioned next to therapist.

Instructions: "Next is transportation. I want you to show me how you access personal and/or public transportation, and transport your wheelchair/scooter. I will provide you with instructions before each task. Please wait until I say ***READY*** before you begin a task. If there are assistive devices you usually use for riding personal/public transportation and transporting your wheelchair/scooter, feel free to use them". *[Wait for response]*

Use provided form for additional space	**Task Instructions**
1a–c. **Personal Transportation (trans.)** ☐ Yes ☐ No	**First, take me to the vehicle you use for personal transportation. [WAIT]** **Please describe how you use this vehicle for personal transportation (i.e., enter/exit and secure/unsecure self and wheelchair/scooter)** *[Wait for response]* **Show me how you and your wheelchair/scooter get in the vehicle, and then how you secure yourself and your wheelchair/scooter for transportation. Ready?** *[Wait for response]* **[WAIT]** **Now, show me how you and your wheelchair/scooter get out of the vehicle. Ready?** *[Wait for response]* **Location/Vehicle & Wheelchair/Scooter Feature(s) Used:** _____
2a–c. **Public Transportation** ☐ Yes ☐ No	**Next, take me [follow me] to where you would catch a bus/van, or meet a public transportation vehicle. [WAIT]** **Please describe how you typically use a public transportation vehicle (i.e., enter/exit and secure/unsecure self and wheelchair/scooter)** *[Wait for response]* **When the bus/van arrives, show me how you get on the bus/van, and how you usually secure yourself and your wheelchair/scooter while riding the bus/van. Ready?** *[Wait for response]* **[WAIT]** *[N.B. ACCESS -- ask the driver to allow the consumer to show how s/he boards/secures/unsecures/exits the van. [N.B. BUS -- board the bus first and ask the driver to assist by going only 2 stops before disembarking -- or -- pay the fare and go 2 stops and disembark].* **Now, show me how you exit the bus/van in your wheelchair/scooter. Ready?** *[Wait for response]* **Location/Vehicle & Wheelchair/Scooter Feature(s) Used:** _____

SCORE	INDEPENDENCE DATA	SAFETY DATA	QUALITY DATA
3	No assists given for task initiation, continuation, or completion	**SP** = Safe practices observed	**SM** = Acceptable (Standards met)
2	**VA** = No physical assists given, **but ≤ 2** verbal assists or **≤ 2** visual assists; **or ≤ 4** verbal and visual assists given	**MR** = Minor risks evident – no assistance provided	**IP** = Acceptable (Standards met – improvement possible)
1	**V^{S}A** = **≤ 2** physical assists given, **but no** total assistance; or **3** verbal assists or **3** visual assists, **or ≥ 5** verbal and visual assists given	**PH** = Risks to safety evident – assistance provided to prevent potential harm	**PM** = Marginal (Standards partially met)
0	**PA** = **3** physical assists given; **or** total assistance required for task initiation, continuation, or completion	**SR** = Severe risks evident – assistance provided to prevent ha	**NM** = Unacceptable (Standards not met)

Task # 10: FEW–C : Personal/Public Transportation

	*Based on the **size, fit, postural support, and functional features** of the wheelchair/scooter:* **Mobility Device used during task:** ☐ Manual ☐ Power ☐ Scooter **Assistive Technology Devices (ATDs) used during task:** 1. 2. **Total # of ATDs used:** _____	INDEPENDENCE DATA			SAFETY DATA				QUALITY DATA				SUMMARY SCORES			FEATURES		
		Verbal Assist	Visual Assist	Physical Assist	Safe practices	Minor risk- no assist	Risk- potential harm	Severe risk- prevent harm	Standards met	SM, Improvement possible	Standards partially met	Standards not met	INDEPENDENCE	SAFETY	QUALITY	STABILITY	DURABILITY	DEPENDABILITY
		VA	V^{S}A	PA	SP	MR	PH	SR	SM	IP	PM	NM						
Subtasks	**FEW–C Subtasks**																	
1a. **Personal Trans.** ☐Y ☐N	(Instructs another) Moves self and wheelchair/scooter into position and enters vehicle adequately (does not bump into or scrape body parts on surrounding surfaces, maintains balance/wheel contact with surface) and efficiently (does not struggle, controlled manner)	VA VA VA	V^{S}A V^{S}A V^{S}A	PA PA PA	SP	MR	PH	SR	SM	IP	PM	NM	3 2 1 0					
1b. **Personal Trans.**	(Instructs another) Moves into position and secures self and wheelchair/scooter in vehicle adequately (does not bump into or scrape body parts on surrounding surfaces, maintains balance/wheel contact with surface) and efficiently (does not struggle, controlled manner)	VA VA VA	V^{S}A V^{S}A V^{S}A	PA PA PA	SP	MR	PH	SR	SM	IP	PM	NM	3 2 1 0					
1c. **Personal Trans.**	(Instructs another) Unsecures self and wheelchair/ scooter, moves into position and exits vehicle adequately (does not bump into or scrape body parts on surrounding surfaces, maintains balance/wheel contact with surface) and efficiently (does not struggle, controlled manner)	VA VA VA	V^{S}A V^{S}A V^{S}A	PA PA PA	SP	MR	PH	SR	SM	IP	PM	NM	3 2 1 0					
2a. **Public Trans.** ☐Y ☐N	(Instructs another) Moves self and wheelchair/scooter into position and enters bus/van adequately (does not bump into or scrape body parts on surrounding surfaces, maintains balance/wheel contact with surface) and efficiently (does not struggle, controlled manner)	VA VA VA	V^{S}A V^{S}A V^{S}A	PA PA PA	SP	MR	PH	SR	SM	IP	PM	NM	3 2 1 0					
2b. **Public Trans.**	(Instructs another) Moves into position and secures self and wheelchair/scooter in bus/van adequately (does not bump into or scrape body parts on surrounding surfaces, maintains balance/wheel contact with surface) and efficiently (does not struggle, controlled manner)	VA VA VA	V^{S}A V^{S}A V^{S}A	PA PA PA	SP	MR	PH	SR	SM	IP	PM	NM	3 2 1 0					
2c. **Public Trans.**	(Instructs another) Unsecures self and wheelchair/ scooter, moves into position and exits bus/van adequately (does not bump into or scrape body parts on surrounding surfaces, maintains balance/wheel contact with surface) and efficiently (does not struggle, controlled manner)	VA VA VA	V^{S}A V^{S}A V^{S}A	PA PA PA	SP	MR	PH	SR	SM	IP	PM	NM	3 2 1 0					

Adapted from the Performance Assessment of Self-Care Skills (PASS), Home, Version 3.1 (Rogers & Holm, © 1989, 1994); (Holm, 2001)

Task # 10: FEW–C : Personal/Public Transportation

Task Instructions & Therapist Task Guide		
3. **Personal Transportation**	**(a) Using this chart, in a typical week, how often do you drive or are driven in a personal transportation vehicle, while either seated in your wheelchair/scooter or a passenger seat?** ____ 0 ____ 1 – 3 ____ 4 – 6 ____ 7 – 9 ____ 10 – 12 ____ ≥ 13 **(b) Does your wheelchair/scooter have secure attachment points for tie-down restraints?** ☐ Yes ☐ No ☐ Not applicable **(c) What type of vehicle do you typically drive or are driven in while either seated in your wheelchair/scooter or a passenger seat?** ____ Modified vehicle with lift or ramp ____ Modified vehicle with lift or ramp, and adaptive driving technology ____ Modified vehicle with external stowing device (e.g., rooftop, under chaise, rear platform attachment) ____ Non-modified vehicle ____ Other: _____ **(d) Using this chart, based on the vehicle you typically use (same as 3c.), how much assistance do you need for you and your wheelchair/scooter to:** Enter the vehicle 5 4 3 2 1 N/A Be secured in the vehicle 5 4 3 2 1 N/A Be unsecured in the vehicle 5 4 3 2 1 N/A Exit the vehicle 5 4 3 2 1 N/A **(e) Using this chart, based only on the features of your wheelchair/scooter, not the vehicle, how safe do you feel while driving or being driven in this vehicle while seated in your wheelchair/scooter for each of the following tasks:** Entering the vehicle 6 5 4 3 2 1 N/A Being secured in the vehicle 6 5 4 3 2 1 N/A Being unsecured in the vehicle 6 5 4 3 2 1 N/A Exiting the vehicle 6 5 4 3 2 1 N/A **(f) Using this chart, based only on the features of your wheelchair/scooter, not the vehicle, how satisfied are you, even if you receive help, with how you perform the following tasks with your wheelchair/scooter:** Entering the vehicle 6 5 4 3 2 1 N/A Being secured in the vehicle 6 5 4 3 2 1 N/A Being unsecured in the vehicle 6 5 4 3 2 1 N/A Exiting the vehicle 6 5 4 3 2 1 N/A	**Using this table** *[Hand personal transportation item sheet to consumer -- point to respective tables on sheet for items 3a, d–f]* **(a) How often do you drive or are driven in a personal transportation vehicle** *[Indicate by marking provided space]* **(b) Does wheelchair/scooter have secure attachment points for tie-down restraints** *[Mark 'Yes', 'No', or 'Not applicable']* **(c) Type of vehicle typically driven or driven in** *[Indicate by marking provided space(s) -- if vehicle is not listed, write consumer response for 'Other' in provided space]* **(d) How much assistance do you need for you and your wheelchair/scooter** *[Circle consumer response]* **(e) How safe do you feel while driving or being driven in this vehicle** *[Circle consumer response]* **(f) How satisfied are you with your performance** *[Circle consumer response]*

Task # 10: FEW–C : Personal/Public Transportation

Task Instructions & Therapist Task Guide		
4. **Public Transportation**	**(a) Using this chart, in a typical week, how often do you use a public transportation vehicle, excluding a disability accessible van/bus/car (e.g., ACCESS), while either seated in your wheelchair/scooter or a passenger seat?** ____ 0 ____ 1 – 3 ____ 4 – 6 ____ 7 – 9 ____ 10 – 12 ____ ≥ 13 **(b) Using this chart, how much assistance do you need for you and your wheelchair/scooter to:** **Enter the vehicle** 5 4 3 2 1 N/A **Be secured in the vehicle** 5 4 3 2 1 N/A **Be unsecured in the vehicle** 5 4 3 2 1 N/A **Exit the vehicle** 5 4 3 2 1 N/A **(c) Using this chart, based only on the features of your wheelchair/scooter, not the vehicle, how safe do you feel while riding in a public trans. vehicle seated in your wheelchair/scooter for each of the following tasks:** **Entering the vehicle** 6 5 4 3 2 1 N/A **Being secured in the vehicle** 6 5 4 3 2 1 N/A **Being unsecured in the vehicle** 6 5 4 3 2 1 N/A **Exiting the vehicle** 6 5 4 3 2 1 N/A **(d) Using this chart, based only on the features of your wheelchair/scooter, not the vehicle, how satisfied are you, even if you receive help, with how you perform the following tasks with your wheelchair/scooter on a public trans. vehicle:** **Entering the vehicle** 6 5 4 3 2 1 N/A **Being secured in the vehicle** 6 5 4 3 2 1 N/A **Being unsecured in the vehicle** 6 5 4 3 2 1 N/A **Exiting the vehicle** 6 5 4 3 2 1 N/A	**Using this table** *[Hand public transportation item sheet to consumer -- point to respective tables on sheet for items 4a–d]* **(a) How often do you use a public transportation vehicle** *[Indicate by marking provided space]* **(b) How much assistance do you need for you and your wheelchair/scooter** *[Circle consumer response]* **(c) How safe do you feel while riding a public transportation vehicle** *[Circle consumer response]* **(d) How satisfied are you with your performance** *[Circle consumer response]*

(3a.) In a typical week, how often do you drive or are driven in a personal transportation vehicle, while either seated in your wheelchair/scooter or a passenger seat?

0 times	1 – 3 times	4 – 6 times	7 – 9 times	10 – 12 times	≥ 13 times

(3d.) Based on the vehicle you typically use, how much assistance do you need for you and your wheelchair/scooter to:

Enter the vehicle

Be secured in the vehicle

Be unsecured in the vehicle

Exit the vehicle

5	4	3	2	1
Independent/No assistance or supervision	Supervision/ Verbal Assists	Minimal Physical Assistance	Moderate Physical Assistance	Total Assist/ Dependent

(3e.) Based only on the features of your wheelchair/scooter, not the vehicle, how safe do you feel while driving or being driven in this vehicle while seated in your wheelchair/scooter for each of the following tasks:

Entering the vehicle

Being secured in the vehicle

Being unsecured in the vehicle

Exiting the vehicle

6	5	5	3	2	1
Completely Safe	Mostly Safe	Slightly Safe	Slightly Unsafe	Mostly Unsafe	Completely Unsafe

(3f.) Based only on the features of your wheelchair/scooter, not the vehicle, how satisfied are you, even if you receive help, with how you perform the following tasks with your wheelchair/scooter:

6	5	5	3	2	1
Completely Satisfied	Mostly Satisfied	Slightly Satisfied	Slightly Unsatisfied	Mostly Unsatisfied	Completely Unsatisfied

Task # 10: FEW–C : Personal/Public Transportation

(4a.) In a typical week, how often do you how often do you ride in a public transportation vehicle, excluding a disability accessible van/bus/car (e.g., ACCESS), while either seated in your wheelchair/scooter or a passenger seat?

0 times	1 – 3 times	4 – 6 times	7 – 9 times	10 – 12 times	≥ 13 times

(4b.) How much assistance do you need for you and your wheelchair/scooter to:

Enter the vehicle

Be secured in the vehicle

Be unsecured in the vehicle

Exit the vehicle

5	4	3	2	1
Independent/No assistance or supervision	Supervision/ Verbal Assists	Minimal Physical Assistance	Moderate Physical Assistance	Total Assist/ Dependent

(4c.) Based only on the features of your wheelchair/scooter, not the vehicle, how safe do you feel while riding in a public trans. vehicle seated in your wheelchair/scooter for each of the following tasks:

Entering the vehicle

Being secured in the vehicle

Being unsecured in the vehicle

Exiting the vehicle

6	5	5	3	2	1
Completely Safe	Mostly Safe	Slightly Safe	Slightly Unsafe	Mostly Unsafe	Completely Unsafe

(4d.) Based only on the features of your wheelchair/scooter, not the vehicle, how satisfied are you, even if you receive help, with how you perform the following tasks with your wheelchair/scooter on a public trans. vehicle:

6	5	5	3	2	1
Completely Satisfied	Mostly Satisfied	Slightly Satisfied	Slightly Unsatisfied	Mostly Unsatisfied	Completely Unsatisfied

Task # 10: FEW–C : Personal/Public Transportation

APPENDIX E

Table of Contents of the FEW Manual

The Functioning Everyday with a Wheelchair (FEW) Outcomes Measures

Therapist Task Guide

APPENDIX F

Functional Abilities in a Wheelchair (FAW)

Functional Abilities in a Wheelchair (FAW)

DIRECTIONS: Please answer the following 10 questions by **placing an 'X' in the box under the response** (completely agree, mostly agree, slightly agree, etc.) that best matches your ability to function without assistance while seated in your wheelchair/scooter. All examples may not apply to you, and there may be tasks you perform that are not listed. **Mark each question only one time.** If you answer, ***slightly, *mostly, or *completely disagree for any question,** please **write the reason for your disagreement in the Comments section.**

	Completely Agree	Mostly Agree	Slightly Agree	*Slightly Disagree	*Mostly Disagree	*Completely Disagree	Does not apply
1. While in my wheelchair/scooter and without assistance from others, I can carry out my daily routine: *(e.g., tasks I want to do, need to do, am required to do- when and where needed)*							
Comments:							
2. While in my wheelchair/scooter and without assistance from others, I can meet my comfort needs: *(e.g., heat/moisture, sitting tolerance, pain, stability)*							
Comments:							
3. While in my wheelchair/scooter and without assistance from others, I can meet my health needs: *(e.g., pressure sores, breathing, edema control, medical equipment)*							
Comments:							
4. While in my wheelchair/scooter and without assistance from others, I can operate it: *(e.g., do what I want it to do when and where I want to do it)*							
Comments:							
5. While in my wheelchair/scooter and without assistance from others, I can reach and carry out tasks at different surface heights: *(e.g., table, counters, floors, shelves)*							
Comments:							

Subject Code: _____

	Completely Agree	Mostly Agree	Slightly Agree	*Slightly Disagree	*Mostly Disagree	*Completely Disagree	Does not apply
6. While in my wheelchair/scooter and without assistance from others, I can <u>transfer</u> from one surface to another: *(e.g., bed, toilet, chair)*							
Comments:							
7. While in my wheelchair/scooter and without assistance from others, I can <u>carry out personal care tasks</u>: *(e.g., dressing, bowel/bladder care, eating, hygiene)*							
Comments:							
8. While in my wheelchair/scooter and without assistance from others, I can <u>get around indoors</u>: *(e.g., home, work, mall, restaurants, ramps, obstacles)*							
Comments:							
9. While in my wheelchair/scooter and without assistance from others, I can <u>get around outdoors</u>: *(e.g., uneven surfaces, dirt, grass, gravel, ramps, obstacles)*							
Comments:							
10. While in my wheelchair/scooter and without assistance from others, I can <u>use personal or public transportation</u>: *(e.g., secure, stow, ride)*							
Comments:							

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