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ORIGINAL RESEARCH

Individualized Physiotherapy and Activity Coaching in Multiple Sclerosis (IPAC-MS): Results of a Randomized Controlled Trial

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Abstract

Objective: To evaluate if a novel intervention involving individualized behavior change strategies delivered by physiotherapists has an effect on physical activity levels in people with multiple sclerosis (MS) who were previously inactive compared with usual care.

Design: Prospective, assessor-blinded, parallel-group, randomized controlled trial.

Setting: Community settings across Saskatchewan, Canada.

Participants: Individuals diagnosed with MS, >18 years of age, and able to walk with or without aids were invited to participate from an MS Saskatchewan database.

Intervention: The intervention group received individualized physical activity behavioral coaching for 12 months compared with a usual care control group. There were 3 consistent features of the intervention: behavior change techniques, recommendations for physical activity, and ongoing physiotherapist support. However, these components were tailored to each participant.

Main Outcome Measures: The primary outcome was change in physical activity levels at 12 months on the Godin Leisure Time Exercise Questionnaire. Secondary measures included MS symptoms (Multiple Sclerosis Impact Scale-29), confidence with managing MS (Multiple Sclerosis Self-Efficacy Scale), and exercise self-efficacy (Exercise Self-Efficacy Scale).

Results: A total of 120 participants (mean age 53 years, 78% female, average disease duration 14.7 years) were enrolled and 117 completed primary outcome. At month 12, the mean (95% confidence interval) difference between intervention and control group for Godin Leisure Time Exercise Questionnaire was 15.9 (12.5-28.4). This improvement occurred regardless of age, gender, if on an MS drug, time since relapse, or comorbidity history. In the intervention group, 33.9% were sufficiently active for substantial health benefits compared with 6.9% in the control group at month 12 ($P<.001$). At baseline, these proportions were 3.4% and 4.9% respectively. Improvement occurred on the Multiple Sclerosis Self-Efficacy Scale and Exercise Self-Efficacy Scale at 12 months in favor of the intervention group.

Conclusion: Physical activity levels and exercise self-efficacy improved clinically and significantly with neurophysiotherapist led individualized coaching.

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Addressing health-related lifestyle behaviors is increasingly emphasized as an important component of comprehensive multiple sclerosis (MS) care[1,2] and reported as a priority for people living with MS.[3] Physical activity is particularly important for people with MS with demonstrated benefits spanning from

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symptom management, function, participation, quality of life, general health, to potential disease modifying effects.[4-7] Despite increased awareness and emphasis on the importance of a physically active lifestyle in MS, most people with MS remain insufficiently active for health benefits.[8]

Several programs have shown beneficial effects in promoting physical activity for people with MS; however, they are often not individually tailored.[9] The typical method for promoting physical activity in MS has been through structured, supervised exercise programs in a research setting, or through prepackaged intervention material (eg, same content offered to all participants at the same time points).[10] Individualizing physical activity behavioral interventions may help enhance meaningful change.[11] Furthermore, providing access to clinical physical therapists as physical activity coaches may enhance the expertise and support reported to be preferred by people with MS.[12] Although previous systematic reviews in MS have shown the importance of incorporating behavior change strategies into physical activity interventions, no study has looked at individualizing the intervention components and using clinical physical therapists as the interventionists.[9,10,13-15]

Health behavior is complex, and more than knowledge of the benefits is required to support positive changes in health behavior.[16] These complexities are emphasized in MS physical activity research.[10,11,13,14] Support from health care providers in addressing physical activity behavior in MS is especially important as symptoms fluctuate and/or disability accumulates.[12] Health care providers play a critical role in providing guidance on how to be active, what to focus on, and in empowering individuals with MS to remain physically active. MS symptoms and their fluctuating nature are a key barrier to being physically active. Access to providers knowledgeable in MS for professional support is a key facilitator to being physically active. An individual's beliefs, knowledge, and self-efficacy regarding physical activity are critical aspects to be considered in supporting physical activity behavior.[17]

Although there is growing research on the role of health care providers in supporting people with MS in addressing physical activity and sedentary behavior, there remains a gap in our understanding of how to structure such services in clinical care.[18] This study uniquely combined 3 essential intervention components (1) access to health care provider support, (2) method of being physical activity, and (3) integration of behavior change techniques, in an individualized manner to address physical activity behavior. The objective of this study was to evaluate if the individualized behavioral coaching delivered by physiotherapists (PTs) with expertise in MS has an effect on physical activity levels in individuals with MS previously reported to be inactive. It was hypothesized that access to the intervention would increase physical activity levels.

Methods

Study design and setting

This project was a patient-oriented research initiative where people affected by MS were involved in all stages of the research, including design of the intervention and identification of outcomes. This study was a prospective, assessor-blinded, parallel-group, randomized controlled trial conducted in Saskatchewan, Canada, and approved by institutional human ethics review board. The study protocol has been previously published.[19]

List of abbreviations:

GLTEQ	**Godin Leisure Time Exercise Questionnaire**
MS	**multiple sclerosis**
PT	**physiotherapist**

Participants

Participants were recruited by a randomized invite list generated through the Saskatchewan MS Drugs Research Program database as detailed in the published protocol paper.[19] Individuals who previously reported to be insufficiently active for health benefits were targeted for recruitment. Inclusion criteria were as follows: (1) older than 18 years of age, (2) clinical diagnosis of MS, (3) Patient Determined Disease Steps[20] score $\leq$6 (ie, able to walk with or without aids), and (4) self-reported exercising less than 4 bouts per week (ie, 2$\times$ strength and 2$\times$ aerobic).[21,22] Exclusion criteria included inability to provide consent or scoring in the moderate-high risk for exercise-related harm as determined by the Physical Activity Readiness Questionnaire at screening.[23] Eligible and consented participants completed a baseline assessment and were then stratified for randomization into 1 of 3 categories based on their baseline Godin Leisure Time Exercise Questionnaire (GLTEQ) "Total Leisure Physical Activity" score.[24] Randomization was completed, in blocks of 4, using the REDCap (Vanderbilt, v6.7) randomization function.

Baseline demographics included information on MS disease status, comorbidities, age, sex, and employment status. Disability status was assessed to define the study population at baseline and at month 12 according to validated measures: the Timed 25 Foot Walk Test[25] (walking speed), the Nine-Hole Peg Test[26] (upper limb coordination), and the Symbol Digit Modalities Test[27] (speed of cognitive processing).

Intervention group

The intervention was an individualized physical activity behavior change program delivered by PTs who have specialized experience working with individuals living with a neurologic condition. All study PTs had previous experience working with people with MS. The intervention was delivered over a 12-month period, during which time, PTs helped create an individualized physical activity plan and served as a behavioral coach to participants. Programs were specifically tailored for each participant, but all contained 3 consistent features: behavior change techniques, a physical activity plan, and ongoing PT support. The number and combination of behavior change techniques, the method and dosage of physical activity, and the method and frequency of access to PT were all individualized. All sessions were one-on-one. Up to 15 hours of PT contact time was available per participant during the 12-month period, and occurred either in-person, via telephone, using web-based methods and/or telehealth.

After randomization, participants in the intervention group received an in-person intake assessment by a PT that served as the foundation for the individualized approach. Study participants were allocated to a PT based on geographical proximity and availability, and participants and PTs had not previously worked together. At the initial intake, PTs evaluated the participants' individual attributes and physical activity needs in addition to a general physiotherapy assessment (eg, MS symptoms, functional levels and goals) to establish goals and create personalized plan. As part of study preparation, all intervention PTs (n=14)

completed a structured in-person training. Intervention PTs were trained in the Behavior Change Wheel,[28] the Behavior Change Technique Taxonomy,[29] the Social-Ecological model,[30] and the Social Cognitive Theory of Behavior Change, including correlates and determinants of physical activity behavior in MS.[31] All training was done with a standardized program and delivered by the same instructor. All PTs had a scheduled check-in with training instructor, and 2 sessions were audited to enhance fidelity. The physical activity recommendations made by the PTs were based on the established MS exercise guidelines,[2,21,22] existing resources, and individual participant needs and preferences. The PTs tracked the types of behavior change techniques used with each participant according to the framework and descriptors from the Behavior Change Technique Taxonomy.[29] Intervention participants also received printed educational material from MS Canada on physical activity, nutrition, and stress management at 2, 4, and 8 months.

Control group

The control group received the same printed educational material as the intervention group at 2, 4 and 8 months. Participants in the control group did not receive any individualized assessments or recommendations and did not have access to the study PT support throughout the 12-month period. Because of the 12-month duration of the study and to replicate "usual care" (where a person may self-select to change behavior), the control group was not asked to abstain from starting new physical activity programs.

Study outcome measures

The primary outcome was the change in physical activity level, as measured by the change in the GLTEQ "Total Leisure Physical Activity Score" from baseline to month 12. The GLTEQ provides a self-reported estimate of physical activity levels over the preceding 7 days and is scored by multiplying the reported bouts of activity (frequency) by metabolic equivalents (based on intensity) and summed to give a unitless measure ranging from 0 to 119.[24] The Total Leisure Physical Activity Score captures light, moderate, and strenuous intensity physical activity.[32] Higher scores indicate increased activity levels. In addition, a GLTEQ "Health Contribution Score" captures only the moderate and strenuous physical activity, from which 3 categories based on health benefits have been defined and validated in ambulatory people with MS: sufficiently active for substantial health benefits (score >23), moderately active for some health benefits (score 14-23), and insufficiently active for health benefits (score <14).[33,34] The change in proportion of participants in these categories were evaluated at 3,6, 9, and 12 months.

Secondary outcomes included MS symptom impact and self-efficacy. The Multiple Sclerosis Impact Scale-29 questionnaire evaluates patient-perceived physical and psychological impact of their MS.[35] The Multiple Sclerosis Self-Efficacy Scale is an MS-specific, self-reported, self-efficacy measure with strong psychometric properties.[36] The Multiple Sclerosis Self-Efficacy Scale measure includes a function and control category. The Exercise Self-Efficacy Scale[37] is a measure of task self-efficacy capturing confidence in an individual's beliefs in their ability to continue to exercise. This is a patient-reported ordinal 6-item measure whereby items are rated on a scale of 0 (not at all confident) to 100 (highly confident) and averaged to obtain a total score.[38] Study measures were completed at baseline and at months 3, 6, 9, and 12 in both groups. To avoid anticipation of surveys potentially influencing responses, participants were informed they would receive survey requests at random over the study period.

Analysis

Descriptive statistics summarized the participant demographics. To evaluate the change on the GLTEQ Total Leisure Physical Activity scores and the secondary outcome measures between the intervention and control groups overtime, mixed effect models were used taking into account the fact that multiple measurements were made repeatedly on the same subjects at 5 different time points (0-, 3-, 6-, 9-, and 12-month follow-up). Mixed effect models allow random effects with fixed effects, for the appropriate handling of potential missing data over time. In the models, we also controlled for interaction terms between groups (intervention vs. control) and time (5 survey times) and for the baseline demographic covariates (table 1). Using a conservative effect size of 0.3 for the primary outcome of change in Total Leisure Physical Activity score, a power of 80%, and an alpha of 0.5, allowing for 20% dropout, 120 participants were the target sample size. Statistical analyses were performed with the IBM SPSS Statistics Version 28 (SPSS Inc.: IBM Corp.[a]). Statistical significance was set by an alpha level .05.

Results

A total of 120 participants were enrolled (n=59 control group, n=61 intervention group, with uneven group distribution secondary to the stratified randomization). Demographics were similar between groups (table 2). Disability status at baseline and at 12 months was similar between groups, with the exception of worsening on the Timed 25 Walk Test in the control group (table 3). Three participants withdrew at the 3-month mark (for reasons unrelated to the study, fig 1). The amount of PT time used by intervention participants across the 12-month intervention period ranged from 4.5 to 15 hours (n=9 participants used PT time in the 4-hour range, n= 10 in the 5-hour range, n=11 in the 6-hour range, n=7 in the 7-hour range, n=3 in the 8-hour range, n=2 in the 9-hour range, n=2 in the 10-hour range, n=6 in the 14-hour range, and n=9 in the 15-hour range).

Primary outcome — GLTEQ

The Total Leisure Physical Activity Scores significantly differed between groups at the primary 12-month end point (fig 2). On the basis of the mixed effect models, the Total Leisure Physical Activity Scores differed significantly over 4 time points after baseline (3, 6, 9, and 12 months). None of the covariates (age, sex, MS disease modifying drug therapy use, most recent relapse, comorbidity, or employment status) were significant in the mixed-effects model. The mean (95% confidence interval) between-group differences in Total Leisure Physical Activity score were as follows: 11.0 (14.8-25.8) at 3 months; 8.2 (17.1-25.3) at 6 months; 11.6 (17.3-28.9) at 9 months, and 15.9 (12.5-28.4) at 12 months.

At baseline, according to the Health Contribution Score, a similar proportion of participants in each group were categorized as either "sufficiently active for substantial health benefits" or "moderately active" or "insufficiently active" (fig 3). Over the course of the study, a significant number of people in the

Table 1 Summary of intervention components based on TIDieR guide

Intervention Component	Summary of IPAC-MS Intervention
What	Intervention included 3 essential components: (1) access to PT, (2) a physical activity plan, and (3) integration of behavior change techniques, in an individualized manner to address physical activity behavior.
Provider	Clinical PTs with previous experience working with people with MS; all participating PTs (n=14) completed a training through the study on behavioral coaching for physical activity.
How	Access to PT was individualized based on participant preference, and included a combination of in-person, virtual live, telephone, email, or text message. All sessions were one-on-one.
Where	Location of PT support was individualized and included a combination of virtual, in-clinic, in-community, or in-home. Similarly, location and method of being physical active was individualized per participant.
When and how much	All participants were allocated a max of 15 hours of PT support to be used in any combination over the 12-month intervention period. The intensity, frequency, session time, and overall duration of all intervention components were individualized.
Tailoring	All intervention components were selected, modified, and/or progressed over the 12-month intervention period based on participant goals and abilities, and codecided between each PT and participant. Process was further guided by PT expertise, behavior change theory (SEM and SCT), the BCW and a mBCTT (as covered in interventionist training).

Abbreviations: BCW, Behavior Change Wheel; mBCTT, modified Behavior Change Technique Taxonomy; MS, multiple sclerosis; PT, physiotherapist; SCT, Social Cognitive Theory of Behavior Change; SEM, Social-Ecological model; TIDieR, template for intervention description and replication.

Table 2 Baseline demographics of study participants

	Control (n=59)	Intervention (n=61)
Age (y), mean (SD)	53.1 (11.7)	52.5 (11.6)
MS disease duration years, mean (SD)	14.7 (8.7)	14.7 (9.6)
Self-reported sex, n (%)		
Male	14 (23.7)	12 (19.7)
Female	45 (76.3)	49 (80.3)
Type of MS, n (%)		
Relapsing progressive	2 (3.4)	3 (4.9)
Primary progressive	3 (5.1)	0 (0.0)
Secondary progressive	6 (10.2)	5 (8.2)
Relapsing-remitting MS	43 (72.8)	49 (80.3)
Unknown	5 (8.5)	4 (6.6)
Employment status, n (%)		
Unemployed/off work	10 (17.0)	4 (6.6)
Student	0 (0.0)	2 (3.3)
Part-time	6 (10.2)	11 (18.0)
Full-time	19 (32.2)	17 (27.9)
Retired/medically retired	24 (40.7)	27 (44.3)
Comorbidities, n (%)		
Nil of note	14 (23.7)	22 (36.1)
Osteoarthritis	8 (13.6)	6 (9.8)
Diabetes	3 (5.1)	2 (3.3)
Asthma	2 (3.4)	1 (1.6)
Cancer	2 (3.4)	1 (1.6)
Osteoporosis	1 (1.7)	3 (4.9)
Other	29 (49.2)	26 (42.6)
On MS disease modifying drug therapy, n (%)		
No	19 (32.2)	19 (31.1)
Yes	40 (67.8)	42 (68.9)
Baseline physical activity, mean (SD)		
GLTEQ − TLPA score	12.8 (10.5)	13.8 (12.0)
Patient Determined Disease Step, mean (SD)	3.0 (1.7)	2.6 (1.8)

Abbreviations: GLTEQ, Godin Leisure Time-Exercise Questionnaire; TLPA, Total Leisure Physical Activity (score determined by the sum of light, moderate and vigorous physical activity).

intervention group moved up categories, increasing their physical activity level for health benefits (fig 3).

Secondary outcomes

Results for the secondary outcomes and descriptors of disability status are displayed in tables 3 and 4. There was a between-group difference (−16.28, 95% confidence interval [−28.57 to −3.99]) in favor of the intervention group for the Exercise Self-Efficacy Scale secondary outcome at month 12 (P=.01). This difference was observed despite there being a large degree of variability even at baseline. The median value was 75 and 80 at baseline for the control and intervention group respectively vs. 50 and 81 (control, intervention) at the 12-month time point.

Discussion

Access to PTs as physical activity behavioral coaches increased activity levels in a group of people with MS previously reported to be inactive. A clinically and statistically significant increase in physical activity levels were seen over a 12-month period in the intervention group. The observed benefits occurred irrespective of age, sex, if a person was on a disease modifying drug therapy, time since most recent MS relapse, presence of comorbidity, and employment status.

The mixed-effects model demonstrated a change of almost 16 points on the Total Leisure Activity Score in the intervention group at 12 months. At the level of the individual, a change score of 16 points would equate to a behavior change of either an increase in light physical activity by 75 minutes/week, or an increase in moderate intensity physical activity by 45 minutes/week, or an increase in strenuous physical activity by 25 minutes/week, or an increase in a combination of the different activity intensities for lesser amounts of time.[24] In this study an increase in light, moderate, and strenuous physical activity contributed to the higher Total Leisure Physical Activity Scores in the intervention group. In addition, a significantly greater proportion of participants transitioned from being previously inactive to being moderately or sufficiently active for substantial health benefits in the

Table 3 Disability Status over time

	Baseline			12 Months		
	Control	Intervention	Mean Difference 95% CI of the Difference	Control	Intervention	Mean Difference 95% CI of the Difference
T25FWT, mean (SD) median (IQR)	7.6 (3.7)	6.7 (3.5)	0.86	8.0 (4.8)	6.1 (2.6)	1.95*
	6.5 (5.1-8.4)	5.9 (4.8-7.4)	(−0.46 to 2.17)	6.1 (5.0-9.2)	5.5 (4.5-7.0)	(0.46-3.44)
9HPT — R, mean (SD) median (IQR)	27.0 (12.4)	24.6 (10.4)	2.40	26.7 (11.8)	25.5 (21.2)	1.16*
	24.3 (19.2-26.7)	22.5 (19.2-26.7)	(−1.74 to 6.54)	22.8 (20.7-27.9)	21.3 (17.1-24.6)	(−5.42 to 7.74)
9HPT — L, mean (SD) median (IQR)	26.3 (9.0)	24.3 (5.7)	2.02	26.8 (10.9)	23.4 (5.9)	3.36
	23.4 (21.5-28.7)	23.9 (19.7-28.5)	(−0.69 to 4.47)	23.8 (21.6-28.3)	23.4 (18.4-26.7)	(0.07-6.67)
SDMT, mean (SD) median (IQR)	49.5 (11.9)	50.5 (13.4)	−1.05	50.7 (11.5)	52.9 (12.3)	−2.27
	51.0 (42.0-57.0)	51.0 (42.5-63.0)	(−5.63 to 3.53)	52.0 (41.0-58.0)	52.0 (43.0-63.0)	(−6.81 to 2.27)

Abbreviations: 9HPT, nine-hole peg test; IQR, interquartile range; L, left hand; R, right hand; SD, standard deviation; SDMT, symbol digit modality test; T25FWT, Timed 25 Foot Walk Test.

* $P<.05$.

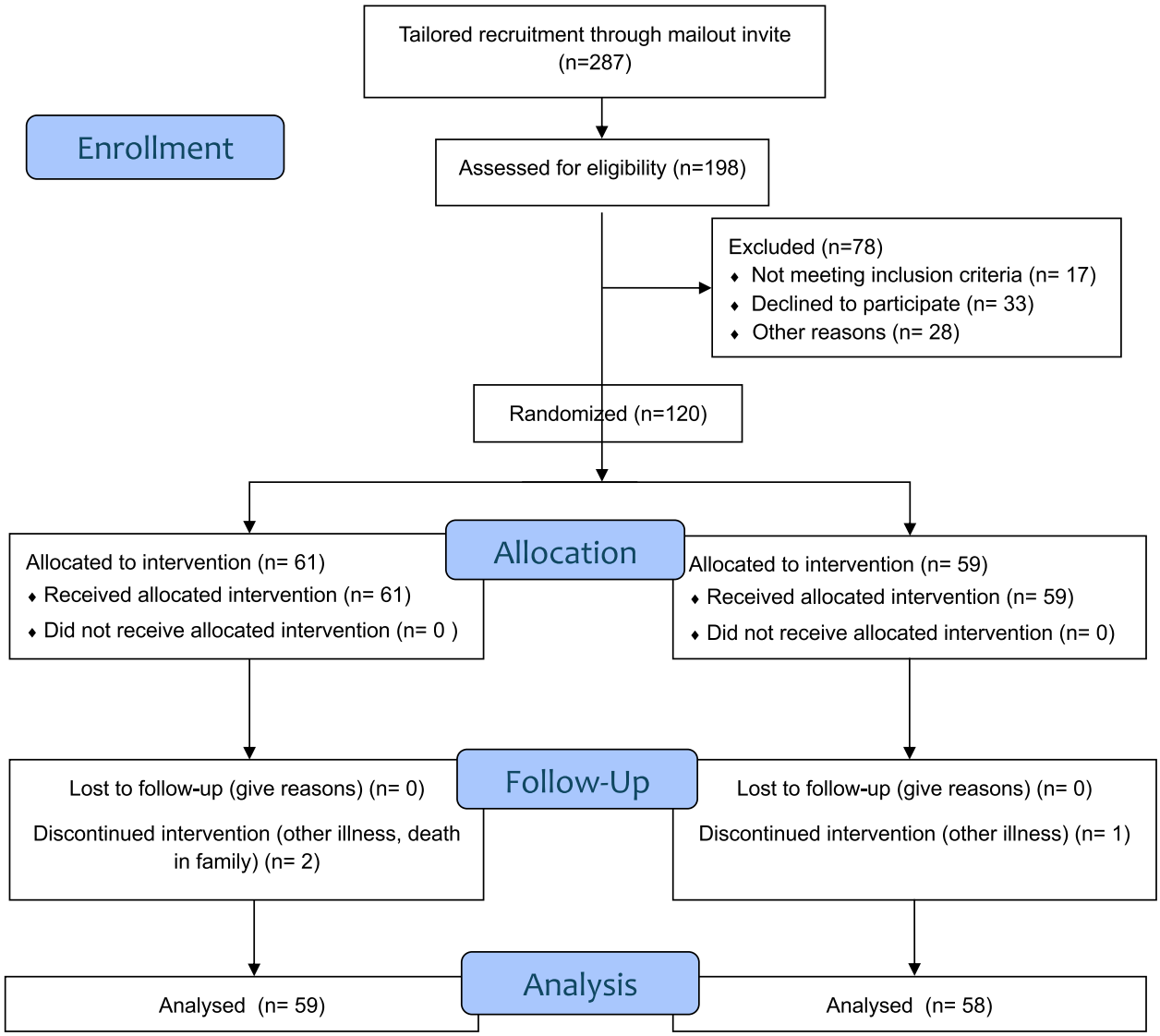

Fig 1 CONSORT flow diagram.

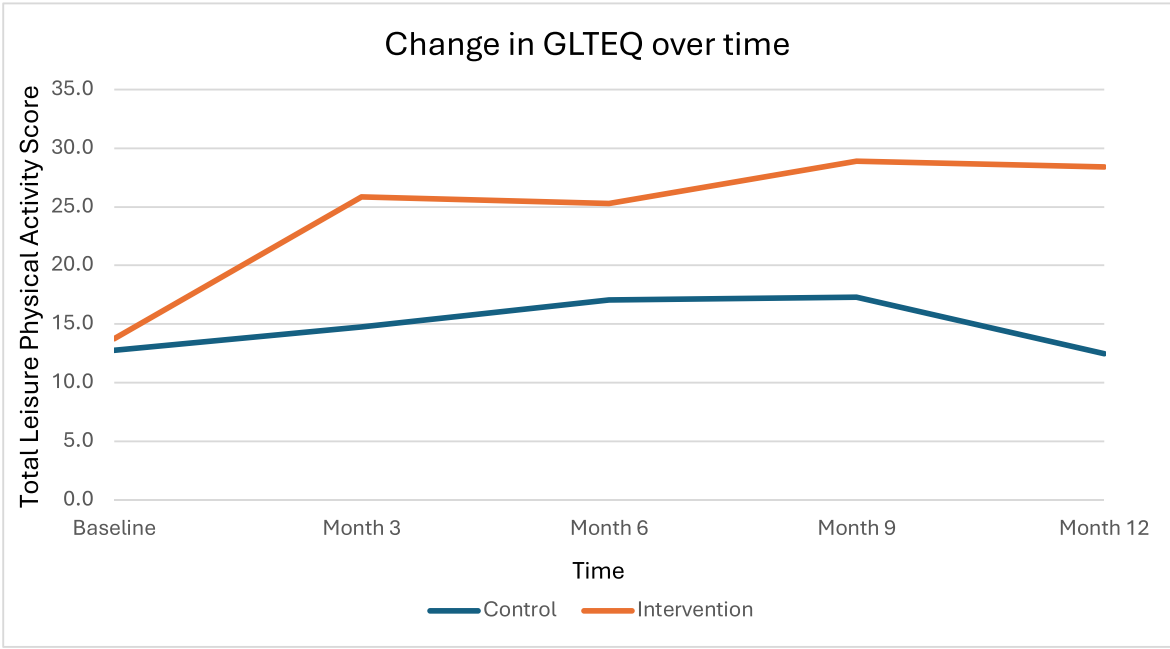

Fig 2 GLTEQ = Godin Leisure Time Exercise Questionnaire.

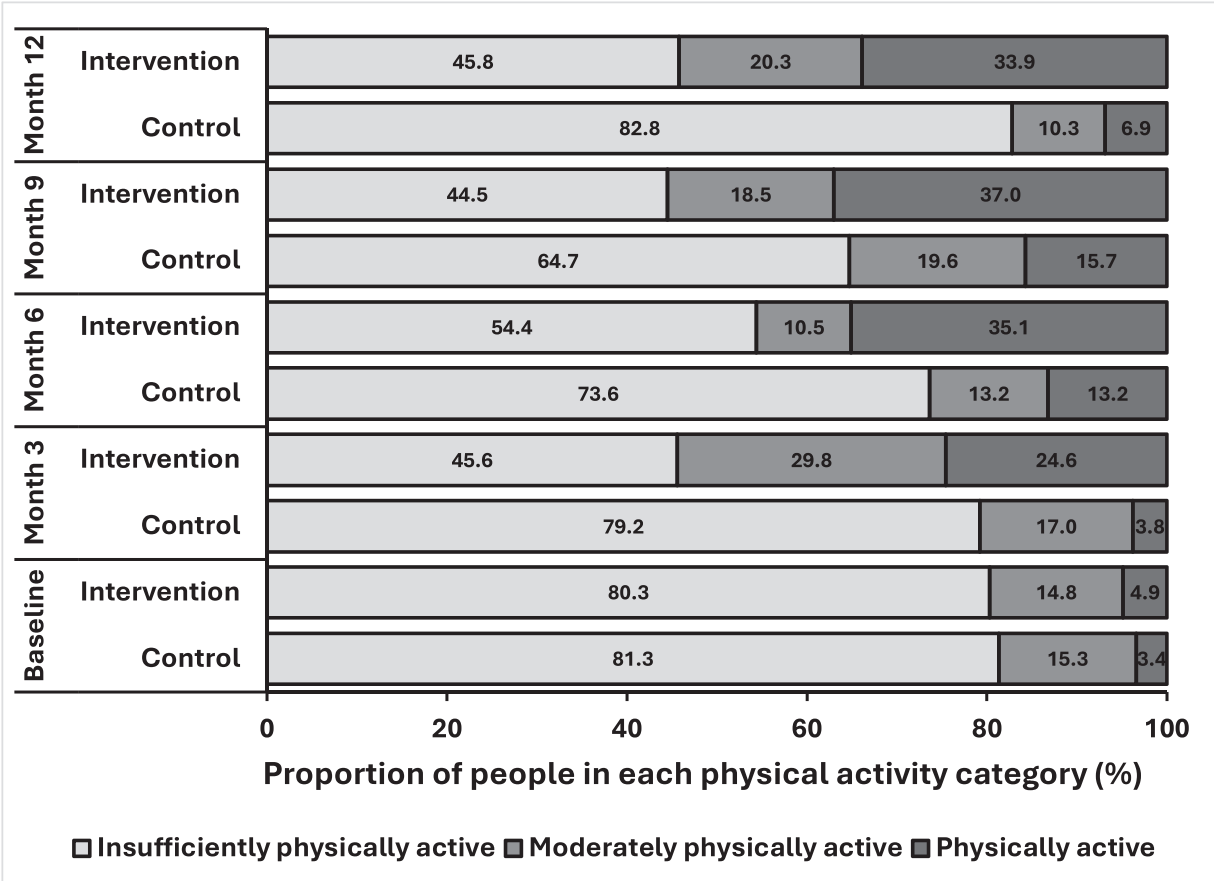

Fig 3 The 3 categories of the Godin Leisure Time Exercise Questionnaire Health Contribution Score are calculated using only the bouts of reported moderate and strenuous physical activity. The categories include sufficiently active for substantial health benefits (score >23), moderately active for some health benefits (score 14-23), and insufficiently active for substantial health benefits (score <14).

Table 4 Scores for secondary outcome measures overtime

	Baseline			3 Months			6 Months			9 Months			12 Months		
	Control	Intervention	Mean Difference 95% CI of the Difference	Control	Intervention	Mean Difference 95% CI of the Difference	Control	Intervention	Mean Difference 95% CI of the Difference	Control	Intervention	Mean Difference 95% CI of the Difference	Control	Intervention	Mean Difference 95% CI of the Difference
GLTEQ- TLPA, mean (SD)	12.8 (10.5)	13.8 (12.0)	−1.01 (−5.09 to 3.07)	14.8 (11.0)	25.8 (17.3)	−11.07† (−16.52 to −5.62)	17.1 (11.9)	25.3 (19.6)	−8.21* (−14.31 to −2.11)	17.3 (13.0)	28.9 (19.7)	−11.60† (−18.03 to −5.16)	12.5 (14.3)	28.4 (17.6)	−15.92† (−21.80 to −10.05)
MSIS − Phys, mean (SD)	45.8 (14.3)	42.3 (14.9)	3.55 (−1.74 to 8.84)	42.3 (12.4)	39.6 (13.8)	2.70 (−2.31 to 7.70)	41.8 (13.3)	39.3 (13.4)	2.56 (−2.57 to7.69)	40.6 (12.0)	39.5 (13.8)	1.11 (−4.05 to 6.27)	43.0 (13.8)	39.1 (13.1)	3.91 (−1.14 to 8.96)
MSIS − Psych, mean (SD)	19.8 (5.8)	19.8 (8.8)	−0.01 (−2.70 to 2.69)	19.3 (6.2)	18.9 (5.9)	0.39 (−1.91 to 2.69)	18.8 (6.3)	18.8 (5.8)	0.07 (−2.25 to2.40)	18.5 (5.4)	18.7 (6.3)	−0.26 (−2.59 to 2.07)	19.9 (6.6)	17.8 (5.6)	2.13 (−0.16 to 4.42)
MSSE − Func, Mean (SD)	750.2 (142.7)	780.5 (144.2)	−30.30 (−83.11 to 22.51)	730.9 (146.3)	762.9 (164)	−31.99 (−92.97 to 28.99)	756.6 (133.0)	779.2 (136.1)	−22.68 (−77.96 to 32.61)	743.2 (156.9)	746.5 (168.5)	−3.31 (−69.60 to 62.98)	703.4 (164.1)	760.7 (169.0)	−57.25 (−120.88 to 6.37)
MSSE − Ctr	588.5 (204.9)	665.8 (185.9)	−77.22 (−150.80 to −3.65)	614.1 (199.7)	663.4 (191.4)	−49.33 (−127.83 to 29.16)	608.8 (223.6)	675 (174.9)	−66.21 (−147.56 to 15.14)	626.8 (209.5)	671.7 (176.8)	−44.88 (−124.48 to 34.73)	567.1 (212.0)	701.3 (177.1)	−134.20* (−210.07 to −58.34)
EXSE	66.2 (33.9)	68.0 (32.7)	−1.82 (−14.12 to 10.48)	57.1 (34.1)	70.8 (31.0)	−13.78* (−26.56 to −1.00)	54.1 (36.5)	67.9 (30.9)	−13.77* (−27.16 to −0.39)	55.6 (36.2)	73.6 (28.7)	−17.97* (−31.01 to −4.93)	52.9 (33.6)	69.2 (30.3)	−16.28* (−28.57 to −3.99)

Abbreviations: EXSE, Exercise Self-Efficacy Scale (score range 0-100); GLTEQ- TLPA, Godin Leisure Time Exercise Questionnaire Total Leisure Physical Activity Score (score range 0-119); MSIS − Phys, multiple sclerosis impact scale − physical score (score range 0-100); MSIS − Psych, multiple sclerosis impact scale − psychological score (score range 0-100); MSSE − Ctrl, multiple sclerosis self-efficacy scale- control (score range 90-900); MSSE − Func, multiple sclerosis self-efficacy scale- function (score range 90-900); SD, standard deviation.

* $P<.05$.

† $P<.0001$.

intervention group. The magnitude of change and the duration that improvements were sustained for are larger and longer than what has been previously reported in physical activity behavior change interventions for MS.[9,10]

In this study, a unique individualized approach demonstrated sustained behavior change for physical activity over a 12-month period. Further quantitative and qualitative analyses may provide insight on the active components and mechanisms underpinning the change in physical activity behavior seen in this study. However, these analyses are outside the scope of the present primary analysis. Further analysis of the intervention components (eg, types of behavior change strategies, methods of being active, and the methods by which participants chose to access the PTs) may also help inform future application in routine clinical care. PT time ranged from 4.5 to 15 hours over the 12-month intervention period. The low dropout rate and modest time investment from PTs support the feasibility of the intervention. Only 3 participants withdrew for reasons unrelated to the study. The appeal of an individualized intervention and the low data collection burden may have influenced study participation. The individualized intervention in this study did not involve a standardized behavior change or exercise protocol. Individualizing the intervention components may be particularly valuable in optimizing physical activity and reducing sedentary behavior when the disease course is unpredictable or heterogeneous, as is the case in MS.[11]

To ensure the groups were similar with respect to disability progression over this longer duration study, and to better define the study population, we collected information on disability at baseline and month 12. The study was not powered to detect change in disability as an outcome. However, the intervention group showed some improvement on the Timed 25 Foot Walk Test, whereas in the control group, there was a statistically significant worsening. A worsening on the Timed 25 Foot Walk Test is predictive of future MS disability progression,[39] suggesting the intervention may play a role in helping delay disease progression. Furthermore, the intervention did not specifically target walking as the exercise intervention. This is relevant because the greatest improvements in walking function may be realized with walking specific exercise protocols.[40,41] Instead, the method of being active was individualized to promote safe, sustainable, and ideally enjoyable participation in physical activity. There was no significant change in the cognitive processing speed or upper limb coordination testing, supporting disease stability at the group level.

The application of exercise research protocols in MS to clinical practice remains challenging.[42,43] It is important to appreciate that this study involved first a training period where study PTs became familiar with behavioral coaching and the use of behavior change techniques. Furthermore, the PTs recruited to assist with this study were already in clinical practice, delivering varied services and working throughout a large geographical area. This study therefore demonstrates external validity to a real-world setting where health care providers may be widely dispersed. Future directions may include the spread and scaling of the intervention for implementation into practice settings with a similar distributed practice model. Similar initiatives, where PTs serve as physical activity, coaches are being studied in other clinical conditions and/or settings.[44-49] The challenge remains that although PTs, as a profession, are well placed to support physical active behavior, the ability to do so is often challenged by clinical and/or health system barriers. Work is still needed to increase access to PT coaches and implementation of such services across care settings.

Study limitations

The primary outcome was based on a patient-reported measure (the GLTEQ) and may be susceptible to recall bias. However, the GLTEQ is one of the most commonly used outcomes for measuring physical activity in people with MS and correlates with accelerometers/wearable measures in ambulatory people with MS.[34,50] We also purposely did not disclose to participants the timing of questionnaire distributions to minimize any potential for participants to alter their behavior because they knew an assessment was coming.

Our enrolment was limited to ambulatory individuals with MS, and therefore the findings may not be directly applicable to those who are nonambulatory. We attempted to increase the study generalizability by having limited exclusion criteria. As such, the sample was heterogeneous, potentially decreasing the ability to detect between-group statistically significant differences on the secondary outcome with respect to MS symptom burden. However, the changes observed were in favor of the intervention group.

Physical activity for longer-term health benefits requires engagement over the lifespan. This study was longer than most interventional physical activity research[51]; however, it was still limited to a 1-year intervention. Looking at whether the improved activity levels were sustained at later follow-up time points would help inform the need for future booster sessions or check-ins to sustain physical activity over the disease course. We did not assess the impact of increasing physical activity levels on health system utilization to assess change in health outcomes. Finally, exploring the nature of the intervention in greater detail may help untangle the most critical ingredients associated with sustained increases in physical activity behavior, and further inform future translation of the intervention to practice.

Conclusions

Meaningful change in physical activity levels for health benefits occurred in people with MS provided with individualized coaching by PTs trained in behavior change. Future directions include exploring the feasibility and effectiveness of implementing the intervention into routine clinical care across different care settings and/or models of care delivery.

Supplier

a. IBM SPSS Statistics Version 28; SPSS Inc.: IBM Corp.

Keywords

Behavior change; Coaching; Exercise; Multiple sclerosis; Patient-oriented research; Physical activity; Physiotherapist; Randomized controlled trial; Rehabilitation

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Author contributions/CRediT statements

SJD: conceptualization, methodology, formal analysis, investigation, resources, supervision, project administration, funding acquisition, writing − original draft; CE: conceptualization, methodology, writing − review & editing; MCL: resources, writing − review & editing; KI: investigation, writing − review & editing; HL: formal analysis, data curation, writing − review & editing; HJL: methodology, formal analysis, data curation, writing − review & editing; KBK: conceptualization, resources, funding acquisition, writing − original draft.

Data availability

The de-identified dataset analyzed during this study may be available from the corresponding author on reasonable request.

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