W.C. MILLER (Convener). Wheelchair mobility in older adults. Are we ready to roll? Gerontechnology 2010;9(2):137; doi:10.4017/gt.2010.09.02.067.00 **Participants**: *W.B. MORTENSON (CANADA), C. AUGER (CANADA), C. SMITH (CANADA), P. RUSHTON (CANADA),* and *P. VISWANATHAN (CANADA)* **ISSUE** The number of Canadians living with mobility impairments will grow exponentially over the next four decades as baby boomers age. Wheelchairs, perhaps the most recognized form of rehabilitation assistive technology, will become the primary source of mobility for many of these individuals. Although these devices have the potential to improve mobility, facilitate social participation and improve quality of life, frequently they do not to meet the needs of wheelchair users. Anecdotal evidence suggests that the judicious use of these devices can be compromised by decreased cognition, confidence, functional ability, as well as insufficient training, but little empirical evidence has been published about this form of assistive technology. **CONTENT** Findings from a recent series of graduate trainee research projects will be provided by 5 investigators representing different regions across Canada. The objectives for the symposium are to provide participants with insight into; (i) the use of the wheelchair by residential and community living older adults, including barriers and facilitators of use (ii) a clinical approach designed to improve the wheelchair skill of older residents of a nursing home; (iii) a newly identified construct, wheelchair use confidence, that may act as a barrier to independent wheelchair use; and (iv) new technology that may promote independent wheelchair use in older adults with dementia. **STRUCTURE** Each speaker will present a brief overview of their research findings and then the convenor will lead an audience oriented discussion to engage in dialogue about the future of wheeled mobility research among older adults. Drawing upon quantitative and qualitative data Mortenson will present insights for the barriers and facilitators of wheelchair mobility among older adults who live in residential care. Auger will provide an overview of how community-living older Canadians use their power mobility devices in various environments, presenting insight into the differences between new and experienced users. Smith will discuss lessons learned from a clinical trial designed to improve wheelchair skills among older residential-living Canadians. Rushton will present data regarding the prevalence of low confidence with wheelchair use among adult wheelchair users. Finally, Viswanathan will review advances made in the field of engineering and computer science with respect to the development of new 'smart' wheelchair technology which can learn about the environment and collaboratively work with the wheelchair user to promote independent mobility. **CONCLUSION** Developing a better understanding of wheeled mobility among older adults will better enable policy and practice changes improve outcomes among this population and insure their needs are met in the future.
Keywords: wheelchair, aging, mobility, smart technology, training.
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W.B. MORTENSON, W.C. MILLER, J.L. OLIFFE, C.L. BACKMAN. Wheelchair mobility among facility residents: Perils, pitfalls and promises. Gerontechnology 2010;9(2):137-138;
doi:10.4017/gt.2010.09.02.068.00 **Purpose** Most individuals in residential care in North America use wheelchairs as their primary means of mobility[1]. Despite the promise of these devices, the equipment they receive is often inadequate and their use by staff may constrain rather than facilitate resident mobility. With the aim of identifying areas suitable for intervention, a mixed

methods research project was conducted to identify and better understand predictors of wheelchair mobility in this understudied vulnerable population. **Method** To contextualize and help identify variables for the quantitative phase of the study a preliminary ethnographic study was undertaken. Over a six month period, 16 residents (and/or their family members) from two facilities were interviewed on three separate occasions about their experiences of wheelchair mobility and were observed using their wheelchairs inside and outside their facilities. To identify predictors of wheelchair mobility a cross-sectional study was undertaken with 268 residents from 11 facilities. This study included 149 self-responding individuals and 119 residents who required proxy respondents. Subjects were administered a variety of standardized measures, and socio-demographic and wheelchair related data were collected. Mobility was measured using the Nursing Home Life Space Diameter measure[2], which quantifies the frequency, independence and extent of residents' indoor and outdoor mobility. **Results & Discussion** In the first phase of the research a wide range of potential variables were identified. Some of these variables, such as wheelchair fit and accessibility were previously documented, while others, such as family support and smoking (which required residents to go outside the facility) were novel. In the second phase of the research, subjects had a mean age of 84 years and 69% were women. Most residents (59%) required seating intervention to address issues such as discomfort, sliding and difficulty propelling; 84% of self-responding residents, but only 37% of proxy respondents, were independently mobile on their units; and 14% of proxy respondents had wheelchairs that could not be self-propelled and 42% had a seat-belt that could not be self-released. Regression models accounted for 48% of the variance in mobility for all subjects. In descending order of importance, the significant predictors of mobility were wheelchair skills, functional independence, and having four or more visits per week from friends or family. This research identifies a number of important wheelchair related issues in these facilities. Most residents would benefit from changes to make their wheelchairs more appropriate and the prevalence of restraint use needs consideration. The effectiveness of a wheelchair skills training program for promoting mobility could be explored in a future intervention study.

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C. AUGER, L. DEMERS, I. GÉLINAS, W.C. MILLER, J. JUTAI, L. NOREAU, M. DEPA. Power mobility use among community living older Canadians: Predicting the impact on new and experienced users. Gerontechnology 2010;9(2):138-139; doi:10.4017/gt.2010.09.02.069.00 **Purpose** For a growing number of older adults, power mobility devices (PMDs), which include power wheelchairs (PWCs) and, more recently, scooters, represent the only alternative to independent mobility, since 59-76% of those above 65 years of age cannot self-propel manual wheelchairs[1]. Life-space mobility[2], defined as the area through which a person moves over a period of time, has been used to characterize how far, how often and with what type of assistance older adults move around in a continuum of environments. To address the effect of PMDs through life-space mobility, it is important to consider a developmental 'time-dependent' framework[3,4], where the stage covering the first six months after device procurement corresponds to an initiation period, and the stage beyond the first year delineates expert use. To date, no study has examined how the stage of PMD use relates to life-space mobility for middle-aged and older adults. The purpose of this study was to: (i) examine the life-space mobility of middle-aged and older adults from initial (1 to 6 months) to expert use (12 to 18 months) in comparison to a reference group of non-users and (ii) explore the factors associated to greater life-space mobility. **Method** A random sample of 116 middle-aged and older adults (50-89 years), who used a powered wheelchair or a scooter, was recruited from four Canadian rehabilitation centers. A multi-cohort was designed by grouping respondents by their stage of PMD

use [reference group (Wait-list; n=42), Initial users (1-6 months; n=35) and experienced users (12-18 months; n=39)]. The cohorts were compared with respect to life-space mobility [Life-Space Assessment composite score (LSC)[2]] over a continuum of environments ranging from inside their home, to out of town using analysis of variance and chi-square tests. Baseline personal, assistive device, intervention and environmental factors associated with life-space mobility were explored with age-adjusted linear regression models. **Results & Discussion** Cohort comparisons revealed higher frequency of outings for PMD users within the neighbourhood ($p<0.001$) and around home ($p<0.05$). Significantly greater LSC scores were observed for initial and expert users compared to the reference group ($p<0.05$), but no significant difference was found between initial and expert users. Factors such as gender, the nature of activities and device type explained variance in LSC ranging from 15.9-18.0% ($p<0.006$). Life-space mobility increases after PMD procurement and appears to be stable across the stages of initial and expert use. To appreciate the impact of PMDs, clinicians should consider the environment and a combination of personal and device factors that are associated to the range of life-space mobility in the first 18 months of use.

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C. SMITH, R.L. KIRBY. Manual wheelchair skills training in a long-term care facility: Lessons learned. Gerontechnology 2010;9(2):139-140; doi:10.4017/gt.2010.09.02.070.00 **Purpose** Operating a manual wheelchair requires individuals to acquire new skills. Evidence suggests that learning how to operate a wheelchair using a systematic approach, based on motor learning principles leads to improved skill performance and safe wheeling capability. However, no studies have looked at the effectiveness of using such an approach with older adults who live in a long-term care facility. In most facilities, more than 50% of residents use a wheelchair[1], however, little time is spent training these individuals on the proper use of their wheelchairs. Logically, these residents represent a large population who may benefit from a training program. The purpose of this presentation is to report the lessons learned from a study designed to evaluate the safety and efficacy of the Wheelchair Skills Training Program[2] with older, manual wheelchair users who reside in long-term care. **Method** A randomized controlled trial was designed for a veterans' facility. The study began with a pre-training Wheelchair Skills Test (WST)[3]. Twenty-four (24) participants were to move through a training or usual-care phase, WST post-test and follow-up survey. **Results & Discussion** After 15 months, the study was stopped. Thirty-five (35) individuals were interested in the study. Thirteen (13) participants completed at least part of the pre-training WST. One participant completed all stages of the study. The most common reasons for not completing the study were illness and death. Many participants reported enjoying the testing and training and associated challenges. There was greater variability in total percentage scores for performance, than the total percentage score for safety. The training was safe. In spite of the feasibility information gathered prior to the study, the health and scheduling challenges of the participants were underestimated. Greater insight into the population was gained and alternative methods of delivering training to long-term residents were suggested. Modifications for both the clinical and research setting were developed. Further research is needed to investigate the feasibility and benefits of these modifications, such as incorporating meaningful, brief training sessions into existing recreational activities.

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P.W. RUSHTON, W.C. MILLER. Confidence with wheelchair use. Gerontechnology 2010;9(1): 140; doi:10.4017/gt.2010.09.02.071.00 **Purpose** Self-efficacy, which focuses on the individual's personal beliefs about their ability to perform a given task[1], offers a theoretical construct with which to develop assessments and interventions in rehabilitation. Recently, the Wheelchair Use Confidence Assessment (WUCA) was developed using a mixed methods, sequential research design, that incorporated semi-structured interviews and a Delphi survey. The 62-item WUCA measures confidence using a 1 (not confident) to 100 (completely confident) scale. It provides us with the opportunity to assess confidence with manual wheelchair use to estimate the seriousness of this potentially modifiable invisible barrier to manual wheelchair use. The purpose of this research was to assess the prevalence of low confidence with manual wheelchair use and describe its relationship to other variables of interest such as age, sex and wheelchair skill. **Method** Cross-sectional data was used to address the study objective. Adult manual wheelchair users who have no, or minimal, cognitive impairment, have used a manual wheelchair for at least 6 months, and reside in one community were recruited for this study. After screening for cognitive impairments, the subjects were asked to provide demographic and clinically relevant information. Next, the subjects completed the WUCA followed by other measures that included the Wheelchair Skills Test (WST) and the Wheelchair Skills Test Questionnaire (WST-Q) version. **Results & Discussion** Fifty-three subjects were enrolled. The mean age of the mostly male (60%) sample was 49.5±15.7 (range 21-94). The mean time spent using a wheelchair was 14.0±12.0 years. The distribution of WUCA scores ranged from 40-100 with a mean score of 80±4.0. Thirty-eight percent of the subjects reported a WUCA of <80 indicating low confidence. The mean WUCA scores for subjects with low confidence versus high confidence (≥80 on the WUCA) were 66±1.4 and 89±5.8 , respectively ($p<0.01$). Interestingly, there were no differences between the two groups with respect to age and sex. Subjects reporting low confidence obtained a statistically significant ($p<0.05$) lower score on the WST and WST-Q. This study indicates that low confidence with wheelchair use is present in a large number of our sample. Low wheelchair mobility confidence may impact participation in daily and social activities. Having the ability to measure confidence will enable clinicians to provide novel interventions to individuals who may benefit from such rehabilitation. Improvement of confidence with wheelchair use will, in turn, impact an individual's ability to perform their chosen activities thereby improving their quality of life.

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P. VISWANATHAN, J.J. LITTLE, A.K. MACKWORTH, A. MIHAILIDIS. The future of power mobility: Intelligent wheelchairs. Gerontechnology 2010;9(2):140-141; doi:10.4017/gt.2010.09.02.072.00 **Purpose** Power wheelchairs are commonly prescribed to enhance mobility in the older adult population. However, safe operation of these wheelchairs requires drivers to have minimal cognitive impairment. In almost all cases, older adults with significant cognitive impairment are not prescribed a power wheelchair resulting in reduced mobility, increased dependence on

caregivers, and a decreased quality of life. In order to address this problem, we are developing an intelligent wheelchair that can automatically detect obstacles in the driver's path and prevent collisions. In addition, our system will enable users to navigate to desired destinations in a timely fashion, by issuing adaptive audio prompts. We have shown that a stereovision camera can be used for obstacle avoidance[1]. Preliminary work has also been completed in using floor plans of homes and the objects recognized within them to automatically label specific regions of interest, for instance, kitchen, bathroom[2]. These labels can be used along with the driver's daily schedule to determine the desired location at a specific time. In this presentation, we discuss a prototype path planning and prompting system, which uses a probabilistic model to provide adaptive navigation assistance. **Method** For our experiments, we constructed a simple graph representation of a section of a nursing home floor plan. In this graph, vertices correspond to intersections, and edges correspond to hallways and doorways. We then picked random start and goal vertices and computed optimal routes using the path planner, which finds the shortest path. We designed an interface to simulate wheelchair motion using a keyboard. Wheelchair locations were read at regular time intervals and used to compute the user's current status (off-route, on-route). If the user was off-route, a new route to the goal was computed. We then used our probabilistic model to compute the optimal system action (for instance, do nothing, prompt, call caregiver) at each time step, based on the user's current status and his/her cognitive state. We tested the model qualitatively by analyzing the system action for different types of simulated user states. We also analyzed system response to user errors that might occur due to temporary distractions. **Results & Discussion** The path planner performs accurately in most cases. However, the simplified graph representation leads to some errors that must be further investigated. The model correctly determines various cognitive states and generates an appropriate action. Further data needs to be collected to incorporate information about the user's wheelchair driving patterns and speed. In addition, the model must be extended to include various levels of prompting. For example, users with mild dementia might require simple reminders, while more detailed prompts might be necessary to assist users with severe dementia. Future work also involves using real wheelchair motion data and maps generated by the stereovision camera[3].

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