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CE ARTICLE

Online Delivery of the Individualized Reduction of Falls Intervention for Persons With Multiple Sclerosis Who Use a Wheelchair or Scooter Full-time: A Pilot Study

Amy Roder McArthur, OTR/L; Elizabeth Walker Peterson, PhD, OTR/L; Jacob Sosnoff, PhD; Deborah Backus, PhD, PT; Rebecca Yarnot, MS; Libak Abou, PhD, MPT; Jacqueline Kish, MS, OTR/L; Sydney Steinkellner, BS; Arman Sandhu, BS; and Laura Rice, PhD, MPT, ATP

CE INFORMATION

ACTIVITY AVAILABLE ONLINE: To access the article and evaluation online, go to https://www.highmarksce.com/mscare.

TARGET AUDIENCE: The target audience for this activity is physicians, advanced practice clinicians, nursing professionals, mental health professionals, social workers, and other health care providers involved in the management of patients with multiple sclerosis (MS).

LEARNING OBJECTIVES:

1. Describe the components of a fall prevention and management program for individuals living with multiple sclerosis who use a wheelchair or a scooter.

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ABSTRACT

BACKGROUND: People with multiple sclerosis (MS) who use a wheelchair or scooter full-time fall frequently; however, fall prevention programming that meets the unique needs of this population is limited. This study examined the preliminary efficacy of a group-based online fall prevention and management intervention designed specifically for people with MS.

METHODS: This pre/post intervention, mixed-methods study included people with MS who used a wheelchair or scooter full-time, experienced at least 1 fall within the past year, and transferred independently or with minimal or moderate assistance. Participants engaged in a 6-week, online, individualized, multicomponent fall prevention and management intervention: Individualized Reduction of Falls–Online (iROLL-O).

RESULTS: No statistically significant change in fall incidence occurred after iROLL-O. However, fear of falling significantly decreased ($P < .01$) and knowledge related to fall management ($P = .04$) and fall prevention and management ($P = .03$) significantly improved. Qualitative results indicated that participants valued the opportunity for peer learning and iROLL-O's attention to diverse influences on fall risk.

CONCLUSIONS: This study is the first to examine the preliminary efficacy of an online fall prevention and management intervention for people with MS who use a wheelchair or scooter full-time. iROLL-O has promise, and participants found it valuable. Further efforts are needed to retain iROLL-O participants with lower confidence and functional mobility, and more research is needed to investigate the impact of the intervention on key outcomes over time.

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Falls and related fear of falling (FOF) negatively impact the lives of many persons living with multiple sclerosis (MS) who primarily use a wheelchair or scooter (WC/S) to support their mobility. Approximately 250,000 people with MS in the United States use a WC/S full-time. Falls are a common concern, with 75% of people with MS who use a WC/S falling at least once per 6 months.[1] Falls in this population result from interacting physical, behavioral, environmental, and psychological influences and can result in death, injuries, and psychological consequences (eg, FOF).[1] Collectively and independently, fall-related injuries and FOF can lead to decreased opportunities for people with MS using a WC/S to participate in preferred activities and decreased quality of life (QOL).[2-4] As a result, an evidence-based fall prevention and management intervention program designed specifically for people with MS who use a WC/S full-time is needed to promote the health and well-being of this population.[5]

To address this need, from June 2018 to March 2020, Rice et al[6] conducted an in-person fall prevention and management intervention, Individualized Reduction of Falls–In Person (iROLL-IP), designed specifically for people with MS using a WC/S full-time. The intervention was created and evaluated by an interprofessional team of physical therapists and occupational therapists. The expertise of team members was used to comprehensively address the diverse influences on fall risk for the target population. Results from the delivery of the iROLL-IP intervention revealed significant improvements in participant reports of fall management strategies, community participation, and transfer quality.[6]

Emergence of the COVID-19 pandemic in early 2020 combined with findings from a process evaluation that highlighted access-related challenges to study participation necessitated the transition of iROLL-IP from face-to-face to remote delivery. In addition to removing access barriers related to travel, online delivery allowed for recruitment from communities without access to large health care or research institutions, such as rural populations.

The purpose of this study was to investigate the feasibility and explore the efficacy of the Individualized Reduction of Falls–Online (iROLL-O) intervention, an online version of iROLL-IP. iROLL-O is a complex fall prevention and management intervention specifically designed for full-time WC/S users with MS. The primary outcome sought through iROLL-O was to reduce fall incidence among people with MS who use a WC/S full-time. Secondary aims were to improve functional mobility skills associated with fall risk (eg, transfer and WC/S skills, balance), increase knowledge of fall risk factors, decrease FOF, and enhance QOL and community participation.

We hypothesized that we would observe decreased incidences of falls and FOF and improved knowledge of fall risk factors and functional mobility immediately after exposure to the intervention. In addition, we hypothesized that these improvements would persist 3 months after exposure to the intervention and that improvements would be seen in reports of community participation and QOL.

METHODS

A longitudinal, pre/post intervention, mixed-methods study was implemented from May 2020 to September 2021. Before recruitment, ethical approval was granted by the institutional review boards at the University of Illinois at Urbana-Champaign, the University of Illinois Chicago, and the

From the Department of Disability and Human Development (ARMA, JK) and Department of Occupational Therapy (ARMA, EWP), College of Applied Health Sciences, University of Illinois Chicago, Chicago, IL, USA; Department of Physical Therapy, Rehabilitation Science, and Athletic Training, University of Kansas Medical Center, Kansas City, KS, USA (JS); Virginia Crawford Research Institute, Shepherd Center, Atlanta, GA, USA (DB); Department of Kinesiology and Community Health (RY, SS, AS, LR) and Center on Health, Aging, and Disability (LR), College of Applied Health Sciences, University of Illinois at Urbana-Champaign, Champaign, IL, USA; and Department of Physical Medicine and Rehabilitation, Michigan Medicine, University of Michigan, Ann Arbor, MI, USA (LA). Correspondence: Laura A. Rice, PhD, MPT, ATP, 219 Freer Hall, 906 S Goodwin Ave, Urbana, IL 61801, USA; email: ricela@illinois.edu.

Note: Supplementary material for this article is available at IJMSC.org.

Shepherd Center (Atlanta, GA). All participants electronically signed an informed consent document via a secure, online data capture platform, Research Electronic Data Capture (REDCap; Vanderbilt University), before engagement in research activities.

Recruitment

Participants were recruited between May 2020 and January 2021 primarily using the North American Research Committee on Multiple Sclerosis research registry. Participants were also recruited through community MS support groups and research registries at Shepherd Center and University of Illinois at Urbana-Champaign Disability Resources and Educational Services.

Inclusion and Exclusion Criteria

Individuals were eligible for this research study if they (1) self-reported a diagnosis of MS, (2) were 18 years or older, (3) primarily use a WC/S for mobility (~75%+ of daily mobility), (4) self-reported ability to transfer independently or with minimal/moderate assistance, and (5) self-reported at least 1 fall in the past 12 months. Individuals were excluded if they (1) had an MS exacerbation in the previous 30 days, (2) received a score of 10 or higher on the Short Blessed Test indicative of minimal to moderate cognitive impairment,[7] or (3) were unable to remain in an upright seated position for at least 1 hour. Sitting tolerance was used to determine study eligibility because sitting upright is often a prerequisite skill for engaging in activities both at home and in the community throughout the day.

Study Protocol

Participants completed 3 assessments virtually over 44 weeks using the REDCap platform (**Figure 1**). Assessment 1 occurred 12 weeks before the start of the intervention, assessment 2 was immediately after the intervention/20 weeks after assessment 1, and assessment 3 was approximately 32 weeks after assessment 1.

Study Assessment 1

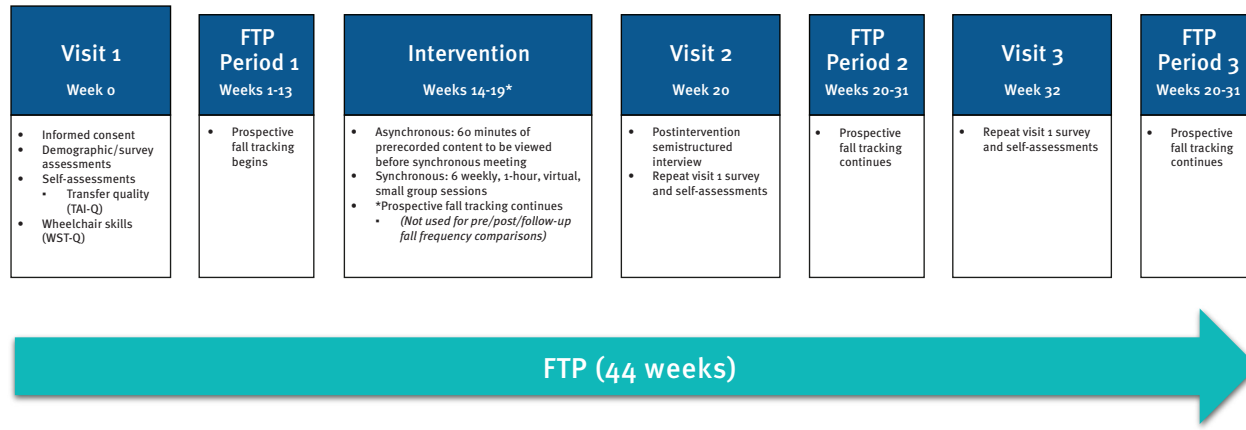
After electronically signing an informed consent document and verifying inclusion criteria, participants were asked to complete questions regarding demographics and health history. Next, participants completed a series of online assessments, as follows, using REDCap. All assessments, unless otherwise noted, have been validated for use among people with MS. Additional details regarding the outcome assessments are noted by Rice et al.[6]

- Fear of falling was evaluated using the Spinal Cord Injury-Falls Concern Scale[8]; higher scores indicate greater concern. Although the scale has been validated only among individuals living with spinal cord injuries, it evaluates FOF while performing a variety of activities that are applicable to many individuals who use a WC/S and has been used successfully in previous studies that included participants living with MS.[9]
- The Falls Prevention Strategies Survey for people with MS[10] was used to examine the frequency of protective behaviors related to fall risk, with higher scores indicating greater frequency.
- The Fall Management Scale[11] was used to measure participants' perceived ability to manage risk of falls or actual falls, with lower scores indicating greater perceived ability. The tool was originally developed for use among older adults but has been used previously among people with MS.[6,12]
- The Fall Prevention and Management Questionnaire[12] was used to assess participants' knowledge in 12 areas related to fall prevention and management, with higher scores indicating greater knowledge.
- Community participation and QOL were evaluated using the Community Participation Indicators,[13,14] which has 2 subcategories (ie, perceived importance of community participation and perceived control over ability to participate), and higher scores indicate greater perceived importance/control. The Multiple Sclerosis Quality of Life–54 instrument[15] was used as well and has 2 composite scores (ie, physical health– and mental health–related QOL), with higher scores indicating greater perceived QOL.
- Participants were asked to self-assess functional mobility skills using 2 questionnaires. The Transfer Assessment Instrument Questionnaire[16] assesses how users of WC/S set up their body and mobility device to perform a transfer, the smoothness and control of the flight phase, and stability and control during the end phase of the transfer. Higher composite scores indicate greater overall transfer quality. Wheelchair and scooter skills were evaluated using the Wheelchair Skills Test-Questionnaire,[17,18] which asks users to consider skill performance, skill confidence, and skill frequency, with higher scores indicating greater performance, confidence, and frequency.
- After completion of the online outcome assessments, participants were asked to prospectively track fall incidence using a paper calendar. Participants were asked to mark an *X* on any date when a fall occurred and to provide a description of the fall, location, injuries sustained, and how they recovered. Participants were asked to track their falls for 44 weeks during the study: fall tracking period (FTP) 1 was 12 weeks before engaging in the intervention, FTP 2 was 12 weeks immediately after the intervention, and FTP 3 was 12 weeks after assessment 3. Participants also tracked falls during the 6-week intervention, although these data were not used for pre/post fall frequency comparisons. Research staff also made follow-up phone calls to all participants every other week to capture fall frequency. Please refer to Figure 1 for an overview of the FTPs.

Study Intervention

After prospectively tracking fall frequency for 12 weeks, participants engaged in iROLL-O. iROLL-O was manualized to support fidelity and included asynchronous and synchronous activities. It was delivered to groups of 2 to 5 study participants by a licensed physical or occupational therapist trained to deliver the intervention. The intervention was

FIGURE 1. Study Design Scheme



FTP, fall tracking period; TAI-Q, Transfer Assessment Instrument Questionnaire; WST-Q, Wheelchair Skills Test-Questionnaire.

implemented over 6 weeks. The same series of activities occurred each week.

- Asynchronous components: Each week participants were emailed a link to view prerecorded videos on topics associated with fall prevention and management. The content of the videos mirrored information presented in iROLL-IP and is described, in detail, by Rice et al.[19] Participants watched 60 minutes of content each week (https://iroll.kch.illinois.edu). Videos were broken down into approximately 10-minute segments to maximize retention and facilitate viewing. Participants completed a variety of written activities, including setting weekly goals and completing journal entries, to reflect on the iROLL-O content and how they applied it in their day-to-day lives. They also completed active learning activities to reinforce the education content. Participants were asked to complete all asynchronous activities before engagement in the weekly synchronous session.

- Synchronous component: Each week, the participants and the trainer delivering the session met online via Zoom (Zoom Video Communications). All trainers facilitating the iROLL-O program were licensed physical or occupational therapists with at least 2 years of clinical practice experience, including at least 1 year specifically working with individuals with neurologic impairments. In addition, all trainers had served as a trainer in the delivery of at least 1 cycle of the iROLL-IP intervention. The trainer delivering the session followed a detailed manual to guide participants. In each session, participants were given the opportunity to ask questions about asynchronous materials and to discuss challenges encountered when applying iROLL-O content in daily life. The trainer also fostered discussions around the participants' goals and journal entries and highlighted key take-home messages presented in the asynchronous materials. Group discussions were especially important vehicles to support participants in daily life application of the material and in devising realistic solutions for each participant's lifestyle. When additional time or hands-on assistance was needed for skill acquisition, participants were encouraged to seek one-on-one physical and/or occupational therapy services.

Study Assessment 2

After completion of the 6-week intervention, participants were sent a link via email to complete the second study assessment virtually via REDCap. Apart from the demographic survey, participants completed the same outcomes described in study assessment 1. Participants also engaged in a semi structured individual interview with a member of the research team via telephone that lasted 15 to 25 minutes. These interviews were designed to capture their overall experience with the program and its effect on their life. Participants were asked to provide feedback on barriers to participating in the intervention and their perceptions of remote delivery of the group intervention. Each interview was recorded and transcribed verbatim. Participants were asked to continue to track fall frequency for the next 12 weeks (FTP 2).

Study Assessment 3

A final study assessment was conducted approximately 12 weeks after completion of study assessment 2 and 32 weeks after completion of assessment 1. Via REDCap, participants were again emailed a link to complete the outcomes assessed in study assessment 1. Participants continued to track fall frequency for a final 12 weeks after completing assessment 3 (FTP 3).

Data Analysis

The distribution of the quantitative data was examined using the Shapiro-Wilk test. Extreme outliers were checked using boxplots. Means and standard deviations are used to present continuous variables, and counts and percentages are used to present categorical variables. The variables included in the analyses were normally distributed. Due to the small sample size, Mann-Whitney *U* tests were used to investigate differences in baseline data between participants who completed assessments 2 and 3 and those who withdrew before assessment 2. Data collected on total number of falls were categorized into 3 periods: 12 weeks before the intervention

TABLE 1. Baseline Participant Characteristics

Characteristic	Overall (N = 18)	Completed assessment 2 (n = 12)	Withdrew before assessment 2 (n = 6)	*P* value
Age, y	64.50 ± 10.71	62.33 ± 12.15	68.83 ± 5.64	.25
Sex, No. (%)				.60
Male	2 (11)	1 (8)	1 (17)	
Female	16 89)	11 (92)	5 (83)	
Falls in past 6 mo, No.[a]	2.47 ± 2.35	2.75 ± 2.66	1.80 ± 1.30	.44
Primary mobility device use, h/wk	65.06 ± 44.68	79.67 ± 45.27	35.83 ± 27.22	.05[b]
Years since MS diagnosis	29.83 ± 13.16	28 ± 10.69	33.50 ± 17.73	.62
Functional mobility scores				
TAI-Q[c]	5.90 ± 1.62	6.16 ± 1.57	5.26 ± 1.73	.44
WST-Q performance	67.52 ± 19.03	74.73 ± 12.08	53.11 ± 23.15	.05b
WST-Q confidence	66.50 ± 20.59	73.09 ± 13.81	53.49 ± 26.71	.18
WST-Q frequency	59.36 ± 19.03	64.16 ± 12.22	49.78 ± 27.18	.37

Note: Results are presented as mean ± SD except where indicated otherwise.
MS, multiple sclerosis; TAI-Q, Transfer Assessment Instrument Questionnaire; WST-Q, Wheelchair Skills Test-Questionnaire.
[a]An outlier was removed from the analysis (withdrew before assessment 2).
[b]Statistically significant.
[c]The TAI-Q data were missing for 1 participant who withdrew before assessment 2.

(FTP 1), 12 weeks immediately after the intervention (FTP 2), and 12 weeks after assessment 3 (FTP 3). The mean number of falls per tracking period was reported. Due to its robustness and the study's small sample size, a repeated-measures 1-way analysis of variance was used to evaluate the effect of the intervention over time on the variables of interest. A post hoc least significant difference test was used to determine differences between time points. Cohen *d* effect sizes were estimated by calculating the differences in mean scores between assessment 1 and assessment 2 or 3 by dividing the pooled SD of the 2 time points. Effect sizes were interpreted as small ($d \leq 0.2$), moderate ($d \sim 0.5$), or large ($d \geq 0.8$).[20] All data analysis was performed using IBM SPSS Statistics for Macintosh, version 25 (IBM Corp).

Semistructured interviews were transcribed and analyzed by 4 research assistants using a thematic analysis framework.[21] Initially, independent open coding for 2 interviews led to the establishment of a shared codebook that was later refined. Subsequent codebooks addressed discrepancies across coders and represented additional codes not initially captured. Intercoder reliability was established by reaching consensus across coders throughout analysis, first among all 4 coders and then in pairs for the remaining interviews. Codes were grouped into themes, code definitions were refined, and exemplary quotes were selected to represent participant perspectives.

RESULTS

Demographic Characteristics

Eighteen participants initially enrolled in this study, and 12 participants completed assessments 2 and 3. Participants who completed assessments 2 and 3 had a mean ± SD age of 62 ± 12 years, were 92% female (n = 11), and had lived with MS for a mean ± SD of 28 ± 11 years (**TABLE 1**).

Reasons for attrition were diverse (**FIGURE S1**, available online at IJMSC.org). Three participants withdrew before the start of the intervention, 2 withdrew during the intervention, and 1 withdrew before assessment 2.

There were significant differences in demographics and baseline outcomes between participants who withdrew from the study and those who completed assessments 2 and 3. Participants who completed assessments 2 and 3 reported significantly more hours of mobility device use per week compared with participants who withdrew before assessment 2 ($P = .05$). At baseline, participants who completed assessments 2 and 3 scored significantly higher on the performance scale ($P = .02$) of the Wheelchair Skills Test-Questionnaire, indicating greater ability to perform wheelchair skills.

Primary Outcome Measure

Fall Incidence

There was no significant change in fall incidence over time after participation in iROLL-O ($P = .64$, $\eta^2 = 0.03$, $d = 0.19$). During FTP 1, 2, and 3, participants reported a mean ± SD of 0.75 ± 1.60, 0.50 ± 0.67, and 0.50 ± 0.91 falls, respectively (**TABLE 2**). Qualitative data indicate that participants perceived fall incidence as being the same as before engaging in iROLL-O; however, participants reported an increased level of awareness when performing functional activities, leading to improvements in safety after the intervention: "…avoiding distractions and I [put] my mind solely on what I was doing for transfers, and it made such a difference…I had gone from so many near accidents to like none" (woman, age 73 years, power WC user).

TABLE 2. Results Across Time Points for the 12 Participants Who Completed the Intervention

Outcome	Visit 1	Visit 2	Visit 3	One-way ANOVA			Cohen *d* (Visits 1-3)
				F statistic	*P* value	Partial η^2	
No. of falls	0.75 ± 1.60	0.50 ± 0.67	0.50 ± 0.91	0.33	.64	0.03	0.19
SCI-FCS	36.33 ± 9.13	34.25 ± 8.78	29.58 ± 7.89	9.70	<.01[ab]	0.47	0.80
FPSS	12.92 ± 3.24	12.67 (2.64	13.50 ± 2.61	0.73	.47	0.06	0.20
FMS	13.50 ± 1.88	12.33 ± 2.74	11.42 ± 2.91	3.80	.04[a]	0.26	0.85
FPMQ	29.25 ± 8.23	35.75 ± 6.77	34.33 ± 6.83	6.06	.03[ac]	0.36	0.67
CPI-Importance	46.69 ± 10.66	47.59 ± 9.21	48.40 ± 10.44	0.37	.66	0.03	0.16
CPI-Control	56.88 ± 15.89	56.47 ± 13.89	58.65 ± 18.13	0.54	.59	0.05	0.10
MSQOL-54 Overall	60.85 ± 19.14	57.51 ± 23.08	57.23 ± 22.48	0.59	.56	0.05	0.17
MSQOL-54 PH	46.33 ± 18.93	46.31 ± 20.95	44.05 ± 19.30	0.51	.61	0.04	0.12
MSQOL-54 MH	66.73 ± 19.78	66.31 ± 19.71	62.48 ± 20.15	0.83	.44	0.07	0.21
TAI[d]	6.40 ± 1.63	6.17 ± 1.10	5.75 ± 1.19	0.99	.39	0.10	0.45
WST-Q performance[e]	74.61 ± 12.66	82.06 ± 19.10	77.97 ± 16.76	2.30	.13	0.19	0.23
WST-Q confidence[e]	72.95 ± 14.48	81.15 ± 19.54	79.81 ± 17.45	3.74	.06	0.27	0.43
WST-Q frequency	65.48 ± 11.85	74.55 ± 20.52	70.37 ± 16.95	2.20	.14	0.18	0.33

Note: Values are presented as mean ± SD.

ANOVA, analysis of variance; CPI, Community Participation Indicators; FMS, Fall Management Scale; FPMQ, Fall Prevention and Management Questionnaire; FPSS, Falls Prevention Strategies Survey; LSD, least significant difference; MH, mental health; MSQOL-54, Multiple Sclerosis Quality of Life–54; PH, physical health; SCI-FC, Spinal Cord Injury-Falls Concern Scale; TAI, Transfer Assessment Instrument; WST-Q, Wheelchair Skills Test-Questionnaire.

[a]Statistically significant difference between visits 1 and 3 using a post hoc LSD test.

[b]Statistically significant difference between visits 2 and 3 using a post hoc LSD test.

[c]Statistically significant difference between visits 1 and 2 using a post hoc LSD test.

[d]n = 10.

[e]n = 11.

Secondary Outcome Measures

Fear of Falling

The FOF was significantly reduced after iROLL-O, as indicated by Spinal Cord Injury-Falls Concern Scale scores ($P < .01$, $\eta^2 = 0.47$, $d = 0.80$). A significant reduction in FOF was noted between assessments 1 and 3 ($P < .01$, mean difference = –6.75) and between assessments 2 and 3 ($P < .01$, mean difference = –4.67). Qualitative data indicated a nuanced experience with FOF and a developing balance between fear that prohibits engagement and being more aware of falls during performance of their daily activities: "… I just have to be cautious, pay attention, and not take unnecessary chances" (woman, age 60 years, power WC user).

Engaging in Protective Behaviors Related to Fall Risk, Fall Management, and Knowledge of Fall Prevention and Management Strategies

Scores on both the Fall Management Scale ($P = .04$, $\eta^2 = 0.26$, $d = 0.85$) and the Fall Prevention and Management Questionnaire ($P = .03$, $\eta^2 = 0.36$, $d = 0.67$) improved significantly. Fall Management Scale scores significantly decreased between assessments 1 and 3 ($P < .01$, mean difference = –2.08), and Fall Prevention and Management Questionnaire scores significantly increased between assessments 1 and 2 ($P = .03$, mean difference = 6.5) and between assessments 1 and 3 ($P = .03$, mean difference = 5.08). No significant differences were seen in Falls Prevention Strategies Survey scores before and after the intervention ($P = .47$, $\eta^2 = 0.06$, $d = 0.20$).

Many participants described an enhanced awareness of the many influences on fall risk, including the environmental context, which included mobility device use: "Constantly look at your environment to identify and address things that can contribute to falls, being overly observant, and not take it for granted just because you think it's safe; it may not be as things change" (man, age 67 years, power WC user). Many participants reported increased insight into personal factors that contribute to their risk of falls: "I'm more aware of [fall prevention strategies] and I think that's important, especially as you age. There's going to be a lot more problems with, not just MS, but aging as well" (woman, age 74 years, power WC user). Participants also reflected on their past approaches to falls, which may have contributed to increased fall risk: "Well, I was just going through life thinking that I can do this no problem and being sorta nonchalant about things and falling" (woman, age 67 years, manual WC user).

Community Participation and QOL

After study participation, the scores on the Community Participation Indicators subscales showed no significant changes (Importance: $P = .66$, $\eta^2 = 0.03$, $d = 0.03$; Control: $P = .59$, $\eta^2 = 0.05$, $d = 0.10$). There were also no significant changes in the scores of the Multiple Sclerosis Quality of Life–54 for

PRACTICE POINTS

Falls are common among people with multiple sclerosis (MS) who use a wheelchair or scooter full-time. Interprofessional perspectives are needed to inform fall prevention and management efforts.

Individualized Reduction of Falls–Online (iROLL-O), a fall prevention and management intervention specifically designed for people with MS who use a wheelchair or scooter full-time, has the potential to reduce fear of falling, manage falls, and improve knowledge of fall prevention and management strategies relevant to people with MS.

Extra effort to retain participants with lower levels of functional mobility and mobility confidence may enhance the impact of the intervention for the most vulnerable full-time wheelchair and scooter users with MS. ■

overall QOL (P = .56, η^2 = 0.05, d = 0.17) or the physical health (P = .61, η^2 = 0.04, d = 0.12) and mental health (P = .44, η^2 = 0.07, d = 0.21) subscales. Importantly, participants described social isolation and identified barriers to participation created by the COVID-19 pandemic and weather-related concerns.

Functional Mobility

After participating in the study, no significant changes were noted in scores on the Transfer Assessment Instrument Questionnaire (P = .39, η^2 = 0.10, d = 0.45) or on the Wheelchair Skills Test-Questionnaire (performance: P = .13, η^2 = 0.19, d = 0.23; confidence: P = .06, η^2 = 0.27, d = 0.43; frequency: P = .14, η^2 = 0.18, d = 0.33). Despite these quantitative findings, participants reported improved safety and confidence in daily transfers: "I think my transfer skills have gotten better. I know…how far away my wheelchair should be to decide what type of transfer is best" (woman, age 38 years, manual WC user).

Additional Intervention Influences

Thematic analysis revealed additional iROLL-O influences. Most participants reported social learning during the group intervention sessions as an important experience. They valued the opportunity to learn strategies to support safe activity and mobility from their peers: "Oh my gosh, it was great. We had a lot of ideas that we shared back and forth, and you know you encourage each other, and it was really, it was a nice blend" (woman, age 60 years, power WC user).

They valued learning more about equipment that can help to reduce falls and how this equipment may be used, as well as an increase in awareness of the future benefits of this knowledge: "It was helpful [to learn about equipment]. [It] gave me an idea of what to prepare myself for in the future" (woman, age 64 years, manual WC user). And they valued learning more to increase their self-efficacy and self-advocacy related to falls and other safety concerns. Many reported increased preparedness and an increased ability to self-direct assistance: "I am practicing. Once you're on the ground whether it was intentional or by a fall, what do you go through to get back up? I am trying to practice that and get it in my routine so that when it does happen, I can be more articulate on instructing people on how to help me get up" (man, age 67 years, power WC user). For some participants this meant an improved ability to plan appropriate assistance and strategically seek out social support and assistance related to safety beyond fall prevention: "Now I have the person in my neighborhood who's gonna help me with the elevator and stuff. So I think this program made me make some better decisions on how I can deal with emergencies" (woman, age 76 years, manual WC user).

DISCUSSION

This study evaluated the feasibility and preliminary efficacy of a 6-week, group-based, individualized fall prevention and management intervention delivered online for people with MS who use a WC/S full-time. After iROLL-O, significant improvements in reduction of FOF and improved knowledge of fall management and prevention strategies relevant to people with MS were noted; however, there was no change in fall incidence or other secondary outcomes. Participants reported the opportunity for peer learning and enhanced awareness of their environment as benefits of the intervention.

Fall frequency did not decrease significantly after iROLL-O; however, many participants reported feeling less likely to fall due to heightened safety awareness and a reduction in near falls after study participation. As many participants detailed, these fall prevention strategies included an enhanced awareness of multiple factors, such as the environmental context and their ability to perform functional mobility skills that previously contributed to falls. Compared with iROLL-IP,[6] which demonstrated a 12.87% decrease in fall incidence, iROLL-O resulted in a 33% reduction in fall incidence between assessments 1 and 3. This finding suggests the potential for this online intervention to reduce fall incidence for this unique population. After participation in iROLL-O, a significant reduction in FOF was found. Importantly, the FOF content included in iROLL-O was intentionally created to foster participants' appreciation for the differences between FOF that is protective and FOF that leads

to undue activity curtailment. Qualitative findings suggest participant receipt and understanding of the nuanced FOF-related communications.

Significant improvements with large effect sizes related to fall management and prevention were also noted. Participants specifically mentioned increased knowledge of functional mobility skills and their relation to falls, environmental safety, and recovery techniques. Given the high incidence of falls for this population,[1] knowing how to best manage falls is a valuable skill that may minimize the severity of a fall's impact.

No significant changes were noted related to functional skills, although moderate effect sizes were noted related to Transfer Assessment Interest Questionnaire and Wheelchair Skills Test-Questionnaire confidence scores. This differs from the results of the in-person delivery of this intervention, where a significant improvement in transfer quality was found.[6] Several possible explanations for this difference exist. In the present investigation, the transfer quality assessment was performed as a self-assessment. During iROLL-IP,[6] transfer quality was assessed in person and was administered by a trained research assistant. Participants may have been more critically aware of safety considerations after the intervention and subsequently scored themselves lower. Despite the lack of significant change, qualitative findings indicate that participants perceived improvement in safety-during-transfer skills. The results of this comparison of participants who withdrew from the study and those who completed the study revealed that participants who completed assessment 2 had greater ability and confidence to perform WC skills at baseline compared with those who withdrew. Thus, there may have been less room for improvement for participants for whom both pretest and posttest data were available. Efforts to recruit and retain individuals with limited WC/S skills are necessary. Refinement of recruitment messaging that the program is designed for all ability levels may help improve engagement and retention. Finally, there may be an enhanced benefit of in-person training for transfer and WC/S skills compared with remotely delivered training.

An improvement in community participation and QOL was not observed in this study, and these areas may require a longer observation period to be fully examined. Consistent with the recommendations of the International MS Falls Prevention Network,[22] community participation is a key component of the iROLL-O program. All components of iROLL-O tie back to the influence on community participation and QOL. For example, during education on WC/S skills, therapists explain how high-quality WC/S skills can facilitate engagement in desired activities and how lack of skills can place limitations on engagement. Content supporting iROLL-O participants' efforts to safely engage in their communities is especially important in light of the fact that among WC/S users with neurologic impairments, being an active member of society is a key factor in preventing health deterioration.[23]

It is also important to note that this study took place during the COVID-19 pandemic in which unique limitations were placed on community access. COVID-19 has been tied to widespread decreases in individual activity levels, especially for individuals with chronic health conditions.[24,25] Similarly, multiple participants described significantly limited community activity as a direct result of the COVID-19 pandemic in the qualitative findings. Emerging evidence also indicates that people with MS and individuals with other chronic health conditions experienced a higher burden of mental distress in relation to the pandemic.[26] Participants noted the social aspect of iROLL-O as an important component to foster learning and interaction. Further research is indicated to capture the impact of this intervention on community participation as public health–related restrictions on community activity are eased.

iROLL-O is a unique online program created by an interprofessional team that fills a void in evidence-based education for people with MS who are full-time WC/S users. The different perspectives of team members helped create a comprehensive program that effectively addressed many different influences on falls. In addition, the program includes features such as a manualized approach to intervention, fidelity checklists, and an online repository of asynchronous participant education videos that would aid in future scaling of the iROLL-O intervention. Improvements in FOF, fall management, and knowledge of fall management and prevention indicate that a remote intervention for full-time WC/S users with MS demonstrates promise. Further research with a larger and more diverse population is needed to fully understand the impact of the intervention.

This study has several limitations. Given the small sample size, the results are not generalizable to people with MS who use WC/S full-time. This small sample size also influences statistical significance. Efforts were made to recruit diverse participants, but women were overrepresented compared with the population of people with MS at large. This longitudinal study used prospective fall tracking before the intervention to establish a baseline of fall incidence, and the pre/post intervention design was suitable for the goal of determining the preliminary efficacy of iROLL-O; however, a control group for comparison was not used. Each participant tracked fall frequency after completing a baseline questionnaire that required them to reflect on their fall experience and concerns about falling. By completing the baseline questionnaires and tracking fall frequency, they may have changed their behaviors related to falling independent of the study intervention. In addition, this study did not track the frequency of transfers. After exposure to the intervention, participants may have increased their transfer frequency because of a reduction in FOF but increased the opportunity to fall. Also, this study did not track whether participants sought out or participated in additional therapy services throughout the study period, which may have influenced their fall frequency. Finally, it

is important to recognize that this pilot study occurred during the COVID-19 pandemic, which confounded efforts to measure community participation and QOL. Future studies occurring outside of the acute phase of the pandemic and involving a longer observation period are needed to better assess the impact of iROLL-O on both community participation and QOL.

Despite the limitations of this study, the results can inform both clinical practice and future research given the paucity of evidence-based fall prevention interventions designed specifically for people with MS. This is especially pertinent because iROLL-O is the only fall prevention and management intervention for people with MS and delivered remotely described in the literature. Future studies can build on the findings by expanding recruitment efforts to obtain a more diverse sample and including a control group as a comparison tool for tracking the intervention's effect on targeted outcomes over time given the nature of MS as a degenerative disease.

CONCLUSIONS

This study measured the impact of iROLL-O, a 6-week, individualized, multicomponent fall prevention and management intervention delivered remotely for people with MS who use a WC/S full-time. After engagement in the intervention, significant improvements in FOF and fall management and prevention were noted in the quantitative findings. Qualitative results indicate that participants valued the improved awareness of diverse influences on fall risk and the peer learning opportunities they gained through participation. Findings suggest that extra effort directed toward recruiting and retaining participants with lower levels of functional mobility confidence and skills may enhance the impact of the intervention for the most vulnerable in the population of full-time WC/S users. Further research involving a randomized controlled trial is needed to assess iROLL-O's efficacy, to investigate the intervention's generalizability, and to test its long-term effect on targeted outcomes. ■

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