# Health, Personal, and Environmental Predictors of Wheelchair-Use Confidence in Adult Wheelchair Users

Brodie M. Sakakibara, William C. Miller, Janice J. Eng, François Routhier, Catherine L. Backman

**Background.** There are no predictive models of wheelchair-use confidence. Therefore, clinicians and researchers are limited in their ability to screen for and identify wheelchair users who may be more prone to low wheelchair-use confidence and may benefit from clinical intervention.

**Objective.** The purpose of this study was to identify health-related, personal, and environmental factors that predict perceived wheelchair-use confidence in community-dwelling adults who use manual wheelchairs.

**Design.** A cross-sectional study was conducted.

**Methods.** Community-dwelling manual wheelchair users (N=124) were included in the study if they were ≥50 years of age, had ≥6 months of wheelchair use experience, and had no cognitive impairment. The Wheelchair Use Confidence Scale was used to assess wheelchair-use confidence. The sociodemographic information form, Functional Comorbidity Index, Seating Identification Tool, Interpersonal Support and Evaluation List, and Home and Community Environment Instrument captured the independent variables. Blocks of health, personal, and environmental variables were sequentially entered into the regression model.

**Results.** Five personal variables (age, standardized beta [$\beta$]=−0.18; sex, $\beta$=−0.26; daily hours of wheelchair occupancy, $\beta$=0.20; wheelchair-use training, $\beta$=0.20; and wheelchair-use assistance, $\beta$=−0.34) and one environmental variable (need for seating intervention, $\beta$=−0.18) were statistically significant predictors, explaining 44% of the confidence variance.

**Limitations.** The sample comprised volunteers and, therefore, may underrepresent or overrepresent particular groups within the population. The study's cross-sectional research design does not allow for conclusions to be made regarding causality.

**Conclusion.** Older women who use wheelchairs and who require assistance with wheelchair use may have low wheelchair-use confidence. The same is true for individuals who have no formal wheelchair-use training, who are in need of a seating intervention, and who report few hours of daily wheelchair use. These wheelchair users may require clinical attention and benefit from intervention.

B.M. Sakakibara, PhD, Graduate Program in Rehabilitation Sciences, University of British Columbia, Vancouver, British Columbia, Canada, and Rehabilitation Research Program, GF Strong Rehabilitation Centre, Vancouver Coastal Health Research Institute, Vancouver, British Columbia, Canada.

W.C. Miller, PhD, FCAOT, Graduate Program in Rehabilitation Sciences and Department of Occupational Science and Occupational Therapy, University of British Columbia, T325-2211 Wesbrook Mall, Vancouver, British Columbia, V6T 2B5 Canada, and Rehabilitation Research Program, GF Strong Rehabilitation Centre, Vancouver Coastal Health Research Institute, Vancouver, British Columbia, Canada. Address all correspondence to Dr Miller at: bcmiller@telus.net.

J.J. Eng, PhD, BSc(PT/OT), Graduate Program in Rehabilitation Sciences and Department of Physical Therapy, Faculty of Medicine, University of British Columbia, and Rehabilitation Research Program, GF Strong Rehabilitation Centre, Vancouver Coastal Health Research Institute.

F. Routhier, PEng, PhD, Department of Rehabilitation, Université Laval, Quebec City, Canada.

C.L. Backman, PhD, FCAOT, Graduate Program in Rehabilitation Sciences and Department of Occupational Science and Occupational Therapy, University of British Columbia.

[Sakakibara BM, Miller WC, Eng JJ, et al. Health, personal, and environmental predictors of wheelchair-use confidence in adult wheelchair users. *Phys Ther.* 2015;95:1365–1373.]



Published Ahead of Print: May 7, 2015
Accepted: April 22, 2015
Submitted: November 24, 2014

*Confidence* is the belief individuals have in their ability to perform a broad range of behaviors to achieve desired outcomes (in this article, we use the terms "confidence" and "general self-efficacy" interchangeably).[1,2] Confidence influences choices and decisions, in addition to efforts, perseverance, and motivation.[1] Individuals with high perceived confidence are more likely to set challenging goals, have positive outcomes, and recover more quickly after setbacks than individuals with low confidence.[1] They also will perceive barriers as surmountable and expend greater effort to overcome the barriers and persevere to reach their goals. For these reasons, confidence is an important factor to consider in rehabilitation because it may influence an individual's adherence to rehabilitation programs, goal setting, efforts, and persistence.

Wheelchair-use confidence, or the belief individuals have in their ability to use a wheelchair in various situations,[3] is emerging as an important research and clinical construct. Evidence indicates that perceived wheelchair-use confidence has statistically significant positive associations with both participation frequency[4,5] and mobility[6] after controlling for confounding variables. Research also shows the association between wheelchair-use confidence and participation frequency may be mediated by mobility and restrictions with participation in social and community activities[5] and that manual wheelchair skills may mediate the construct's association with mobility.[6] It has further been established that wheelchair-use confidence is modifiable by means of wheelchair skills training[7] and that improvements in confidence may have more important participation implications for men than women given evidence that sex has been shown to moderate the confidence/participation association (ie, the strength of the association is greater for men than for women).[3] A recent estimate indicates that 39.0% (95% confidence interval [CI]=29.0%, 49.0%) of community-dwelling manual wheelchair users aged 50 years and older may have lowered levels of wheelchair-use confidence.[8] When considering the projected increase in the number of wheelchair users due to population aging,[9] increasing numbers of individuals with low wheelchair-use confidence is likely. Therefore, identifying manual wheelchair users who have low confidence and may be in greatest need of confidence-enhancing interventions is important and warrants investigation.

Wheelchair-use confidence has been conceptualized as a body function[5] in the *International Classification of Functioning, Disability and Health* (ICF) framework.[10] Although body function variables have the potential to be influenced by activity and participation variables,[10] it is the predisposing health and contextual factor (ie, environmental and personal) variables that are easily accessed and may be used by clinicians and researchers to identify those wheelchair users who may have low wheelchair-use confidence.

Health, personal, and environmental contextual factor variables are shown to influence various forms of confidence in different patient populations. For example, Horn et al[11] illustrated the influence of health condition on confidence in their study of individuals with spinal cord injury; less severe neurological impairment at the onset of injury significantly predicted higher confidence related to activities of daily living at a 12-month follow-up.

In terms of personal factors, because declines in health and physical functioning are associated with aging, older individuals tend to report lowered beliefs in their ability.[1] Research findings corroborate this negative association.[12,13] Sex is another personal factor that has been shown to be associated with confidence in nonwheelchair users. Men consistently report higher levels of confidence than women on tasks perceived to be more masculine or physical.[13,14] Because manual wheelchair use requires physical ability, women may similarly report lower levels of wheelchair-use confidence than men. Because declines in health and physical functioning are associated with aging, older individuals tend to report lowered beliefs in their ability.[1] There is some empirical evidence on the association between age and wheelchair-use confidence that both corroborates and conflicts with theory. Whereas Rushton et al[15] observed a statistically nonsignificant negative correlation of low magnitude between age and wheelchair-use confidence in a sample of mostly male community-dwelling wheelchair users (median age=50 years), Fliess-Douer et al[16] established a statistically significant association between age and confidence in a mostly male sample of elite and recreational athletes (mean age=38 years). The association between age and wheelchair-use confidence, therefore, warrants further investigation.

When considering the environment, those variables related to the wheelchair, social, and physical environments may contribute to the shaping of wheelchair-use confidence. For example, individuals using better sporting equipment (eg, tennis racket) have been shown to report higher sport-related confidence than individuals using less-than-optimal equipment.[17] Likewise, differences in confidence specific to wheelchair use may be observed between individuals with either proper or prob-

lematic wheelchair seating and fit. In terms of the social environment, as individuals age, their social network shrinks due to retirement and deaths of family and friends, as examples. As a result, it is likely that confidence diminishes due to losses of social support. Furthermore, barriers and facilitators in the physical environment are postulated to influence confidence.[1] It is likely, therefore, that wheelchair users in nonaccessible physical environments have lower confidence relative to wheelchair users in accessible environments. This association, however, has yet to be investigated.

Because there are no predictive models of wheelchair-use confidence, clinicians and researchers are limited in their ability to screen for and identify wheelchair users who may be more prone to low confidence and benefit from clinical intervention. Therefore, the purpose of this study was to identify health, personal, and environmental factors that predict manual wheelchair-use confidence, using the ICF framework to categorize potential predictors. We hypothesized that in community-dwelling manual wheelchair users aged 50 years and older: (1) health condition variables would independently predict wheelchair-use confidence, (2) personal factor variables would predict wheelchair-use confidence after controlling for health conditions, and (3) environmental factor variables (eg, wheelchair, social, physical) would predict wheelchair-use confidence after controlling for health and personal factor variables.

## Method

### Study Design and Participants

This study was a secondary analysis of data from a cross-sectional study[5] of a volunteer sample of community-dwelling wheelchair users aged 50 years and older recruited from British Columbia and Quebec, Canada. Individuals had at least 6 months of experience using a manual wheelchair on a daily basis and were able to communicate in either English or French. Individuals with a Mini-Mental State Examination score less than 23[18] or who are not medically stable were excluded from the study.

### Recruitment

In British Columbia, therapists from 3 (of 5) regional health authorities that provide health services to both urban and rural populations recruited volunteer participants. Individuals who were either attending outpatient rehabilitation programs or receiving rehabilitation from community rehabilitation teams and who were eligible to participate in the study were provided with study information. Study advertisements also were posted at community and senior centers and sent to disability advocacy groups. In Quebec, participants were recruited from 2 wheelchair and seating departments in Quebec City and Montreal rehabilitation centers. Those individuals who expressed interest about the study either contacted the research team directly or provided consent to be contacted, in which case a research assistant contacted the individual to provide study information and answer questions. Those volunteers providing written informed consent (which promised confidentiality) to participate met with a trained research assistant, who explained and administered all measures in a 60- to 90-minute session.

### Variables and Measures

All variables were selected based on either empirical or conceptual rationale and organized by ICF domain. An overview of the measures used in this study to capture data for the relevant variables is presented below.

**Dependent variable.** Perceived wheelchair-use confidence was measured with the 65-item Wheelchair Use Confidence Scale (WheelCon).[3] This measure assesses the belief individuals have in their ability to use their wheelchair in 6 conceptual areas: maneuvering around the physical environment (34 items), performing activities (11 items), knowledge and problem solving (8 items), social situations (7 items), advocacy (4 items), and emotions (1 item). Items are rated on a scale of 0 to 100 points. A mean score is calculated, with higher scores indicating stronger confidence.[3] In a recent methodological study of community-dwelling manual wheelchair users, the internal consistency reliability (Cronbach alpha) of the WheelCon measures was .92, and the 1-week-retest intraclass correlation coefficient (ICC) was .84 (95% bootstrapped CI=.7, .9).[15] This study also provided evidence for validity through hypothesizing associations with wheelchair skills (Spearman correlation [$r_s$]=.52), activities of daily living ($r_s$=.32), depression ($r_s$=−.43), and life-space mobility ($r_s$=.38).[15]

Consistent with previous research,[5] we categorized wheelchair-use confidence as a body function. A key conceptual difference between body function and personal factor variables in the ICF is that variables are viewed as a body function when they are influenced by health or disabling conditions.[19] Personal factor variables, however, are not influenced by the health condition.[10] Rather, they are long-standing attributes that individuals display over time regardless of health or functional status. Therefore, in the context of wheelchair-use confidence, because it has the potential to be influenced by a number of events, including health and disability, we categorized it as a body function.

**Health condition.** A study-specific sociodemographic information

form was used to collect data on the participants' primary diagnosis or reason for using a wheelchair, which was dichotomized to distinguish between individuals with and without a neurological condition. The 18-item Functional Comorbidity Index (FCI)[20] was used to identify number of comorbid conditions. Participants are asked if they have any of 18 chronic conditions or not (yes=1). Total scores range from 0 to 18. The FCI is associated with physical functioning ($R^2$=.29)[20] and has been shown to distinguish between patients who are high functioning and those who are low functioning.[20]

**Personal factor variables.** Data on age, sex, income, education, and marital and employment status were collected using the sociodemographic information form. Data also were collected on years of wheelchair-use experience, daily hours of wheelchair occupancy (ie, both moving around and sitting), formal training to use a wheelchair (yes/no), and assistance needed with wheelchair use (eg, transfers, setup, supervision) (yes/no).

**Environmental factor variables.** The wheelchair environment was assessed using the 11-item Seating Identification Tool (SIT),[21] which evaluates a person's need for a seating intervention (ie, those individuals who would benefit from adaptive or special seating). Each item is scored using a dichotomous scale (yes=1, no=0). After adjusting for the weighted items (items 1, 2, 4, and 10), total scores range from 0 to 15, with higher scores suggesting a greater need for a seating intervention and a cutoff score of 2 indicating need for intervention.[21] In this study, we classified participants as either needing or not needing seating intervention based on the validated cutoff score. In a sample of older wheelchair users, the SIT's measurements were found to have good test-retest (ICC=.83) and interrater (ICC=.83) reliability.[21]

Perceived social support was measured using a modified version of the 6-item Interpersonal Support and Evaluation List (ISEL).[22,23] Total scores range from 0 to 18, with higher scores indicating more social support. The measurement properties of the original ISEL have been established in the general population including older adults[22] and have demonstrated construct validity with the Community Integration Measure ($r$=.42)[24] and the Sense of Support Scale ($r$=.78).[25]

Finally, the number of physical environmental barriers in the home and community was gathered with the Home and Community Environment Instrument.[26] Scores in the 9-item home subscale range from 0 to 10, and scores in the 5-item community subscale range from 0 to 5. Higher scores indicate more barriers. Measurements from both subscales have support for their reliability and validity in adults (≥21 years) with mobility limitations.[27] Data also were collected on the participants' geographic location (ie, British Columbia or Quebec).

## Study Protocol

After completing the sociodemographic information form, participants were administered the Mini-Mental State Examination and the WheelCon. The WheelCon was administered at the beginning to limit people from reflecting on other measures that may influence their confidence. Participants completed the remaining measures in a random sequence to minimize an ordering effect response bias. A trained researcher administered all of the measurement scales.

## Data Analyses

Categorical variables were calculated as frequencies and percentages, and continuous variables were calculated as means and standard deviations. Data from British Columbia and Quebec were combined for analyses because the mean difference in the wheelchair-use confidence dependent variable was not statistically significant. The details of the hierarchical multiple regression procedures used to develop the wheelchair-use confidence prediction model and test our hypotheses are presented below.

## Maximum Model

Using G*Power version 3.1[28] and an estimated moderate effect size ($f^2$=0.15) and alpha of .05, we determined that a sample size of 123 participants would have a statistical power of 0.80 to model a maximum of 11 independent variables. A sample size of 123 was considered feasible and exceeds common regression principles if modeling a maximum of 11 variables.[29]

## Variable Selection

In order to reduce the 17 variables for which data were collected (shown in Tab. 1), only those categorical variables demonstrating a statistically significant ($P$≤.05) mean difference in the dependent variable, determined using independent-sample $t$ tests or one-way ANOVAs, were included for regression analyses, as well as those continuous variables with at least a fair association (ie, $r$≥.25)[30] with the confidence variable. If no variable met the entry criteria in a particular domain, one was selected for entry based on strongest correlation with the confidence variable to test our hypotheses (eg, number of comorbidities).

Collinearity (ie, strong correlation between 2 independent variables) was identified by a variance inflation factor value greater than 10[31] and an

intercorrelation of .70 between independent continuous variables. To minimize collinearity, all continuous variables were mean centered; however, when collinearity was identified, the variable with the highest correlation with the dependent variable was entered into the model. Scatterplots of the bivariate data were examined for potential outliers. Data points greater than 1.5 times the variable's interquartile range were considered cases that could influence the magnitude of the correlations[30] or the statistical significance of the mean difference. These cases were removed from the variable selection stage only, and the data were reanalyzed to identify variables for inclusion in the model. All other regression assumptions (ie, normally distributed residuals, homoscedasticity, and linearity) also were tested.[31]

### Regression Modeling

Variables were categorized using the ICF framework, and a chunkwise hierarchical regression modeling strategy was used to develop the predictive model.[31] The health condition variables were entered first into the model (model 1), followed by the personal factor variables (model 2), and then the environmental factor variables, including those variables related to the wheelchair, social, and physical environments (model 3). The order of variable entry is consistent with other multivariate research examining the proximal factors first, followed by increasing distal factors.[32] In each modeling stage, both forward selection and backward elimination procedures were used to develop and verify a robust model.[31] Once a variable was selected to remain in the model, it was retained in all subsequent analyses. Because the purpose of the study was to develop a predictive model, we did not test for confounding or interaction effects. IBM SPSS version 19.0 (IBM Corp, Armonk, New York) was used for all analyses.

### Role of the Funding Source

This work was supported by the Canadian Institutes of Health Research (Doctoral Scholarship to Dr Sakakibara and Operating Grant IAP-107848) and the Michael Smith Foundation for Health Research (Senior Scholar Award to Dr Eng).

## Results

One hundred twenty-four individuals were enrolled in this study. The mean age of the total sample was 59.7 years (SD=7.5), and 74 (59.7%) were men. The sample had 22.3 mean years (SD=16.1) of wheelchair-use experience and used their wheelchair a mean of 12.3 hours per day (SD=4.3). Thirty-nine individuals (31.5%) required some form of assistance with using their wheelchair (eg, mobility, transferring, setup), and 22 (17.7%) received training to use their wheelchair after a rehabilitation program. Sixty-eight individuals (54.8%) had a need for a seating intervention (SIT score >2). The mean number of comorbidities was 2.7 (SD=2.4) out of a possible 18 conditions. The mean wheelchair-use confidence score was 78.4 (SD=19.2) out of 100. Sample characteristics are detailed in Table 1.

### Regression Modeling

Overall, 7 variables were selected for regression modeling. Table 1 presents the correlations with and mean differences in the perceived confidence dependent variable. There was no violation of any regression assumption.

In model 1, there was a statistically significant negative association between the number of comorbidities and confidence variables. The neurological condition variable was not statistically significant and, therefore, was not included in the model. The adjusted $R^2$ was 5.0% ($F_{1,121}=6.78$, $P=.01$). Table 2 presents the regression results for all models.

In model 2, both age and sex were observed to be statistically significant predictors of wheelchair-use confidence. Male sex and younger age were associated with higher confidence. In addition, the 3 variables related to wheelchair use (ie, daily hours of wheelchair occupancy, formal wheelchair-use training, and assistance with wheelchair use) were predictive of confidence. The number of comorbidities variable failed to remain statistically significant. The adjusted $R^2$ increase resulting from the addition of personal factor variables was 32.0% ($F_{6,116}=15.53$, $P<.001$), yielding a total adjusted $R^2$ of 37%.

In model 3, the need for a seating intervention variable was a statistically significant predictor of confidence, which increased the adjusted $R^2$ value by 7.0% ($F_{7,115}=14.84$, $P<.001$), yielding a total adjusted $R^2$ of 44%.

The final predictive model included one health condition variable (ie, number of comorbidities), 5 personal factor variables (ie, age, sex, daily hours of wheelchair occupancy, training to use a wheelchair, and assistance with wheelchair use), and one environmental factor variable (ie, need for a seating intervention) and accounted for 44.0% of the wheelchair-use confidence variance.

## Discussion

In this study, we developed a wheelchair-use confidence predictive model using health condition (model 1), personal factor (model 2), and environmental factor (model 3) variables. Individuals in this study were experienced wheelchair users who used their wheelchair daily. Compared with another Canadian study of younger wheelchair users,[15]

## Table 1.

Descriptive Statistics and Correlations With Mean Differences in Wheelchair-Use Confidence (N=124)

| Variable | Total | | Confidence |
|---|---|---|---|
| | $\bar{X}$±SD | Frequency (%) | *r* or (Mean Difference) |
| **Body functions** | | | |
| Confidence (score range: 0–100) | 78.38±19.19 | | 1 |
| **Health condition** | | | |
| Comorbidities (score range: 0–18) | 2.69±2.40 | | −0.23[a] |
| Neurological conditions: | | 97 (78.20) | (7.25) |
| Spinal cord injury | | 60 (48.40) | |
| Multiple sclerosis | | 16 (12.90) | |
| Stroke | | 12 (9.70) | |
| Other (eg, Parkinson disease, cerebral palsy, brain injury) | | 9 (9.30) | |
| Nonneurological conditions | | 27 (21.80) | |
| Amputation | | 9 (9.30) | |
| Poliomyelitis | | 5 (4.03) | |
| Arthritis | | 4 (3.23) | |
| Other | | 9 (9.30) | |
| **Personal factors** | | | |
| Age (y) | 59.67±7.49 | | −0.30[a] |
| Men | | 74 (59.68) | (14.75)[a] |
| Education (high school graduate) | | 110 (89.40) | (−0.61) |
| Income[b] | | | |
| <$30,000 | | 43 (34.68) | (5.61) |
| Prefer not to answer | | 21 (16.94) | (4.16) |
| Married | | 59 (47.60) | (0.80) |
| Employed/volunteer | | 46 (37.10) | (−5.28) |
| Wheelchair use | | | |
| Years of experience | 22.31±16.05 | | 0.23 |
| Daily use (h) | 12.30±4.29 | | 0.27[a] |
| Formal training | | 22 (17.70) | (−14.67)[a] |
| Wheelchair assistance | | 39 (31.50) | (20.19)[a] |
| **Environmental factors** | | | |
| Wheelchair | | | |
| Need for seating intervention | | 68 (54.84) | (−10.70)[a] |
| Social | | | |
| Social support (score range: 0–18) | 14.48±3.71 | | 0.12 |
| Physical | | | |
| British Columbia | | 74 (59.70) | (1.78) |
| Home barriers (score range: 0–10) | 1.10±1.22 | | 0.06 |
| Community barriers (score range: 0–5) | 1.06±0.85 | | −0.14 |

[a] Included for modeling.
[b] Mean difference from ≥$30,000.

**Table 2.**
Hierarchical Regression Modeling to Identify Predictors of Wheelchair-Use Confidence (N=124)[a]

| Variable | Model 1 | | | | Model 2 | | | | Model 3 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | b | SE | β | 95% CI | b | SE | β | 95% CI | b | SE | β | 95% CI |
| Constant | **78.37** | 1.69 | | 75.02, 81.72 | **77.75** | 1.90 | | 73.98, 81.52 | **78.29** | 1.87 | | 74.58, 82.00 |
| Health condition | | | | | | | | | | | | |
| FCI | **−1.84** | 0.71 | −0.23 | −3.24, −0.44 | −0.09 | 0.60 | −0.01 | −1.27, 1.10 | 0.18 | 0.59 | 0.02 | −1.00, 1.36 |
| Personal factors | | | | | | | | | | | | |
| Age | | | | | **−0.48** | 0.19 | −0.19 | −0.86, −0.11 | **−0.46** | 0.19 | −0.18 | −0.82, −0.09 |
| Sex | | | | | **−10.85** | 2.81 | −0.28 | −16.41, −5.28 | **−10.02** | 2.77 | −0.26 | −15.50, −4.54 |
| Daily hours in WC | | | | | **0.87** | 0.32 | 0.20 | 0.25, 1.49 | **0.89** | 0.31 | 0.20 | 0.28, 1.50 |
| Training with WC | | | | | **9.56** | 3.55 | 0.19 | 2.54, 16.59 | **9.80** | 3.47 | 0.20 | 2.93, 16.66 |
| Assistance with WC | | | | | **−14.35** | 3.08 | −0.35 | −20.44, −8.26 | **−14.05** | 3.01 | −0.34 | −20.01, −8.10 |
| Environmental factors | | | | | | | | | | | | |
| SIT | | | | | | | | | **−6.81** | 2.70 | −0.18 | −12.16, −1.47 |
| Adjusted $R^2$ | **5%** | | | | **37%** | | | | **44%** | | | |

[a] b=unstandardized coefficient, SE=standard error, β=standardized coefficient, CI=confidence interval, WC=wheelchair, FCI=Functional Comorbidity Index, SIT=Seating Identification Tool. Men with no training to use a wheelchair, no assistance with wheelchair, and no seating intervention were coded as −0.50. Values in bold type=$P \leq .05$.

individuals in this sample reported fewer wheelchair skills and lower wheelchair-use confidence estimates. These observations are not surprising when considering evidence that functional limitations increase and perceived confidence diminishes with aging.[1]

The results partially support our hypotheses that health, personal, and environmental variables would each independently predict the confidence construct. Although a statistically significant negative association between number of comorbidities and confidence was observed in model 1, the health condition variable failed to remain significant after entering the personal factor variables in model 2. The association between aging and declining health may be the reason why the number of comorbidities variable failed to remain statistically significant. In this study, there was a slightly stronger bivariable correlation between number of comorbidities and age than the correlation between number of comorbidities and confidence (data not presented), which supports our reasoning. Furthermore, one report shows that chronic conditions, such as arthritis and vision problems, are more prevalent in older adults than younger individuals.[33] Therefore, countering the negative confidence effects of cumulative health conditions in aging wheelchair users may be important because issues that create functional limitations potentially threaten independence and well-being. Confidence may be a protective factor.[1] Individuals with stronger confidence with their wheelchair use may work harder and persevere when faced with difficulties to overcome limitations brought on by older age.

Evidence resulting from model 2 supports the hypothesis that after controlling for health condition variables, personal factor variables predict wheelchair-use confidence. More specifically, after controlling for number of comorbidities, older women, requiring assistance with wheelchair use, receiving no formal wheelchair-use training, and using the wheelchair for minimal hours per day were found to be associated with lowered confidence. Several reasons may explain these findings. In terms of age, individuals who are older may have more health issues and physical limitations[33] than younger individuals, resulting in lower beliefs in their abilities.[1] In addition, issues such as minor aches and pains are more likely to be attributed to perceived declines in abilities by older individuals compared with younger individuals, which also may lead to low confidence attributed to old age.[1] Previous studies corroborate our findings. For example, in a study of individuals with a spinal cord injury, Horn et al[11] observed that older individuals reported lower confidence related to performing activities of daily living than younger individuals. Similarly, in a large study of community-dwelling individuals (N=703) with a variety of health conditions, those in their 60s reported lower levels of physical activity confidence than those in their 40s and 50s.[34]

Sex was also a statistically significant predictor of confidence, with being

a woman predictive of lower perceived confidence relative to being a man. In other studies, the extent to which confidence differs by sex has to do with the specific form of confidence in question. Those inquiring about beliefs about physical abilities or tasks that are perceived to be more masculine in nature demonstrate larger differences in confidence, with men reporting higher or stronger confidence than women.[14] It may be that wheelchair use is perceived as requiring large amounts of physical ability, explaining higher confidence among the men in this study. Future research looking at differences in wheelchair-use confidence by sex is warranted to investigate the association we observed in this study and our speculation.

Also in model 2, three personal factor variables related to wheelchair use were statistically significant predictors of confidence. More daily use of the wheelchair and having received training to use the wheelchair were predictive of stronger wheelchair-use confidence, whereas requiring assistance with wheelchair use was associated with weaker confidence. These findings are not surprising because it seems intuitive that the more time spent using the wheelchair and training to use the wheelchair properly may lead to more positive experiences, which then may be reflected upon to enhance confidence. Our results suggest that individuals who require assistance with wheelchair use have lower confidence than individuals who do not require such assistance. It is not unexpected for individuals who have difficulties using their wheelchair to also report lower confidence compared with individuals who have no such difficulties.

Model 3 supported the hypothesis that the environment is predictive of wheelchair-use perceived confidence, after controlling for health condition and personal factor variables, where individuals who have a need for seating intervention perceive a lower level of wheelchair-use confidence. It is likely that those people who experience discomfort from sitting in their wheelchair or who have been at risk of tipping over their wheelchair due to an improper setup may have low confidence due to experiencing issues with their wheelchair. Different diagnostic groups may be more prone to having a need for a seating intervention, which would influence confidence. More research on the confidence of specific diagnostic groups is warranted. In general, however, a better fitting wheelchair may lead to more positive experiences and thus higher confidence.

It is interesting that the perceived amount of social support and physical barriers in the community were not statistically significant predictors of wheelchair-use confidence. The lack of an association between confidence and perceived social support may have been due to the global measure of social support used in this study. The 6-item ISEL captures both emotional (eg, people to talk to) and physical (eg, people to help with daily activities) forms of support. Whereas physical support may limit opportunities to perform tasks that individuals are capable of, which then act to compromise confidence, it is likely that emotional support has positive influences.[15,35] That the 2 forms of support have opposing effects on confidence may be the reason why no association was found. Finally, our finding that the physical barriers in the community did not significantly predict confidence is contrary to other research on the effects of community environments on confidence.[36] It is plausible that community accessibility is improving for wheelchair users[9] and, therefore, issues with confidence are of little importance to accessibility.

## Limitations

This study had several limitations. First, the sample was composed of volunteers and, therefore, may underrepresent or overrepresent particular groups within the population. Further research is needed to cross-validate the model, as well as to test the prediction model in specific subgroups of wheelchair users. Next, through the use of a volunteer sample, there was a lack of information on the number of individuals who received study information and potential reasons why they chose not to participate. Our findings are limited to community-dwelling manual wheelchair users aged 50 years and older who had at least 6 months of wheelchair-use experience. There may be important health condition, personal factor, or environmental factor variables for which data were not collected and, therefore, that were left out of the analyses (eg, indoor versus outdoor use of the wheelchair). Despite this limitation, the modeled variables accounted for 44.0% of wheelchair-use confidence variance. Furthermore, the use of the ICF to organize variables may be considered a limitation given the lack of conceptual clarity among domains. In addition, due to the study's cross-sectional research design, conclusions cannot be made regarding the direction of the observed associations or causality. Lastly, the use of self-report measures may have been affected by a social desirability bias, leading to a common methods bias. As a result, individuals may have reported artificially high perceived confidence scores.

The findings in this study suggest that older women who use wheelchairs may be prone to lowered levels of perceived confidence. The same is true for individuals who require assistance with their wheelchair use, use their wheelchair for few hours throughout the day, received no formal wheelchair-use

training, and have a greater need for a seating intervention. Individuals with any of these characteristics could be targeted for further evaluation and provided with appropriate interventions comprising the 4 sources of information (performance accomplishment, vicarious learning, verbal persuasion, and interpretation of physiological and affective states[9]) theorized to modify confidence.

All authors provided concept/idea/research design. Dr Sakakibara, Dr Eng, and Mr Routhier provided writing. Dr Sakakibara and Mr Routhier provided data collection and participants. Dr Sakakibara provided data analysis and project management. Dr Sakakibara, Dr Miller, and Mr Routhier provided fund procurement. Dr Miller and Mr Routhier provided facilities/equipment. Dr Sakakibara, Dr Miller, and Dr Backman provided consultation (including review of manuscript before submission).

The ethics boards of all participating sites approved the study.

This work was supported by the Canadian Institutes of Health Research (Doctoral Scholarship to Dr Sakakibara and Operating Grant IAP-107848) and the Michael Smith Foundation for Health Research (Senior Scholar Award to Dr Eng).

DOI: 10.2522/ptj.20140537

## References

1 Bandura A. *Self-efficacy: The Exercise of Control*. New York, NY: Freeman; 1997.

2 Luszczynska A, Scholz U, Schwarzer R. The general self-efficacy scale: multicultural validation studies. *J Psychol*. 2005; 139:439–457.

3 Rushton PW, Miller WC, Kirby RL, et al. Development and content validation of the Wheelchair Use Confidence Scale: a mixed-methods study. *Disabil Rehabil Assist Technol*. 2011;6:57–66.

4 Sakakibara BM, Miller WC, Eng JJ, et al. Preliminary examination of the relationship between participation and self-efficacy in older manual wheelchair users. *Arch Phys Med Rehabil*. 2013;94:791–794.

5 Sakakibara BM, Miller WC, Routhier F, et al. Association between self-efficacy and participation in community-dwelling manual wheelchair users aged 50 years or older. *Phys Ther*. 2014;94:664–674.

6 Sakakibara BM, Miller WC, Eng JJ, et al. Influences of wheelchair-related efficacy on life-space mobility in adult, community-dwelling manual wheelchair users. *Phys Ther*. 2014;94:1604–1613.

7 Sakakibara BM, Miller WC, Souza M, et al. Wheelchair skills training to improve self-efficacy with using a manual wheelchair among older adults: a pilot study. *Arch Phys Med Rehabil*. 2013;94:1031–1037.

8 Miller WC, Sakakibara BM, Rushton PW. The prevalence of low confidence with using a wheelchair and its relationship to wheelchair skills. *Gerontologist*. 2012; 52(suppl 1):205.

9 LaPlante MP, Kaye HS. Demographic trends in wheeled mobility equipment use and accessibility in the community. *Assist Technol*. 2010;22:2–17.

10 *International Classification of Functioning, Disability and Health: ICF*. Geneva, Switzerland: World Health Organization; 2001.

11 Horn W, Yoels W, Wallace D, et al. Determinants of self-efficacy among persons with spinal cord injury. *Disabil Rehabil*. 1998;20:138–141.

12 Wilcox S, Bopp M, Oberrecht L, et al. Psychosocial and perceived environmental correlates of physical activity in rural and older African American and white women. *J Gerontol B Psychol Sci Soc Sci*. 2003;58: 329–337.

13 Wilcox S, Sharpe PA, Hutto B, Granner ML. Self-efficacy for exercise questionnaire in a diverse sample of men and women. *J Phys Act Health*. 2005;3:285–297.

14 Lirgg CD. Gender differences in self-confidence in physical activity: a meta-analysis of recent studies. *J Sport Exerc Psychol*. 1991;13:294–310.

15 Rushton PW, Miller WC, Kirby RL, Eng JJ. Measure for the assessment of confidence with manual wheelchair use (WheelCon-M) version 2.1: reliability and validity. *J Rehabil Med*. 2013;45:61–67.

16 Fliess-Douer O, van der Woude LHV, Vanlandewijck YC. Development of a new scale for perceived self-efficacy in manual wheeled mobility: a pilot study. *J Rehabil Med*. 2011;43:602–608.

17 Pellett TL, Lox CL. Tennis racket head-size comparisons and their effect on beginning college players' achievement and self-efficacy. *J Teach Phys Educ*. 1998;17:453–467.

18 Folstein MF, Folstein SE, McHugh PR. "Mini-mental state": a practical method for grading the state of patients for the clinician. *J Psychiatr Res*. 1975;12:189–198.

19 Threats T. Access for persons with neurogenic communication disorders: influences of personal and environmental factors of the ICF. *Aphasiology*. 2007;21:67–80.

20 Groll DL, To T, Bombardier C, Wright JG. The development of a comorbidity index with physical function as the outcome. *J Clin Epidemiol*. 2005;58:595–602.

21 Miller WC, Miller F, Trenholm K, et al. Development and preliminary assessment of the measurement properties of the Seating Identification Tool (SIT). *Clin Rehabil*. 2004;18:317–325.

22 Cohen S, Mermelstein R, Kamarck T, Hoberman HN. Measuring the functional components of social support. In: Sarason I, Sarason B, eds. *Social Support: Theory, Research, and Applications*. Dordrecht, the Netherlands: Martinus Nijhoff; 1987: 73–94.

23 Schulz R, Williamson G. A 2-year longitudinal study of depression among Alzheimer's caregivers. *Psychol Aging*. 1991;6: 569–578.

24 McColl MA, Davies D, Carlson P, et al. The Community Integration Measure: development and preliminary validation. *Arch Phys Med Rehabil*. 2001;82:429–434.

25 Dolbier CL, Steinhardt MA. The development and validation of the Sense of Support Scale. *Behav Med*. 2000;25:169–179.

26 Keysor JJ, Jette AM, Haley SM. Development of the Home and Community Environment (HACE) instrument. *J Rehabil Med*. 2005;37:37–44.

27 Keysor JJ, Jette AM, Valley MP, et al. Community environmental factors are associated with disability in older adults with functional limitations: the MOST study. *J Gerontol A Med Biol Sci*. 2010;65:393–399.

28 G*Power version 3.1. Available at: http://www.softpedia.com/get/Science-CAD/G-Power.shtml. Accessed May 24, 2015.

29 Norman GR, Streiner DL. *Biostatistics: The Bare Essentials*. 3rd ed. Hamilton, Ontario, Canada: BC Decker Inc; 2008.

30 Portney LG, Watkins MP. *Foundations of Clinical Research: Applications to Practice*. 3rd ed. Upper Saddle River, NJ: Prentice-Hall Inc; 2009.

31 Kleinbaum DG, Kupper LL, Nizam A, Muller KE. *Applied Regression Analysis and Other Multivariate Methods*. 4th ed. Pacific Grove, CA: Duxbury Press; 2008.

32 Martin-Ginis KA, Arbour-Nicitopoulos KP, Latimer-Cheung AE, et al. Predictors of leisure time physical activity among people with spinal cord injury. *Ann Behav Med*. 2012;44:104-118.

33 *A Portrait of Seniors in Canada*. Ottawa, Ontario, Canada: Statistics Canada; 2006.

34 Anderson-Bill ES, Winett RA, Wojcik JR, Williams DM. Aging and the social cognitive determinants of physical activity behavior and behavior change: evidence from the Guide to Health trial. *J Aging Res*. 2011;2011:1–11.

35 Pang MY, Eng JJ, Lin K-H, et al. Association of depression and pain interference with disease-management self-efficacy in community-dwelling individuals with spinal cord injury. *J Rehabil Med*. 2009;41: 1068–1073.

36 Morris KS, McAuley E, Motl RW. Neighborhood satisfaction, functional limitations, and self-efficacy influences on physical activity in older women. *Int J Behav Nutr Phys Act*. 2008;5:13.