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Original Research

# Pilot Study of a Fall Prevention and Management Intervention Program for People With Multiple Sclerosis Who Use a Wheelchair or Scooter Full-Time



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**KEYWORDS**
Accidental falls;
Multiple sclerosis;
Rehabilitation;
Wheelchairs

**Abstract** *Objective:* To examine the efficacy of a fall prevention/management intervention among persons with multiple sclerosis (PwMS) who use a wheelchair (WC) or scooter full-time.
*Design:* Pre-post/follow-up trial
*Setting:* Community and research laboratory
*Participants:* Twenty-one PwMS who used a WC or scooter full-time, self-reported at least 1 fall/12 months, and could transfer independently or with minimal/moderate assistance (N=21).
*Intervention:* Six-week, group and community-based fall prevention and management intervention. The intervention included six 2-hour in-person weekly sessions led by a physical or

*List of abbreviations:* FOF, fear of falling; iROLL, Individualized Reduction of Falls (iROLL); MS, multiple sclerosis; PWC, power wheelchair; PwMS, persons with multiple sclerosis; QOL, quality of life; SCI-FCS, Spinal Cord Injury-Falls Concern Scale; WC, wheelchair; WST, Wheelchair Skills Test.

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occupational therapist featuring interactive group discussions, skill practice, and action planning opportunities.
*Main Outcome Measures:* Fall frequency tracked 12 weeks pre- and 24 weeks post intervention. Outcomes were assessed pre- and post intervention and 12 weeks post intervention. Measures included surveys to examine fear of falling (FOF), fall prevention/management, quality of life, community participation, and assessment of functional mobility skills. Semistructured interviews were administered post intervention to ascertain overall experiences with the program and effect on daily life. A Friedman test with signed-rank post hoc analysis was run to determine differences across the 3 study visits.
*Results:* After the intervention, fall incidence did not significantly change, but fall management strategies ($P$=.01-0.05), importance of community participation ($P$=.01), and transfer quality ($P$=.02) significantly improved. Moderate effect sizes were noted among concerns about falling, activity curtailment because of to FOF, and WC skills. Qualitative results indicate that participants found the intervention beneficial and applied intervention content in their daily lives.
*Conclusions:* This study is the first to describe the effect of a multicomponent fall prevention/management intervention designed specifically for PwMS who use a WC or scooter full-time. Results indicate the program has potential to reduce fall risk; however, further testing is needed to fully examine the effect of the program.


Falls and fear of falling (FOF) are common among persons with multiple sclerosis (PwMS) who use a wheelchair (WC) or scooter for functional mobility.[1,2] Approximately 75% of PwMS who use a WC or scooter full-time report FOF, and 65% limit their activities because of these fears.[1] Falls and activity curtailment as a result of FOF have physiological consequences, including injury and deconditioning,[3,4] as well as psychosocial ones, such as loss of confidence and independence.[5-8] Thus, the effect that falls and FOF can have on quality of life (QOL) and community participation is significant.[2]

Evidenced-based fall management education designed for individuals who use a WC or scooter is sparse. Although a systematic review by Abou et al[9] found several home-based exercise programs effective at reducing falls in ambulatory PwMS, only 1 pre-post intervention study specific to individuals who use a WC or scooter by Rice et al[10] was identified. Rice[10] demonstrated the benefit of a single 45-minute intervention for PwMS who use a WC or scooter full-time, but it had several limitations. Based on lessons learned from this investigation[10] and advances in the field,[11] this research team refined the intervention to comprehensively address fall risk factors. This expansion resulted in the creation of a multicomponent, community-based fall prevention and management intervention designed for this specific population.[12]

The purpose of this study is to examine the efficacy of a multicomponent fall prevention and management intervention to reduce fall incidence among PwMS who use a WC or scooter full-time. Secondary aims were to examine the influence of the intervention on functional mobility skills associated with fall risk (eg, transfer and WC/scooter skills, balance), knowledge of fall risk factors, FOF, community participation, and QOL. We hypothesized that 12 weeks after completing the intervention, participants would report a significant decrease in falls, display improved functional mobility skills, and report an increase in their knowledge of fall risk factors, decreased FOF, and greater community participation and QOL compared with baseline measures. Findings from this study will inform future iterations of the Individualized Reduction of Falls (iROLL) program.

## Methods

### Recruitment

A mixed-method, pre-post/follow-up design was implemented. All study-related procedures were approved by the Institutional Review Boards at all study locations. Participants were recruited between June 2018 and October 2019 through community multiple sclerosis (MS) support groups and the research registries of the North American Research Committee on Multiple Sclerosis, a rehabilitation center, and the disability resources services at a large public university. The flow of participants through the study is shown in fig 1.

### Inclusion and exclusion criteria

Individuals were invited to participate if they met the following inclusion criteria: (1) self-reported diagnosis of MS; (2) 18 years or older; (3) WC or scooter as the main form of mobility (≥40h/wk)[13]; (4) self-reported ability to transfer independently or with moderate or minimal assistance; and (5) at least 1 self-reported fall in the past 12 months. Individuals were excluded if they (1) had an MS exacerbation in the past 30 days, (2) received a score ≥10 on the Short Blessed Test[14] (indicative of mild to moderate cognitive impairment), or (3) were unable to remain in an upright sitting position for at least an hour.

### Study design

#### Study visits

Participants completed 3 assessments at a research site with a trained investigator. The study design scheme is shown in fig 2. Participants provided written informed consent, health history, and demographic information at visit 1. The following assessment tools were used at all study visits, additional details about the measures are described in table 1:

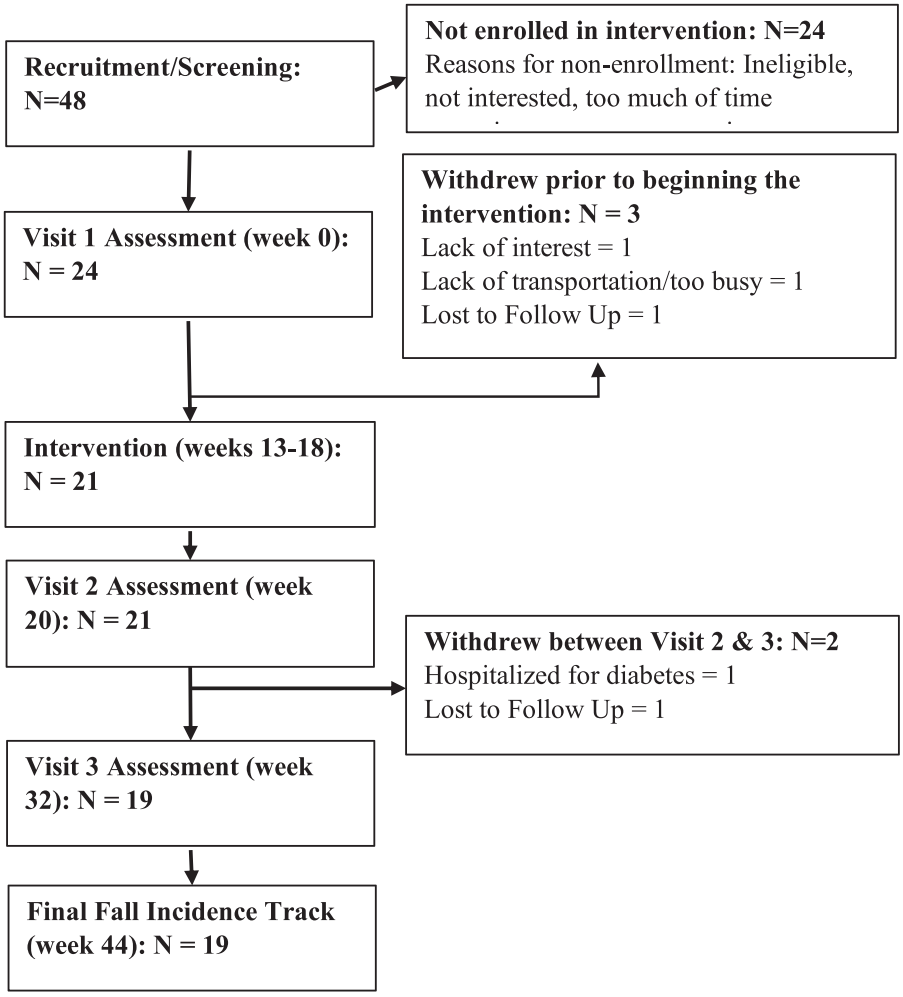


**Fig 1** Flow of participants through study.

To assess FOF, the Spinal Cord Injury-Falls Concern Scale (SCI-FCS)[15], was used. Although the SCI-FCS has only been validated among individuals living with spinal cord injury, it evaluates FOF while performing a variety of activities that are applicable to many individuals who use WC or scooter. Additionally, participants were asked to respond to 2 questions drawn from previously published work on FOF and associated activity curtailment[6,16–18]: (1) "In general, are you worried or afraid of falling;" and (2) "Do you think FOF has made you cut down on any activities that you used to do?"

To assess fall-related knowledge and prevention strategies, the Falls Prevention Strategies Survey for PwMS,[19] Fall

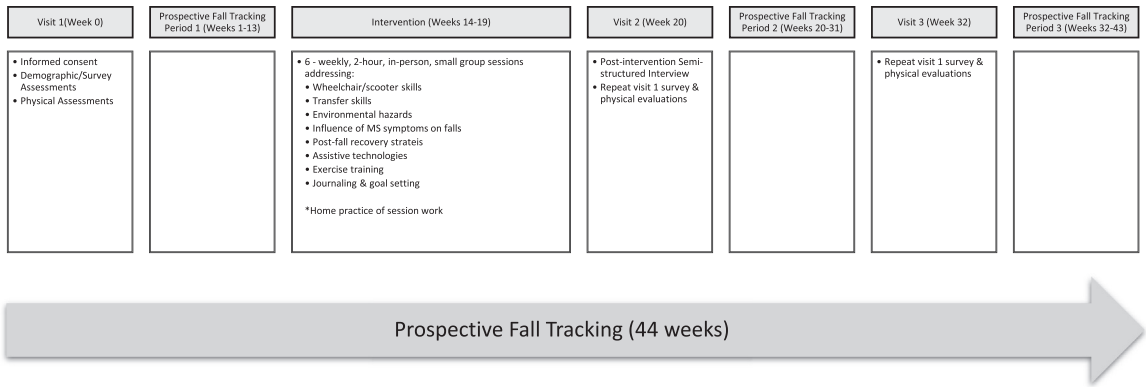


**Fig 2** iROLL study design scheme.

**Table 1** Study visits assessment measures

| | |
|---|---|
| **Paper-based assessments** | |
| **Fear of falling** | |
| SCI-FCS | • 16 items ranging 1 (not at all concerned) to 4 (very concerned)<br>• Possible score range: 16-64<br>• **Higher** scores indicated greater concern about falling |
| Afraid of falling | • Single item ranging 1 (not at all afraid) to 4 (very afraid)<br>• **Higher** scores indicated greater fear of falling |
| Activity curtailment because of FOF | • Single item with yes/no response |
| **Fall prevention strategies** | |
| Fall prevention strategies | • 11 items ranging 0 (never do) to 2 (do regularly)<br>• Possible score range: 0-22<br>• **Higher** scores indicate greater use of fall prevention strategies |
| Fall management | • 5 items ranging 1 (very sure) to 4 (not at all sure)<br>• Possible score range: 5-20<br>• **Lower** scores indicate greater confidence in ability to manage falls |
| Fall Prevention and Management Questionnaire | • 12 items ranging from 4 (strongly agree) to 0 (strongly disagree)<br>• Possible score range: 0-48<br>• **Higher** scores indicate greater perceived fall prevention/management ability |
| **Community participation and quality of life** | |
| Community participation indicators | • 48 items ranging from: 5 (all the time) to 1 (almost never)<br>• 2 subcategories: **importance** of participation (14 items) and **control** over participation (13 items)<br>• Possible score range: 0%-100%<br>• **Higher** scores indicate greater perceived importance/control over community participation |
| MSQOL-overall quality of life | • 54 items with various response options<br>• Data used in analysis: 1 subcategory: **overall QOL** and 2 composite scores: **physical** health-related QOL, **mental** health-related QOL<br>• possible score range: 0%-100%<br>• **Higher** scores indicate greater perceived QOL |
| **Physical assessments** | |
| **Functional mobility** | |
| Transfer Assessment Instrument | • 2-4 transfers to/from mat table to WC/scooter performed<br>• Transfer quality scored by a trained researcher<br>• Possible score ranged: 0-10<br>• **Higher** scores indicate greater transfer quality |
| Function in Sitting Test | • 14 physical tasks performed from a seated position scored by a trained researcher<br>• Item score ranged from 4 (successfully completed task independently) to 0 (dependent/unable to complete task successfully)<br>• Possible score range: 0-56<br>• **Higher** scores indicate greater seated postural control |
| Wheelchair Skill Test | • 30-35 (varied by mobility aid type and assessment location) physical tasks performed in WC/scooter scored by a trained researcher<br>• Item scores ranged from 2 (successfully completed task without difficulty) to 0 (task incomplete)<br>• Scores were summed and divided by the no. of items attempted for a possible score range: 0%-100%<br>• **Higher** scores indicate greater WC/scooter skill performance |

Abbreviations: MSQOL, Multiple Sclerosis Quality of Life; WC, wheelchair.

Management Scale,[20] and Fall Prevention and Management Questionnaire[17] were used.

To assess community participation and QOL, the Community Participation Indicator[21,22] and the Multiple Sclerosis Quality of Life-54[23] were used.

To assess functional mobility, the Transfer Assessment Instrument 3.0,[24,25] Function in Sitting Test,[26,27] and Wheelchair Skills Test[25] were used.

After the intervention, participants engaged in a brief semistructured interview with a member of the research team, in person or via phone, to qualitatively explore how the iROLL program influenced their fall prevention behaviors. Participants also provided feedback on barriers to participating in the intervention. Questions asked are provided in appendix 1. All interviews were recorded and subsequently transcribed verbatim for later analysis. Participants were compensated for their time.

### Fall incidence tracking

Participants prospectively tracked fall incidence using a paper calendar, by marking an X on any date when a fall occurred and provide a description of the fall, location, injures sustained, and recovery. Fall monitoring continued throughout the duration of the study, including 12 weeks before engaging in the intervention (fall tracking period 1), 12 weeks post intervention (fall tracking period 2), and 12 weeks after visit 3 (fall tracking period 3). Research staff also made follow-up phone calls to participants biweekly.

### Intervention

The intervention was delivered by physical or occupational therapists (trainers) to groups of 2-5 participants. Groups met weekly for six 2-hour sessions. Full details of the intervention are described in another publication.[12] Using the theoretical foundation of the health belief model[28] and social cognitive theory,[29] we created the intervention to address influences on fall risk for individuals who use WC or scooter,[1,30–32] including WC or scooter skills, transfer skills, exercises to improve sitting balance and core strength, management of environmental hazards and MS symptoms, post-fall recovery, and the use and/or maintenance of assistive technologies.

Trainers used multiple education methods to engage participants including a program manual, videos and pictures, physical demonstrations, interactive group discussions, and skill practice opportunities. Participants worked with the trainer to establish goals and completed reflection activities. Action planning strategies were used to implement long-term goals. All instruction was performed in a group setting, allowing participants to learn from both the trainer and fellow participants.

## Data analysis

Quantitative data analysis was performed using SPSS Statistics for Windows version 27.0.[a] For continuous variables, the data were checked for extreme outliers (>3 IQR) using box plots. Extreme outliers were assessed for effect on the analysis and were retained if they did not have an appreciable effect on the results. Three data points from the Wheelchair Skills Test (WST) were identified as extreme outliers but were retained for final analysis. Normality was examined using the Shapiro-Wilk test. To examine differences in baseline data between participants who completed the intervention and those who withdrew prior to the intervention, an independent samples *t* test was run. A point-biserial correlation was used to examine the relationship between visit 1 scores and intervention completion to identify potentially distinguishing factors about participants to inform future modifications of the iROLL program. Fall data were separated into 3 periods: fall tracking period 1, fall tracking period 2, and fall tracking period 3. An average and median number of falls experienced during each fall tracking period is reported. All continuous variables were assessed using a nonparametric Friedman test with post hoc Wilcoxon signed-rank test for significant findings. Given the pilot nature of this study, no corrections were made for multiple comparisons. Effect sizes were calculated using Cohen's *d* by examining the differences in mean scores between 2 visits divided by the pooled SD of the 2 time points. Effect sizes (*d*) were interpreted as small ($d \leq 0.2$), moderate ($d \sim 0.5$), or large ($d \geq 0.8$). Significance was set a priori at $P = .05$.

Semistructured interviews, which lasted approximately 15 minutes, were subsequently transcribed and analyzed by 2 research assistants using a thematic analysis framework.[33] A shared codebook was established upon discussion and agreement on key themes after initial independent open coding of the interviews. Intercoder reliability was established by reaching consensus between coders throughout analysis. A third member of the research team who did not take part in the initial coding addressed discrepancies between coders if consensus could not be reached. Exemplary quotes were selected to represent participant perspectives and have been integrated into the quantitative findings below. Themes from participant interviews are reported in Table 2.

## Results

### Demographic characteristics

Twenty-four participants were initially enrolled in the study; 21 of these participants completed the intervention and were included in the pre-post/follow-up analysis (see fig 1). Participants who completed the intervention were 57.57± 10.78 years old, had been diagnosed with MS for 20.67± 9.18 years, and 76.19% were female (n = 16). The majority (66.67%) of participants used a power wheelchair (PWC) as their main form of mobility (n = 14) and used their mobility device 64.65±33.86 hours per week. Full details are presented in Table 3.

### Group differences

No significant differences were observed between participants who completed the intervention and those who withdrew (n = 3). However, a large positive correlation between visit 1 wheelchair skills (WST) and intervention completion, $r_{pb}(20) = 0.58$, $P = .005$, was noted, indicating that greater baseline skills were associated with completion of the program.

**Table 2** Postintervention participant interview themes, subthemes, and codes

| Theme | Subtheme | Code |
|---|---|---|
| Application of program content to daily life | Things I think or feel | Heightening awareness |
| | | Increased confidence |
| | | Increased strength overall |
| | | Listen to body |
| | | Overall movement improvement |
| | Things I do | Refined transfer skills |
| | | Improved wheelchair skills |
| | | Improved wheelchair maintenance |
| | | Task modification/seek assistance more often |
| | | Action/activity planning |
| | | Addition of assistive device |
| | | Environmental modifications |
| | | Continued exercises |
| | | Continued journaling |
| | | Symptom management |
| Addressing program outcomes | Fall frequency | Decreased fall frequency |
| | | Increased fall frequency |
| | | No changes to fall frequency |
| | Fear of falling | Decreased fear of falling |
| | | No changes to fear |
| | Community and participation in meaningful activities | Increased participation |
| | | No changes to participation |
| | Transfer skills | Improved transfer skills |
| | | No changes to transfer skills |
| Barrier to program participation | Distance/transportation | |
| | Intervention time | |
| | No barriers | |

## Primary outcome measure

### Fall incidence

A total of 94 falls were reported throughout the duration of the study, with 5 participants reporting no falls at any point during the study. A 12.84% reduction ($d$ = 0.09) in fall incidence occurred between fall tracking period 1 and fall tracking period 3 (see Table 4); however, this was not significant. Compared with fall tracking period 1, a total of 8 participants experienced a decrease in fall frequency during fall

**Table 3** Baseline participant characteristics

| Characteristic | Overall (N=24) | Visit 2 Completed (n=21) | Withdrew Prior to Visit 2 (n=3) | Equality of Means | |
|---|---|---|---|---|---|
| | | | | *t* | *P* Value |
| Age (y), mean ± SD | 58.04±10.22 | 57.57±10.78 | 61.33±3.50 | −0.58 | .57 |
| Sex, n (%) | | | | 0.34 | .74 |
| Male | 6 (25) | 5 (23.81) | 1 (33.33) | | |
| Female | 18 (75) | 16 (76.19) | 2 (66.67) | | |
| Falls in past 6 mo, mean ± SD | 2.17±1.81 | 2.24±1.92 | 1.67±0.50 | 0.50 | .63 |
| Primary mobility device use (h/wk), mean ± SD | 62.65±34.62 | 64.65±33.86 | 49.33±38.74 | 0.70 | .50 |
| Years since MS diagnosis, mean ± SD | 21.38±9.92 | 20.67±9.18 | 26.33±16.01 | −0.92 | .37 |
| Functional mobility, mean ± SD | | | | | |
| Transfer Assessment Instrument | 7.31±1.53 | 7.35±1.52 | 7.08±1.90 | 0.28 | .78 |
| Function in Sitting Test | 46.79±8.88 | 46.62±8.88 | 48.00±10.44 | −0.25 | .81 |
| Wheelchair Skills Test | 79.05±16.43 | 81.35±15.56 | 63.70±16.21 | 1.82 | .08† |

*Equal variance assumed.
† Trend in data.

**Table 4** Results across time points for participants who completed intervention

| Variable | Previsit 1/FTP 1 (n=21) | Post Visit 2/FTP 2 (n=21) | Follow-up Visit 3/FTP 3 (n=19) | Friedman Test | | Cohen's *d* | |
|---|---|---|---|---|---|---|---|
| | | | | $\chi^2(2)$ | *P* Value | Visit 1 to Visit 2 | Visit 1 to Visit 3 |
| SCI-FCS | 34.1±7.72 | 30.62±7.72 | 31.21±6.1 | 4.03 | .133 | 0.45 | 0.42 |
| Afraid of falling | 2.81±0.93 | 2.62±0.74 | 2.63±0.83 | 0.86 | .65 | 0.23 | 0.20 |
| Cut activity due to FOF, n (%) | | | | | | | |
| Yes | 15 (83.3) | 10 (52.6) | 10 (58.8) | | | | |
| No | 3 (16.7) | 9 (47.4) | 7 (41.2) | | | | |
| Fall prevention strategies | 11.57±3.8 | 14.1±2.83* | 14.47±3.67† | 8.696‡ | .01‡ | 0.76‡ | 0.78 |
| Fall management | 11.7±3.76 | 9.38±2.27* | 9.74±2.9† | 9.864‡ | .01‡ | 0.75‡ | 0.58 |
| Fall Prevention and Management Questionnaire | 31.75±6.7 | 37.24±5.76* | 37.63±5.55† | 6.11‡ | .05‡ | 0.89‡ | 0.96 |
| Community participation indicators-importance | 42.76±11.36 | 44.43±10.38* | 47.26±10.61† | 12.86‡ | <.01‡ | 0.15 | 0.41 |
| Community participation indicators-control | 49.29±10.84 | 51.05±9.2 | 52.32±7.98 | 3.58 | .17 | 0.18 | 0.32 |
| MSQOL-overall quality of life | 64.14±21.9 | 63.9±13.11 | 66.5±15.28 | 2.27 | .32 | 0.01 | 0.12 |
| MSQOL-composite physical health | 52.23±15.18 | 48.57±14.89 | 51.07±16.6 | 2.21 | .33 | 0.24 | 0.07 |
| MSQOL-composite mental health | 68.98±20.68 | 69.22±17.53 | 72.71±15.77 | 0.95 | .62 | 0.01 | 0.20 |
| Transfer Assessment Instrument | 7.35±1.52 | 8.31±1.32* | 8.63±0.92† | 8.33‡ | .02‡ | 0.67‡ | 1.02 |
| Function in Sitting Test | 46.62±8.91 | 45.65±10.43 | 47.78±9.74 | 1.48 | .48 | 0.1 | 0.12 |
| Wheelchair Skill Test | 81.35±15.56 | 84.06±18.24 | 83.56±17.13 | 2.12 | .35 | 0.16 | 0.13 |
| No. of falls, mean ± SD; median | 1.48±2.11; 1 | 1.71±1.95; 1.5 | 1.29±1.98; 0 | 2.22 | .33 | 0.11 | 0.09 |

NOTE. Data are presented as mean ± SD unless otherwise indicated.
Abbreviations: FTP, fall tracking period; MSQOL, Multiple Sclerosis Quality of Life.
* Significant difference between V1 and V2.
† Significant difference between V1 and V3.
‡ Statisitcally significant.

tracking period 3, and 7 experienced no change. Subjectively, many participants attributed their perceived decrease in falls to heightened attention to themselves and their surroundings: "I think they [falls] markedly decreased. I think because I stop and think more, set up more, plan more." Male, 72, PWC

## Secondary outcome measures

### Fear of falling

Fall concern (SCI-FCS) and reports of FOF did not significantly decrease over time. However, reported activity curtailment did decreased from 83% to 53% at visit 2. Many participants discussed a perceived decrease in FOF after the intervention, citing improved confidence in their transfer skills: "I am less afraid of falling because I know better how to maneuver myself for a transfer or when I am in the middle of a transfer and feel like I am going to fall." Male, 39, PWC

### Fall prevention strategies

Fall prevention strategies and management were statistically different across visits (Falls Prevention Strategies Survey: $\chi^2[2] = 8.70$, $P = .01$; fall management: $\chi^2[2] = 9.86$, $P = .01$; Fall Prevention and Management Questionnaire: $\chi^2[2] = 6.11$, $P = .05$). Post hoc analysis revealed significant differences in all fall prevention and management assessments from visit 1 to visit 2 ($P = .01$; $P = .01$; $P = .01$) and visit 1 to visit 3 ($P = .01$; $P = .04$; $P = .01$). Many participants discussed having a heightened awareness of their surroundings and their body's needs, enabling them to make safer choices to prevent falls: "This program has helped me to focus more, to think about where my feet are, to make sure my wheelchair is off. All of those things you kind of knew, but this formally taught me, 'No you have to do this because it's safer.'" Female, 61, PWC

### Community participation and QOL

Importance of community participation significantly varied across visits ($\chi^2[2] = 12.86$, $P \leq .01$), although control over participation did not. Post hoc analysis revealed significant differences in importance from visit 1 to visit 2 ($P = .04$) and

visit 1 to visit 3 ($P$ = .02). No significant changes to physical, mental, or overall QOL were seen. Subjectively, many participants reported an increase in participation and comfort in community-based activities after the intervention: "I'm less afraid to go out and about now . . . before I would be too nervous to go to any swim meets that were held a further distance from where she [daughter] swims with her team, but now I'm not worried." Male, 39, PWC

**Functional mobility**

Transfer quality (Transfer Assessment Instrument) significantly varied across visits ($\chi^2$[2] = 8.33, $P$ = .02), with significant differences shown from visit 1 to visit 2 ($P$ = .04) and visit 1 to visit 3 ($P$ = .01). Participants discussed the perceived refinement of their transfer skills and increased confidence in performance: "The transfer training was especially helpful . . . I'm cautious and consciously thinking about it before I make the actual transfer. Before I wasn't doing that, I was just doing the transfer to the best of my ability, but I have learned some good techniques." Female, 61, PWC

Wheelchair skills performance (WST) did not significantly vary over time. However, participants noted the value of WC skills practice provided in the intervention: "I'm more conscious of what I'm doing. So instead of saying, 'Oh yeah I can do this,' it's like, "Alright, how are you gonna do this and do it that way you won't end up on the floor?'" Female, 68, manual WC

Similarly, no significant changes in postural control (Function in Sitting Test) occurred, although participants indicated that the exercises included in the intervention influenced their postural control for the better: "Because the exercises that I have learned from the program . . . I have learned better ways to keep my balance to prevent from a near fall turning into an actual fall." Male, 39, PWC

**Overall participant perceptions**

Participants' postintervention perceptions of iROLL were overwhelmingly positive. Multiple participants lamented that they had not had something like this sooner but were grateful to incorporate the new skills into their everyday lives: "I thought it was very beneficial and that it was something that I probably needed earlier in my 50s . . . I really appreciated all the things that I learned . . . I started using a lot of [them] day one." Female, 59, PWC

## Discussion

This study examined the efficacy of a fall prevention and management intervention for PwMS who use a WC or scooter full-time. After the intervention, transfer quality, community participation, and fall management strategies significantly improved, although fall incidence did not significantly change. Postintervention interviews demonstrated that participants were very receptive of the intervention and found the program to be beneficial and effective in their day-to-day lives.

During recruitment, several individuals declined to participate, citing concern about the time commitment and transportation limitations. Two participants withdrew from the study, indicating a loss of interest and difficulty with transportation. A significant positive correlation between baseline WC skills and successful completion of the program was noted. This correlation suggests that while there was not a statistically significant difference in baseline skills between those who withdrew from the study and those who did not, participants with less developed baseline WC skills were less likely to complete the intervention. This may have been because of greater anticipated difficulty traveling to the in-person intervention when WC skills were not strong. Had these participants remained for the intervention, it is possible a greater change in WC skills would have resulted. Online delivery of the intervention may improve accessibility for less skilled participants and those with transportation concerns.

Most participants felt their frequency of falls decreased. Objective data reflected this perception although not significantly. Because relatively few falls occurred for most participants, a larger, higher power study with a longer follow-up period is needed to yield significance. Results, however, indicate that small improvements were effectful to participants, who felt more competent using skills learned in the intervention to avoid unnecessary falls. During fall tracking period 3, a 12.84% decrease in fall frequency occurred compared with fall tracking period 1. In the study by Rice et al,[10] with a single 45-minute 1-on-1 fall prevention intervention, 16 participants experienced a 41.2% overall reduction in fall frequency. However, the use of retrospective[10] fall reporting, rather than prospective as in this study, may have influenced differences in the fall frequency results observed across the 2 studies.

Participants reported decreased FOF after the intervention with a moderate effect size ($d$ = 0.42), whereas a small effect size was noted by Rice.[10] Most participants felt less fearful of falling. Some reported that their fear did not decrease, but they were more cautious and had better knowledge of how to safely avoid falling. Additionally, fewer participants reported activity curtailment because of FOF after the intervention, which is important to prevent physical deconditioning.[6]

After the intervention, participants' knowledge and use of fall prevention strategies significantly improved with moderate to large effect sizes noted for each measure. Participants continued to use tools provided to them during the intervention to make positive changes to their skills and environment (ie, continuing the exercise program). Although increased fall prevention strategies did not significantly reduce falls during the study, the knowledge received may have a lasting effect on the safety of participants.

Importance of community participation significantly improved with a moderate effect size ($d$ = 0.41). Qualitative data highlighted increased participation in meaningful activities, particularly outside of participants' homes. For example, a participant reported the ability to attend a family activity that he had previously been fearful to attempt. This pilot study successfully demonstrated that comprehensive fall management training could facilitate active engagement in desired activities.

Transfer quality also significantly improved with a large effect size ($d$ = 0.67). Nearly all participants reflected on the benefits of the transfer skills training given in this intervention. Previous literature[32] has shown that the majority of falls reported by individuals who use a WC or

scooter full-time occur when performing a transfer, so improving these skills is likely to have a long-term positive effect.

### Study limitations

Several limitations associated with this study should be considered. The small sample size reduces generalizability, and larger renditions of the program are needed to determine its true effect. However, given the lack of evidenced-based fall prevention and management programs designed for this population, this study provides an important resource for clinicians and promising preliminary results that will inform future iterations of the study. Efforts were made to recruit from both rural and urban regions, but transportation challenges were cited as reasons for nonparticipation. Future studies with a larger and more diverse sample are needed. An internet-based intervention with the capacity to remotely evaluate functional mobility may address this need, will expand the ability to recruit from diverse geographic areas, and will promote home-based intervention, which has been shown to reduce falls[9] and FOF in ambulatory PwMS.[34]

This pre-post/follow-up trial did not have a control group, although it did include prospective fall tracking prior to intervention to establish an accurate baseline for comparison within participants. Given that MS is a degenerative disease, future studies will benefit from the use of a control group as a comparison tool to help rule out changes over time unrelated to the intervention itself.

## Conclusions

This study evaluated the effect of a 6-week multicomponent fall prevention and management intervention. Quantitative results indicated that after the intervention, transfer quality, community participation (importance), and fall management strategies significantly improved. Qualitative results indicate that the intervention was well received by participants, who found benefit in the program and noted an effect on their day-to-day lives. This study is noteworthy because it is the first to describe the effect of a multicomponent fall management study designed specifically for PwMS who use WC or scooter full-time. A version of the iROLL program with a larger sample size and increased accessibility for diverse populations is needed to examine the full effect of the intervention and further test its effect on fall frequency.

## Supplier

a. SPSS Statistics for Windows version 27.0; IBM, Armonk, NY.

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