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Association between self-efficacy and participation in community-dwelling manual wheelchairs users aged 50 years or older

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Abstract

Background—Self-efficacy with using a wheelchair is an emerging construct in the wheelchair-use literature that may have implications on the participation frequency in social and personal roles of wheelchair-users.

Objectives—To investigate the direct and mediated effects of self-efficacy on participation frequency in community-dwelling manual wheelchair-users, aged 50 and over.

Design—Cross-sectional

Methods—Participants were community-dwelling wheelchair-users (n=124), 50 years of age and older (mean = 59.7 years), with at least 6 months experience with wheelchair use. The Late-Life Disability Instrument, the Wheelchair Use Confidence Scale, the Life Space Assessment, and the Wheelchair Skills Test-Questionnaire measured, participation frequency, self-efficacy, life-space mobility, and wheelchair skills, respectively. Multiple regression analyses with bootstrapping were used to investigate the direct and mediated effects. The International Classification of Functioning, Disability, and Health was used to guide the analyses.

Results—Self-efficacy was a statistically significant determinant of participation frequency, and accounted for 17.2% of the participation variance after controlling for age, number of comorbidities, and social support. The total mediating effect by life-space mobility, wheelchair skills, and perceived participation limitations was statistically significant, (point estimate=0.14, bootstrapped 95%CI 0.04,0.24), however, the specific indirect effect by the wheelchair skills

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variable did not contribute to the total effect above and beyond the other two mediators. The mediated model accounted for 55.0% of the participation variance.

Limitations—Causality cannot be established due to the cross-sectional nature of the data, and the self-report nature of our data from a volunteer sample may be influenced by measurement bias and/or social desirability.

Conclusion—Self-efficacy directly and indirectly influences the participation frequency in community-dwelling manual wheelchair-users, aged 50 and over. Development of interventions to address low self-efficacy is warranted.

Keywords

self-efficacy; wheelchair; social participation; mediation; International Classification of Functioning, Disability, and Health

INTRODUCTION

Participation, or involvement in life situations,[1] is an important focus in the rehabilitation of older individuals because of its strong association with quality of life.[2,3] Mobility limitations are a cause of disability among community-dwelling individuals,[4,5] and are the primary reason for participation restrictions in individuals 50 years and older.[6] Individuals with mobility limitations are often prescribed wheelchairs to overcome participation restrictions; however, these individuals commonly report low participation levels, with rates as low as 8.3% in the frequency and duration of physical activity participation compared to 48.8% reported by ambulatory individuals.[7]

There is little evidence explaining the low participation frequency of community-dwelling manual wheelchair-users. Shields notes, however, that older individuals are more likely to lack independence with using their wheelchair than younger individuals,[8] and LaPlante and Kaye report difficulties with wheeled mobility increases with age.[9] Although there is a void in our knowledge on the participation of community-dwelling manual wheelchair-users, aged 50 and over, the existing evidence from other populations of wheelchair-users may inform our understanding. For example, existing predictive models of participation developed with younger community-dwelling wheelchair-users[10,11] and older wheelchair-users residing in nursing homes[12] identify wheelchair skills as a determinant of participation. Wheelchair skills, therefore, may also impact the participation of community-dwelling manual wheelchair-users aged 50 and over. It is also plausible that variables such as depression,[12] mobility,[12] and injury or demographic (e.g. age, sex) factors[11,13] may be important, but this is not established.

Although existing evidence may contribute to the development of models predicting the participation frequency of adult community-dwelling wheelchair-users, the variables considered to date have explained between 9.0%[13] and 53.0%[12] of the variance of various forms of participation. This indicates that there is much more to be investigated to enhance our knowledge about the participation of wheelchair-users in order to sufficiently address areas for improvement. When considering reports that the proportion of older American

wheelchair-users has been increasing by 4.3% per year,[9] and evidence that aging is a risk factor for wheelchair use,[8,9] there is clear need for more research.

Because studies consistently report ability to use a wheelchair is an important determinant of participation, a person's belief in their ability (i.e. self-efficacy[14]), may similarly provide important explanatory value, as has been demonstrated in many areas of health. For example, self-efficacy has been shown to be an important determinant of leisure and physical activity participation in several populations, including individuals with a lower extremity amputation,[15] and older adults with chronic conditions.[16] The construct, however, has yet to receive adequate investigation in wheelchair-users.

Self-efficacy with using a wheelchair is the belief individuals have in their ability to use their wheelchair in a variety of challenging situations.[17] There is prevalence data suggesting 39.0% (95% CI=29.0,49.0) of older community-dwelling individuals have low self-efficacy with wheelchair use.[18] Some evidence also indicates a statistically significant positive association between self-efficacy and participation frequency in older, community-dwelling wheelchair-users,[19] and that the construct is modifiable.[20] These preliminary data suggest self-efficacy with using a wheelchair may be of clinical interest, however, more robust research is needed.

Because Social Cognitive Theory postulates self-efficacy has both direct and indirect effects on behaviour,[14] the objective of this study is to investigate the direct effect of self-efficacy on participation frequency, and test the indirect effect via multiple mediators. The International Classification of Functioning, Disability and Health (ICF)[1] framework was used to classify variables and guide our investigation of the hypotheses that self-efficacy (conceptualized as a body function) is an independent predictor of participation frequency in older, community-dwelling manual wheelchair-users after controlling for important health, environmental and personal contextual factors, and that the association is mediated by functioning/disability variables at the ICF's body, person, and societal levels.

METHODS

Design/Participants

Community-dwelling, manual wheelchair-users who were 50 years of age and older, and living in British Columbia (BC), or Quebec, Canada were enrolled in this cross-sectional study. Participants had at least 6 months experience using a wheelchair on a daily basis, and communicated in English or French. Individuals with a Mini Mental State Examination score less than 23[21] and/or an acute illness were excluded from study.

Recruitment

Therapists from BC's largest rehabilitation centre recruited volunteer participants, as did community-based therapists servicing both urban and rural populations in three health authorities. Advertisements about the study were also posted at community and senior centers, and sent to disability advocacy groups. In Quebec, participants were recruited from two rehabilitation centers in Quebec City and Montreal. Individuals who met the study's inclusion criteria were given information about the study. Those 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. A trained researcher then met with the volunteer participants at a location of their convenience, and explained and administered all measures in a 60 to 90 minute session. The ethics boards from the relevant institutions approved this study. Informed consent was obtained from all participants.

Measures

Variables/measures were selected based on either empirical or conceptual rationale. The properties of all measures used in this study have been evaluated with wheelchair-users and/or older adults, and are detailed and classified by the ICF domains in table 1. For measures not available in French, two bilingual researchers, and a professional translator forward- and back-translated the measures. We followed Vallerand's international standards for the transcultural validation of questionnaires.[22,23]

Dependent variable–Participation domain—Participation was measured using the 16-item frequency dimension in the Late Life Disability Instrument (LLDI).[24] Participants rate their participation frequency in social and personal roles using a response scale ranging from 1 (never) to 5 (very often). Item responses are summed to derive a raw total score, which are then standardized into scores ranging from 0 to 100.[24] Higher scores indicate more frequent participation. Scores of 51.4 and less are considered low participation frequency in older adult populations.[25] Validity testing found the LLDI total scores to differentiate between older adults assigned to four functional levels,[24] and to moderately correlate with the London Handicap Scale (r=0.47).[26] The measure has been shown to be reliable for use with adult wheelchair-users (ICC=0.86, 95% CI=0.76–0.93).[27]

Independent variable of interest – Body function domain—The self-efficacy with wheelchair use construct was measured using the 65-item Wheelchair Use Confidence Scale (WheelCon).[17] This measure assesses self-efficacy in six conceptual areas including maneuvering around the physical environment, performing activities, knowledge and problem solving, social situations, advocacy, and emotions. Items are rated on a 0 to 100 scale. A mean score is calculated with higher scores indicating more self-efficacy.[17] This measure has construct validity, with excellent test-retest reliability (ICC=0.84, 95% CI 0.70–0.92) in a sample of community-dwelling manual wheelchair-users (age range=31–60 years).[17]

We categorized the self-efficacy construct as a body function for several reasons. 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. [28] Conversely, personal factor variables have nothing to do with or are not caused by the health condition.[1] Rather, they are long-standing attributes individuals display over time regardless of health and/or functional status. Therefore, in the context of self-efficacy with wheelchair use, because it is a state, and has the potential to be influenced by a number of events, including health and disability,[14] it was specified as a body function.

Potential confounding variables – Health, environmental and personal domains—According to Kleinbaum, a confounding variable must be a risk factor for the outcome, cannot be an intervening/mediating variable, and must be associated with the key independent variable of interest.[29 (Ch.9, pg. 132–134)] In this study, all potential confounders were health-related, personal or environmental contextual factors, as per the ICF.

Health (e.g. diagnosis), personal (e.g. age, sex), and wheelchair-related environmental factor (e.g. hours of daily use) variables were collected using **a** socio-demographic information form. Number of comorbidities, need for a seating intervention, and perceived social support were captured with the Functional Comorbidity Index,[30] the Seating Identification Tool,[31] and the Interpersonal Support and Evaluation List-6,[32] respectively. Physical environmental barriers were captured using the Home and Community Environment Instrument.[33] Table 2 lists all confounding variables tested organized by ICF domain.

Potential mediating variables – Body function, activity, and participation domains—Mediating variables help to explain why hypothesized associations exist.[34] An important difference between mediators and confounders is that mediators are intervening/causal variables, and confounders are not. That is, an independent variable may have an indirect influence on an outcome through a mediating variable.[34] In this study, mediators were selected on the basis of existing evidence showing them to both influence participation,[12,35,36,37] and be influenced by self-efficacy[14,38,39,40] in various populations. The life-space mobility[12,38] of wheelchair-users was evaluated with the Life-Space Assessment.[41] The Wheelchair Skills Test–Questionnaire[42] assessed wheelchair skills,[12,14] while the Barthel Index,[43] Hospital Anxiety and Depression Scale,[44] and Wheelchair User Shoulder Pain Index,[45] measured ability to perform activities of daily living,[35,40] depression and anxiety symptoms,[12,14,39] and shoulder pain,[14,39] respectively. The perceived participation limitations[14,37] variable was quantified using the 16-item limitations dimension in the LLDI.[24]

Analyses

A sample size of 122 was determined by G*Power to have 80% power to detect significance in a model with 9 independent variables using an alpha of 0.05, and a moderate effect size (f^2=0.14). An effect size[46] was calculated using the R-square increase (10%) reported in a previous study of wheelchair-users.[19] After completing the socio-demographic information form, the Mini Mental State Examination, and the WheelCon, participants were administered the remaining measures in a random sequence to minimize response bias. Data from BC and Quebec were combined for analyses because the mean difference in the dependent variable was less than the LLDI's 95% minimal detectable change observed in wheelchair-user of 7.18,[27] thereby indicating no difference in participation frequency.

Descriptive statistics were used to characterize the sample. Results from categorical variables were calculated as percentages, and from continuous variables as means and standard deviations. Income was collapsed into three categories using the median $30,000 as a cutpoint, in addition to the prefer not to answer category. The following variables were dichotomized, and coded as −0.5 (no) or 0.5 (yes):[47] diagnosis (neurological condition);

education (high school graduate); formal wheelchair skills training; assistance with wheelchair use (e.g. supervision, transfers); married or common law; and employed and/or volunteer. Regression modeling was used to establish the direct and mediated self-efficacy effects on participation frequency.

The direct effect of self-efficacy on participation frequency—To establish a valid and precise estimate of the direct effect, we followed Kleinbaum's 3-stage modeling strategy to develop a valid regression model.[48 (Ch. 6, pg 169–173),49 (Ch.11, pg189–204)] In the first stage, potential confounding variables and interaction terms were specified for modeling. Data was collected for 16 potential confounders (see table 2). Only those continuous variables with a fair relationship (i.e. $r \geq 0.25$[50(Ch. 23, pg. 525)]) with participation frequency, and/or those categorical variables with a mean difference in participation frequency that exceeded the LLDI's 95% minimal detectable change[27] were included in the model. To minimize collinearity all continuous variables were mean centered. However, when potential collinearity was identified (i.e. $r \geq 0.70$ between independent variables, and with a variation inflation factor value greater than 10[49 (Ch. 14, pg 315)]), the measure with the highest correlation with the dependent variable was selected, unless there was theoretical rationale to choose one variable over another, or to retain both. Finally, we included two interaction terms (i.e. self-efficacy x sex, and self-efficacy x age) to determine if the relationship between self-efficacy and participation frequency differs by sex, and age, which is in accordance with Social Cognitive Theory[14] and existing evidence.[19] After specifying variables for modeling, all regression assumptions were tested.[49(Ch.5, pg. 45–48)]

The second modeling stage tested the statistical significance of the interaction terms.[48(Ch. 7, pg 207–210)] After forcing the self-efficacy variable, and the lower order components of each interaction term into the model, the statistical significance ($p<0.05$) of the interaction terms were then evaluated using both forward selection and backward elimination regression approaches. The result of this analyses was considered the crude model for the next modeling stage.

In the final stage of model development, we assessed for confounding.[48(Ch. 7, pg. 211–215)] Confounding refers to the association of interest having a meaningful different interpretation when potential confounding variables are ignored (i.e. crude model) or included (i.e. adjusted model) in the model.[49(Ch. 11, pg. 190)] We considered a change in the unstandardized self-efficacy regression coefficient in the adjusted model, relative to the estimate in the crude model, that exceeded **10%**[29 (Ch. 15, pg. 261–262),51] to be indicative of confounding.

If the adjusted model indicated confounding, subsequent analyses were performed to identify subsets of the confounding variables that provide equivalent control of confounding, but with a more precise self-efficacy estimate. Precision was evaluated by examining the width of the 95% confidence interval around the self-efficacy estimate. A narrowing of the confidence interval indicated improved precision.[49(Ch. 11, pg. 201)] The model with equivalent control of confounding, relative to the adjusted model, and the narrowest 95% confidence interval was deemed to provide the most valid and precise estimate of the direct effect of self-efficacy on participation frequency. This model was then used in the mediator analyses.

The mediated effects of self-efficacy on participation frequency—Because multiple variables were hypothesized as mediators, we tested a single multiple mediation model[34] in lieu of separate simple models. Path c in figure 1a depicts the direct effect of self-efficacy on participation frequency after controlling for confounders. Figure 1b represents the mediated effects via the 7 possible mediators. For mediators to be included in the model, they had to have at least a fair correlation magnitude (i.e. $r \geq 0.25$[50 (Ch. 23, pg. 525)]) with participation frequency. A bias corrected bootstrapping method was used to derive the point estimates for the total and individual mediation effects, and 95% confidence intervals.[34] The proportion of the direct effect accounted by the mediators was calculated as $\Sigma_i(a_i b_i)/c$.

SPSS version 19.0 (SPSS Inc., Chicago, IL), G*Power version 3.1.3 (G*Power, http://www.psycho.uni-duesseldorf.de/abteilungen/aap/gpower3/), and the INDIRECT macro[34] were used for the analyses.

RESULTS

Seventy-four individuals from BC and 50 individuals from Quebec were enrolled. The mean age of the total sample was 59.67 (SD=7.49), and 74 (59.7%) were male. The majority of the participants reported having a neurological condition (78.2%), with just under half reporting a spinal cord injury (48.4%). Participants reported few comorbid conditions (mean=2.69, SD=2.40), and low severity of depressive and anxiety symptoms. Individuals were experienced with using their wheelchair (mean=22.31 years, SD=16.05), and had a mean wheelchair skills of 75.5% (SD=14.89). The sample's mean LLDI score was low (mean=50.66, SD=7.85). Sample characteristics are further detailed in table 2.

The direct effect of self-efficacy on participation frequency

Pearson correlation coefficients between the continuous independent and dependent variables are presented in table 2, along with the mean difference in the dependent variable for the dichotomized variables. Variables specified for inclusion into the regression model included age, number of comorbidities, perceived social support, and the age and sex interaction terms. All model assumptions were met.

After forcing the self-efficacy, age, and sex variables into the model, neither the age nor sex interaction term reached statistical significance. The crude model (table 3) therefore included the self-efficacy variable, which accounted for 29.1% of the participation frequency variance.

In the adjusted model (table 3), the self-efficacy estimate was confounded by 18.2% after controlling for age, number of comorbidities, and perceived social support. This model accounted for 41.5% of the participation frequency variance (17.2% by the self efficacy variable). It was also deemed the most valid and precise estimate of the self-efficacy effect on participation frequency because other confounder subsets provided neither equivalent control of confounding nor a more precise estimate.

The mediated effect of self-efficacy on participation frequency

Three mediators were identified for analyses, including life-space mobility, wheelchair skills, and participation limitations. Although the correlation between wheelchair skills and self-efficacy (r=0.84) indicated potential collinearity, we chose to retain both variables in the model because the variation inflation factor value (VIF=3.78) indicated no need for corrective action, and because according to Social Cognitive Theory a causal path exists in which higher levels of self-efficacy may lead to better abilities through various processes.[14] For example, individuals with higher levels of self-efficacy are more likely to develop better abilities than individuals with lower self-efficacy because they will exert greater levels of perseverance to overcome challenges and impediments.[14] The total mediated effect was statistically significant (point estimate = 0.14, 95% bootstrapped CI 0.04,0.24) (table 4), and accounted for 78.0% of the direct effect on participation frequency. This mediation model accounted for 55.0% of the variance. Subsequent examination of the specific indirect effects revealed that the wheelchair skills variable was not a statistically significant mediator, because the 95% confidence interval included 0, and therefore did not contribute to the total indirect effect above and beyond life-space mobility, and participation limitations (see table 4 for the magnitude of each mediation effect).

DISCUSSION

This study's findings provide evidence in support of our hypothesis that after examining and controlling for important confounding effects, self-efficacy has important implications on the participation frequency of community-dwelling manual wheelchair-users, aged 50 and over. Social Cognitive Theory explains that self-efficacy is at the foundation of human motivation and action.[14] Therefore, our results suggest that if people believe they can produce desired effects by their actions while using their wheelchair, they have greater incentive to participate in personal and social roles more frequently. When considering that the mean participation frequency score in this study's sample is low despite being in good health (i.e., individuals reported few number of comorbidities, and low severity of depression and anxiety symptoms), improvements to self-efficacy with using a wheelchair may result in notable participation and quality of life outcomes.

Our results substantiate preliminary findings that illustrated the importance of the self-efficacy construct on participation frequency.[19] However, the findings contrast in that we observed no difference in the magnitude of the association by sex. This disagreement may be due to the larger sample size used in this study that allowed for more robust analyses, such as controlling for additional confounders. Nonetheless, the evidence suggests that strategies to improve low self-efficacy may have beneficial effects on participation frequency regardless of sex. More research is needed to investigate the differences by sex.

Finding that the self-efficacy term remained a statistically significant determinant of participation frequency after examining for interaction and confounding effects, has both clinical and research implications. Because low self-efficacy may present as a barrier to participation frequency, clinical trials are justified to develop and test self-efficacy enhancing interventions. According to Bandura, low self-efficacy is an amenable condition influenced by a variety of social cognitive means.[14] In fact, in a pilot study of older individuals who

were inexperienced with using a wheelchair, the researchers demonstrated positive effects of wheelchair skills training on self-efficacy with using a manual wheelchair.[20]

In a recent study, Phang et al. examined self-efficacy as a mediator in the relationship between wheelchair skills and participation in leisure-time physical activity in younger manual wheelchair-users (i.e. mean age≤50years) with spinal cord injuries.[52] Contrary to our findings, they found an absence of an association between self-efficacy and participation after controlling for skills, and therefore demonstrated no mediating effect.[52] A reason for this discrepancy relative to our findings is likely in how self-efficacy was measured. Their study assessed the self-efficacy construct with items in the WheelCon only pertaining to moving around the physical environment. Our findings may reflect the multifaceted nature of participation being accounted for by the different conceptual areas comprising the entire scale that was used in this study. We also differed in our modeling approach. Whereas they investigated self-efficacy as a mediator, we specified wheelchair skills to mediate the association between self-efficacy and participation. The use of situation specific self-efficacy measures is in accordance with theory, as is the functional form of our model.[14]

The results from the mediation analyses also support our hypothesis that the association between self-efficacy and participation frequency is mediated by multiple functioning/disability variables. The results of the analyses suggests a causal direction in which higher levels of self-efficacy act to improve life-space mobility, and perceptions about participation limitations, which in turn lead to more frequent participation. Therefore, efficacy-enhancing interventions targeted towards improving all of life-space mobility, and participation limitations, may be more beneficial at improving participation frequency than unilateral approaches. Clinical trials investigating the causal nature of self-efficacy are needed to corroborate our observations, as is research into the specific relationships between self-efficacy and the mediators.

Limitations

Although causality cannot be established due to the cross-sectional nature of the data, our findings are in agreement with both theory, and a large body of research demonstrating the beneficial effects of enhanced self-efficacy on various outcomes, and the expected relationships between our hypothesized mediators and participation. Next, we only considered two-way interaction terms in order to keep the models hierarchically well-formulated. Although lower order interactions minimize collinearity, the sample size limited our ability to evaluate possible higher-order interactions that included province. Furthermore, the self-report nature of our data from the use of questionnaires and a volunteer sample may be influenced by selection and measurement bias and/or social desirability. As a result, the volunteer sample may not accurately represent the population as a whole.

CONCLUSION

Self-efficacy with using a manual wheelchair has both direct effects on the participation frequency of community-dwelling manual wheelchair-users, aged 50 and over, as well as statistically significant indirect effects through life-space mobility, and participation

limitations. Self-efficacy is an important construct to consider in the study of wheelchair-users' participation, and the development of interventions to address low self-efficacy with wheelchair use is warranted.

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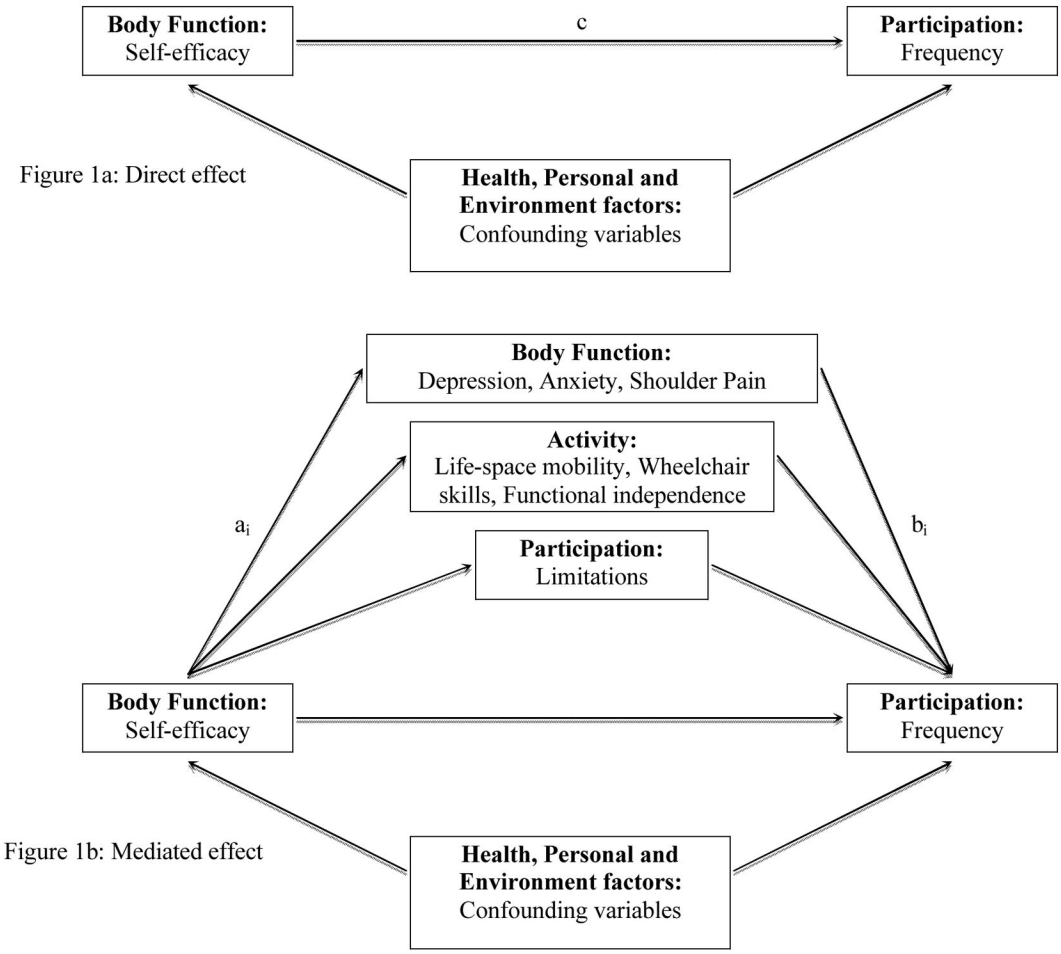

Figure 1. Diagrams Showing the Direct and Mediated Paths of Self-Efficacy on Participation

Figure 1a displays the direct effect (path c) of self-efficacy with using a manual wheelchair on participation frequency while controlling for health, personal, and environmental confounding variables. Figure 1b displays the mediated effect (paths a and b) of self-efficacy with using a manual wheelchair on participation frequency after controlling for health, personal, and environmental confounding variables.

Table 1

Variables/Measures Organized by the International Classification of Functioning, Disability and Health

ICF domain	Variable	Measure	# of items	Focus and Scoring	Studies providing measurement evidence
Dependent variable					
Participation	Frequency	Late Life Disability Instrument[24]	16	The frequency of participating in two role domains (social and personal). Response scale: 1 (never) to 5 (very often). 0 to 100: Higher scores indicate more frequent participation.	Older adults[24,26] Older wheelchair-users[27]
Independent variable of interest					
Body function	Self-efficacy	Wheelchair Use Confidence Scale[17]	65	Self-efficacy in six areas including maneuvering around the physical environment, performing activities, knowledge of the wheelchair and solving problems, social situations, advocacy, and emotions. Response scale: 0 (low) to 100 (high). 0 to 100: Higher scores indicate more self-efficacy.	Wheelchair-users[17]
Potential confounding variables					
Personal factors	Comorbidities	Functional Comorbidity Index[30]	18	Participants respond as either yes or no when asked if a doctor has diagnosed them with any of the 18 health conditions. 0 to 18: Higher scores indicate more comorbidities.	Spine patients[30]
Environmental factors	Need for a seating intervention	Seating Identification Tool[31]	11	Participants respond as either yes or no when asked about pressure, discomfort behaviours, mobility, positioning, and stability. 0 to 15: Higher scores indicate more issues with the wheelchair.	Wheelchair-users[31]
	Social support	Interpersonal Support and Evaluation List-6[32]	6	Perceived social support is rated on scale ranging from 0 (definitely false) to 3 (definitely true). 0 to 18: Higher scores indicate more social support	General population[32]
	Barriers - home	Home and Community Environment Instrument[33]	8/5	Amount of physical barriers in the home and community are quantified. 0 to 10: Higher scores indicate more home barriers. 0 to 5: Higher scores indicate more community barriers.	Adults with mobility limitations[33]
Potential mediating variables					
Participation	Limitations	Late Life Disability Instrument[24]	16	The extent of limitation in performing tasks in two role domains (instrumental and management). Response scale: 1 (completely) to 5 (not at all). 0 to 100: Higher scores indicate fewer limitations.	Older adults[24] Older wheelchair-users[27]

ICF domain	Variable	Measure	# of items	Focus and Scoring	Studies providing measurement evidence
Activity	Life-space mobility	Life Space Assessment[41]	15	Questions pertain to the frequency of movement in five areas (within the home, around the home, in the neighbourhood, in town, and outside of town) over the pastfour weeks, and if any assistance (from other persons or with equipment) was used. 0 to 120: Higher scores indicate more mobility.	Older adults[41]
	Wheelchair skills	Wheelchair Skills Test – Questionnaire[42]	32	Participants are asked if they can safely complete a wheelchair skill. Responses are given either a pass or fail. 0 to 100: Higher scores indicate more skills.	Wheelchair-users[42]
	Activities of daily living	Barthel Index – postal version[43]	10	Ability to perform activities of daily living are rated. Response scales differ for each item. 0 to 20: Higher scores indicate more ability.	Individuals with stroke[43]
Body function	Depression/Anxiety	Hospital Anxiety and Depression Scale[44]	7	Depression and anxiety symptoms experienced during the past week are rated on a scale from 0 (not at all) to 3 (very often indeed). 0 to 21: Higher scores indicate more severe symptoms.	Individuals with a spinal cord injury[53]
	Pain	Wheelchair User Shoulder Pain Index[45]	15	The degree of shoulder pain experienced while performing various activities are identified on a 10cm visual analog scale. Participants also had the option to select ‘item not performed’. 0 to 150: Higher scores indicate more pain.	Wheelchair-users[45]

ICF = International Classification of Functioning, Disability, and Health

Table 2

Descriptive Statistics and Correlations With/Mean Differences in Participation Frequency (n=124)

	Variable by ICF domain	Total	Participation frequency	
		Mean (SD)/frequency (%)	r	Mean difference
	Participation:			
	Frequency (0–100)	50.66 (7.85)	1	
	Limitations (0–100)	63.68 (11.71)	0.54*	
	Activity:			
	Life-space mobility (0–120)	46.99 (17.84)	0.55*	
	Wheelchair skills (0–100)	75.49 (14.89)	0.51*	
	Functional independence (0–20)	14.37 (2.79)	0.22	
	Body functions:			
	Self-efficacy (0–100)	78.38 (19.19)	0.54*	
	Depression (0–21)	3.79 (3.13)	−0.24	
	Anxiety (0–21)	5.09 (3.87)	−0.10	
	Pain (0–150)	19.12 (28.21)	−0.03	
	Health condition:			
	Comorbidities (0–18)	2.69 (2.40)	0.31*	
	Neurological condition:	97 (78.2%)		**−(1.70)**
	Spinal cord injury	60 (48.4%)		
	Multiple sclerosis	16 (12.9%)		
	Stroke	12 (9.7%)		
	Other (e.g. Cerebral palsy)	9 (9.3%)		
	Non-neurological condition:	27 (21.8%)		
	Amputation	9 (9.3%)		
	Polio	5 (4.0%)		
	Arthritis	4 (3.2%)		
	Other	9 (9.3%)		
Potential confounding variables	**Personal factors:**			
	Age	59.67 (7.49)	−0.28*	
	Sex (male)	74 (59.7%)		**(1.71)**
	Education (high school graduate)	110 (89.4%)		**(−0.70)**
	Income:†			
	<$30,000	43 (34.7%)		**(−1.91)**
	Prefer not to answer	21 (16.9%)		**(2.78)**
	Married (yes)	59 (47.6%)		**(0.36)**
	Employed/volunteer (yes)	46 (37.1%)		**(−2.94)**
	Formal training (yes)	22 (17.7%)		**(−2.09)**
	Wheelchair assistance (yes)	39 (31.5%)		**(4.81)**
	Years experience	22.31 (16.05)	0.10	

Variable by ICF domain	Total	Participation frequency	
	Mean (SD)/frequency (%)	r	Mean difference
Daily use (hours)††	12.30 (4.29)	0.17	
Environmental factors:			
Wheelchair			
Need for seating intervention (0–15)	1.98 (1.69)	−0.13	
Social			
Social support (0–18)	14.48 (3.71)	0.39*	
Physical			
Home barriers (0–10)	1.10 (1.22)	−0.05	
Community barriers (0–5)	1.06 (0.85)	−0.13	

*included for modeling;

†mean difference from ≥30,000;

††n=123;

SD=standard deviation; r=Pearson correlation

Table 3

The Direct Effect of Self-Efficacy on Participation Frequency

	Crude model				Adjusted model			
Factor	**b**	**SE**	**95% CI**	**β**	**b**	**SE**	**95% CI**	**β**
Self-efficacy (path c*)	0.22	0.03	0.16, 0.28	0.54	0.18	0.03	0.12, 0.24	0.44
Age					−0.12	0.08	−0.27, 0.03	−0.12
Comorbidities					−0.40	0.24	−0.87, −0.08	−0.12
Social support					0.66	0.15	0.36, 0.96	0.31
adj R^2			**29.1%**				**41.5%**	

b=unstandardized regression coefficient; SE=standard error; CI=confidence interval; β=standardized regression coefficient

*path c = the direct effect of self-efficacy on participation frequency.

Table 4

The Mediated Effect of Self-Efficacy on Participation Frequency

Factor	path a_i	path b_i	a_ib_i	95% CI*
Life-space mobility	0.36	0.12	0.04	0.02, 0.08
Wheelchair skills	0.63	0.04	0.03	−0.05, 0.10
Participation limitations	0.29	0.23	0.07	0.02, 0.13
Total mediated effect			0.14	0.04, 0.24
Proportion of the direct effect accounted for by the mediators		0.14/0.18 = 0.78		
adj R^2		55.0%		

*1000 bootstrap samples; CI = confidence interval path a_i = the associations between self-efficacy and the mediators; path b_i = the associations between the mediators and participation frequency; a_ib_i = the magnitude of each mediated effect.