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Characteristics of Subjects Who Avoid Activities and Participation due to a Fear of Falling in Parkinson's Disease

Morgan Lopker
University of Nevada, Las Vegas

Molly Newman
University of Nevada, Las Vegas

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CHARACTERISTICS OF SUBJECTS WHO AVOID ACTIVITIES
AND PARTICIPATION DUE TO A FEAR OF FALLING
IN PARKINSON'S DISEASE

By

Morgan Lopker

Molly Newman

A doctoral project submitted in partial fulfillment
of the requirements for the

Doctorate of Physical Therapy

Department of Physical Therapy

School of Allied Health Sciences

The Graduate College

University of Nevada, Las Vegas

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THE GRADUATE COLLEGE

We recommend the doctoral project prepared under our supervision by

Morgan Lopker and Molly Newman

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Characteristics of Subjects Who Avoid Activities and Participation due to a Fear of Falling in Parkinson's Disease

is approved in partial fulfillment of the requirements for the degree of

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Department of Physical Therapy

Kai-Yu Ho, Ph.D., Research Project Coordinator

Merrill Landers, Ph.D., Research Project Advisor

Merrill Landers, Ph.D., Chair, Department Chair Physical Therapy

Kathryn Hausbeck Korgan, Ph.D., Interim Dean of the Graduate College

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ABSTRACT

Background and Purpose: The purpose of this study was to compare individuals with Parkinson's disease (PD) exhibiting fear of falling avoidance behavior to those with no fear of falling avoidance behavior. Because avoidance behavior can have deleterious downstream consequences, it is important to determine what potentially mitigated physical and psychological factors are associated with it.

Subjects: Fifty-six community dwelling individuals (age=72.1 years, SD=9.6; males=42, females=14) with PD (Hoehn and Yahr Scale stage median=2.0, mode=3.0) were classified into two groups using the Fear of Falls Avoidance Behavior Questionnaire (FFABQ): avoiders (n=26, ≥ 20 FFABQ), and non-avoiders (n=30, < 20 on the FFABQ).

Methods: Avoiders and non-avoiders were compared using five domains: demographics (age, gender, socioeconomic status (SES), education), PD (Parkinson's Unified Parkinson's Disease Rating Scale (MDS-UPDRS), Hoehn and Yahr Scale, Parkinson's Disease Questionnaire (PDQ-39)), balance and falls (fall history, Berg Balance Scale (BBS), Activities Specific Balance Scale (ABC)), physical performance (2-minute step test (2MST), 30 second Sit to Stand Test (30STS), Timed Up and Go Test (TUGT), ActivPAL physical activity monitor data), and psychological factors (Zung Anxiety Scale (ZAS), Beck Depression Inventory (BDI)).

Results: There were no differences between avoiders and non-avoiders in age, gender, SES, education, year of diagnosis, and fall history, including injurious falls ($ps > 0.272$). Avoiders had worse scores on the MDS-UPDRS (sections I-III, $ps < 0.014$) and the PDQ (mobility, ADLs, emotion, stigma, cognition, and bodily discomfort subscales, $ps < 0.028$). Avoiders also exhibited poorer balance performance and less balance

confidence (BBS, $p=0.003$; ABC, $p<0.001$; FES, $p=0.048$). Avoiders reported higher depression, anxiety, and catastrophization (BDI, $p=0.015$; ZAS, $p=0.028$; CAFS, $p=0.001$; CoFQ, $p<0.001$).

Discussion: Results of this study suggest that individuals with PD who report higher avoidance behaviors have more involved PD symptoms, score lower for balance, strength and conditioning, and have greater psychological distress, including depression, anxiety, and catastrophization. There were no differences in fall history between the two groups, presumably because avoiders may have avoided activities that increase the risk for a potential fall. While these findings suggest that avoidance behavior has both physical and psychological dimensions, the cause-effect relationship cannot be determined.

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TABLE OF CONTENTS

ABSTRACT.....	iv
ACKNOWLEDGEMENTS.....	vi
LIST OF TABLES.....	viii
LIST OF FIGURES.....	ix
INTRODUCTION.....	1
METHODS.....	3
RESULTS.....	6
DISCUSSION.....	8
CONCLUSION.....	12
APPENDIX A- Tables.....	13
APPENDIX B- Figures.....	19
REFERENCES.....	28
VITAS.....	35

LIST OF TABLES

Table 1. Comparisons of avoiders and non-avoiders using t-tests with means.....	13
Table 2. Parkinson’s disease domain variables.....	15
Table 3. Balance and fall domain variables.....	16
Table 4. Physical performance domain variables.....	17
Table 5. Psychological domain variables.....	18

LIST OF FIGURES

Figure 1. Overall study design.....	19
Figure 2. Radar plot of the Movement Disorders Society Unified Parkinson’s Disease Rating Scale (MDS-UPDRS) total score and subscales.....	20
Figure 3. Radar plot of the Parkinson’s Disease Questionnaire-39 (PDQ-39) total score and subscales.....	21
Figure 4. A comparison of non-avoiders and avoiders with fall history.....	22
Figure 5. Radar plot of measures of balance and related issues.....	23
Figure 6. Radar plot of the Impact of Events Scale and subscales.....	24
Figure 7. A comparison of three different measures of physical performance.....	25
Figure 8. Radar plot of time spent in different daily physical activities.....	26
Figure 9. A comparison of anxiety and depression.....	27

INTRODUCTION

Falling is a major problem among those with Parkinson's disease (PD) where 60.5% fall annually and 39% are recurrent fallers with an average fall rate of 20.8 times per year.¹ Falls in those with PD are associated with decreased function and quality of life, an increased risk of hospital/nursing home admission, and increased mortality.²⁻⁴ Recurrent falls substantially increase the likelihood of injury and long-term disability.⁵ Allen et al found that fall history, longer PD history, increased motor impairment, and fear of falling (FOF) were factors associated with recurrent falling.¹

Fear of falling can easily develop among the general elderly population after experiencing a fall, with about one-third developing FOF after a fall event.⁶ However, Howland et al⁷ found that a recent fall is not necessary in developing FOF, with 20% of older individuals reporting a FOF without a recent fall, and among those with PD, a FOF appears to be unrelated to fall history.⁸ Individuals with PD who have FOF are estimated to be 35-59%, and as many as 70% of people with PD acknowledge activity avoidance due to a FOF.⁹⁻¹⁵ Fear of falling can lead to worry, low balance confidence, and activity avoidance, and may affect social interaction, which leads to disability.^{7,14}

Up to three-quarters of all adults 65 and older avoid at least one activity due to FOF, with 15% reporting severe activity restrictions.¹⁶ It is thought that catastrophization, or focusing on the worst possible outcome, can be the root of avoidance behavior and has been described as a leading cause of disability.^{17,18} While avoidance due to a FOF may initially decrease the chances of a fall, decreasing activity leads to lower activity

tolerance and functional ability. The cycle of falling and FOF is propagated by impaired balance due to inactivity and postural instability in those with PD.^{9,19} Fear of falling can lead to various levels of activity avoidance by people, which can be described as non-avoiders and avoiders.¹⁹ Impaired balance due to inactivity, coupled with postural instability, perpetuates the cycle of falling and FOF in individuals with PD.^{9,19}

Avoiders may have a lower quality of life due to their decreased participation in activities of daily living. Understanding the role of fear-based avoidance of activities, and its relationship to activity and function is an important topic that has received little attention in the PD literature. Understanding this phenomenon may help to develop more effective rehabilitative treatment plans for people with PD. The purpose of this study was to examine FOF avoidance behaviors in people with PD and to identify possible differences between non-avoiders and avoiders in six different domains: demographics domain, PD domain, balance and fall domain, physical performance domain, and psychological domain. By identifying common characteristics among people with PD and high avoidance behavior, individualized treatments can be better administered and lead to improved treatment outcomes.^{19,20} Ultimately, this study hopes to identify modifiable and non-modifiable characteristics of high avoiders.

METHODS

Subjects

Fifty-six community dwelling individuals (age mean = 72.1 years, SD = 9.6; males = 42, females = 14) with neurologist-diagnosed idiopathic PD (Hoehn and Yahr Scale score median = 2.0, mode = 3.0) participated in this study. Participants were excluded if they were unable to read or speak English (n = 0), non-compliance (n = 1), had cognitive impairment (Mini-Mental State Exam score < 23 (n = 4)), or if they had comorbidities that significantly impaired balance (n = 0). Subjects were from local PD support groups via print ads and snowball recruitment.

Study Design

A prospective, cross-sectional research design was used to compare the characteristics of subjects with PD who were classified as having moderate/high avoidance behavior (avoiders) or low-avoidance behavior (non-avoiders) as a result of FOF. The Fear of Falling Avoidance Behavior Questionnaire (FFABQ)²¹ was used to dichotomize subjects into avoider and non-avoider groups (Table 1).

The FFABQ is based on the construct of avoidance behavior due to FOF and is a separate and distinct construct from measures of balance confidence, self-efficacy, and FOF.²¹ This questionnaire consists of 14 Likert scale items (completely disagree, disagree, unsure, agree, completely agree) related to the International Classification of Functioning, Disability, and Health (ICF) on the participation level. Scores range from 0 to 56 with higher scores indicative of more avoidance behavior. A score of 20 was determined to be the cut-point (avoiders \geq 20; non-avoiders < 20), because an overall

score of 20 for the 14 items indicates that the average response for each item would fall into the range of “Completely disagree” or “Disagree.” In order to compare the avoiders and non-avoiders, subjects were assessed across the following five domains:

1. **Demographic domain:** this domain was used to determine if demographic characteristics (e.g., age, gender, socioeconomic status (income per year), educational attainment, and year of diagnosis) were associated with avoidance behavior;
2. **PD domain:** this domain included the Movement Disorder Society-Unified Parkinson’s Disease Rating Scale (MDS-UPDRS), Hoehn and Yahr Scale, and Parkinson’s Disease Questionnaire (PDQ-39) (Table 2);
3. **Balance and fall domain:** this domain included items about subjects’ fall history that could logically be associated with avoidance behavior (fall history = more than one unexplained fall during the most recent year, recent falls = number of falls during the most recent month, fall injury = number of falls resulting in an injury) and also scales of balance performance (Berg Balance Scale (BBS)), balance confidence (Activities-Specific Balance Confidence Scale (ABC) and Falls Efficacy Scale (FES)), psychological impact of a fall (Impact of Events Scale (IES)), and fall catastrophization (Consequences of Falls Questionnaire (CoFQ) and Catastrophization about Falls Scale (CAFS) (Table 3);
4. **Physical performance domain:** this domain was used to understand subjects’ current state of strength and conditioning (Two Minute Step Test (2MST), 30 Second Sit to Stand Test (30STS)), functional mobility (Timed-Up and Go Test

(TUGT)), and average daily physical activity levels using activPAL monitors¹ (Metabolic equivalents (METS) expended, time sitting or lying, time standing, time stepping, number of steps taken, and up/down transitions) (Table 4); and,

5. **Psychological domain:** this domain was used to determine the role of other psychological constructs putatively associated with the consequences of experiencing a fall or having balance impairment (Zung Anxiety Scale (ZAS) and Beck Depression Inventory (BDI)) (Table 5).

Data for all subjects were collected at the subjects' residence since it was theorized that many high avoiders would be reluctant to leave their homes for participation in a study. Subjects were assessed twice: once for the initial assessment and once approximately one week later to collect the activity monitor and self-report questionnaires (Figure 1).

Data Analysis

All data were analyzed using SPSS version 21.0.² The level of significance for all of the analyses was set at $\alpha = 0.05$. Avoiders and non-avoiders were compared using t-tests for all parametric variables unless there was a violation of an assumption wherein a Mann-Whitney nonparametric analysis was used. Mann-Whitney analyses were also utilized for dependent variables at the ordinal measurement level. Chi-square was used to compare gender proportions.

¹PAL Technologies LTD, Glasgow, United Kingdom

² SPSS Inc, Chicago, Illinois

RESULTS

Demographic domain

There were no differences between avoiders and non-avoiders in age, gender, SES, education, year of PD diagnosis, and mental status ($p>0.221$) (Table 1).

PD domain

Avoiders had worse scores on the MDS-UPDRS (sections I-III, $p<0.014$) and the PDQ-39 (mobility, ADLs, emotion, stigma, cognition, and bodily discomfort subscales, $p<0.028$) (Table 1). No statistically significant differences were found between avoiders and non-avoiders in the following variables: MDS-UPDRS section IV, Hoehn & Yahr score, PDQ Social support, PDQ Communication ($p>0.14$) (Table 1; Figures 2,3).

Balance and fall domain

While there were no differences between avoiders and non-avoiders in fall history and injurious falls ($p\geq 0.292$), avoiders exhibited significantly poorer balance performance (BBS, $p=0.003$) (Table 1; Figure 4). Additionally, avoiders reported less balance confidence (ABC, $p<0.001$; FES, $p=0.048$) and were more likely to catastrophize about falls (CoFQ, $p\leq 0.001$; CAFS, $p=0.001$) (Table 1; Figure 5). For individuals reporting a fall history (avoiders $n=22$; non-avoiders $n=18$), the IES was used to explore the subjective impact of a traumatic event (i.e., fall/falls). Avoiders exhibited greater total subjective stress ($p=0.018$) and more feelings of intrusion ($p=0.006$), avoidance ($p=0.050$), and hyperarousal ($p=0.023$) from the fall/falls (Table 1; Figure 6).

Physical performance domain

There were no differences between avoiders and non-avoiders on the TUGT ($p=0.100$) and the 2MST ($p=0.110$); however, avoiders had fewer completions on the 30STS test ($p=0.029$) (Table 1; Figure 7). Average daily activity levels (hours stepping per day, steps taken in a day, METs per day) were lower for avoiders ($p\leq 0.018$) (Table 1; Figure 8).

Psychological domain

Avoiders reported more depressive symptoms (BDI, $p=0.015$) and anxiety (ZAS, $p=0.028$) than non-avoiders (Table 1; Figure 9).

DISCUSSION

These results indicate that individuals with PD who report higher avoidance behaviors have more involved PD symptoms, reduced scores for balance and physical performance, as well as greater psychological distress, including depression, anxiety, and catastrophization. There were no differences in fall history between the two groups despite the fact that avoiders had lower balance performance and lower balance confidence. It is theorized that avoiders may be naturally responding to their own sense of balance confidence by avoiding activities that put them at risk for a fall. While these findings suggest that avoidance behavior has both physical and psychological dimensions, the cause-effect relationship cannot be determined. Therefore, it is unclear whether the avoidance behavior has caused these symptoms or if these symptoms have caused the avoidance behavior.

Demographic profiles of the individuals in the two groups were found to be similar between avoiders and non-avoiders, with no significant between group difference in age, SES, education, or year of diagnosis. As such, the results suggest that these non-modifiable demographic factors are not the primary contributors to FOF avoidance behaviors.

The MDS-UPDRS overall score, and mental, ADL, and motor subscales were significantly different between avoiders and non-avoiders. The difference in subjective mental measures include memory, cognition, hallucinations, anxiety, depression, bowel and bladder complications, pain, fatigue, and apathy. The differences between the two

groups suggest that these non-motor aspects of PD that increase with disease progression⁸ are also likely to play a role in FOF avoidance behavior. On the other hand, it is possible that these symptoms may indicate disease severity and are not directly related to FOF avoidance behavior. In consideration of the former, addressing these factors with pharmacotherapeutic approaches may lead to decreased activity avoidance and a resultant increase in QOL of individuals with PD. The ADL subscale is the one section of the MDS-UPDRS that is completely self-reported. The significantly higher scores in the avoiders compared to the non-avoiders supports their awareness of their impaired function and/or their lack of confidence in their ability to perform various ADLs. The difference between the avoiders and non-avoiders in the motor subsection of the MDS-UPDRS including key motor symptoms of PD of rigidity, resting tremor, bradykinesia, akinesia, and postural instability indicates a potential role of increasing severity of these symptoms on FOF and resultant avoidance of activities. Again, it is difficult to ascertain if these motor have caused the FOF avoidance behavior or if the avoidance behavior has caused the neurodegeneration to progress more rapidly. Several studies suggest that physical inactivity can increase the risk for PD^{22,23} and increase the rate of PD progression.²⁴⁻²⁶

While Masud et al⁹ reported approximately one third of older people develop FOF after an incidental fall, not all people who have a FOF have a history of falls, and not all people with a history of falls have a FOF. According to Howland et al,¹⁰ 20% of individuals without a recent history of falls reported to be very or somewhat afraid of experiencing a fall. When compared to experiencing an actual fall, the FOF may be more

problematic and a greater contributor to activity avoidance for individuals with or without a fall history.¹⁰⁻¹² The lack of a difference in the current study's results found in fall history (number of falls within the past year, number of falls within the past month, and total number of falls resulting in injury) is consistent with this notion. The results support other previous findings that FOF and related avoidance behaviors are not the direct result of a prior incident and are multifactorial.

Activity avoidance minimizes participation in common tasks that would require normal body movements such as weight-bearing, weight-shifting, and reaching outside one's base of support. An inverse relationship was found between FOF avoidance level and subjective, self-report balance questionnaire scores, including the ABC. Clinically, balance confidence may be an important, potentially modifiable target for health care providers to assess and treat in PD. Evidence suggests that clinical-setting balance confidence can be improved with skilled intervention.¹⁴

As functional balance declines, a person is more likely to cope with their lack of balance by avoiding the tasks that challenge balance altogether.¹⁵ Consequently, a reduction in activity due to FOF, poor balance, and low balance confidence may contribute to physical deconditioning, functional decline, social isolation, and decreased QOL, which are factors correlating with increased fall incidence. The results of this study suggest that PD avoiders are indeed less physically conditioned as is evidenced by lower 30STS scores. Again, based on the design of the present study, it is difficult to determine if the deconditioning is a cause of the avoidance behavior or the result thereof. It is also

possible that this relationship could be bidirectional, which would result in a vicious cycle.

Although the findings of the 30STS suggest a relationship between strength and FOF avoidance behavior classification, other measures, including TUGT and 2MST, do not. While 2MST requires single leg balance and functional lower extremity range of motion, its ability to be used as an isolated measure of strength may be limited. A potential floor and ceiling effect of the TUGT may exist in this study cohort. However, future large-scale studies would be necessary to examine the relationship between FOF and physical performance.

All psychological factors utilized in this study assessed were different between the two groups. This finding is supported by the finding by Howland et al¹⁷ who suggests that activity avoidance is not just associated with extreme levels of fear but rather is complex and multifactorial. Previous research, including Lachman et al,¹⁸ has proposed a multidimensional treatment approach for addressing fall risk. This approach may entail assessment of avoidance behaviors, anxiety, and depression, while attempting to alter a person's sense of control over falls through cognitive restructuring. The findings of the present study support this approach and of approaches utilizing physical and psychological interventions for FOF avoidance behaviors.

CONCLUSION

This study suggests that individuals with PD who show higher avoidance behaviors report more involved PD symptoms, reduced scores of balance and physical performance, as well as greater psychological distress, including depression, anxiety, and catastrophization. Avoidance behaviors in individuals with PD have not been found to be a direct consequence of a fall incident and resultant fear of future falls but rather have been demonstrated to be multifactorial. This study suggests that when treating patients with PD, the contributing factors to patients' FOF avoidance behaviors outlined previously should be taken into consideration. Further research is needed to confirm whether modifiable factors (physical performance, balance, balance confidence) identified in this study can be improved with rehabilitative treatment.

APPENDIX A- TABLES

Table 1. Comparisons of avoiders and non-avoiders using t-tests with means (standard deviations) of the five domains. Several analyses were conducted using non-parametric analyses (indicated). In those cases, medians (ranges) and frequencies are included.

Domains	Dependent variables	Non-Avoiders N=30	Avoiders N=26	Analysis	P value
Demographic domain	Age	71.5 (9.4)	72.7 (9.9)	t-test	0.636
	Gender	24 males (80.0%)	18 males (69.2%)	Chi square	0.353
	Socioeconomic Status (SES)	\$50-75,000	\$50-75,000	Mann-Whitney*	0.914
	Education	BA/BS degree	Some college	Mann-Whitney*	0.321
	Diagnosis year	2005.8 (4.2)	2004.4 (4.8)	t-test	0.272
	Mini-Mental State Exam	29.1 (1.3)	28.7 (1.2)	t-test	0.221
	Parkinson's disease subtype	PIGD (55.2%)	PIGD (69.2%)	Chi square	0.109
PD domain	Movement Disorders Society (MDS)-UPDRS	58.5 (28.4)	82.2 (21.5)	t-test	0.001 [#]
	MDS-UPDRS I (non-motor experiences of daily living)	12.0 (7.1)	17.3 (5.9)	t-test	0.005 [#]
	MDS-UPDRS II (motor experiences of daily living)	14.5 (8.6)	22.3 (7.5)	t-test	0.001 [#]
	MDS-UPDRS III (Motor)	26.8 (15.6)	37.0 (14.2)	t-test	0.014 [#]
	MDS-UPDRS IV (Motor complications)	5.2 (4.4)	5.6 (4.8)	t-test	0.752
	Hoehn & Yahr	3.0 (40.0%)	3.0 (46.2%)	Chi square	0.440
	Parkinson's Disease Questionnaire (PDQ)-39	22.7 (13.7)	36.3 (14.2)	t-test	0.001 [#]
	PDQ Mobility	25.2 (22.1)	50.0 (20.9)	t-test	<0.001 [#]
	PDQ ADLs	23.6 (21.3)	41.4 (20.9)	t-test	0.003 [#]
	PDQ Emotion	18.7 (14.4)	29.2 (18.4)	t-test	0.021 [#]
	PDQ Stigma	11.0 (13.8)	22.1 (19.9)	t-test	0.018 [#]
	PDQ Social support	16.1 (15.8)	22.1 (24.0)	t-test	0.268
	PDQ Cognition	28.1 (22.5)	40.4 (17.2)	t-test	0.028 [#]
PDQ Communication	32.5 (23.3)	41.3 (20.5)	t-test	0.140	
PDQ Bodily discomfort	25.8 (20.2)	42.6 (24.7)	t-test	0.007 [#]	
Balance and fall domain	Falls in the last year	8.4 (24.8)	16.6 (68.1)	Mann-Whitney*	0.292
	Falls in the last month	3.6 (15.5)	1.4 (5.9)	Mann-Whitney*	0.513
	Injurious falls in the last year	0.6 (1.6)	0.4 (0.6)	Mann-Whitney*	0.700
	Impact of Events Scale – revised	1.73 (2.00)	3.38 (2.21)	t-test	0.018 [#]
	Impact of Events Scale – avoidance	0.63 (0.73)	1.11 (0.79)	t-test	0.050 [#]
	Impact of Events Scale – intrusion	0.57 (0.71)	1.28 (0.81)	t-test	0.006 [#]
	Impact of Events Scale – hyperarousal	0.53 (0.68)	1.10 (0.81)	t-test	0.023 [#]
	Berg Balance Scale	47.8 (11.8)	38.3 (10.5)	t-test	0.003 [#]
	Activities-Specific Balance Confidence Scale	73.7 (23.8)	50.9 (19.6)	t-test	<0.001 [#]
	Consequences of Falls Questionnaire	24.6 (5.0)	30.7 (5.2)	t-test	<0.001 [#]
Falls Efficacy Scale	22.4 (16.2)	33.4 (24.2)	t-test	0.048 [#]	
Catastrophizing about Falls Scale	5.4 (2.1)	7.4 (1.8)	t-test	0.001 [#]	
Physical performance domain	2-minute Step Test	57.8 (36.8)	41.5 (37.1)	t-test	0.110
	30 Second Sit-To-Stand Test	10.8 (7.4)	6.8 (5.6)	t-test	0.029 [#]
	Timed Up and Go Test	12.1 (6.2)	20.7 (27.0)	t-test	0.100
	Hours sitting/laying down per day	18.7 (1.9)	19.7 (3.1)	t-test	0.219

	Hours standing per day	4.2 (1.5)	3.4 (2.2)	t-test	0.144
	Hours stepping per day	1.2 (0.6)	0.7 (0.8)	t-test	0.018 [#]
	Steps taken in a day	5798 (2580)	3381 (3878)	t-test	0.011 [#]
	Up/down transitions	51.6 (12.4)	46.5 (21.6)	t-test	0.324
	Metabolic equivalents (METs) per day	32.8 (1.1)	31.8 (1.7)	t-test	0.017 [#]
Psychological domain	Zung Anxiety Scale	43.3 (9.8)	49.2 (9.6)	t-test	0.028 [#]
	Beck Depression Inventory	9.6 (6.9)	15.2 (9.7)	t-test	0.015 [#]

*Violation of an assumption of normal distribution or non-parametric dependent variable

Indicates a significant difference at $p < 0.05$

Table 2. Parkinson’s disease domain variables.

Scale	Construct	Evidence for reliability	Evidence for validity in PD
MDS-UPDRS²⁷	65 item clinical rating scale for PD including interview, clinician rating and self-assessment of PD severity that has 4 parts: I. Non motor experiences of daily living; II. Motor experiences of daily living; III. Motor examination; IV. Motor complications	High internal consistency (Cronbach’s $\alpha= 0.79 – 0.93$ across parts)	Found to be highly correlated with the original UPDRS ($r=.96$)
Hoehn and Yahr²⁸	0 to 5 Staging scale that provides a general estimate of disease severity clinical function in PD 5 with 0 indicating that the individual is asymptomatic and 5 indicating severely impaired postural stability and functional mobility.	Good reliably for moderate stages (2-4) ²⁸	Correlations with β -CIT SPECT scanning ²⁹ and fluorodopa PET scanning ³⁰ suggesting convergent validity
PDQ-39^{31,32}	Self-report measure of PD related QOL with 39 items in 8 sections (mobility, activities of daily living, emotional well-being, stigma, social support, cognition, communication, bodily discomfort). Each item ranges from 0 (never) to 4 (always). The mean of each section and the overall mean are obtained for analysis. Respondents must affirm one of five categories (from never to always), because of their PD, they have experienced the problem defined by each item during the past month.	Cronbach’s $\alpha= 0.72 – 0.95$; test-retest reliability .76 – 0.93	Correlations found with BDI>17, MMSE<25, history of falls, postural instability and gait impairments ($p < 0.001$)

Table 3. Balance and fall domain variables.

Scale	Construct	Evidence for reliability	Evidence for validity
Falls Efficacy Scale (FES) ³³	Measure of ones confidence in their ability to avoid falling during daily activities with 10 items answered on a 10-point scale. 1 being very confident and 10 being not at all confident. A total score of >70 indicates a fear of falling	High internal consistency (Cronbach's $\alpha = .90$) and test retest reliability ($r=0.71$) ³³	Concurrent validity with ABC scale ($r = 0.83$) ³⁴
Catastrophizing about Falling Questionnaire (CFQ) ³⁵	Three questions assessing the perceived impact that a fall would have on one's functional status answered on a 4 point scale. A score of 12/12 indicates the highest degree of catastrophization	High internal consistency (Cronbach's $\alpha = .83$) ¹⁷	Independent predictor of concerns about falling and subsequent mobility restrictions ¹⁷
Impact of Events Scale (IES) ^{36,37}	15 item self-report measure to assess subjective distress levels related to a specific life event. The total score is the overall subjective stress from the event (fall/falls). There are three subscales: intrusion (e.g., intrusive thoughts, nightmares, intrusive feelings and imagery, dissociative-like re-experiencing), avoidance (e.g., numbing of responsiveness, avoidance of feelings, situations, and ideas), and hyperarousal (e.g., anger, irritability, hypervigilance, difficulty concentrating, heightened startle).	High internal consistency (Cronbach's $\alpha = .86$ for intrusion, and Cronbach's $\alpha = .82$ for avoidance) ³⁸	Can discriminate between stress reactions at different times after an event and highly correlates with post-traumatic stress disorder diagnosis ³⁸
Berg Balance Scale (BBS) ³⁹	Clinician-rated assessment of balance with 14 tasks. Scores range from 0 to 56 with higher scores suggesting better balance performance.	Excellent test-retest reliability (ICC = 0.94) ⁴⁰ and interrater reliability (ICC = 0.95 in PD) ⁴¹	Area under the ROC curve (0.851) for predicting fall status in those with PD ⁴²
Timed Up and Go Test (TUGT) ⁴³	A timed test of functional mobility consisting of time it takes to rise from a chair, walk three meters, turn around, walk back to the chair, and sit down.	Good test-retest reliability in PD (ICCs < 0.80) ^{40,44} and excellent interrater reliability ($r=0.99$) in PD ⁴⁵	Moderate to good convergent validity evidence in PD (correlated with the BBS ($r=-0.78$), Fast gait speed ($r=-0.69$), and comfortable gait speed ($r=-0.67$) ⁴⁶

Table 4. Physical performance domain variables.

Scale	Construct	Evidence for reliability	Evidence for validity
2 Minute Step Test (2MST)⁴⁷	Functional measure of aerobic endurance by counting the number of full right knee steps subject make, raising each leg to a height midway between the patella and iliac crest, in a two minute period.	Excellent test-retest reliability (ICC=0.95) ⁴⁸	Able to discriminate physically active from sedentary older adults ⁴⁸ and also exercisers and nonexercisers ⁴⁷
ActivPAL Activity monitor	Electronic device measuring five components: hours standing, hours stepping, hours sitting or lying, up/down transitions, and metabolic equivalent of tasks	Inter-device reliability of step number and cadence: ICC (2,1) \geq 0.99 ⁴⁹	Absolute percentage of error <1% for outdoor ambulation, <2% for walking speeds of \leq 0.67 m/s ⁵⁰
30 second Sit-to-Stand Test (30STS)^{47,51}	Assessment of one's ability to perform repeated sit to stands from a chair for 30 seconds as a measure of functional lower extremity strength	Excellent test-retest reliability (ICCs>0.84) ^{48,51}	Able to discriminate physically active from sedentary older adults ⁴⁸ and also exercisers and nonexercisers ⁴⁷

Table 5. Psychological domain variables.

Scale	Construct	Evidence for reliability	Evidence for validity
Zung Anxiety Scale (ZAS) ⁵²	A self-rating instrument for anxiety disorders with 20 items that are identified by- a little, some, good part, or most of the time.	Good item-total correlations and a good test-retest reliability in non-PD populations ⁵³	In non-PD patients it has shown to be sensitive to change in treatment studies of anxiety ⁵³
Beck Depression Inventory (BDI) ⁵⁴	Most widely used instrument for measuring the severity of depression based on symptoms from 21-items rated by the individual on a 0-3 scale.	Cronbach's α = 0.88 and ICC = 0.89 in patients with PD ⁵⁵	85.67% - 88.0% area under the ROC curve for distinguishing depressed from nondepressed in PD ^{55,56}

APPENDIX B- FIGURES

Figure 1. Overall study design.

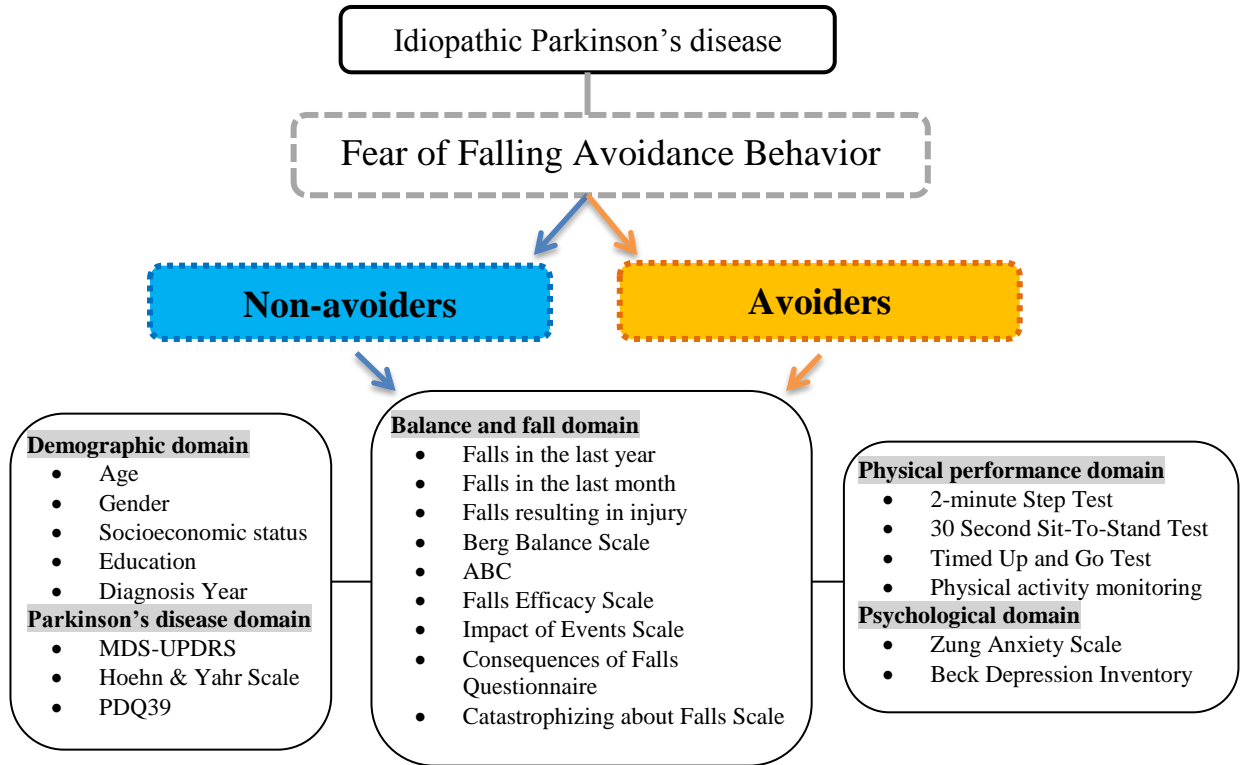


Figure 2. Radar plot of non-avoiders and avoiders on the Movement Disorders Society Unified Parkinson’s Disease Rating Scale (MDS-UPDRS) total score and each of the four subscales.

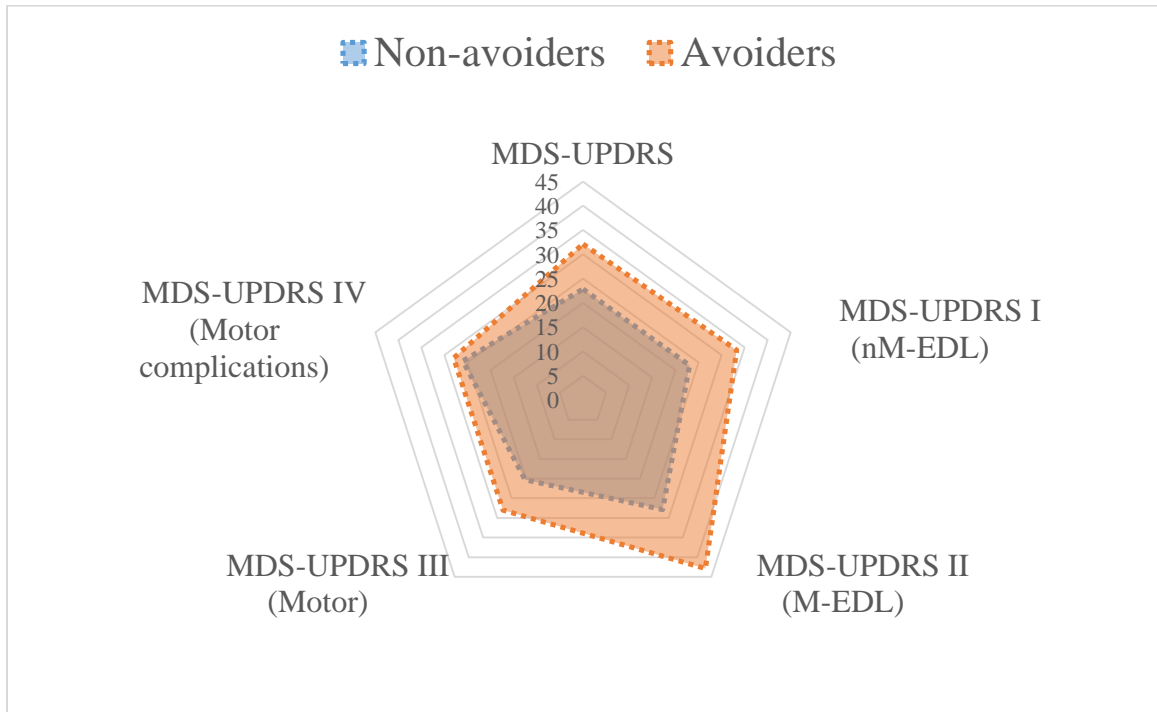


Figure 3. Radar plot of non-avoiders and avoiders on the Parkinson’s Disease Questionnaire – 39 (PDQ-39) total score and each of the eight subscales.

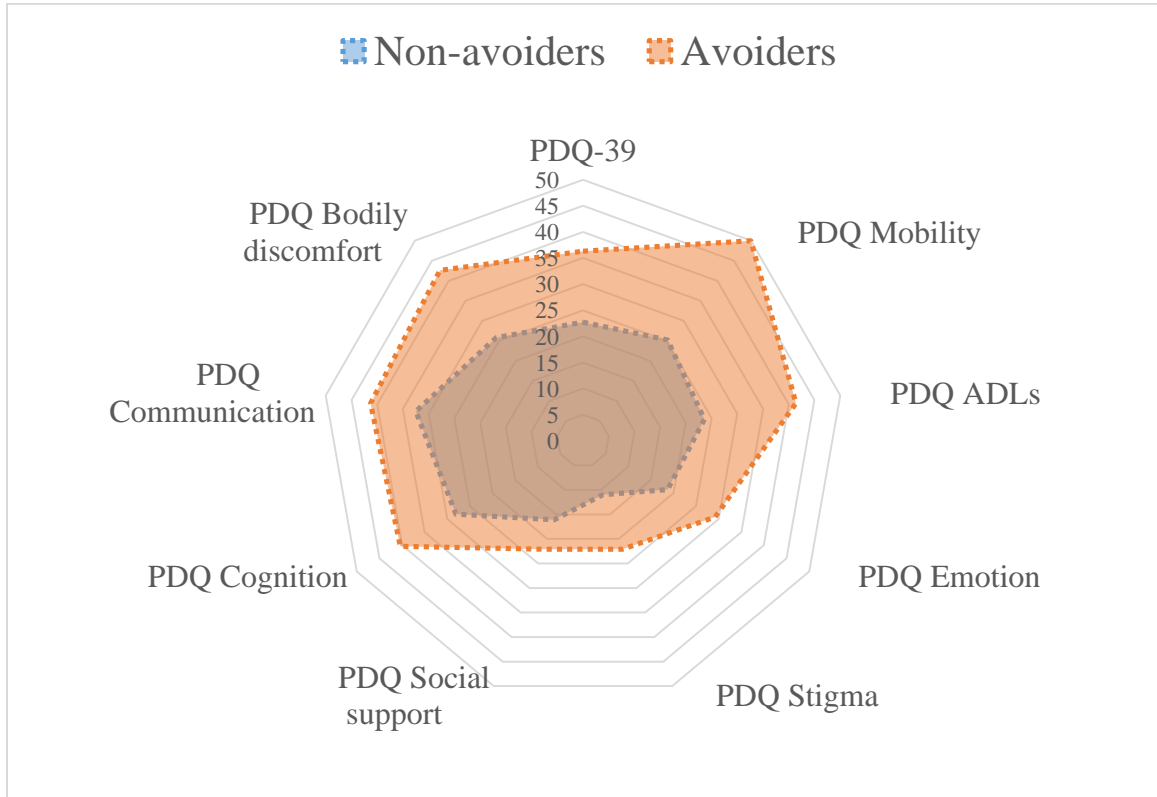


Figure 4. A comparison of non-avoiders and avoiders across three different measures of fall history.

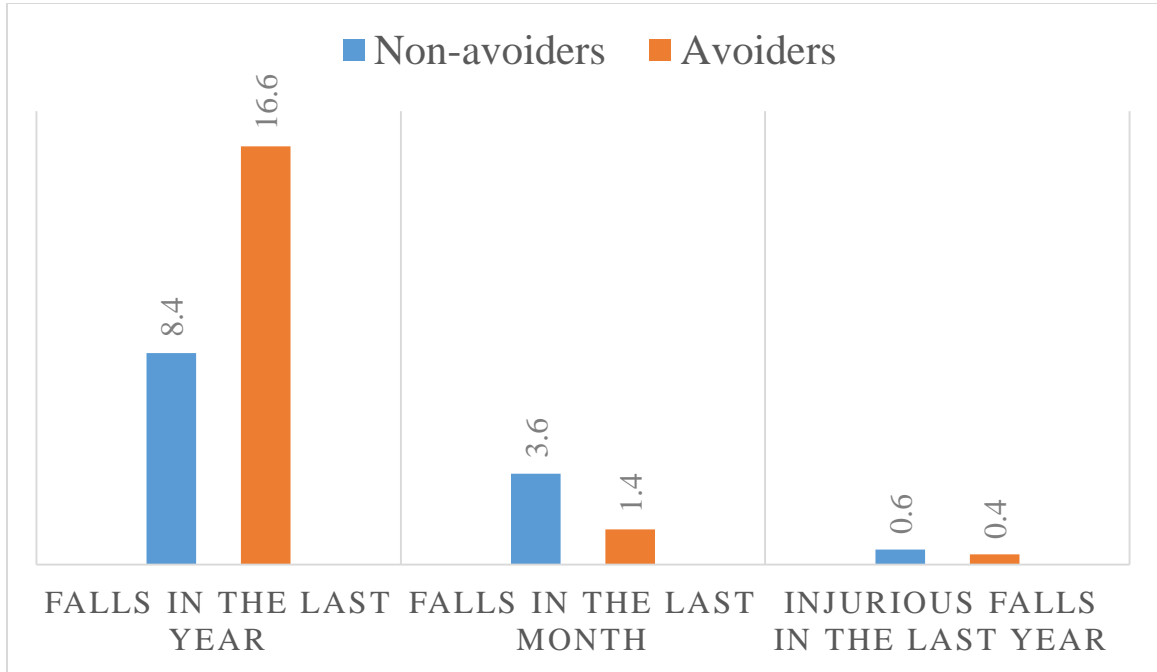


Figure 5. Radar plot of non-avoiders and avoiders on measures of balance and related issues.

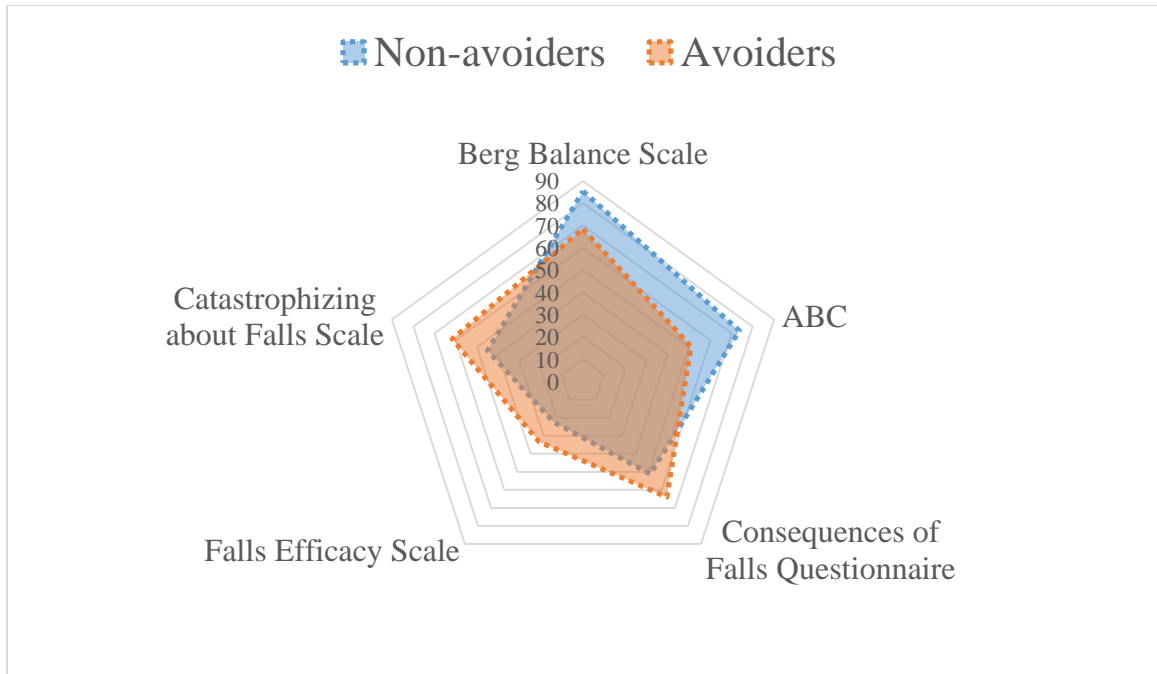


Figure 6. Radar plot of non-avoiders and avoiders on the Impact of Events Scale and each of the three subscales.

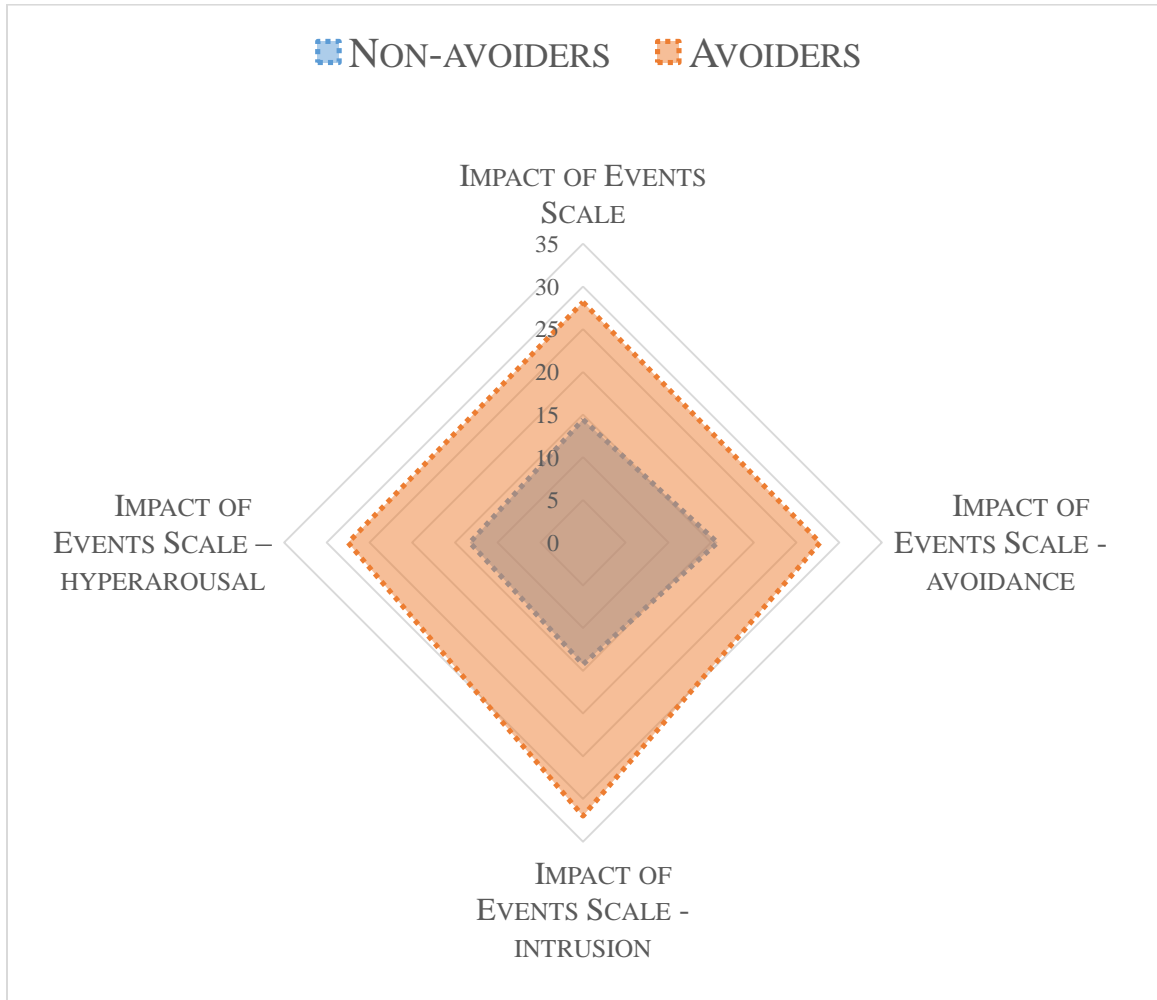


Figure 7. A comparison of non-avoiders and avoiders on three different measures of physical performance.

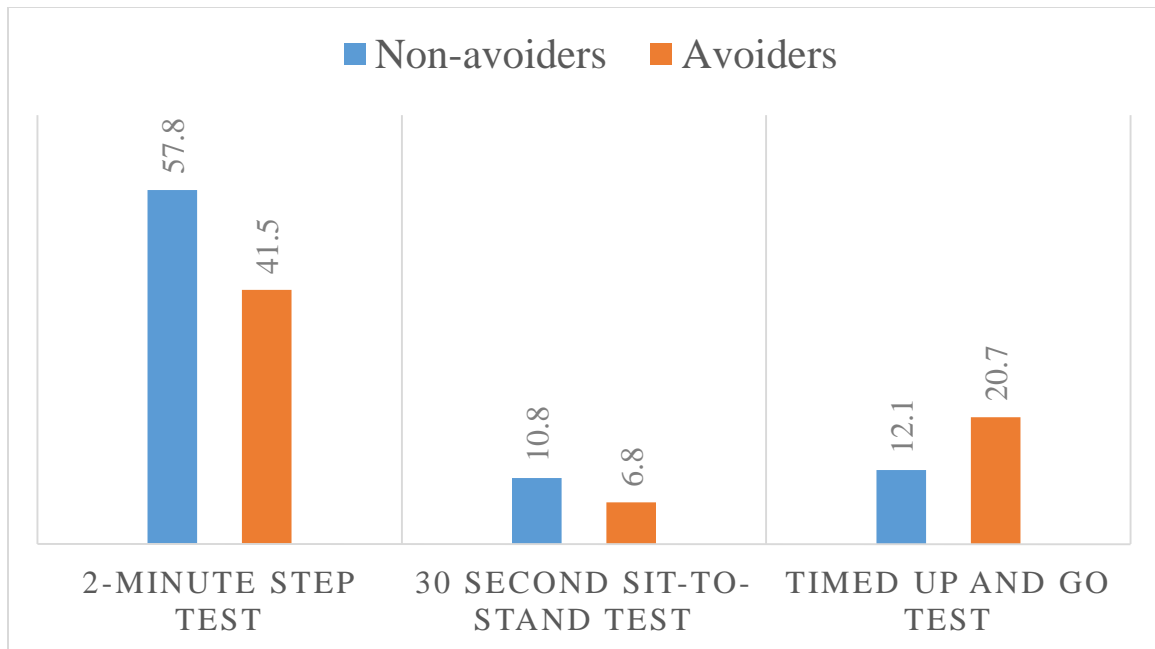


Figure 8. Radar plot of non-avoiders and avoiders on time spent in different daily physical activities.

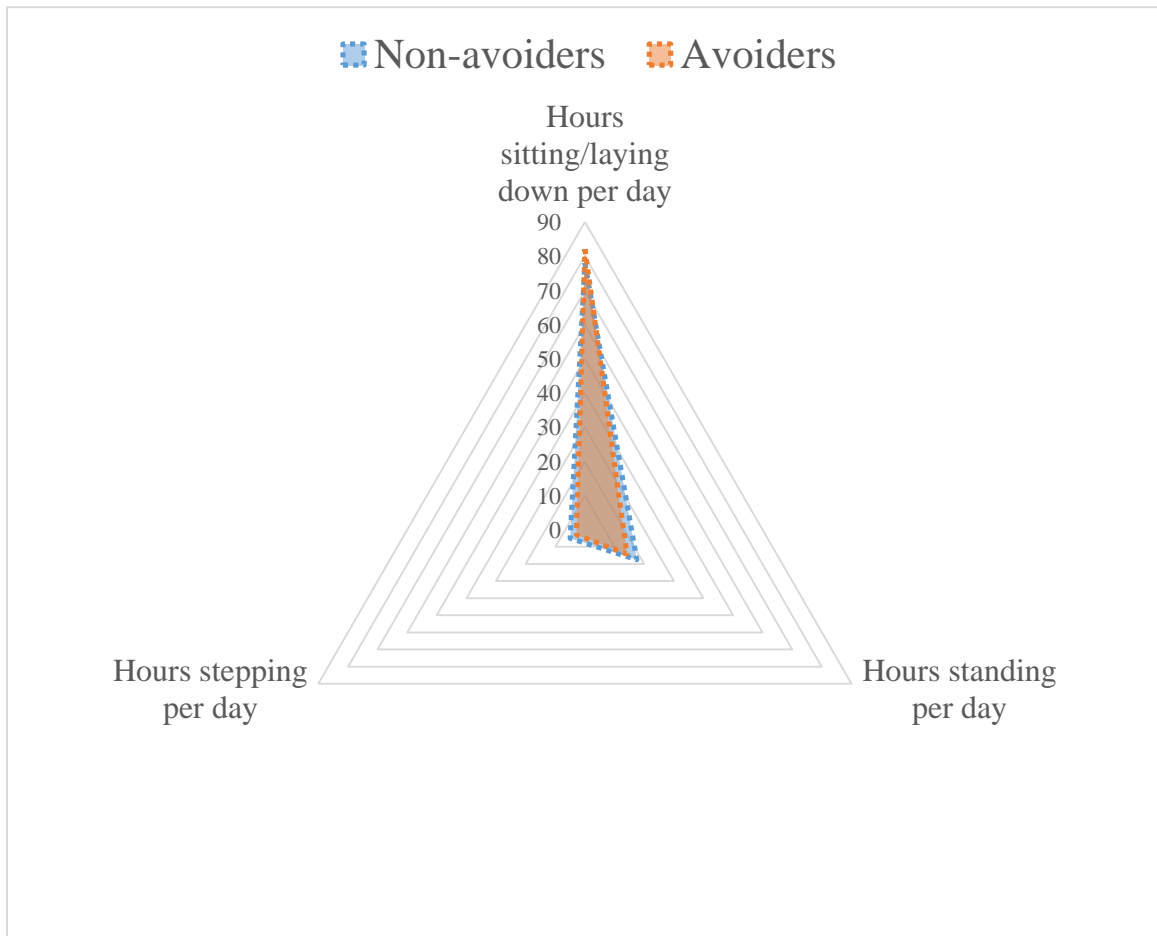
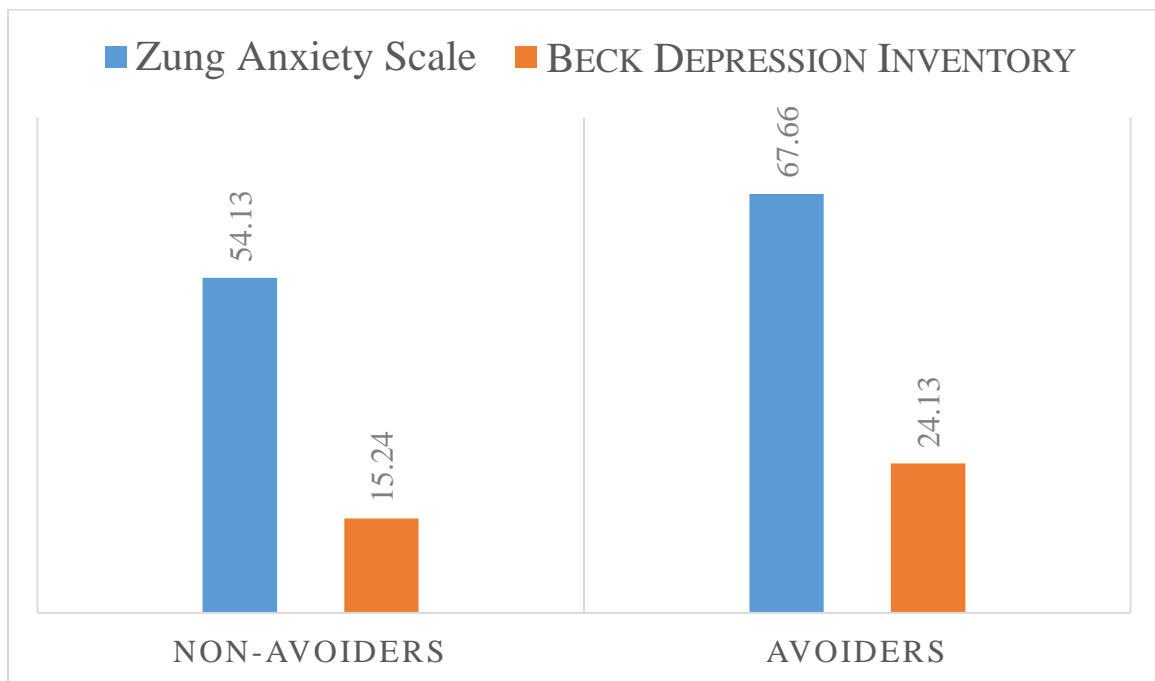


Figure 9. A comparison of non-avoiders and avoiders on anxiety and depression.



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VITAS

Morgan Lopker, SPT, BS

Education

- University of Nevada, Las Vegas: Las Vegas, Nevada.
 - Doctor of Physical Therapy. Expected degree: May 2014
- University of California, San Diego: San Diego, California.
 - Bachelor of Science in Physiology and Neuroscience. December 2009.

Clinical Experience

- Care Meridian: Las Vegas, Nevada. January-March 2013.
 - Clinical internship
 - Adult and pediatric sub-acute inpatient rehabilitation
- Spring Valley Hospital: Las Vegas, Nevada. October-December 2013.
 - Clinical internship
 - Acute physical therapy
- Scripps Health: San Diego, California. July-September 2013.
 - Clinical Internship
 - Outpatient orthopedic physical therapy
- Tru Physical Therapy: Henderson, Nevada. June-August 2012.
 - Clinical Internship
 - Outpatient orthopedic physical therapy
- Xcelerate Physical Therapy: Thousand Oaks, California. 2005-2011.
 - Physical Therapy Aide and Administrative Specialist.
 - Private practice, outpatient orthopedic physical therapy

- San Diego Veteran's Affairs Healthcare System: La Jolla, California. 2008-2009.
 - Volunteer physical therapy aide
 - Long-term care and acute care physical therapy

Continuing/Supplemental Education

- UNLV Physical Therapy Graduate School Class of 2013 Thesis Presentations. May 2013.
- Hip Arthroscopy and Differential Diagnosis: Dr. Hanson lecture. April 2013
- Distinguished lecture series: Dr. Linda Fetters. April 2013.
- Pain Seminar: Dr. Adriaan Louw. February 2013.
- Hand Anatomy and Pathologies: Dr. George Gluck. February 2013.
- Functional Biomechanics of the Lower Quadrant: Dr. Chris Powers. January 2013.
- Pain Management: Dr. John Reneau. November 2012.
- McKenzie Method, Fallacies, Realities, and Research Validity: Dr. Boyd Etter. October 2012.
- NPTA Fall Risk Assessment Presentation: Dr. Jennifer Nash. September 2012.
- UNLV Physical Therapy Graduate School Class of 2012 Thesis Presentations. May 2012.
- Pain Seminar: Dr. Adriaan Louw. February 2012.
- NPTA Vestibular Rehabilitation Presentation: Dr. Jennifer Nash. February 2012.
- HIPAA Clinical Care Job Training Completion. January 2012.
- HIPAA Basics Training Completion. January 2012.
- CITI Training Completion. January 2012.
- Rotator Cuff Presentation: Dr. James Detting. November 2011.

Professional Association Membership

- American Physical Therapy Association (APTA) member since 2011
 - Memberships: Orthopedic Section, Research Section
- Nevada Physical Therapy Association (NPTA) member since 2011
 - Memberships: Student Special Interest Group (SSIG)
- American Heart Association Healthcare Provider CPR and AED Certification since 2010
 - Expires in April 2014

Professional Leadership

- UNLV Class of 2014 Graduate Assistant. January-May 2013.
- NPTA SSIG Director. 2012-2013.
- UNLV Class of 2014 Class Treasurer. 2012-2014.

Scholarships and Awards

- 2013 UNLV Physical Therapy Academic Scholarship
- 2013 Spring Semester UNLV Graduate College Student Grant Award

State/National Conference Attendance

- APTA Combined Sections Meeting: Las Vegas, Nevada. January 2014.
- APTA Combined Sections Meeting: San Diego, California. February 2013.
- Sports Physical Therapy Section Team Concepts Conference. Las Vegas, Nevada. November 2012.
- Nevada Physical Therapy Association Strategic planning meeting: Las Vegas, Nevada. July 2012.
- APTA Combined Sections Meeting: Chicago, Illinois. February 2012.

- California Physical Therapy Association Annual Conference: Pasadena, California.
October 2009.

Research in Progress

- Characteristics of subjects who avoid activities and participation due to a fear of falling in Parkinson's disease.
 - Student Investigator.

Molly Newman, SPT, BS

Education

- University of Nevada, Las Vegas: Las Vegas, Nevada.
 - Doctor of Physical Therapy. Expected degree: May 2014
- Oregon State University: Corvallis, Oregon.
 - Bachelor of Science in Exercise and Sport Science, Minor in Spanish. Cum Laude. June 2011

Clinical Experience

- Providence Willamette Falls Medical Center: Oregon City, Oregon. January-March 2013.
 - Clinical internship
 - Acute and outpatient physical therapy; rural setting
- Therapeutic Associates Physical Therapy: Clackamas, Oregon. October-December 2013.
 - Clinical internship
 - Outpatient orthopedic physical therapy
- Kindred Sunnyside Nursing and Rehabilitation: Salem, Oregon. July-September 2013.
 - Clinical Internship
 - Rehabilitation/skilled physical therapy
- Vancouver Rehabilitation and Therapy Clinic: Vancouver, Washington. June-August 2012.
 - Clinical Internship
 - Outpatient orthopedic physical therapy

- Oregon State University IMPACT Program: Corvallis, Oregon. Winter 2011; Fall 2007.
 - Volunteer
 - Participating in aquatic therapy with children with disabilities
- Samaritan Rebound Physical Therapy: Albany, Oregon. June-December 2010.
 - Physical therapy aide
 - Outpatient orthopedic physical therapy
- La fundacion del hermano Miguel: Quito, Ecuador. June-August 2009.
 - Volunteer
 - Outpatient orthopedic and neurologic physical therapy clinic for uninsured patients

Continuing/Supplemental Education

- UNLV Physical Therapy Graduate School Class of 2013 Thesis Presentations. May 2013.
- Hip Arthroscopy and Differential Diagnosis: Dr. Hanson lecture. April 2013
- Distinguished lecture series: Dr. Linda Fetters. April 2013.
- Pain Seminar: Dr. Adriaan Louw. Febraury 2013.
- Hand Anatomy and Pathologies: Dr. George Gluck. February 2013.
- Benefits of Strength Training and Older Adults: Dr. Sue Schuerman. February 2013.
- Face into the Storm: Dr. Alan Jette. November 2012.
- Innovations in Rehabilitation Outcome Measurement: Dr. Alan Jette. November 2012.
- Before the Fall- Strength, Balance, and Flexibility: Dr. Sue Schuerman. November 2012.
- Pain Management: Dr. John Reneau. November 2012.

- NPTA Fall Risk Assessment Presentation: Dr. Jennifer Nash. September 2012.
- Quantum wheelchair manufacturing facility tour: Las Vegas, Nevada. May 2012.
- UNLV Physical Therapy Graduate School Class of 2012 Thesis Presentations. May 2012.
- Pain Seminar: Dr. Adriaan Louw. February 2012.
- NPTA Vestibular Rehabilitation Presentation: Dr. Jennifer Nash. February 2012.
- HIPAA Clinical Care Job Training Completion. January 2012.
- HIPAA Basics Training Completion. January 2012.
- CITI Training Completion. January 2012.
- Rotator Cuff Presentation: Dr. James Detting. November 2011.

Professional Association Membership

- American Physical Therapy Association (APTA) member since 2011
 - Memberships: Nevada Chapter, Orthopedic Section, Student Special Interest Group
- American Heart Association Healthcare Provider CPR and AED Certification since 2010
 - Expires in April 2014

Professional Leadership

- UNLV Class of 2014 Curriculum Committee Representative. 2013-2014.
- UNLV Class of 2014 Class Secretary. 2011-2014.

Research in Progress

- Characteristics of subjects who avoid activities and participation due to a fear of falling in Parkinson's disease. Student Investigator.