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ARTICLE

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Qualitative analysis of perceived motivators and barriers to exercise in individuals with spinal cord injury enrolled in an exercise study

Cindy Tiu[1]✉, Christa Ochoa[2] and Katherine Froehlich-Grobe[2,3]

STUDY DESIGN: Cross-sectional.
OBJECTIVES: Examine exercise perceptions of SCI individuals enrolled in an exercise trial about their: (a) reasons for enrolling, (b) barriers to exercise, and (c) solutions to address barriers.
SETTING: World-wide web.
METHODS: US individuals ≥18 years old with SCI completed password-protected free-response surveys ($n = 144$) as part of a larger internet-based intervention to promote exercise. Participants' online reporting about their motivations to exercise, barriers, and solutions to identified barriers were analyzed using an inductive thematic qualitative approach. Participants could enter up to 10 responses for each category.
RESULTS: Study staff analyzed 956 participant responses across questions regarding their motivations, barriers, and solutions. Leading reasons reported for enrolling were to improve their physical health (69%), function (61%), and attitude (59%) while commonly reported barriers were time constraints (54%), lack of motivation (31%), accessibility issues (24%), and SCI-specific barriers (23%). Participant-generated solutions were scheduling exercise (47.9%) for time constraints, making exercise more fun (21.8%) to increase motivation, obtaining home exercise equipment (30.3%), and locating accessible facilities (27.3%) to resolve accessibility barriers. Solutions for SCI-specific barriers of temperature control, skin breakdown, and pain included getting adapted equipment or finding exercises they could perform independently (29.3%) and enlisting support from friends or family (24.4%).
CONCLUSIONS: The results offer insights about exercise motivators and barriers reported by people with SCI who enrolled in an exercise intervention program and offer insights regarding topics to address for SCI-tailored exercise programs. Further research should examine what strategies are most useful in helping people with SCI engage in exercise.

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INTRODUCTION

Accumulating evidence over the past 25 years indicates that moderate-intensity physical activity reduces risk for prevalent chronic health conditions facing Americans, such as hypertension, high cholesterol, diabetes, and arthritis [1, 2]. Currently, only half of Americans engage in sufficient levels of physical activity to enjoy these health benefits, and exercise participation in people with spinal cord injury (SCI) is significantly lower [3]. The focus of health promotion for millions of Americans with disabilities, including those with SCI, has shifted from primary prevention of disability to prevention of secondary conditions (e.g., obesity, hypertension, pressure sores) [4].

Cowan [5, 6] has recommended that rehabilitation professionals adopt the approach of the Exercise Is Medicine (EIM) initiative to consider physical activity as the 5th vital sign [2, 5]. Exercise has been shown to improve functional capacity [7], endurance [8], muscle strength [9], pain [10], and to reduce stress [11]. Not only can regular exercise and physical activity improve fitness and cardiovascular health among people with SCI [12], but it can also enhance quality of life through maintaining independence [13]. Despite these potential benefits and a recognized need to promote activity, limited evidence identifies intervention approaches specifically targeted to people with SCI [14].

Programs specific to SCI should address pertinent barriers and target improving SCI-unique issues, a subject of a handful of previous studies. Several studies have examined barriers to physical activity that individuals with SCI report facing; three surveyed [15–17] participants and a fourth [18] conducted semi-structured phone interviews. Participants (sample size ranged from 25–180) were predominantly middle-aged (average age was between 44–49 years old), white (ranged from 78–89%), men (63–69%) and lived with their SCI more than a decade (~13–14 years). The leading barriers to physical activity participants cited were consistent across the studies and included personal, resource, and environmental factors. Lack of motivation and energy topped the list of barriers while other

[1]UT Southwestern Medical Center, 5323 Harry Hines Blvd, Dallas, TX 75390, USA. [2]Baylor Scott & White Institute for Rehabilitation, 909N Washington Ave, Dallas, TX 75246, USA. [3]Craig Hospital, 3425S Clarkson St, Englewood, CO 80113, USA. ✉email: Cindy.Tiu@phhs.org

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leading barriers were lack of financial resources, lack of knowledge, lack of accessible equipment at home or facilities, and lack of time [15–18]. Additionally researchers who conducted the qualitative study asked participants during the interview about factors that motivated them to participate in exercise. Participants reported the desire to remain independent in daily activities, to maintain health/wellbeing, and prevent secondary conditions (ex: urinary tract infections, pressure injuries) [18]. The current evidence base regarding barriers to physical activity for individuals living with SCI are remarkably consistent. What is less clear is whether the barriers identified by individuals with SCI who are initiating an exercise program that targets commonly cited barriers (i.e., lack of knowledge and access to accessible equipment) will differ from those reported by surveyed individuals who are not active or those already active. This study addresses that knowledge gap through conducting secondary analyses of data obtained from participants enrolled in a 16-week virtually-delivered and peer-supported intervention, Workout on Wheels Internet Intervention (ClinicalTrials.Gov NCT# 03189095) [19, 20]. The purpose of this study is to describe the reasons that people with SCI reported as guiding their decision to enroll in the exercise program, the barriers they reported facing in adopting strength training and aerobic exercise as a regular part of their weekly routine, and their action plans to address the identified barriers.

METHODS

Recruitment

We recruited 168 participants locally from the Dallas/Fort Worth metroplex as well as nationally, though data included in this study are based on the 144 participants who completed at least one of the two online modules. Local recruitment was conducted through organizations that have regular contact with those who have experienced SCI, such as local rehabilitation-related clinics, independent living centers, and durable medical equipment providers. Flyers and signs were distributed throughout outpatient physical rehabilitation outpatient clinics in the area and posted on Facebook. Data collection occurred from March 2017 to February 2019. Recruitment was ongoing during this time.

Nationally, we disseminated study information to several federally funded SCI Model System programs and organizations with a national presence, such as Facing Disability, the Paralyzed Veterans of America, and United Spinal Association. These groups shared study information with their members by posting study information on their website, within their newsletters, and via email to their constituents. Information about the study and how to participate was also placed on the New Mobility magazine website and SCI-Info-Pages (www.sci-info-pages.com/sci-studies.html).

Procedures

All study activities were approved by the local institutional review board (Baylor Scott & White Research Institute, IRB #016–093) and informed consent was obtained from all participants before beginning study-related activities. Data were collected as part of a larger trial that evaluated the feasibility and effectiveness of delivering the theory-based Workout on Wheels (WOWii), a 16-week, internet-based intervention to promote weekly exercise participation. The WOWii program was designed to reduce several identified SCI-related barriers to physical activity [15, 16, 18]. Targeted components included (a) reducing barriers to accessible equipment by providing participants a "starter-package" of exercise equipment (i.e., table-top pedal exerciser, resistance bands, links to online exercise videos on the WOWii website, and arm-based activity tracker); (b) delivering education about safe and appropriate exercise options, using different metrics to assess exercise intensity, and discussing how self-advocacy can be useful with improving access to facilities and activities; and (c) eliminating transportation barriers by delivering the program virtually [19, 20]. WOWii program delivery includes providing participants with access to the WOWii website that houses 16 modules that each address an evidence-based behavioral skill to support starting and continuing with a program of regular exercise plus delivering weekly group-based, virtual sessions led by a program facilitator who guides the group's discussion about how the behavioral skill can assist them in making behavioral changes.

In terms of the physical setting in which the qualitative data were obtained, the program facilitator also served as the individual who introduced the activity at the end of the module where participants create a plan for themselves of how they will put the skill into action the following week. The full trial details and results are published [20]. Participants received $20 for completing surveys at each assessment point, but did not receive any remuneration for participating in the weekly virtual sessions or completing the online modules, which is where data for this study derive. Eligible participants were those who had chronic SCI (due to traumatic or non-traumatic causes) for at least 6 months, were not currently meeting the national recommendation for 150 min of exercise per week, over the age of 18 years old, primarily using a wheelchair for ambulation, were able to independently use a computer and navigate internet, and received physician approval to participate.

Participants received access to the WOWii website which houses content organized into 16 modules corresponding to each program week. Every module presents a topic related to self-management skills such as goal setting, identifying barriers to exercise, garnering social support, and problem-solving. Supplementary Table 1 lists the 16 module topics. Details of the content development and customization of the website for people with SCI have been published elsewhere [19].

Our analysis focused on participants' responses to 2 of the 16 program module activities: the week 1 module, in which participants were prompted to identify why they enrolled in the exercise study, and the week 3 module, in which participants were prompted to report barriers to exercise. The week 3 module included a prompt to write a free response comment about proposed solutions to the identified barriers. Participants could provide up to 10 responses for each of the module activities, which allowed for more responses to code than the number of participants. These module activities were completed during the final 15–20 min of the group-based virtual session, which was led by the program facilitator. Participants who wished could share their responses with the group, which often facilitated discussion among the members about the issue raised. The week 1 module activity asks participants to list *all* the reasons that led to their enrolling in the study and the week 3 module activity asks participants to list *all* the barriers that they are facing as they are attempting to incorporate exercise into their weekly routine. Completing each module response took about 5–10 min. Supplementary Fig. 1 illustrates each module activity as they were presented to participants.

Qualitative data analysis

This is a secondary analysis of participant data collected as part of delivering a 16-week exercise intervention program to individuals with SCI [20]. The paper presents participants' responses to online activities completed as part of that larger exercise trial and thus, this study was not formally designed as a qualitative study. Nevertheless, the research team conducted the qualitative analyses with rigor. The data were de-identified and subjects were aware that any information provided as part of their participation of the study could be used for analysis. The first author (CT) was a 4th year medical student conducting a research practicum at the time she was involved in the study and did not have interaction with study participants. The 2nd (CO) and 3rd (KFG) authors both assisted with intervention delivery, which allowed them to interact with some of the study participants. Both have basic knowledge about SCI and experience conducting research with those who live with SCI.

Qualitative data analysis was completed using an inductive thematic approach. Qualitative data from participant responses entered on the WOWii site into the 2 module activities were analyzed by identifying themes that emerged. All responses were reviewed, categorized, and tabulated by thematic category in Microsoft Excel. The first coder (CO) completed an initial review of the participant-generated responses and developed the original thematic coding categories through a first-pass analysis of each item. The second coder (CT) conducted an independent review of each item and categorized each one into the thematic categories identified by CO. Any areas of discrepancy between the two coders were resolved through group discussion and consensus with the principal investigator (KFG). Confirmability was established with maintaining an audit trail that detailed all coding definitions and decisions. The themes identified through this analysis were summarized by frequency of participant report. Results were summarized using SAS software v9.4 (SAS Institute, Cary, NC) and visualized with the ggplot2 package in R version 3.6.0.

RESULTS

Participant characteristics

All participants who completed either Module 1 (purposes for enrolling in the study) or Module 3 (barriers to exercise) over the course of the study were included in the analysis. The overall study sample of 144 participants (which represents those who completed the online activities of the two modules) had a mean age of 49.8 years and averaged 16 years post-injury. Participants were mostly White ($n = 114$, 79%) and Non-Hispanic ($n = 125$, 87%), and just over half were male ($n = 80$, 56%). The sample was highly educated with more than half ($n = 73$, 51%) having completed a bachelor's degree or higher and 35% were employed at least part-time. In terms of injury-level, nearly half reported thoracic injury ($n = 71$, 49%), followed by cervical injury ($n = 61$, 42.4%), and several experienced injury at the lumbar level ($n = 9$, 6%). Almost two-thirds of the sample reported using a manual chair ($n = 92$, 64%) and one-third use a power chair ($n = 48$, 33%). Participants resided across 32 states, though most lived in Texas. Demographic information is illustrated in Table 1.

Table 1. Demographics of Sample ($n = 144$).

Characteristic	*n*	*M*	*SD*
Age (years)	144	49.80	12.50
Time with spinal cord injury (years)	144	16.00	12.40
Gender	*n*	%	
Male	80	55.6%	
Female	64	44.4%	
Race			
White	114	79.2%	
Black	16	16.0%	
Other	14	9.7%	
Ethnicity			
Non-Hispanic	125	86.8%	
Hispanic	12	8.3%	
Unknown	7	4.9%	
Marital status			
Married	76	52.8%	
Not married	68	47.2%	
Education level			
High school or below	9	6.3%	
Technical school/Some college/ Associate's	62	43.1%	
Bachelor's degree or above	73	50.7%	
Employment status			
Employed full- or part-time	50	34.7%	
Not currently employed	94	65.3%	
Income level			
$0–39,000	55	38.2%	
$40,000–69,999	32	22.2%	
$70,000–99,999	28	19.4%	
>$100,000	29	20.1%	
Paraplegic or Tetraplegic			
Paraplegic	84	58.3%	
Tetraplegic	58	40.3%	
N/A or Unknown	2	1.4%	
Injury group			
Cervical	61	42.4%	
Thoracic	71	49.3%	
Lumbar	9	6.3%	
N/A or Unknown	3	2.1%	
Wheelchair type			
Manual wheelchair	92	63.9%	
Power wheelchair	48	33.3%	
Scooter	4	2.8%	
US Regions Resided	States		
West	AK, CA, NM, CO, OR, WA		
Midwest	MO, NE, MN, IA, MI, WI, OH		
Southwest	AZ, TX[a]		
Southeast	LA, MS, AL, GA, FL, SC, NC, VA, WV, TN		
Northeast	MD, PA, CT, MA, NY, NH, ME		

[a]Most study participants resided here, as the study site was in TX and the greatest recruitment efforts occurred in the state.

Reported reasons to enroll in exercise study

There were 549 responses from 132 participants in the week 1 module activity, as each participant was asked to list all the reasons they decided to enroll in the study and the webpage had 10 blank lines on which participants could enter their responses. The leading reasons participants reported as motivating them to enroll in the exercise trial were health, function, mood, and weight loss (Fig. 1). More than two-thirds (69%) stated they joined the program to improve their health. Specific health reasons included responses such as "better health", "live longer", and "decrease cardiovascular risk". Over half (61%) reported a desire to improve their physical function and quality of life. Responses included "better transfers", "balance", "enjoy life more", and "more independence". Other commonly cited reasons included a desire for better overall mood (59%), weight loss (51%), improved fitness (48%), and increased energy (39%).

Reported barriers to exercise and plans to address identified barriers

There were 205 responses from 139 participants in the week 2 module activity, as participants were asked to list all the barriers they faced in adopting exercise and the webpage had 10 blank lines on which participants could enter their responses. Participants described time constraints as the leading barrier (54%) based on responses that included work responsibilities, family responsibilities, and not getting enough sleep. Lack of motivation was the second most reported barrier (31%) and example responses included "lack of interest" and "accountability". About a quarter of participants reported accessibility issues (24%) and SCI-specific (23%) barriers. Accessibility issues included difficulties finding accessible gyms and lack of equipment while SCI-specific barriers included difficulties with temperature control, skin breakdown, and pain.

Figure 2 depicts the frequency of participant-generated solutions to address the most common barriers of time, motivation, access, and SCI-related issues. Participant-generated solutions to address time constraints included scheduling exercise, which accounted for 48% of responses, going to sleep or waking earlier (19%), and using friends or technology to support exercise efforts (15%). Solutions noted to address lack of motivation included making exercise more fun (22%) and simply just performing exercise despite feeling a lack of motivation (18%). Outside help in the form of friends or family was another top-cited solution (16%) for lack of motivation. Having a better attitude (15%) and scheduling the time of day to exercise (13%) were also common plans to overcome lack of motivation.

The top accessibility-related solutions included obtaining equipment for home use (30%) and locating accessible facilities

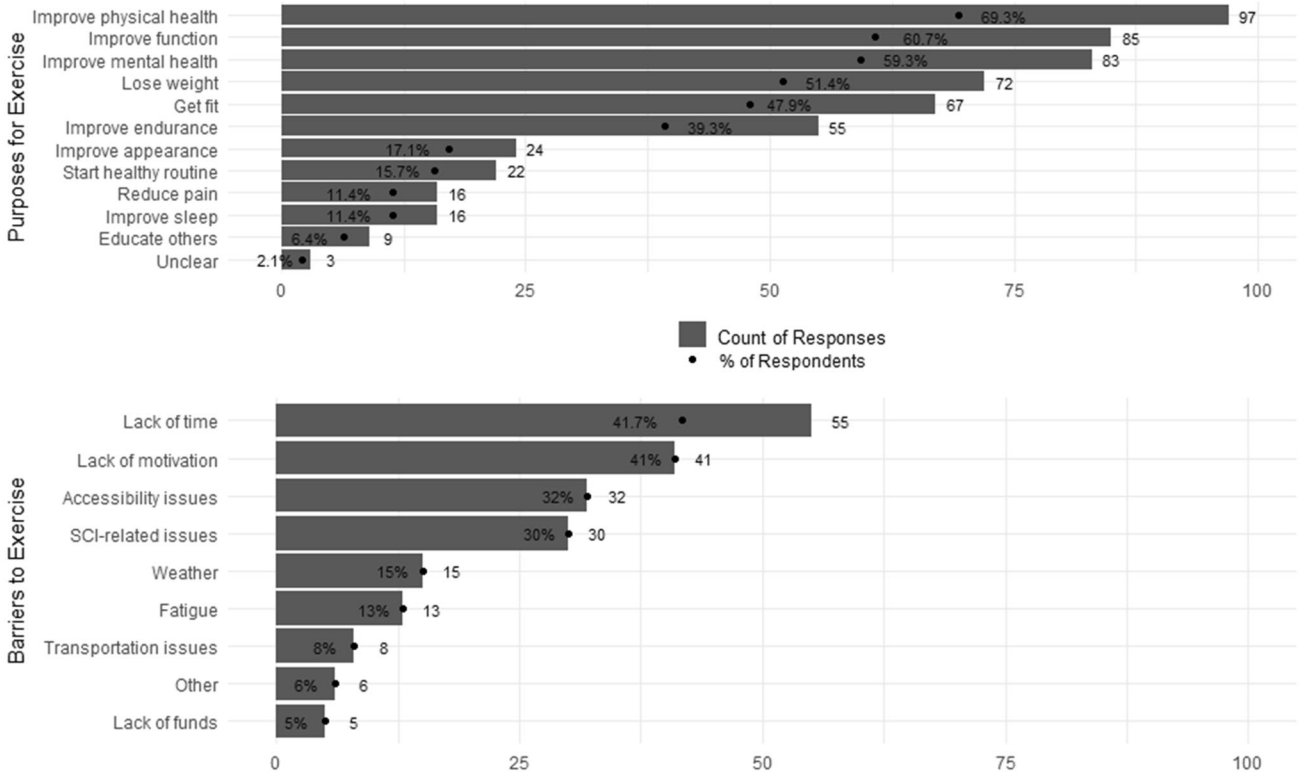

Fig. 1 Motivators and barriers for enrolling in the exercise trial. The leading reasons participants reported as motivating them to enroll in the exercise trial were health, function, mood, and weight loss. The top reported barriers to exercise were lack of time, lack of motivation, accessibility issues, and SCI-related issues.

(27%). Participants planned to address SCI-specific barriers by getting adaptable equipment or finding exercises that could be done independently (29%). Enlisting support from friends or family, along with planning ahead/being flexible with scheduling each accounted for 24% of the total plans for addressing SCI-specific barriers. Finally, adjusting expectations and accepting areas of potential weakness accounted for 20% of the plans listed to address SCI-related barriers.

DISCUSSION

This study describes the perspectives of people with SCI who were participating in a 16-week exercise trial. Our findings, like those of another study [21], suggest that exercise among those with SCI is influenced by a unique combination of motivational and environmental factors, making generic exercise prescription a less viable option for this population.

Commonly reported personal barriers revolved around time constraints (54%) and lack of motivation (31%). This reflects similar results indicating that personal barriers (exercise perceptions, lack of motivation, not liking exercise) were stronger predictors of doing exercise than factors such as environmental barriers or lack of resources [16]. Perceptions of motivation and enjoyment are similar to those reported by Kehn and Kroll [21], who identified the presence or lack of motivation as the most critical factor to being active in their cross-sectional study.

Accessibility issues (24%) and SCI-specific barriers (23%) such as pain and poor temperature control were commonly reported by participants as inhibiting exercise. While these may not be as influential as motivational factors, it is important to remove or mitigate environmental barriers and control SCI-specific issues. Furthermore, environmental barriers in those with disability is not unique to the problem of exercise [21]. Kehn and Kroll previously showed that motivation aside, exercisers were able to be active because of availability of an accessible community-based facility or capability of home equipment [21]. These findings align with those of another study that found the main motivating factor individuals with a disability reported for committing to physical exercise was contact with another disabled person [22]. Those results also indicated that many exercisers with disability who use home equipment rely on assistance of another person to use the equipment [22]. Researchers should identify what unique supports that individuals with SCI require to effectively adopt and maintain an exercise program. It will be important for programs to offer these supports to those who need them to assure they are fully accessible to those with disability.

Furthermore, it is important to understand what motivates people with SCI to decide to participate in exercise. Our study found that the leading reasons participants reported for enrolling in the WOWii exercise study were improving physical health (70%), function (61%), and attitude (60%). These top-reported motivators among our sample align extremely well with those reported to Kehn and Kroll [18] by individuals with SCI during semi-structured interviews about factors motivating their desire to be physically active. A notable finding is that functional goals like being a better parent or spouse and improving flexibility were among leading motivational factors that participants with SCI reported as behind their committing to a regular exercise program. It is important that programs address how exercise can help improve functional outcomes and assure that participants set realistic expectations for achieving those benefits.

Limitations. Numerous study limitations should be noted. First, because these results derive from secondary analysis of data obtained in a randomized controlled trial and was not part of the conceptualization of the primary study, the scientific rigor of this qualitative study is reduced. Another limitation is due to self-selection bias because the participants had to contact the study team and receive medical clearance from their physicians before

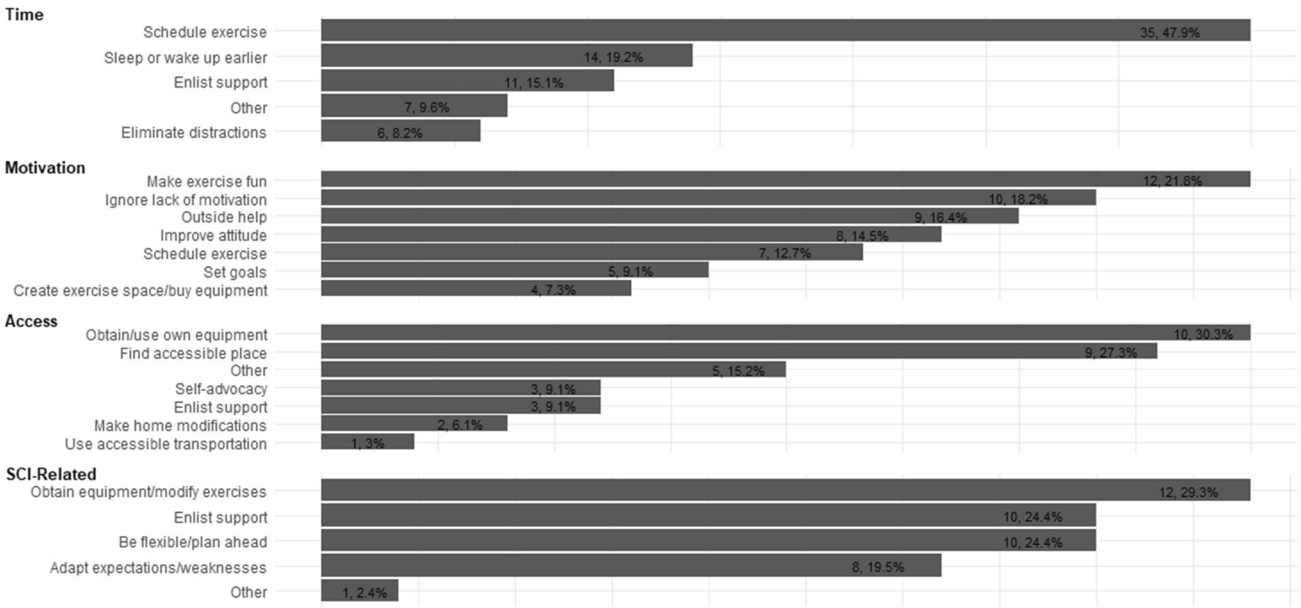

Fig. 2 Participant-reported solutions to exercise barriers. The figure depicts the frequency of participant-generated solutions to address the most common barriers of time, motivation, access, and SCI-related issues.

enrolling. Thus, the sample likely represents those with greater motivation and self-efficacy. Generalizability may also be limited because the sample had higher education levels than is observed nationally among people with SCI. Another potential limitation is that the investigators may have misinterpreted the participants' intentions of statements provided, as we were unable to follow up with participants to confirm the intent of their online entries. This concern was mitigated by ensuring that all comments were coded by two independent coders and all discrepancies were resolved by incorporating a 3rd person to come to mutual agreement.

CONCLUSION

These results can guide future efforts to promote exercise among those living with SCI by illuminating those factors which serve as motivators, barriers, and potential solutions to barriers. The findings highlight the importance to those with SCI on the potential of exercise to improve function and the need to address accessibility issues to support peoples' efforts to exercise. Removing barriers and promoting facilitators is vital for enhancing opportunities for exercise participation and improving long-term health and wellness.

Findings from this study can help guide clinicians who work with individuals with SCI to engage in more physical activity and live a healthier life. For example, clinicians can discuss with their patients the specific health benefits of physical activity in terms of reducing risk for chronic disease as well as more proximal benefits of better sleep, improving mood, reducing stress, and managing weight. Additionally, information about the most commonly reported barriers is important for clinicians to be aware of, so that they can also address individuals concerns about time and motivation as well as issues of access to appropriate health-promoting physical activities.

Future studies should examine the effectiveness of implementing the knowledge of motivators, barriers, and problem-solving strategies into a physical activity program. An exercise program that provides access to exercise equipment, physical resources, a supportive network, and activities for self-efficacy can provide valuable information of the efficacy of a multi-pronged approach to encourage long-term physical activity independence in those with SCI.

DATA AVAILABILITY

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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AUTHOR CONTRIBUTIONS

CT was responsible for designing the study protocol, extracting and analyzing data, interpreting results, and writing the manuscript. CO was responsible for screening and recruiting eligible participants, creating figures and tables, analyzing data, interpreting results, and writing the manuscript. KFG was responsible for designing the study protocol, screening and recruiting eligible participants, and providing feedback on the manuscript.

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COMPETING INTERESTS

The authors declare no competing interests.

ETHICS APPROVAL

We certify that all applicable institutional and governmental regulations concerning the ethical use of human volunteers were followed during the course of this research.

ADDITIONAL INFORMATION

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Correspondence and requests for materials should be addressed to Cindy Tiu.

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