Pilot study of a peer-led wheelchair training program to improve self-efficacy using a manual wheelchair: A randomized controlled trial.

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Objective: The primary objective was to evaluate the effect of a peer-led wheelchair training program on self-efficacy for manual wheelchair (MWC) use. Secondary outcomes were to explore influences of the intervention on MWC skills, life-space mobility and satisfaction with participation.

Design: Pilot randomized controlled trial

Setting: Rehabilitation centre and community

Participants: Community-living, MWC users, mean MWC experience 13y, mean age 49y, 21% female.

Interventions: The experimental group (n=16) received 6,1.5 hour sessions of a peer-led self-efficacy enhanced wheelchair training program (WheelSee). Based on individualized goals, peer-trainers administered WheelSee to pairs of MWC users. The control group (n=12) receive no intervention.

Main Outcome Measures: The primary outcome, wheelchair use self-efficacy, was assessed using the Wheelchair Use Confidence Scale (WheelCon3.0). Secondary outcomes included wheelchair skills capacity and performance (Wheelchair Skills Test-Questionnaire (WST-Q 4.1)), life-space mobility (Life-space Assessment (LSA)), and satisfaction with participation (Wheelchair Outcome Measure (WhOM)).

Results: Controlling for baseline scores, analysis of co-variance revealed that WheelSee had a large statistically significant effect on MWC use self-efficacy (Cohen's d=1.4, p=0.002) compared to a control group. WheelSee also had a large statistically significant effect on MWC skills capacity (Cohen's d=1.3, p=0.003) and performance (Cohen's d=1.0, p=0.02). There were no statistically significant differences between the groups for life-space mobility or satisfaction with participation.

Conclusion: A peer-led MWC training program improves wheelchair use self-efficacy in adult MWC users, and had a positive influence on other wheelchair-related outcomes. WheelSee may offer a promising intervention strategy to accommodate the training needs of community-living manual wheelchair users.

Key Words: Wheelchair use; self-efficacy; wheelchair skills; peer-training; social cognitive theory

Abbreviations:

MWC = manual wheelchair;

WheelCon = Wheelchair Use Confidence Scale;

WST-Q = Wheelchair Skills Test-Questionnaire;

LSA = Life-space Assessment;

WhOM = Wheelchair Outcome Measure;

The ultimate goal of rehabilitation for manual wheelchair (MWC) users is participation in meaningful activities;[1] however, procurement of a MWC alone does not guarantee this. In fact, MWC use is associated with reduced participation in physical and leisure activities,[2] and community events.[3,4] Acknowledging that wheelchair skills training is just one important factor,[5] it is key for maximizing capacity for participation in meaningful activities.[6]

An effective and validated wheelchair skills training program exists,[7] but is rarely used in clinical practice[8,9] or clinical curriculum.[10] The most common reasons for not using such programs were limited time and knowledge.[8] Therefore, training is likely limited to basic wheelchair skills, which may hinder participation.[11] Knowledge translation of existing programs provides one potential solution, but has not been overly successful to date.[9] Alternative approaches to MWC training offer another potential solution that may reduce clinician burden and provide advanced skills training after rehabilitation when there are less competing priorities and better understanding of task demands.

Self-efficacy has been recently shown to influence MWC use[12,13] and may be just as or more important than skill in predicting mobility and participation.[14] The Wheelchair Skills Training Program effectively improved wheelchair use self-efficacy and wheelchair skills in a sample of non-wheelchair users.[15] However, since participants did not have previous wheelchair experience, it is likely that the task demands of wheelchair use were not well understood and perceived wheelchair use self-efficacy was different than it would be for experienced wheelchair users. Therefore, it has been suggested that MWC training interventions should focus on both skills and self-efficacy[12-15].

Social Cognitive Theory provides a framework for enhancing self-efficacy through enactive mastery, vicarious experience, verbal persuasion, and reinterpretation of physiological responses.[16] Although enactive mastery is the most powerful source, self-efficacy is best enhanced through inclusion of all four sources.[16] The use of peer-trainers to attain vicarious experience is effective in changing behaviour.[17] Peer-trainers may be especially influential for MWC users, as peers have been described as being more credible than able-bodied individuals for showing different MWC-use techniques.[18,19] Furthermore, peer-led interventions may foster a sense of community,[16] may reduce clinician burden, and can be cost-effective.[20,21]

The tenants of Social Cognitive Theory were applied to the development of a peer-led Wheelchair Self-efficacy enhanced training program (WheelSee). The primary objective of this pilot study was to evaluate the effect of WheelSee on wheelchair use self-efficacy in community-living adult MWC users compared to a control group who received no training. The secondary objectives were to provide first estimates of the effect of WheelSee on MWC skills capacity and performance, life-space mobility, and satisfaction with participation. A tertiary objective was to solicit perceived benefits of WheelSee.

METHODS

Design

A parallel-group randomized controlled trial was done using a 1:1 allocation ratio. To conceal the sequence, allocation was performed by a research assistant who was independent of the study. To

support balance between groups a central computerized randomization process was designed with a randomly selected and variable block size. The primary author obtained randomization from the research assistant and instructed participants not to discuss their training period with the Data Collector, who was blinded to group allocation.

Participants

Participants were recruited on a volunteer basis upon discharge from rehabilitation and the community through clinicians, wheelchair vendors, word of mouth and posters. Some snowball sampling occurred. An institutional review board approved the study.

Participants were included if they: were ≥19 years of age; lived in the community; used a MWC ≥2 hours/day; could independently propel a MWC ≥10 meters; had MWC mobility goals; and were cognitively able (Mini Mental State Examination score ≥24).[22] Individuals were excluded from the study if they: could not communicate in English; had a degenerative health condition; or had previously received standardized MWC training (e.g., Wheelchair Skills Training Program).[7]

Power analysis

Sample size was estimated using WheelCon variability data from an experimental study.[15] With α=0.05 and standard deviation=17.0,[15] a sample of 24 participants (12 per group) was needed to achieve 84% power to detect the expected effect (partial $\eta^2 = 0.39$) in WheelCon scores between the experimental and control group. Based on previously reported drop-out rates of 9 to 13%, the sample size was conservatively adjusted by 20% for a total n=28.[23,24]

Procedure

Upon enrolment, a Data Collector completed baseline measures and scheduled post-study evaluations six weeks later. In pairs, participants in the intervention group (WheelSee) attended 6x1.5 hour training sessions at a frequency of one to two sessions per week. Participants in the control group did not receive any training. The Data Collector called all participants to remind them about post-study evaluations. All data collection took place at a research institution.

WheelSee intervention

WheelSee was co-administered by a peer-Trainer who had 15 years MWC experience, and a support-Trainer who had >10 years MWC skills training experience. The support-Trainer's role was to reinforce safety and assist the peer-Trainer. The future intent of WheelSee is that it could be administered without a support-Trainer. Family members or friends (i.e., caregivers) were encouraged to attend WheelSee to reinforce verbal persuasion and to act as a spotter, but was not an intervention requirement.

The peer-Trainer received two days of comprehensive training in the SMART goal framework,[25] teaching MWC skills[7] and using social cognitive approaches.[16] Enactive mastery was facilitated through goal-setting, such that the peer-trainer identified and taught the necessary MWC skills using the Wheelchair Skills Training Program as a guide.[7] Vicarious learning and verbal persuasion were achieved through the peer-trainer and by delivering WheelSee in pairs. Reinterpretation of physiological responses, or reappraising discomfort (i.e., increased heart rate)

that may be experienced in situations that challenge self-efficacy, was incorporated using situational vignettes, role-playing, and discussion of personal experiences.

WheelSee was tailored to participant-identified goals. During the first four WheelSee sessions, participants were selected goals related to performing activities and negotiating the physical environment *(e.g., 'making a hot meal and carrying it to the table').* The peer-Trainer guided the selection of specific objectives that may be required to achieve each goal, such as specific skills, skill sequencing, and overcoming barriers. For example, if the goal was: *'cross the street at a crosswalk'*, objectives may include: '*manoeuvre wheelchair to push walk light, descend a curb cut, propel wheelchair across the street, ascend a curb cut*'. Based on personal experience, the peer-Trainer also addressed issues of anxiety that may arise.

The final two WheelSee sessions focused on less tangible skills, including knowledge and problem solving, advocacy, managing social situations, and controlling emotions. Goals were identified using the same method as above, but rehearsal of these skills occurred through discussion and role-playing using situational scenarios. For example, if the goal was to *'overcome feelings of embarrassment when entering a friend's house with wet tires',* participants achieved enactive mastery by role-playing and practicing to ask for a towel to clean the tires. Vicarious experience, verbal persuasion and reinterpretation of symptoms was integrated by having the peer-Trainer discuss what to do and how to deal with feelings.

Sessions were held in community locations (i.e., research centres, public gardens, shopping malls). Each participant received a manual, including details about each session and goal-setting and monitoring worksheets. Participants used their own MWCs.

Control group

This pilot study used a pragmatic approach such that a no contact control was used for comparison.[26]

Safety

WheelSee employed a MWC spotter strap and training of safe techniques.[27] As part of the WheelSee intervention, if a potentially unsafe situation arose, the trainers acknowledged the unsafe behaviour and provided training on how to avoid future situations. A protocol was in place for reporting adverse events.

Measures

Demographic and personal information were collected at baseline to describe the sample, including: age; sex; marital status; education; diagnoses; previous MWC experience; propulsion method; and previous accidents. Levels of anxiety and depression and social support could confound wheelchair use self-efficacy,[16,28,29] life-space mobility and participation frequency.[30] Therefore, the level of anxiety and depression (Hospital Anxiety and Depression Score (HADS))[31,32] and social support (Interpersonal Support Evaluation List (ISEL))[33,34] were evaluated.

Primary outcome

Wheelchair use self-efficacy was measured at baseline and post-intervention using the Wheelchair Use Confidence Scale for MWC Users (WheelCon-M 3.0).[35] The WheelCon-M is a 65-item, self-report scale. Items are rated on a scale from 0 to 100 and a mean percentage scores is calculated. Higher scores indicate higher self-efficacy. The WheelCon-M is reliable and valid with a Standard Error of Measurement (SEM)=5.9% and Smallest Real Difference (SRD)=16.4%.[32]

Secondary outcomes

Secondary outcomes were collected at baseline and post-intervention using reliable and valid measures. Wheelchair skills capacity and wheelchair skills performance were evaluated using the Wheelchair Skills Test-Questionnaire version 4.1 (WST-Q).[36-40] The Life-Space Assessment (LSA) collected information about the frequency of independent movement in the community.[41-43] Satisfaction with participation in meaningful activities was assessed using the Wheelchair Outcome Measure (WhOM).[44,45]

Immediately upon completion of last the WheelSee session, the peer-Trainer administered a self-report post-WheelSee survey that asked 9 open-ended questions about perceptions of WheelSee.

Data analysis

Means (SD) for continuous variables and frequencies (%) for categorical variables were calculated. Analysis of covariance (ANCOVA) was used to determine between-group post-intervention differences for WheelCon, WST-Q, LSA scores, controlling for baseline scores. An

analysis of variance (ANOVA) was used to determine post-intervention between-group differences in WhOM scores. Intention-to-treat analyses were performed with missing data treated using multiple imputation method. Statistical inferences were made on the pooled effects of 10 imputations.[46,47]

Parametric assumptions were analyzed and Log_{10} transformations were performed to meet the assumption of normality for the WheelCon and WST-Q capacity. Significance testing (*p*) was performed on reflected Log_{10} transformations, and back transformations were done to estimate the 95% confidence interval.[48] Effect sizes were calculated as a ratio of the effect and total sums of squares (partial η^2), then Cohen's d effect sizes were estimated.[49] Effect sizes were defined as small (0.2), medium (0.5) and large (0.8).[50] Statistical Package for the Social Sciences (SPSS) Version 19 (Chicago, IL) was used for data analysis with a statistical significance level $p<0.05$.

Responses from the Post-WheelSee survey were summarized and frequency counts were recorded when applicable. Consensuses on representative statements were obtained from two independent researchers.

RESULTS

The flow of participants through the study is depicted in Figure 1. Twenty-eight individuals completed baseline assessments and were randomized into the experimental (n=16) or control group (n=12). Twenty-seven of 28 participants completed all assessments. One participant did

not complete the intervention or post-intervention assessments due to health conditions unrelated to the study. Therefore, one participant completed the intervention without a pair.

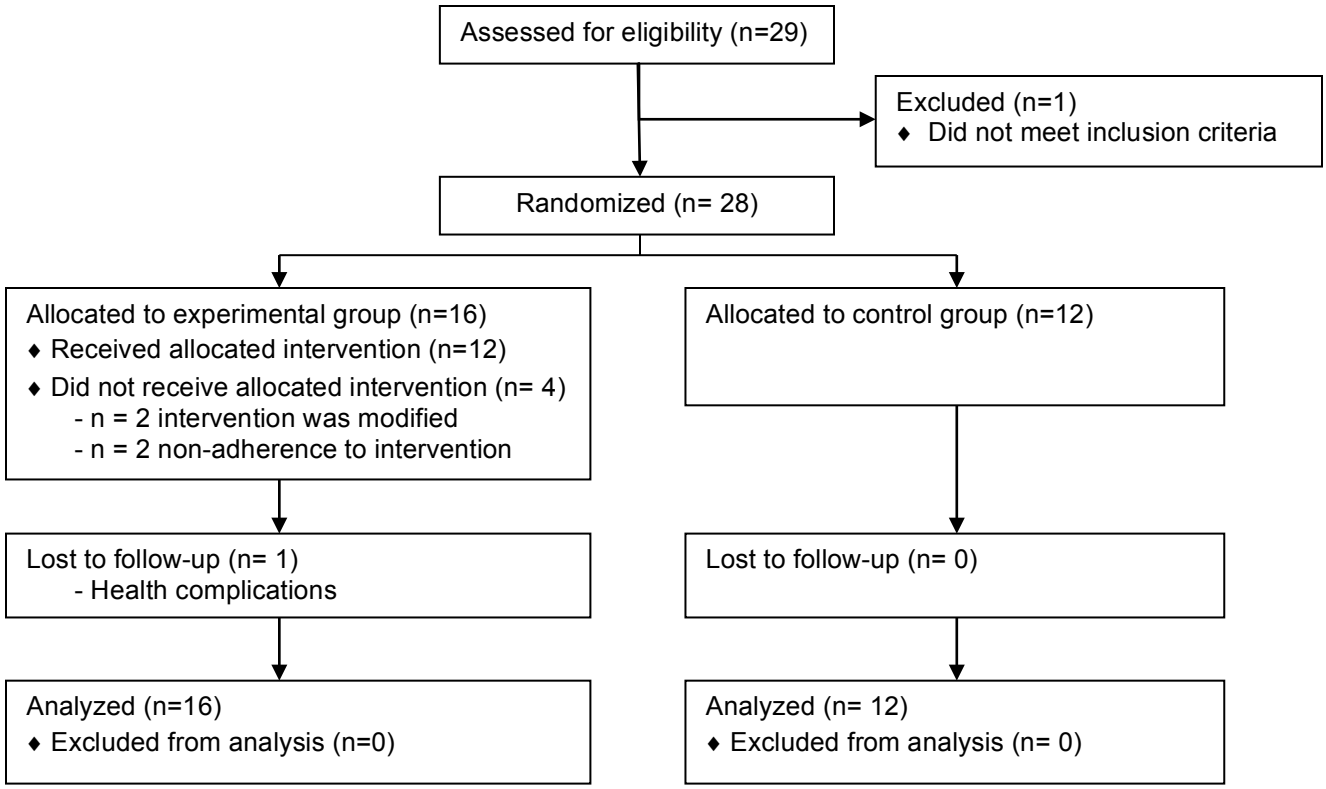

Figure 1. CONSORT flow of participants through the WheelSee study.

Demographic and personal information

The mean (SD) age of the subjects was 48.8(17.0) years. Most participants were unmarried (68%), males (79%), with spinal cord injury (68%). The mean (SD) previous MWC use was 13.1(12.6) years. Table 1 provides baseline demographic information and clinical characteristics.

Table 1: Summary and comparison of demographic and personal information, wheelchair related variables and clinical variables.

Participant Characteristics	WheelSee (n=16)	Control (n=12)
Demographic and personal information		
Age, y, mean (SD); range	49.1 (18.7); 20-84	48.5 (15.2); 25-71
Sex, no. (%)		
Male	14 (87.5)	8 (66.7)
Marital status, no. (%)		
Married or common law	6 (37.5)	3 (25)
Education, no. (%)		
College or university	13 (81.3)	9 (75)
Income CAD, no. (%)		
< 15,000	5 (31.3)	5 (41.7
15,000 - 50,000	4 (25)	3 (25)
Primary language, no. (%)		
English	14 (87.5)	11 (91.7)
Primary Diagnosis, no. (%)		
Spinal cord injury	10 (62.5)	9 (75)
Multiple Sclerosis	2 (12.5)	-
Cerebral Palsy	2 (12.5)	2 (17)
Other (Stroke, Parkinson's, Amputation)	2 (12.5)	1 (8)
Wheelchair related variables		
Previous MWC use, m, mean (SD); range	113.3 (125.3); 2-432	215.9 (168.0); 11-492
Use in current MWC, m, mean (SD); range	36.3 (36.8); 0-120	44.6 (51.2); 2-168
Type of MWC		
Rigid frame	6 (37.5)	7 (58.3)
Propulsion method, no. (%)		
2 hands only	15 (93.8)	11 (91.7)
2 feet only	1 (6.2)	1 (8.3)
Hours per day spent in MWC, no. (%)		
>8	9 (56.3)	7 (58.3)
5 – 8	3 (18.8)	2 (16.7)
WC related accident in the past year, no. (%)		
Yes	4 (25)	6 (50)
No. of accidents in past year, mean (SD)	1.8 (1.0)	2.3 (0.5)
Clinical variables at baseline		
MMSE score (/30)	27.0 (2.4)	26.9 (3.3)
ISEL Score (/18)	13.7 (2.5)	14.4 (2.7)
HADS anxiety (/21)	4.7 (3.2)	5.3 (4.4)
HADS depression (/21)	3.6 (2.5)	2.8 (2.9)
WheelCon (/100)	69.1 (18.7)	78.9 (15.3)
WST capacity (/100)	82.2 (13.1)	78.4 (18.2)
WST performance (/100)	55.5 (22.0)	64.3 (20.0)

Recruitment occurred between June 2012 and November 2013. For the 27 participants who completed assessments at both time points, the mean (SD) time between baseline and post-intervention assessments was 44.7(9.5) days. The experimental group completed 8.4(2.3) hours of training. Four caregivers attended WheelSee. There were no adverse events.

Primary objective: Wheelchair use self-efficacy

Controlling for baseline scores, the experimental group had statistically significant higher wheelchair use self-efficacy post-intervention compared to the control group ($F_{1,26}$=12.7; mean difference=12; 95%CI=7.3,26.8; Log_{10}transformation). The effect size was large and statistically significant (Cohen's *d*=1.4)(Table 2).

Secondary objectives

Controlling for baseline scores, the experimental group had higher wheelchair skills capacity and wheelchair skills performance than the control group that reached statistical significance ($F_{1,26}$=9.3; mean difference=8.5; 95%CI=3.3,13.9, Log_{10}transformation; $F_{1,26}$=6.2; mean difference=13.9; 95%CI=1.9,20.2, respectively). WheelSee had a large statistically significant effect on wheelchair skills capacity and performance (Cohen's *d*=1.3, 1.0 respectively). There was not a statistically significant difference in life-space mobility scores between the experimental and control groups ($F_{1,26}$=0.02, 95%CI=-9.3,10.6)(Table 2).

Participation outcomes included learning specific MWC skills, improving community access, and increasing physical activity (Table 3). WheelSee had a moderate effect on satisfaction with

participation (Cohen's d=0.7), but the between-group differences on the WhOM did not reach statistical significance ($F_{1,24}$=3.49, mean difference =16.5, 95%CI =-2.2,35.3)(Table 2).

Table 2: Mean (SD)[‡] changes from baseline to post-intervention and estimated effect sizes for primary and secondary outcomes.

	Experimental group		**Control group**		**$F_{1,26}$**	**Effect size**
	T1	T2	T1	T2		*Cohen's d*
Primary						
WheelCon	69.1 (18.7)	87.8 (81.2, 95.0[‡])	78.9 (15.3)	75.6 (63.0, 91.0[‡])	3.5	1.4*
Secondary						
WST-Q capacity	82.2 (13.1)	87.7 (84.9,92.6[‡])	78.4 (18.2)	75.5 (62.7, 92.6[‡])	4.72	1.3*
WST-Q performance	55.5 (21.0)	79.6 (46.2)	64.3 (20.0)	66.4 (19.4)	1.14	1.0*
LSA	40.5 (19.5)	47.6 (24.6)	49.2 (16.3)	53.7 (13.8)	0.88	0.1
WhOM	45.7 (30.4)	61.2 (18.1)	39.4 (30.1)	45.5 (28.9)	3.49	0.7[†]

[‡] 95% Confidence Intervals are presented for back transformations.[45]
[*]$p < 0.05$; [†]$p = 0.10$

Abbreviations: T1 = baseline, T2 = post-intervention, SD = standard deviation, WheelCon = Wheelchair Use Confidence Scale, WST-Q = Wheelchair Skills Test-Questionnaire, LSA = Life-space Assessment, WhOM = Wheelchair Outcome Measure.

Table 3: Participant identified goals during baseline assessments and (number of participants who indicated as a goal). *Note: Participants could choose up to 5 goals.

Specific MWC skills	**Community**	**Physical Activity**	**Leisure Activity**
Wheelie (2)	Shopping (6)	Exercise (5)	Travel (2)
Escalators (2)	- at market	Wheeling (5)	Meet with friends (5)
Up / down stairs (3)	- at the mall	-streets/trails	Events (4)
Up / down curbs (6)	- window shopping	- with a dog	- concerts
Uneven terrain (3)	- curbside shopping	Community centres (2)	- sports
Up steep hills or ramps (3)	- grocery shopping	Sports (3)	Restaurants (2)
Crossing streets (1)	Employment/Volunteer (2)		Parks, beaches (2)
Transportation	Getting gas (1)		Hobbies (4)
Transfer (2)	Mailing parcels (1)		- carpentry
Manoeuvring (5)	Cooking (4)		- fishing
Get from ground to MWC (2)			

Tertiary objective

All intervention participants felt their wheelchair use self-efficacy improved after completing WheelSee. The components of WheelSee that worked best were described as: *"positive reinforcement from facilitators"[n=3]; "trying new skills"[n=8]*; *"an experienced peer-trainer" [n=4]; and "watching other participants"[n=4]*. The component that worked the least was *"practicing skills that could already be done"[n=4]*.

DISCUSSION

This pilot RCT suggests there may be potential benefits of peer-led wheelchair training, as WheelSee had a statistically significant large effect on wheelchair use-self-efficacy, wheelchair skills capacity and performance. All participants in the experimental group felt that their personal level of self-efficacy for using a MWC improved from participating in WheelSee, thus demonstrating clinical importance. There were no statistically significant differences between the experimental and control groups for life-space mobility or satisfaction with participation. Findings from this pilot RCT are preliminary and must be interpreted with caution.

Low wheelchair use self-efficacy (<80% on the WheelCon,[51]) can have a negative influence on participation and quality of life.[13] At baseline, 56% of participants in the experimental group had WheelCon scores below 80%. This is slightly higher than previous findings that reported low self-efficacy in 40% of older MWC.[51] After completing WheelSee, only 13% participants had low wheelchair use self-efficacy. Fifty percent of participants had improvements in WheelCon scores that exceeded the smallest real difference,[32] suggesting that WheelSee may contribute to

important clinical changes regarding wheelchair use self-efficacy. Since previous wheelchair use in the sample varied from 2 months to 25 years, it seems plausible that WheelSee may have benefits for both novice and experienced wheelchair users. Future studies should examine how training can be best facilitated at various stages of rehabilitation, which may increase our understanding of dosage, optimal timing, and benefits of ongoing training. Additionally, future studies may screen for low wheelchair use self-efficacy as part of the inclusion criteria.

A validated Wheelchair Skills Training Program has previously improved wheelchair use self-efficacy with similar effect sizes as this study.[15] However, the previous study examined able-bodied older adults who had never used a MWC. Since self-efficacy is largely informed by previous experience,[16] it is likely that items related to wheelchair use self-efficacy lacked meaningful interpretation for non-wheelchair users. Moreover, individuals with physical disabilities have to consider how their functional limitations may influence performance abilities, in addition to the consequences of an unsuccessful performance (e.g., tipping the wheelchair).

WheelSee also effectively improved wheelchair skills capacity (Cohen's d=1.3) and performance (Cohen's d=1.0). An improvement of 3% on the WST is approximately equivalent to improvement in one wheelchair skill.[52] From a clinical perspective, learning and using just one additional wheelchair skill may have a profound clinical impact. For example, learning to climb a curb may make the difference in accessing a building or not. Compared to the control group, participants in the experimental group had 9% higher wheelchair skills capacity and 13% higher wheelchair skills performance post-intervention (i.e., three and four more wheelchair skills respectively). Although each wheelchair skill does not have the same clinical implication,

improvement in just one intermediate or advanced skill may enable participation in meaningful activities.

Wheelchair skills capacity tends to be higher than performance, such that it is common for an individual to posses the ability to execute a wheelchair skill, yet not regularly apply that skill in day-to-day use.[53] WheelSee had a large statistically significant effect on wheelchair skills performance, suggesting that participants increased the number of skills actually used. This may be reflective of improved wheelchair use self-efficacy, as having the confidence to perform the skill is just as or more important as having skill itself.[16] From a rehabilitation outlook, this is promising because performance indicates how the wheelchair is being used to achieve participation in meaningful activities. However, findings from this pilot study are preliminary and must be interpreted with caution as participation in the study alone may have provoked increased performance.

There is an association between wheelchair use self-efficacy and life-space mobility that is mediated by wheelchair skills.[14] However, WheelSee did not have a statistically significant effect on life-space mobility or satisfaction with participation. Although the possibility of measurement error cannot be excluded, it is possible that engaging in a research study alone may have influenced changes observed in both groups. Long-term follow-up is needed to truly understand how self-efficacy and wheelchair skills influence life-space mobility and satisfaction with participation in wheelchair users. Individuals may need more opportunity to integrate newly leaned skills. Moreover, this highlights the need to understand skill retention and whether or not newly learned skills are retained or abandoned upon completion of the intervention.

Study limitations

Generalizability of our results is limited to MWC users living in Vancouver, which is more accessible and varying in climate compared to other Canadian cities. Additionally, due to convenience and snowball sampling methods, our sample may not be representative of all MWC users. Although there was heterogeneity among participants, varying ages and previous wheelchair experience may generalize to larger groups of MWC users. A small sample did not allow for sub-group analyses on these potentially important variables (i.e., age, previous wheelchair experience). Although variability in previous wheelchair experience between the experimental and control group may have influenced the findings, large statistically significant effects sizes were obtained for wheelchair use self-efficacy, wheelchair skills capacity and performance. Future studies may consider powering for stratification of potentially confounding factors (i.e., age, previous experience). Finally, our study was limited by comparisons of an experimental group to a no-contact control group. Although justification of a no-contact control group was provided for this pragmatic pilot study, the potential influence of for attention bias cannot be eliminated. Findings from this pilot study have informed the design of larger randomized controlled trials, including the development of an active control group.[54]

CONCLUSIONS

WheelSee is a novel approach to a health service dilemma that positively influenced wheelchair use self-efficacy and wheelchair skills. Findings from this pilot study support continued research

to evaluate the effect of peer-led wheelchair training for novice and experienced MWC users of varying age. A peer-led, goal-oriented approach to wheelchair training shows promise and is worthy of further study.

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