

**Title: The Impact of COVID-19 on Community-Based Exercise Classes For People With Parkinson Disease**

**RUNNING HEAD: COVID Impact on Exercise for People With PD**

**TOC CATEGORY: COVID-19**

**ARTICLE TYPE: Original Research**

**SUBMITTED: April 9, 2021**

**REVISED: May 21, 2021**

**ACCEPTED: July 19, 2021**

**KEYWORDS:** Parkinson Disease, Exercise, Health Care Surveys, Neurology, Movement Disorders

Authors and Institutions:

Mark M. Mañago, PT, DPT, PhD, NCS<sup>1,2</sup>

Laura A. Swink, PhD, OTR<sup>2</sup>

Emily R. Hager, MS<sup>1,2</sup>

Robyn Gisbert, DPT<sup>1</sup>

Gammon M. Earhart, PhD, PT, FAPTA<sup>3</sup>

Cory L. Christiansen, PhD, PT<sup>1,2</sup>

Margaret Schenkman, PhD, PT, FAPTA<sup>1</sup>

<sup>1</sup>Department of Physical Medicine and Rehabilitation, University of Colorado, Aurora, CO, United States

<sup>2</sup>VA Eastern Colorado Geriatric Research, Education, and Clinical Center, Rocky Mountain Regional VA Medical Center, Aurora, CO, United States

<sup>3</sup>Program in Physical Therapy, Washington University in St. Louis School of Medicine, St. Louis, MO, United States

Corresponding Author:

Mark M. Mañago

Phone: 303-56-9428

Fax: 303-724-9016

Email: [mark.manago@ucdenver.edu](mailto:mark.manago@ucdenver.edu)

Twitter: @Manago\_PT

Mail: CU Physical Therapy Program, Mail Stop C244, 13121 E 17th Ave, Room 3108, Aurora, CO, 80045

**Abstract**

**Objective.** The purpose of the study was to determine the impact of COVID-19

restrictions on community-based exercise classes for people with Parkinson disease (PD)

and their instructors.

**Methods.** Data were collected via custom-designed electronic surveys for people with PD and class instructors who reported attending or teaching PD-specific exercise class  $\geq 1$ /week for  $\geq 3$  months prior to pandemic restrictions (March 2020). The PD group also completed the Godin Leisure-Time Questionnaire (GLT-Q), Self-Efficacy for Exercise (SEE) scale, Schwab-England scale, and Parkinson's Disease Questionnaire 8 (PDQ-8).

**Results.** Eighty-seven people with PD (mean = 70 [7.3] years old) and 43 instructors (51 [12.1] years old) from the United States completed surveys (October 2020 to February 2021). Mean Schwab-England (84 [16]) and PDQ-8 (21 [15]) scores indicated low-to-moderate disability in the PD group. Ninety-five percent of the PD group had COVID-19 exposure concerns and 54% reported leaving home  $\leq 1$ /week. While 77% of the PD group scored "active" on the GLTQ, the mean SEE score (55 [24]) indicated only moderate exercise self-efficacy, and  $>50\%$  reported decreased exercise quantity/intensity compared to pre-COVID. There was decreased in-person and increased virtual class participation for both groups. The top in-person class barrier for the PD (63%) and instructor (51%) groups was fear of participant COVID-19 exposure. The top virtual class barriers were lack of socialization (20% of PD group) and technology problems (74% of instructor group).

**Conclusions.** During COVID-19 there has been less in-person and more virtual exercise class participation in people with PD, and decreased exercise quantity and intensity. Virtual classes may not fully meet the needs of people with PD, and primary barriers include technology and lack of socialization.

**Impact.** As COVID-19 restrictions wane, it is imperative to help people with PD increase exercise and activity. The barriers, needs, and facilitators identified in this study might help inform approaches to increase participation in exercise and activity for people with PD.

**Lay Summary.** During COVID-19, there has been less in-person and more virtual exercise class participation in people with PD--and a decrease in exercise quantity and intensity. If you have PD, virtual classes might not fully meet your needs. Primary barriers may include technology problems and lack of social interaction.

## **Introduction**

Parkinson disease (PD) is a neurodegenerative movement disorder characterized by rigidity, bradykinesia, tremor, and postural instability.<sup>1</sup> Physical activity and exercise are essential complements alongside pharmacological treatment in the management of PD, as they can slow the progression of PD-related symptoms and improve quality of life.<sup>2-4</sup> Community-based exercise classes have become an important way for people with PD to engage in exercise and maintain physical activity, and have become increasingly popular options.<sup>5</sup> Nevertheless, people with PD still experience a number of barriers to exercise participation such as fear of falling, fatigue, depression, and lack of knowledge on modifying exercise for PD-related symptoms.<sup>6-8</sup> Since the beginning of the novel coronavirus 2019 (COVID-19) pandemic additional barriers for participation in physical activity and exercise have appeared such as stay-at-home orders, gym closures, social distancing recommendations, and the cancellation of community-based exercise classes.<sup>9-11</sup> In addition, people with PD often fall into the “high-risk group” for developing severe COVID-19 symptoms because of age and potential comorbidities, and for much of the pandemic have been advised to limit activities outside of their home.<sup>12,13</sup> A recent study that evaluated telehealth utilization in people with PD during COVID-19 found that about half of the respondents reported doing less activity during COVID-19.<sup>14</sup> However, the specific impact of COVID-19 restrictions on physical activity and exercise participation in people with PD who regularly participated in structured outpatient or community-based classes prior to the pandemic is not known.

While COVID-19 has created new barriers to in-person exercise class participation for people with PD, there are also new opportunities for alternate ways to stay active. One obvious alternative to continue participating in exercise classes during the pandemic is through virtual classes (ie, virtual or online delivery). However, it is not clear to what extent people with PD or their exercise class instructors have adopted this exercise format. Nor is it clear if virtual classes can successfully meet the needs of class participants and allow them to maintain similar levels of activity. In addition, it is not known if people with PD who were previously participating in structured in-person exercise classes modified their routines in other ways or found alternate ways to engage in exercise.<sup>9,15</sup> Therefore, it is important to understand how people with PD have adapted to changes in exercise class formats and/or modified physical activity levels.

In addition to learning about the experience of people with PD, it is important to consider the experience of exercise class instructors, especially in regard to their reported changes, barriers, facilitators, and current needs for both in-person and virtual class formats. Understanding key environmental, social, and motivational barriers, facilitators, and needs of both people with PD and their instructors may help to better understand how to develop strategies that can help inform current and future approaches to maximize participation in structured exercise for people with PD.

Therefore, the primary objective of this study was to determine current self-reported physical activity and exercise participation levels in people with PD who regularly participated in community-based exercise classes prior to COVID-19. An electronic survey was completed by people with PD and exercise class instructors in order to determine self-reported changes in exercise class participation and formats (in-person or virtual), and identify current critical environmental, social, and motivational barriers and related to exercise participation. We hypothesized that people with PD would

report decreased physical activity levels since COVID-19 restrictions started and that both the PD and instructor groups would report similar changes in class formats, but that each group would have unique barriers, facilitators, and needs for exercise class participation.

## **[H1] Methods**

This cross-sectional study used anonymous electronic surveys to gather data from people with PD and class instructors. All participants completed electronic consent and self-screening questions. Participants with PD confirmed the following inclusion criteria: 45-85 years old, attendance of a community-based exercise class designed for people with PD at least 1x/week for the 3 months prior to COVID-19 pandemic restrictions being enacted in the United States (March 2020), and ability to answer survey questions either independently or with the help of a caregiver. Class instructors were included who were 18-85 years old, taught a PD-specific exercise class, and had the ability to fill out the survey electronically.

The electronic survey was distributed via email by two separate sites (University of Colorado Anschutz Medical Campus and Washington University in St. Louis) through PD association listservs, exercise instructor databases, professional networks, and snowball sampling to participant contacts. A standardized script was used in each email that explained the study purpose and general eligibility criteria for both the instructor and class participant surveys. The study was approved by the Institutional Review Boards at the two respective study sites. All data were collected through an anonymous public survey link to prevent re-identification and data were stored in a secure REDCap database. No protected health information or other unique identifiers were collected.

## **[H2] *Survey Design and Outcomes***

Separate surveys for people with PD and exercise instructors were used. Both surveys used a combination of Likert scale and multiple choice closed-ended questions to identify current modifications to exercise class participation and format due to COVID-19 restrictions, general knowledge of COVID-19 restrictions, and overall adherence to these restrictions. Both groups were then asked to identify current environmental, social, and motivational barriers, facilitators, and needs for in-person and virtual class formats. The people with PD were also asked about current barriers, facilitators, and needs for general (ie, overall) exercise participation; and to report changes in their exercise frequency and intensity compared to pre-COVID levels. Finally, the following demographic data were collected: age, sex, race/ethnicity, and education/training level. There were 31 base multiple-choice questions for people with PD, and 20 for instructors, with branching logic to provide further clarification for a number of the base questions. Several questions contained open-ended response options for participants to provide additional information if desired. All questions were developed by the study team and consensus was reached on their face validity. The surveys were then piloted in four older adults without neurological conditions for usability and time estimation, then in two people with PD and one instructor.

The participants with PD were also asked to fill out standardized questionnaires based on their current status: the Godin Leisure-Time Questionnaire (GLT-Q),<sup>16</sup> the Self-Efficacy for Exercise (SEE) Scale,<sup>17</sup> the Schwab-England Activities of Daily Living Scale,<sup>18</sup> and the Parkinson's Disease Questionnaire-8 (PDQ-8),<sup>19,20</sup> The GLT-Q quantifies self-reported physical activity and exercise participation and classifies individuals into one of three categories: 1) Active, 2) Moderately Active, or 3) Insufficiently Active.<sup>16</sup> The SEE is a reliable and valid scale that assesses perceptions about ability to participate in at least 20 minutes of moderate physical activity 3x per week.<sup>17</sup> The Schwab-England is a commonly used, reliable and valid scale that measures self-reported disability in people with PD via

questions about ability to perform activities of daily living.<sup>18</sup> Finally, the PDQ-8, a validated self-report assessment of quality of life in people with PD, was used to further characterize the people with PD.<sup>19,20</sup>

## **[H2]** *Data Analysis*

A minimum sample size of 15 class instructors and 50 participants was determined a priori in order to provide information about current physical activity levels, changes in exercise class structure, and barriers and facilitators associated with current exercise. Based on the time-sensitive nature of the study topic, it was determined the survey would be open no later than February 2021.

Descriptive statistics were used to characterize the data and describe the sample characteristics, activity levels in the PD group, and class format changes in both groups. Narrative summary was used to compare difference in barriers, facilitators, and needs of class participants and instructors. All analysis was performed using SPSS Statistics 27 (IBM, Armonk, NY, USA).

## **[H2]** *Role of the Funding Source*

This work was supported by a grant from the Colorado Clinical & Translational Science Institute (NIH/NCATS UL1-TR001082, TL1-TR002535). The funder played no role in the design, conduct, or reporting of this study.

## **[H1]** **Results**

### **[H2]** *PD and Instructor group characteristics*

Eighty-seven people with PD (70 [7.3] years old) and 43 instructors (51 [12.1] years old) from 20 different states in the United States completed the surveys between October 2020 and February 2021. In the PD group, 52% identified as female, 93% as



Caucasian, and 92% as non-Hispanic. The majority of people with PD (57%) were diagnosed over 5 years ago (n = 38). Mean Schwab-England score was 84.0 (15.7), mean PDQ-8 score was 21 (14.6), and mean SEE score was 55.0 (23.5). Fifty-five percent reported at least one fall in the past 12 months (Table 1). In the instructor group, 85% identified as female, 93% as Caucasian, and 91% as non-Hispanic. The majority (63%) had been teaching 1-5 years, came from a variety of professional backgrounds, and 79% had PD-specific exercise training (Table 2).

## **[H2]** *COVID-19 knowledge and behaviors in PD and Instructor Groups*

Almost all of the people with PD were aware of their local COVID-19 restrictions (93%) and the remainder reported being “somewhat aware” (7%). All of the instructor group (100%) reported being aware of their local COVID-19 restrictions. In the PD group, 23% had one or more medical comorbidities for developing severe illness from COVID,<sup>10</sup> compared with 9% in the instructor group. Only 2 people with PD (2%) and 4 instructors (9%) had a known positive COVID test.

In the PD group, 95% of respondents were at least a “little concerned” about their own COVID-19 exposure compared to 77% of the instructor group. Similarly, regarding their household’s COVID-19 exposure, the PD group (94%) and the instructor group (93%) were at least a “little concerned”. Finally, 95% of the instructor group was at least a “little concerned” about COVID-19 exposure for their class participants. Fifty-four percent of the PD group reported leaving home weekly or less, while 74% of the instructor group reported leaving home at least once a day. The top reasons why the PD group left home were to attend to essential activities such as medical appointments (85%) and shopping (77%), and for the instructor group it was for shopping (88%) and work (74%). Very few people in either group reported leaving the home for non-essential activities. Table 3 details COVID-19 related concerns and behaviors for both groups.

## **[H2]** *PD group exercise activity and class changes*

At the time of the survey 77% of the people with PD were categorized as “active” on the GLT-Q. Compared to pre-COVID levels, the majority reported decreased exercise quantity (58%) and intensity (56%). Only 30% of the PD group reported currently attending in-person class. Conversely, 64% of the PD group currently attended virtual class, compared to only 21% pre-COVID-19, with 45% reporting an overall increase in virtual class frequency. Despite the novelty of virtual class attendance for many, of the 56 who reported virtual class attendance, 45 (80%) said they were comfortable attending virtual classes, and 29 (52%) stated they were likely to continue virtual classes after COVID-19 restrictions were lifted. In addition, 68% of the entire PD group reported participating in unstructured exercise (walking, biking, etc.), with 25% reporting an increase in unstructured exercise. Finally, 21% of the PD group were getting supervised 1-on-1 exercise instruction (with physical therapist, personal trainer, etc.), with 6% reporting an increase in 1-on-1 exercise instruction. Figure 1 details current physical activity levels and changes in exercise for the PD group.

## **[H2]** *Instructor group class changes*

Prior to COVID-19, all instructors taught in-person classes but, at the time of the survey, 58% reported no longer teaching any in-person class in the previous 3 months. Of those that continued to teach in-person, the most common adaptations made were having fewer participants, social distancing, requiring masks, and cleaning more frequently. Prior to COVID-19, only 12% of the instructors reported having any virtual class options while at the time of the survey 60% reported they offered a virtual class option. Of the 26 instructors who were currently teaching virtually, 21 (81%) reported they were likely to continue with virtual classes. Figure 2 details instructor class formats before and during COVID-19 restrictions.

## **[H2]** *Barriers, Facilitators, and Needs in PD and Instructor Groups*

The PD group reported their top general barriers for exercise during COVID-19 were feeling less motivated (37%) and having more fatigue (24%). Their top facilitators for continuing any form of exercise during COVID-19 were having an independent home exercise program (35%) and more time to exercise (23%). Despite having more time, and some independent resources, participants with PD still indicated they needed help to stay motivated (28%) and a place to exercise safely (22%).

For in-person class participation, the PD group reported top barriers were COVID-19 exposure fear for self (63%) and family (48%). Instructors were also cognizant of exposure concerns and reported participants' fear of COVID-19 exposure (72%) and their own concern about participant exposure (51%) as top barriers to in-person classes. To mitigate these concerns, participants with PD reported top facilitators to be smaller (14%) and socially-distanced (14%) classes. Instructors reported top facilitators for in-person class to be employer/facility support (26%) and adequate cleaning supplies (26%). The top in-person needs for the PD group were the need to feel safe from COVID-19 exposure (58%) and to have more class options/times available (29%), while the instructors reported their top needs to be more indoor (35%) or outdoor (28%) space for instruction.

For virtual class participation, 53% of the PD group reported that nothing made it more difficult to attend virtual classes, but only 5% of the instructors reported no difficulties attending virtual classes. The top virtual barriers for the PD group were lack of socialization (20%) and accountability (15%). Instructors saw participant safety concerns (eg, fall risk, 65%) and participant technology use problems (74%) as the top virtual barriers. Both groups reported elements that made virtual participation easier, such as not having to travel to class (47% of PD group, 37% of instructors) and participants feeling safe from COVID-19 exposure (40% of PD group, 51% of instructors). Virtual class needs

differed among the two groups. For the PD group, the top needs were a way to stay accountable (18%) and have more class options/times available (18%). For the instructor group, the top needs were helping participants use (58%) and access (42%) needed technology. Figure 3a details barriers, facilitators, and needs for the PD group, and Figure 3b for the instructor group. Supplementary material details all barriers, facilitators, and needs for both groups.

## **[H1] Discussion**

This study determined that in people with PD who regularly participated in community-based exercise classes prior to COVID-19 there was a marked decrease of in-person class participation and a subsequent increase in virtual classes during COVID-19 restrictions. The majority of people with PD continued to be active but reported an overall decrease in exercise frequency and intensity, suggesting that virtual classes may not be fully meeting the needs of people with PD during COVID-19. As any decrease in activity or exercise for people with PD can have negative consequences on overall health and disease progression,<sup>2-4</sup> these results highlight the potential devastating impact of COVID-19 may have for people with PD for years to come. These results also highlight a need to help people with PD return to regular exercise and activity. The barriers, facilitators, and needs reported in this study by people with PD and their exercise class instructors can help to directly inform clinical approaches to increase participation in exercise and activity for people with PD both during COVID-19 restrictions and as restrictions wane.

The PD group in this study were all attending exercise classes at least 1x/week for at least 3 months prior to when the COVID-19 restrictions began in the US (March 2020).

Therefore, it may not be surprising that their current mean Schwab-England score indicated relatively low disability (functional independence but with slowness).

Furthermore, the mean PDQ-8 scale of 21 is consistent with Hoehn & Yahr I-II,<sup>19</sup> further

confirming the low-to-moderate level of disability in this sample. Considering their pre-COVID level of exercise engagement, it also was not surprising that the majority of the PD group was currently considered “active” on the GLT-Q.<sup>16</sup> However the majority did report a decrease in intensity and frequency of activity compared to pre-COVID, and their current mean SEE scores indicated only moderate confidence to overcome exercise and activity barriers.<sup>17</sup> Furthermore, the top general barriers to exercise for the PD group were increased fatigue and decreased motivation, which can both influence exercise self-efficacy.<sup>8,21</sup> Due to the cross-sectional nature of this study, change in GLT-Q, SEE, fatigue, and motivation are unknown. However, given that this group exercised regularly prior to COVID-19, it is plausible that COVID-19 created new barriers of fatigue and decreased motivation which influenced self-efficacy and therefore lowered exercise frequency and intensity.

The top barrier for attending in-person classes for both the PD and instructor groups was concern of COVID-19 exposure for the people with PD. Given that many people with PD in this study were over 65, and over 20% had at least one medical risk factor for developing severe COVID-19 symptoms, it follows that they were carefully following COVID-19 precautions by their infrequently leaving home, especially for non-essential and/or social activities. These findings are supported by Feeney et al, who reported people with PD were commonly cancelling non-essential activities due to a fear of COVID-19 exposure.<sup>14</sup> Even as restrictions ease, and more people get vaccinated, it is important for clinicians to realize that people with PD overall may be apprehensive about returning to in-person exercise and may need assurance that they will be safe.

In the current study, there was a marked increase in virtual class participation and instruction for the PD and instructor groups, respectively. The rate of current virtual class attendance in this study (64%) is similar to a recent study by Feeney et al (2021)<sup>14</sup> that

reported 58% of people with PD were attending virtual or wellness classes during the COVID-19 pandemic. Feeney et al (2021)<sup>14</sup> also reported that the majority of the people with PD reported they would continue with telehealth appointments in the future. Similarly, in the current study, the majority of both groups reported they would likely continue virtual exercise class after COVID-19 restrictions ended. However, while most of the PD group reported no barriers to virtual class, 95% of instructors reported at least one barrier. Virtual classes may continue to be an important resource for people with PD, but instructors may perceive more barriers and therefore require more support, training, and/or resources in order to successfully instruct virtual classes.

The current study identified differences in the top barriers reported by the PD and instructor groups for virtual classes. The top barriers for virtual class participation in the PD group were lack of accountability and social interaction. In people with PD, social engagement has been previously linked to exercise enjoyment and cited as a motivator for exercise,<sup>22</sup> and accountability of peers and instructors has been found to be important for exercise class participation.<sup>23</sup> Feeney et al (2021)<sup>14</sup> reported that for people with PD during the COVID-19 pandemic there have been increased feelings of depression and negative mood alterations, which were associated with getting less exercise. While the current study did not include a measure of mood, it is plausible that negative mood alterations, social isolation, and lack of exercise have combined to greatly affect overall health and quality of life in people with PD during the COVID-19 pandemic. Moving forward, virtual classes may be an important way to complement in-person exercise, but instructors may need to consider novel ways to engage participants, meet social needs, and offer accountability as a way to maximize participation. Future research should explore the role of social support, mood, and engagement in the context of virtual exercise classes for people with PD.

Meanwhile, top instructor barriers for participation in virtual classes were participant safety (eg, fall risk), followed by participant technology access and use. Safety is a concern for any virtually based exercise class, especially in people with PD where fall risk is high.<sup>24</sup> Consistent with prior literature, the current study found that over half the PD group reported falling at least once in the past year.<sup>24</sup> While these falls were not necessarily associated with exercise, these results suggest that virtual classes should be designed in a way that minimizes fall risk. Interestingly, participant technology problems was identified as a top barrier by the instructor but not the PD group. In the future, clinicians and instructors may need to proactively ask about and address potential technology issues, as people with PD may not readily identify them. Of note, Feeney et al (2021)<sup>14</sup> reported that people with PD who have postsecondary education or higher household income were more likely to use telehealth services during COVID-19. As higher income and education might mean better access to reliable technology and more familiarity with virtual platforms, careful consideration of these barriers is needed to ensure virtual exercise classes are reaching all interested participants, regardless of ability to access or use technology.

A common facilitator for exercise reported by both the PD and instructor groups was the lack of travel associated with virtual classes. About 25% of PD group also reported that in general they had more time to exercise. In addition, 25% of the PD group reported an increase in unstructured exercise participation such as walking, biking, or independent home programs. However, much like the virtual class options, this increase in unsupervised exercise did not appear to help people with PD maintain their previous exercise frequency and intensity. Nevertheless, in order to maximize return to activity and exercise, clinicians may try to gauge patient interest in an independent exercise program

and leverage behavioral intervention frameworks to help people maintain appropriate frequency, intensity, and dosing.<sup>25,26</sup>

Decreased physical activity and exercise are not unique to people with PD during the COVID-19 pandemic restrictions. Two recent studies have found reductions in physical activity of between 39.2% and 43.8% in older, community dwelling adults during COVID-19 restrictions in Japan and France, respectively.<sup>27,28</sup> A survey of people with multiple sclerosis living in Israel also found that during COVID-19 about 50% reported decreasing or stopping leisure time physical activity.<sup>29</sup> As COVID-19 restrictions begin to ease, it is important to understand how exercise participation can best be supported so that we can collectively assist people with PD and other at-risk populations return to prior levels of activity as soon as possible. In the immediate future at least, it seems plausible that in order to have the greatest impact, a combination of in-person and virtual classes, along well-planned and monitored independent programs will be needed. Considering the barriers, needs, and facilitators found in this study could help to inform clinical decisions and research questions related to the development of these intervention approaches as we begin to transition out of the most restrictive COVID-19 recommendations and into a new future where the consequences of decreased activity at a population level may be profound.

## **[H2]** *Limitations*

This was a cross-sectional study so could not measure reported activity and exercises changes over time. Furthermore, asking respondents to report on past behaviors could have introduced recall bias. The primary recruitment strategy was through professional connections and snowball sampling so it was not feasible to track percentage of responders out of how many people received the survey link. The vast majority of respondents reported being non-Hispanic Caucasians, had at least a 4-year college



degree, and had lower disability, so may not represent a general sample of people with PD.

## **[H2] Conclusion**

During COVID-19 there has been less in-person and more virtual exercise class participation for people with PD, with less frequent and less intense self-reported exercise participation. Both the PD and instructor groups reported their top barrier was COVID-19 exposure concerns for in-class participation. However, the groups reported different top barriers for virtual class participation. The barriers, needs, and facilitators identified in this study can help inform approaches to increase exercise and activity participation for people with PD.

## **Author Contributions**

Concept/idea/research design: M.M. Mañago, L.A. Swink, C.L. Christiansen, M. Schenkman

Writing: M.M. Mañago, L.A. Swink, E.R. Hager, C.L. Christiansen, M. Schenkman

Data collection: M.M. Mañago, L.A. Swink, E.R. Hager

Data analysis: M.M. Mañago, L.A. Swink, C.L. Christiansen

Project management: M.M. Mañago

Providing participants: R. Gisbert, G.M. Earhart

Consultation (including review of manuscript before submitting): L.A. Swink, E.R. Hager, R. Gisbert, G.M. Earhart

## **Acknowledgments**

The authors acknowledge the Parkinson's Association of the Rockies and American Parkinson Disease Association-Greater St Louis Chapter for assistance in survey distribution.

### **Ethics Approval**

The study was approved by the Institutional Review Boards at the 2 respective study sites (University of Colorado Anschutz Medical Campus and Washington University in St. Louis).

### **Funding**

This work was supported by a grant from the Colorado Clinical and Translational Science Institute (NIH/NCATS UL1-TR001082, TL1-TR002535).

### **Disclosure**

The authors completed the ICMJE Form for Disclosure of Potential Conflicts of Interest and reported no conflicts of interest.

### **References**

1. Kalia LV, Lang AE. Parkinson's disease. *Lancet Lond Engl*. 2015;386:896-912.
2. Factor SA, Bennett A, Hohler AD, Wang D, Miyasaki JM. Quality improvement in neurology: Parkinson disease update quality measurement set: Executive summary. *Neurology*. 2016;86:2278-2283.
3. Rafferty MR, Schmidt PN, Luo ST, et al. Regular Exercise, Quality of Life, and Mobility in Parkinson's Disease: A Longitudinal Analysis of National Parkinson Foundation Quality Improvement Initiative Data. *J Park Dis*. 2017;7:193-202.
4. Goodwin VA, Richards SH, Taylor RS, Taylor AH, Campbell JL. The effectiveness of exercise interventions for people with Parkinson's disease: A systematic review and meta-analysis. *Mov Disord*. 2008;23:631-640.
5. Hirsch MA, Iyer SS, Englert D, Sanjak M. Promoting exercise in Parkinson's disease through community-based participatory research. *Neurodegener Dis Manag*. 2011;1:365-377.

6. van Nimwegen M, Speelman AD, Hofman-van Rossum EJM, et al. Physical inactivity in Parkinson's disease. *J Neurol*. 2011;258:2214-2221.
7. Ellis T, Motl RW. Physical Activity Behavior Change in Persons With Neurologic Disorders: Overview and Examples From Parkinson Disease and Multiple Sclerosis. *J Neurol Phys Ther*. 2013;37:85-90.
8. Afshari M, Yang A, Bega D. Motivators and Barriers to Exercise in Parkinson's Disease. *J Park Dis*. 2017;7:703-711.
9. Hammami A, Harrabi B, Mohr M, Krusturup P. Physical activity and coronavirus disease 2019 (COVID-19): specific recommendations for home-based physical training. *Manag Sport Leis*. Published online April 20, 2020:1-6.
10. CDC. Coronavirus Disease 2019 (COVID-19). Centers for Disease Control and Prevention. Published February 11, 2020. Accessed July 28, 2021. <https://www.cdc.gov/coronavirus/2019-ncov/index.html>
11. Personal recreation | Colorado COVID-19 Updates. Accessed July 28, 2021. <https://covid19.colorado.gov/safer-at-home/recreation>
12. Top Questions and Answers on COVID-19 and Parkinson's Disease | Parkinson's Foundation. Accessed July 28, 2021. <https://www.parkinson.org/blog/COVID-19-questions>
13. Galati Z. Critical Information for those with Parkinson's during the Coronavirus Pandemic. [Parkinsonfoundation.org](https://parkinsonfoundation.org). Published March 20, 2020. Accessed August 17, 2020. <https://parkinsonfoundation.org/blog/important-information-for-those-with-parkinsons-during-the-coronavirus-pandemic>
14. Feeney MP, Xu Y, Surface M, et al. The impact of COVID-19 and social distancing on people with Parkinson's disease: a survey study. *Npj Park Dis*. 2021;7:10.
15. Jiménez-Pavón D, Carbonell-Baeza A, Lavie CJ. Physical exercise as therapy to fight against the mental and physical consequences of COVID-19 quarantine: Special focus in older people. *Prog Cardiovasc Dis*. 2020;63:386-388.
16. Godin G. The Godin-Shephard leisure-time physical activity questionnaire. *Health Fit J Can*. 2011;4:18-22.
17. Resnick B, Jenkins LS. Testing the reliability and validity of the Self-Efficacy for Exercise scale. *Nurs Res*. 2000;49:154-159.
18. Ramaker C, Marinus J, Stiggelbout AM, Hilten BJ van. Systematic evaluation of rating scales for impairment and disability in Parkinson's disease. *Mov Disord*. 2002;17:867-876.
19. Jenkinson C, Fitzpatrick R, Peto V, Greenhall R, Hyman N. The PDQ-8: Development and validation of a short-form parkinson's disease questionnaire. *Psychol Health*. 1997;12:805-814.
20. Jenkinson C, Fitzpatrick R. Cross-cultural evaluation of the short form 8-item Parkinson's Disease Questionnaire (PDQ-8): results from America, Canada, Japan, Italy and Spain. *Parkinsonism Relat Disord*. 2007;13:22-28.

21. Elbers R, van Wegen EEH, Rochester L, et al. Is impact of fatigue an independent factor associated with physical activity in patients with idiopathic Parkinson's disease? *Mov Disord Off J Mov Disord Soc.* 2009;24:1512-1518.
22. Zaman A, Ellingson L, Sunken A, Gibson E, Stegemöller EL. Determinants of exercise behaviour in persons with Parkinson's disease. *Disabil Rehabil.* Published online July 19, 2019:1-7.
23. Hunter H, Lovegrove C, Haas B, Freeman J, Gunn H. Experiences of people with Parkinson's disease and their views on physical activity interventions: a qualitative systematic review. *JBI Database Syst Rev Implement Rep.* 2019;17:548-613.
24. Allen NE, Schwarzel AK, Canning CG. Recurrent Falls in Parkinson's Disease: A Systematic Review. *Park Dis.* 2013;2013:1-16.
25. Lai B, Kim Y, Wilroy J, Bickel CS, Rimmer JH, Motl RW. Sustainability of exercise intervention outcomes among people with disabilities: a secondary review. *Disabil Rehabil.* Published online February 6, 2018:1-12.
26. Young MD, Plotnikoff RC, Collins CE, Callister R, Morgan PJ. Social cognitive theory and physical activity: a systematic review and meta-analysis. *Obes Rev Off J Int Assoc Study Obes.* 2014;15:983-995.
27. Genin PM, Lambert C, Larras B, et al. How Did the COVID-19 Confinement Period Affect Our Physical Activity Level and Sedentary Behaviors? Methodology and First Results From the French National ONAPS Survey. *J Phys Act Health.* Published online February 13, 2021:1-8.
28. Makizako H, Nakai Y, Shiratsuchi D, et al. Perceived declining physical and cognitive fitness during the COVID-19 state of emergency among community-dwelling Japanese old-old adults. *Geriatr Gerontol Int.* n/a(n/a).
29. Kalron A, Dolev M, Greenberg-Abrahami M, et al. Physical activity behavior in people with multiple sclerosis during the COVID-19 pandemic in Israel: Results of an online survey. *Mult Scler Relat Disord.* Published online October 2020:102603.

**Table 1.** Descriptive Characteristics of the PD And Instructor Groups

<b>Characteristics</b>	<b>n = 87</b>
<b>Age, y, mean (SD)</b>	70.2 (7.3)
<b>Sex, % female (n)</b>	51.7% (45)
<b>Race, % Caucasian (n)</b>	93% (81)
<b>Ethnicity, % Non-Hispanic (n)</b>	92% (80)
<b>Highest Degree earned</b>	
High School Diploma/ Associates Degrees, % (n)	14.9% (13)

Bachelor's Degree, % (n)	39.1% (34)
Masters, Doctoral, Professional Degree, % (n)	40.2% (35)
<b>Years since diagnosis</b>	
<1 y, % (n)	0% (0)
1-3 y, % (n)	20.7% (18)
3 to 5, % (n)	21.8% (19)
5 to 10 y, % (n)	29.9 (26)
>10 y, % (n)	27.6% (24)
<b>Schwab-England</b> , mean (SD)	84.0 (15.7)
<b>PDQ-8 Score</b> , mean (SD)	21.0 (14.6)
<b>SEE Score</b> , mean (SD)	55.0 (23.5)
<b>Falls in the past year</b>	
None	44.8% (39)
≥1	55% (48)
GLT-Q = Godin Leisure-Time Leisure Questionnaire; PDQ-8 = Parkinson's Disease Questionnaire-8; SEES = Self-Efficacy for Exercise Scale.	

<b>Table 2. Descriptive Characteristics of the Instructor Group</b>	
<b>Characteristics</b>	<b>n = 43</b>
<b>Age</b> , y, mean (SD)	51.4 (12.1)
<b>Sex</b> , %female (n)	86.0% (37)
<b>Race</b> , % Caucasian (n)	93% (40)
<b>Ethnicity</b> , % Non-Hispanic (n)	91% (39)
<b>Years teaching class</b>	<b>Years teaching class</b>
<1 y, % (n)	0% (0)
1-3 y, % (n)	32.6% (14)

3 to 5 y, % (n)	30.2% (13)
5 to 10 y, % (n)	27.9% (12)
>10 y, % (n)	9.3% (4)
<b>Degree/ Training</b>	
Athletic Trainer, % (n)	51.2% (22)
Physical/ Occupational Therapist or Assistant, % (n)	32.6% (14)
Other (Aquatic, Dance, Medical Exercise, Pilates, Yoga), % (n)	13.9% (6)
PD-specific exercise training, % (n)	79.1% (34)

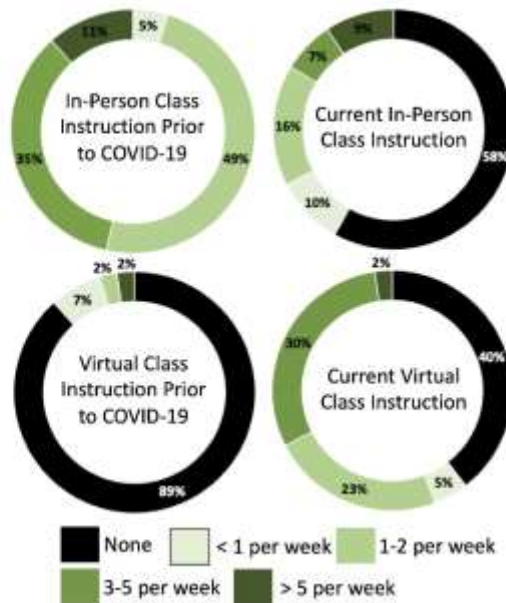
**Table 3. COVID-19 Related Concerns and Behaviors**

	<b>PD Group n = 87</b>	<b>Instructor Group n = 43</b>	<b>PD Group n = 87</b>	<b>Instructor Group n = 43</b>	<b>PD Group n = 87</b>	<b>Instructor Group n = 43</b>
<b>COVID exposure concerns</b>	<b>Concern about your own exposure?</b>		<b>Concern about your household's exposure?</b>		<b>Concern about class participant exposure?</b>	
Not concerned, % (n)	4.6% (4)	23.3% (10)	5.7% (5)	7.0% (3)	--	4.7% (2)
A Little concerned, % (n)	23.0% (20)	23.3% (10)	16.1% (14)	30.2% (13)	--	7.0% (3)
Somewhat concerned, % (n)	39.1% (34)	18.6% (8)	41.4% (36)	32.6% (14)	--	23.3% (10)
Very concerned, % (n)	33.3% (29)	34.9% (15)	36.8% (32)	30.2% (13)	--	65.1% (28)
<b>Frequency of leaving home</b>	<b>Multiple Times/ day</b>		<b>1x day</b>		<b>Weekly or less</b>	
	6.9% (6)	18.6% (8)	39.1% (34)	55.8% (24)	54.0% (47)	25.6% (11)
	<b>Medical Appointments</b>		<b>Shopping</b>		<b>Work</b>	

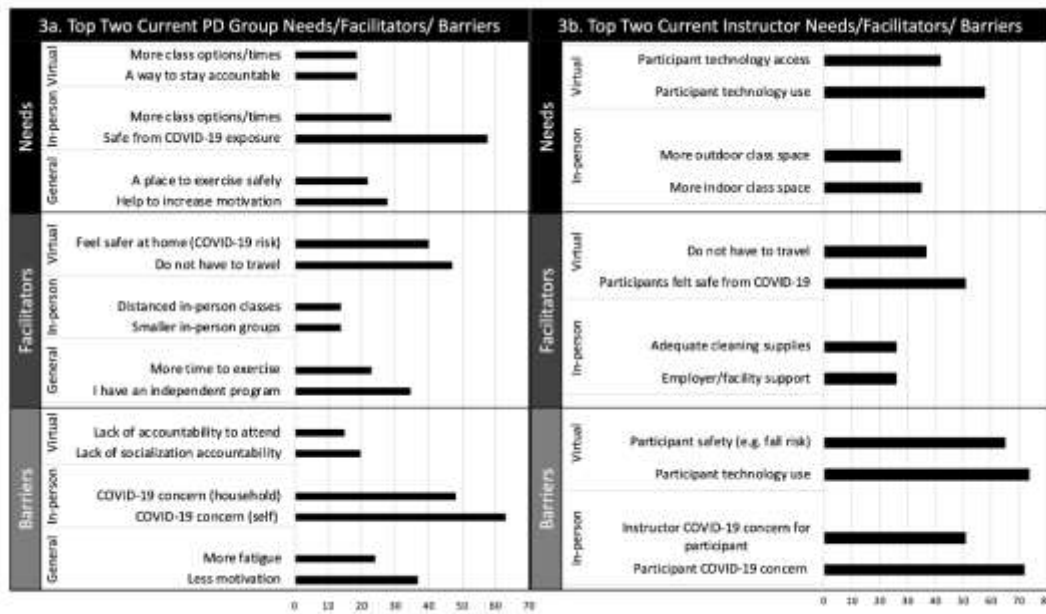
<b>Reasons for leaving home (essential activities)</b>	85.1% (52)	44.2% (19)	77.0% (67)	88.4% (38)	9.2% (52)	74.4% (31)
<b>Reasons for leaving home (non-essential activities)</b>	<b>Church/ Religious Meetings</b>		<b>Family Obligations</b>		<b>Socialization</b>	
	18.4% (16)	9.3% (4)	20.7% (18)	27.9% (12)	14.9% (13)	11.6% (5)



**Figure 1.** PD Group Activity levels and Exercise Changes during COVID-19.



**Figure 2.** Instructor-reported In-Person and Virtual Class Instruction before and after COVID-19 Restrictions.



**Figure 3.** Top Two Needs/ Facilitators/ Barriers for (3a) Virtual, In-person, and General Exercise in the PD group and (3b) Virtual and In-person Exercise Class in the Instructor Group.