Objective. This quantitative study describes the transition from manual to powered mobility and its influence on occupational performance (organization of daily tasks, assumption of responsibility, roles, interests) and feelings of competence, adaptability, and self-esteem.

Method. The Occupational Performance History Interview (OPHI) was used with a convenience sample of 8 participants with both static and progressive conditions to measure retrospectively changes in occupational performance after the change from a manual wheelchair to a powered mobility device (PMD). The Psychosocial Impact of Assistive Device Scale (PIADS) was used to measure participants’ perceptions of the impact of the PMD on their competence, adaptability, and self-esteem.

Results. A comparison of the pretest and posttest means on the OPHI scores showed a significant improvement in occupational performance (p = .001) after the introduction of PMDs. The PIADS scores showed a positive impact of 2 or greater for 75% of the participants on 19 of 26 items. Scores were similar to scores in a PIADS database of persons with comparable conditions. No significant relationship between occupational performance and psychosocial impact was demonstrated.

Conclusion. Results suggest that the transition to a PMD enhances occupational performance, competence, adaptability, and self-esteem for persons with severe mobility impairments.


Persons who use wheeled mobility devices rely on them to move independently in their surroundings, engage in meaningful activities, and enact the roles of their everyday lives. These components of everyday life are possible when persons with disabilities use mobility devices matched to their specific needs and environments (Scherer, 1996; Verbrugge, Rennert & Madans, 1997). Persons with complex or progressive impairments who are unable to use manual wheelchairs can use powered mobility devices (PMDs) to gain independent mobility (Schmeler, 1995; Trefler & Taylor, 1987). Having the appropriate mobility device may significantly affect how persons with disabilities experience their worlds and the people and objects encountered within their lives.

The literature describing and quantifying the impact of mobility devices on quality of life is limited. Verbrugge et al. (1997) investigated the impact of reduced mobility on a sample of noninstitutionalized adults (N = 1,164) living in the United States. Participants in this study preferred using mobility equipment over human assistance to complete functional tasks. They reported that mobility equip-
ment helped to maintain autonomy and self-sufficiency, both of which they believed were relinquished when they required human assistance. Persons with equipment-supported mobility demonstrated increased performance and satisfaction with daily living tasks.

Trefler, Hobson, Taylor, Monahan, and Shaw (1993) advocated the use of powered mobility for persons with borderline manual propulsion skills as a means to conserve energy and increase efficiency during daily activities. Optimizing mobility enables persons to perform desired tasks efficiently, with attention focused appropriately on the task or outcome rather than on the means of mobility. According to Warren (1990), moving around under one's own volition is the foundation for a lifestyle of independence and self-initiated behaviors. This concept of independence was supported in an ethnographic study of 11 Canadian users of powered mobility (Miles-Tapping & MacDonald, 1994). The investigators uncovered themes of self-direction and empowerment as participants described using powered mobility to facilitate work, leisure, and family pursuits and conserve energy for self-care.

Approximately 100,000 powered wheelchair and 60,000 scooter users live in the United States compared with 1.4 million full-time manual wheelchair users (Jones & Sanford, 1996). Improvements in PMDs in the past 5 years have led to increased use by persons with disabilities (Cooper, 1998). Digital controllers and batteries have increased the PMDs' travel range and dependability. The current price for an entry-level powered wheelchair is approximately $6,000, and the price for a scooter is $2,100. A variety of user interfaces permit persons with significant impairments or limited motor control to drive PMDs (Cooper, 1998; Cooper & Barnes, 1994).

Users make the transition from manual to powered mobility primarily for one of two reasons. Advances in medical care allow many persons with progressive impairments to survive into the later stages of their disease. When they reach a point where they lack the strength needed to self-propel manual wheelchairs, many transition to PMDs. Others who make this transition are persons with nonprogressive impairments who have experienced overuse symptoms and cumulative trauma disorders as a result of long-term wheelchair propulsion (Cooper, 1998). For example, wheelchair users at an average of 15 years post–spinal cord injury are seeking treatment for shoulder, wrist, and hand pain, resulting in experiences of functional task limitations pertinent to life roles and forcing them to transition to powered mobility (Pentland & Twomey, 1991).

The transition from manual wheelchairs to PMDs may not be viewed initially as providing more freedom (Gallagher, 1992; Holicky, 1996; Spruill, 1997). Users describe the transition as something that they resisted and accepted only with great reluctance. These persons view the PMD as a symbol of lost function or greater disability. Additionally, the transition represented the loss of a familiar and trusted means of mobility that had been incorporated into daily routines and self-images.

PMDs can restore independent mobility, yet they require complex adjustments in the human and nonhuman environments. Batteries require frequent charging, and the sophisticated technology in motors and controllers must be maintained and adjusted. PMDs are larger and heavier than manual wheelchairs. The environments in which they are used must provide sufficient turning space, ramped entrances, and transportation systems that include power lifts and tie-downs. Whether the advantage of independent powered mobility offsets the need for these changes in both human and nonhuman environments is not always clear.

The transition to a PMD exemplifies a new model for reducing disability—the Person Environment Interaction Model (Brandt & Pope, 1997). This model uses a “flexible mat” to represent a person's physical and social environment. The more significant the person's disability, the further he or she sinks into the mat, thus representing the degree of functional disadvantage. When assistive devices or environmental modifications are added, the mat is given greater resilience that counteracts the deflection caused by disability. The increased resilience represents the effect of adaptive environments. Occupational therapy practice has traditionally included the appropriate use of assistive devices in combination with adaptive environments and social supports to sharply reduce functional limitations and support engagement in the occupations of work, rest, play, and self-care (American Occupational Therapy Association, 1995).

In an effort to study the perceived impact of powered mobility on occupational performance, this study focused on persons who transitioned from manual to powered mobility. The purpose of this study was to describe how powered mobility, in contrast to manual mobility, is perceived to change organization of daily life, role performance, and quality of life. The study explored three research questions:

1. Is transition to a PMD perceived to enhance occupational performance (the ability to assume or resume personally valued responsibilities, interests, roles)?
2. Is the nonhuman environment more adaptive after introducing a PMD?
3. Do users describe increased feelings of competence, adaptability, and self-esteem when using a PMD?

Method
Participants
The study criteria required participants to be at least 21 years of age, have previously used a manual wheelchair, have received their first PMD at least 6 months but not
more than 24 months before the start of the study, and have a condition that caused them to be unable to propel a manual wheelchair as their primary mobility device. The criterion of receiving their powered wheelchair within 6 to 24 months was chosen to ensure that participants were able to remember their level of function before receiving a PMD and to compare that state to their current level of function. Because the data collection format was a structured interview, participants also needed sufficient language skills and cognitive ability to recall and describe their lives over the past 2 years. Participants were also required to be living in the community (not in a long-term-care facility) so that their reports would reflect the daily routines, responsibilities, roles, and interests of community-living adults. Finally, to reduce unforeseen risks and interference from extraneous health-related variables, participants could not be under the care of a physician for an acute illness at the time of the study.

The participants were 8 adults (4 men, 4 women) between 27 and 52 years of age who had used outpatient services from a center for assistive technology and had received a PMD within the previous 6 to 24 months. Diagnosed conditions included spinal cord injury (n = 2), muscular dystrophy (n = 2), multiple sclerosis (n = 2), cardiopulmonary insufficiency (n = 1), and traumatic brain injury (n = 1). All participants lived within a 100-mile radius of a northeastern city in the United States.

A convenience sample of 16 persons who met study criteria was contacted about the study by a mailing (a cover letter and postcard) from their assistive technology provider. Nine potential participants returned postcards, indicating their interest in the study, and all were called within 5 days to confirm that they met study criteria. One did not meet the criterion of previously using a manual wheelchair and, therefore, was excluded. Human subject protection procedures were followed and informed consent was obtained before initiation of the interview.

Procedure

The first author, an occupational therapist experienced with interview techniques, modifications for wheelchair access, and strategies for adapting daily living tasks, interviewed each participant once. The interviewer had not previously met or worked with the participants. Each 1-hr interview followed a script of preset questions in order to compare interviews later. Questions were adapted for PMD use and based on sample probes from the Occupational Performance History Interview (OPHI; Kielhofner & Henry, 1988). After the structured interview, a 15-item questionnaire collected demographic data, reason for mobility device change, and satisfaction with manual and PMDs. Finally, the Psychosocial Impact of Assistive Device Scale (PIADS; Day & Jutai, 1996; Jutai, Ladak, Schuller, Nauman, & Wright, 1996) was administered. Study participants were asked to reflect on their use of a PMD and rate its impact. The 15-item questionnaire and PIADS required 10 min.

Six participants were interviewed in their homes, 1 in a vocational training facility, and 1 at a workplace. Immediately following each encounter, the interviewer transcribed her handwritten notes with a word processor and scored the OPHI and PIADS. The transcribed notes were later read and discussed by three occupational therapists experienced in assistive technology practice for the purpose of identifying common or recurring themes.

Instruments

The OPHI was used to structure and rate each participant’s interview responses because it has the capacity for retrospective comparison of daily life before and after a demarcation event. Questions focus on the participant’s behavior in both the past and the present in the following five areas: (a) organization of daily living routines; (b) life roles; (c) interests, values, and goals; (d) perception of ability and assumption of responsibility; and (e) influences of the human and nonhuman environment on his or her daily activities and performances. Responses are transformed into numerical scores ranging from 1 (maladaptive) to 5 (adaptive). A past and present score are given for each area, with a possible total score of 10 to 50. The demarcation event for this study was the introduction of a PMD.

The interrater reliability for the OPHI is reported as .77 for past ratings and .55 for present ratings (Kielhofner & Henry, 1988) when raters agreed on demarcating events and interpreted interview responses using the same frame of reference. The lower reliability for present was attributed to both the presence of less information about adaptation in the present than the past and the influence of present events on the quality of the respondent’s historical report. In this study, the interviews were interpreted using the occupational behavior frame of reference (Kielhofner, 1985), which offers higher reliability for the instrument. Validity estimates are not reported. A recent revision of this instrument as the OPHI-II (Kielhofner et al., 1998) was not available at the time of this study.

The PIADS is a self-report paper-and-pencil tool designed to measure the psychosocial impact of assistive device use on 26 characteristics of self within 3 domains: competence, adaptability, and self-esteem. The possible score for each characteristic ranges from –3 to +3; a score of 0 indicates that the assistive device made no difference (no increase or decrease) in the characteristic. In this study, the assistive device was a PMD. At present, the PIADS is undergoing validity studies. Test–retest reliability is very high: The reliability coefficient of the PIADS is high (Cronbach’s alpha = .95), and the split-half reliability of the data is also high (Guttman split-half = .89) (Day & Jutai, 1996).
Descriptive statistics were calculated for the 8 participants. The first and second research questions regarding change from past to present scores on both the total scores and the partial human and nonhuman environment scores were tested with the nonparametric Wilcoxon signed rank tests. These tests, equivalent to the related-samples t test, tested the ordinal before-and-after scores on the OPHI for this small, heterogeneous sample ($\alpha = .05$) (Huck & Cormier, 1996). A Spearman rank order correlation between the posttest score on the OPHI and the summed PIADS score was calculated to test the third question regarding the relationship between occupational performance and the psychosocial impact of a PMD. Using the database at the Bloorview MacMillan Centre, we compared the PIADS results with those for other PMD users with similar conditions.

Three additional occupational therapists with expertise in assistive technology service delivery independently read each interview narrative for the purpose of identifying common themes. Narratives contained both responses to interview questions and descriptions of the participant's human and nonhuman environments that were based on the interviewer's observations in the interview setting. A 2-hr, tape-recorded work session was held in which the interviewer and the occupational therapist experts discussed the stories. The authors referred to the tape to confirm the accuracy of discussion notes. The common themes identified by this group are presented in the results section of this article.

Results

Descriptive data of the participants are reported in Table 1. Occupational therapists experienced in mobility interventions had assessed all participants before they received their PMDs. The manual wheelchair ratings of satisfaction varied widely (see Table 1), with a mean satisfaction score of 4.69 on a 5-point Likert scale. Satisfaction ratings of PMDs may have been elevated because they were relatively new and, thus, reliable and free of electromechanical problems.

**OPHI Results**

For all participants, the mean OPHI past score (perceptions of occupational performance before receiving a PMD) was 34.9, and the mean OPHI present score (after receiving a PMD) was 43.6. Wilcoxon signed rank tests revealed that the scores were significantly different ($T = 0$, $p = .001$), with $T$ equal to the sum of the ranks of the differences with the less frequent sign. In this case, all differences were positive or in the same direction (Huck & Cormier, 1996). With the assisted mobility means, role performance for participants with progressive conditions did not diminish. These participants described continued ability to perform roles despite neuromuscular losses that led to the use of powered mobility.

One portion of the OPHI rates the contribution of the human and nonhuman environments to occupational performance, so it was of particular interest because successful PMD use is interdependent with the human and nonhuman environments. The past and present scores for the nonhuman environment subtests also were analyzed with the Wilcoxon signed rank tests and were found to be significantly different ($T = 0$, $p = .001$). This difference supports the idea that PMDs offer a more adaptive nonhuman environment.

**PIADS Results**

A positive response to the study's third question regarding a correlation between the present scores on the OPHI and the scores on the PIADS was not supported by Spearman rank order correlations ($r = .21$) probably because of the small data set. However, independent of this correlation, PIADS scores showed that PMDs had a perceived positive impact on adaptability, competence, and self-esteem subscores. Scores for each of the 26 items on the PIADS are shown in Table 2. A score of ±2 meant that the characteristics somewhat increased or decreased. A score of ±3 meant that the item increased or decreased very much. The small number of scores in the present study were compared with scores of PMD users in the Bloorview MacMillan database, which contains normative data for the PIADS. The comparison showed that the pattern of mean scores for the present study was, on average, similar to scores in the database for persons with similar conditions who had also reported on the impact of using a PMD (J. Jutai, personal communication, June 2, 1999).

The PIADS data show the characteristics that participants perceive are positively or negatively affected by the use of the PMD. Overall, they reported positive psychosocial impact from using PMDs. At least 75% gave a score of 2 or greater on 19 of the 26 items. The items that 100% of the participants rated as 2 or greater when using PMDs were independence, adequacy, quality of life, ability to adapt to the activities of daily living, and ability to take advantage of opportunities.
The experiences of 2 participants are provided for illustration. With powered mobility, Participant 6, a young mother with paraplegia, was more independent in her role as mother. Her PMD allowed her to go to the zoo (a very hilly location) and enjoy herself with her two young daughters. She no longer had to plan ahead and invite another person along to push her manual wheelchair.

Participant 8, an attorney, added productive time to each workday. His PMD increased his efficiency, and he gained 20 min on each trip to the courthouse from his office. This extra time, which was previously spent propelling his manual wheelchair, could be used for legal advocacy work to which he was deeply committed. He was also able to extend his workday when his caseload demanded. Previously with his manual wheelchair, he was constrained by the need to catch a particular bus at the end of the day. Its route stopped at the uphill end of his street and allowed him to easily coast downhill to his home. However, with the PMD, he was able to use several other buses that stopped at the downhill end of his street. This flexibility in transportation allowed him to remain in his office later in the day to attend a meeting or to finish a legal brief.

Some participants indicated that they were beginning to assume new roles facilitated by PMD use. Again, Participants 6 and 8 provide illustration. As a teen, Participant 6 had engaged in high-risk behavior that led to her injury. She subsequently married and gave birth to two girls in rapid succession. The repetitive stress of wheelchair propulsion caused carpal tunnel syndrome, making a powered chair necessary. The subsequent exposure to medical and community resources and services caused her to think anew about an old dream—obtaining an engineering degree. The increased efficiency provided by her PMD along with adaptive strategies for child care permitted her to complete pre-engineering course work at a community college. She anticipates transferring to a nearby university soon.

The wife of Participant 8 had a baby at the same time that the PMD was delivered. The PMD allowed him to share in child care responsibilities. He took on the role of picking up their son from day-care, taking him on his lap for walks in the park, and caring for him until his wife came home from work. Before using the PMD, he had never gone grocery shopping, but with the PMD, he assumed this task, allowing his wife to spend some quality time with their child.

**Discussion**

The OPHI and PIADS results for this small sample support the idea that use of a PMD has positive consequences. The use of a PMD enables occupational performance as indicated by increased ability to assume or resume personally valued responsibilities, interests, and roles. PMDs not only made the nonhuman environment more adaptive for the participants, but also, on average, increased their feelings of competence, adaptability, and self-esteem.

Use of assistive technology devices, such as PMDs, as told by the participants, demonstrate that the Person Environment Interaction Model accurately represents reducing the impact of disability (Brandt & Pope, 1997). Repeatedly, PMDs contributed to creating a “more resilient

### Table 2

**Results on the Psychosocial Impact of Assistive Device Scale**

<table>
<thead>
<tr>
<th>Competence</th>
<th>% &gt;2</th>
<th>Adaptability</th>
<th>% &gt;2</th>
<th>Self-Esteem</th>
<th>% &gt;2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competence</td>
<td>75</td>
<td>Well-being</td>
<td>50</td>
<td>Happiness</td>
<td>88</td>
</tr>
<tr>
<td>Independence</td>
<td>100</td>
<td>Willingness to take chances</td>
<td>75</td>
<td>Self-esteem</td>
<td>63</td>
</tr>
<tr>
<td>Adequacy</td>
<td>100</td>
<td>Ability to participate</td>
<td>75</td>
<td>Security</td>
<td>50</td>
</tr>
<tr>
<td>Confusion</td>
<td>25</td>
<td>Eagerness to try new things</td>
<td>75</td>
<td>Frustration</td>
<td>50</td>
</tr>
<tr>
<td>Efficiency</td>
<td>75</td>
<td>Ability to adapt to the ADL</td>
<td>100</td>
<td>Sense of power</td>
<td>75</td>
</tr>
<tr>
<td>Productivity</td>
<td>88</td>
<td>Ability to take advantage of opportunities</td>
<td>100</td>
<td>Sense of control</td>
<td>75</td>
</tr>
<tr>
<td>Usefulness</td>
<td>88</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expertise</td>
<td>38</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skillfulness</td>
<td>75</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capability</td>
<td>75</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quality of life</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Performance</td>
<td>88</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. The scores reflect the self-reported impact of a powered mobility device on 26 items in 3 constructs. The results for the 8 participants are shown as the percentage of responses that were 2 (or –2) or greater. A score of 2 means “somewhat increased” (or “decreased”). ADL = activities of daily living.

*a*Items scored with a negative number to show improvement.
Limitations and Directions for Future Research

The limitations of this pilot study should be dealt with by selecting a larger and more homogeneous sample. Larger sample size will reduce variability and allow the use of a random selection procedure, thus increasing the external validity. A larger study that requires the use of more than one rater would make it important to establish interrater reliability on the assignment of numerical values to the OPHI data and to consider using the OPHI-II, which has simplified scoring. A more homogeneous sample (i.e., involving participants with either static or progressive conditions) will increase internal validity. Homogeneous diagnostic groups will control for variables related to onset of loss of manual self-propulsion or other losses or factors that affect occupational performance.

Future work should also control for differences in lapsed time between the transition to a PMD and interview in order to reduce threats to recall of manual wheelchair experiences. Scheduling study interviews for exactly 6 months posttransition would control for differences related to selective memory and variance in amount of time spent using a PMD. The transition from manual to powered mobility might be more objectively and completely investigated through a prospective study. If manual wheelchair users were followed longitudinally and their occupational performance assessed periodically, those making the transition to powered mobility might be identified and interviewed about their occupational performance just before the transition.

Conclusion

All participants were highly motivated to share their stories about the contribution of PMDs to daily life. They were enthusiastic about PMDs as an adaptation of task and environment that enabled them to perform valued occupations. People are empowered to seize, take possession of, or occupy the spaces, time, and roles of their lives when occupational performance is enabled (Fisher, 1998).

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