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# Factors Predicting Fear of Falling Avoidance Behavior in Parkinsonisms

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# FACTORS PREDICTING FEAR OF FALLING AVOIDANCE BEHAVIOR IN PARKINSONISMS

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**ABSTRACT**

**BACKGROUND:** Fear of falling avoidance behavior (FFAB) is common in parkinsonisms and results in potentially mitigable downstream consequences.

**OBJECTIVE:** Determine the characteristics of individuals with parkinsonisms most associated with FFAB.

**METHODS:** A retrospective, cross-sectional study was conducted from medical records data of 142 patients with parkinsonisms. These data included: demographics (age, sex), disease characteristics (Movement Disorders Society – Unified Parkinson's Disease Rating Scale Part III (MDS-UPDRS III), years since diagnosis), fall history (number of fall injuries in previous year), and gait and balance function (five times sit to stand, MiniBESTest, Timed Up and Go (TUG), dual-task TUG, ten-meter walk test (10MWT), observed freezing of gait (FOG) (MDS-UPDRS III item 11)).

**RESULTS:** 10MWT ($p < .001$) and MDS-UPDRS III item 11 ($p < .014$) were significantly associated with FFAB above and beyond disease severity, which also contributed significantly to the overall model (*p*s < .046). Fall history was not associated with FFAB.

**CONCLUSION:** Our findings suggest that the largest portion of variability in FFAB is explained by gait velocity and FOG; however, disease severity also explains a significant portion of the variability of FFAB. Further investigation into factors predictive of FFAB and mitigation of downstream consequences, using more robust designs, is warranted.

**KEYWORDS:** parkinsonism, fear of falling, avoidance behavior, gait velocity, freezing of gait

**ARTICLE TYPE:** Research article

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## INTRODUCTION

Fear of falling avoidance behavior (FFAB) is associated with several negative downstream consequences. Many individuals who experience  fear of falling avoid activities that they perceive put them at risk for a fall (Cumming, Salkeld, Thomas, & Szonyi, 2000; Deshpande et al., 2008). This avoidance behavior can be protective, resulting in less exposure to risky situations (Kader, Iwarsson, Odin, & Nilsson, 2016; Landers et al., 2017). However, avoidance behavior can also have unintended consequences that are associated with sedentary behavior (Landers et al., 2021; Nilsson, Jonasson, & Zijlstra, 2020). Falls are frequent in individuals with PD and other parkinsonisms and have received considerable research attention among individuals with PD (Crouse, Phillips, Jahanshahi, & Moustafa, 2016; Fasano, Canning, Hausdorff, Lord, & Rochester, 2017). There has also been substantial attention in the literature to the related constructs of fear of falling, balance confidence, and falls self-efficacy, but there is a lack of consensus into the downstream consequences associated with avoidance behavior that results from these (Landers, Durand, Powell, Dibble, & Young, 2011; Mak & Pang, 2009a, 2009b; Thomas, Rogers, Amick, & Friedman, 2010).

FFAB is common in people with PD (Kader et al., 2016; Landers et al., 2017). Evidences shows a decrease in the number of steps taken per day, time spent standing per day, up/down transitions per day, and the metabolic equivalents (METs) per day with a subsequent increase in hours sitting/laying down per day as a result of fear of falling (Landers et al., 2017). Ultimately, avoidance behavior may lead to general physical inactivity and deconditioning (Hatch, Gill-Body, & Portney, 2003; Howland et al., 1993; Wijlhuizen, de Jong, & Hopman-Rock, 2007). This deconditioning, in turn, leads to a higher risk of falls because of weakened balance systems, further perpetuating the cycle of fear of falling for people with PD (Landers et al., 2021; Landers & Nilsson, 2021). Further complicating this vicious cycle is the degenerative course of PD itself.

Identifying different factors associated with FFAB in parkinsonisms is important in developing treatment plans to address potentially mitigable factors (Landers et al., 2017). This occurs in primarily two steps: identification of factors and improvement of interventions. Understanding which individual factors associated with FFAB in parkinsonism are the most modifiable and generally the most detrimental to people with parkinsonisms, may lead to modifications in management approaches and intervention techniques employed. Although neurodegenerative changes associated with parkinonsisms are currently unpreventable, the negative effect that FFAB has on risk of falling and functional balance may be mitigated through targeted interventions (Landers & Nilsson, 2021). However, only after identifying these factors can targeted treatment approaches be developed. Targeting specific factors that have the capacity to be improved will ideally lead to more rapid and efficient improvement in outcomes from treatment than using traditional, generalized, or broad treatment approaches. Implementing interventions that target the root cause(s) associated with FFAB, holds the most promise to interrupt the cycle and limit the negative downstream consequences of deconditioning and subsequent exacerbation of decline in overall function from neurodegenerative changes (Landers et al., 2021; Landers & Nilsson, 2021).

The primary aim of this research was to determine the individual characteristics, including demographics, severity of disease, and gait and balance abilities of people with parkinsonisms that are most associated with FFAB. Determining which of these factors relate to FFAB will facilitate a greater understanding of disease progression and provide preliminary research for the development of more effective treatment approaches addressing FFAB and the associated downstream consequences in parkinsonisms.

## METHODS

### Study design

A retrospective, exploratory, cross-sectional analysis of medical record information for all patients with a diagnosis of a parkinsonism who had a physical therapy (PT) evaluation at [blinded] from 2017 to 2020. These patients were identified from billing records. The following variables were extracted from their medical records: demographic information (i.e., sex, age), diagnosis, disease characteristics, fall history, and gait and balance outcome measures.

### Participants

Patients were included if they had a physical therapy evaluation, were diagnosed with a parkinsonism by a neurologist, and had completed the modified Fear of Falling Avoidance Behavior Questionnaire (mFFABQ). Patients were excluded if they had evidence of dementia as indicated by a score of <18 of the Montreal Cognitive Assessment (Hoops et al., 2009). A total of 142 participants (mean age = 73.4 ± 8.9 years; males = 88, females = 53, missing = 1; Hoehn and Yahr stage: 1.0 = 6, 1.5 = 7, 2.0 = 25, 2.5 = 17, 3.0 = 42, 4.0 = 9, 5.0 = 3.0, missing = 33) were analyzed. Of the total participants, 121 were diagnosed with PD, 8 with Lewy Body Disease, 6 had a non-specific parkinsonism, 1 with cortical basal syndrome, 1 with multisystem atrophy, and 5 with progressive supranuclear palsy. Means and standard deviations of patient characteristics (demographic and descriptive variables) are found in table 1. (See Appendix)

## Sample size

Sample size was estimated using the multiple regression module from PASS 24.0 (NCSS, LLC. Kaysville, Utah, USA, ncss.com/software/pass). For the prediction of mFFABQ, a sample size of 61 participant records was needed ($\alpha$=0.05, 80% power) with two variables entered first (age and sex) and conservatively estimated ($R^2$ of 0.150); followed by nine other variables (Movement Disorder Society-Unified Parkinson's Disease Rating Scale part III (MDS-UPDRS III), years since diagnosis, number of fall injuries in the last year, 5 Time Sit to Stand (5STS), Mini Balance Evaluation Systems Test (MBT), Timed Up and Go (TUG), dual-task TUG (DT-TUG), 10 Meter Walk Test (10MWT), and MDS-UPDRS III item 11 entered at a low to moderate $R^2$ of 0.20.

## Variables

The dependent variable assessed was the score on the mFFABQ (Landers et al., 2014), which has different stems than the original Fear of Falling Avoidance Behavior Questionaire to improve clarity and participant understanding (Landers et al., 2011). The modified stems ask participants to respond to the following prompt for 14 different activities, "Due to my fear of falling, I avoid…walking (item 1)" by indicating never, rarely, sometimes, often, or always. The mFFABQ has good evidence for its reliability in neurologic populations, including parkinsonisms (Landers et al., 2011). The predictor variables were categorized based on the following:

1. Disease characteristics (MDS-UPDRS III total score, years since diagnosis)
2. Fall history (number of fall injuries in the last year)
3. Gait and balance function (5STS, MBT, TUG, DT-TUG, 10MWT, MDS-UPDRS III item 11)

**Disease characteristics**

Disease duration and the MDS-UPDRS II total score were used to assess the severity of parkinsonism in each patient. Disease duration was designated as the number of years since diagnosis. Part III on the MDS-UPDRS is a measure of motor disease burden consisting of a motor examination that includes the upper extremity, lower extremity, and functional motor control. Evidence has been shown for its reliability (Cronbach's $\alpha = 0.93$) and validity in assessing the symptoms and severity of PD (Goetz et al., 2008; Martinez-Martin et al., 2013).

**Fall history**

The number of falls resulting in an injury requiring medical intervention was used for fall history.

**Gait and balance function**

Gait and balance abilities were assessed with the following: 5STS, MBT, TUG, DT-TUG, 10MWT, and MDS-UPDRS III item 11. 5STS assesses lower extremity strength and postural control during repeated sit to stand transfers. The patient was instructed to fold their arms across their chest and then were timed while they stood up and sat down five times as fast as they could. The 5STS has excellent intrarater and test-retest reliability for people with PD (ICC = .99 and .76, respectively) (Duncan, Leddy, & Earhart, 2011). The MBT is a 14-item physical performance measure of balance and postural control comprising four domains: anticipatory balance, reactive postural control, sensory orientation, and dynamic gait (Leddy, Crowner, & Earhart, 2011). It has been shown to have high interrater and test-retest reliability among people with PD (ICC = 0.91 and 0.92, respectively) (Leddy et al., 2011).

The TUG test is a timed test of functional mobility in which the patient stood up from a chair, walked three meters in a straight line, turned around and returned to the chair, and sat back down. It has an ICC of .99 for community-dwelling elderly people (Podsiadlo & Richardson, 1991). The DT-TUG is similar to the TUG with the addition of completing a secondary task while completing the TUG test simultaneously (Shumway-Cook, Brauer, & Woollacott, 2000). For this study, the secondary task selected was a cognitive task, serial subtraction by three from an arbitrary number between 70 and 100. The DT-TUG exhibits excellent test-retest reliability (ICCs>0.85) in individuals with PD (Steffen & Seney, 2008).

The 10MWT was used to caputre self-selected gait velocity. Ten meters are marked off with the beginning and ending 2-meter sections used to accelerate and decelerate, respectively. The participant is instructed to walk at their comfortable walking speed for ten meters and the time to complete the middle six meters is collected and gait velocity calculated in meters per second. Two trials are performed, and the average of the two is taken. The 10MWT has been shown to have excellent test-retest reliability for comfortable gait velocity (ICC = .96) in individuals with PD (Steffen & Seney, 2008). Part III item 11 of the MDS-UPDRS assesses freezing of gait, including start hesitations and stuttering movements, especially during turning and reaching (Lichter, Benedict, & Hershey, 2021; Wang, Yixin, Miao, & Kejia, 2021). The assessors grade the severity of observed freezing during gait and score it from zero (normal) to four (severe). A score of one or greater is indicative of observed freezing of gait.

**Data analysis**

Data were analyzed using SPSS version 27.0 (IBM SPSS Statistics for Windows, Armonk, New York, USA: IBM Corp) at $\alpha = 0.05$. Missing data were observed on ten of the variables examined, with 13.6 percent of the data missing. Multiple imputation was used to handle the missing data. Multiple imputation was used as it is recognized as a "state of the art" missing data handling technique that maximizes the accuracy of parameter and standard error estimation and statistical power compared with traditional approaches to missing data management (Schafer & Graham, 2002). The chained equations full conditional specification Markov Chain Monte Carlo algorithm was used to generate five imputed data sets with ten iterations per chain. The imputation process included the 14 analytic variables, including disease duration, Parkinsonian diagnosis, presence of depression or anxiety, sex, age, fall injuries in the last year, MDS-UPDRS III item 11, MDS-UPDRS III total score, MBT total, 5STS, TUG, DT-TUG, 10MWT, and the mFFABQ. After generating the five imputed data sets, the statistical analyses were performed across the imputed data sets. Subsequently, pooled statistics were calculated using the mean across the imputed data sets.

The substantive analyses were conducted using hierarchical multiple linear regression to examine the relationship between predictor variables on the mFFABQ. Two differing models were analyzed. In Model 1, the following variables were entered: block 1 (disease duration and

UPDRS III), block 2 (fall injury in the last year), and block 3 (gait and balance – 5STS, MBT, TUG, DT-TUG, 10MWT, UPDRS III item 11). In Model 2, the following variables were entered: block 1 (disease duration and UPDRS III) and block 2 (gait and balance – 5STS, MBT, TUG, DT-TUG, 10MWT, UPDRS III item 11). Normality, collinearity diagnostics, and bivariate correlations were also conducted.

**RESULTS**

**Model 1** was statistically significant, ($R^2$ = .524, $F_{(9,132)}$=16.20, *p*<.001), such that the full model accounted for 52.4% of the variability in mFFABQ. Block 1 ($F_{(2,139)}$=13.56, p<.001) and block 3 ($F_{(9,132)}$=15.53, p<.001) were found to be statistically significant predictors of mFFABQ, accounting for 16.3% and 33.5% of variability in mFFABQ, respectively (Table 2). However, block 2 ($F_{(3,138)}$=4.52, *p*=.063) was not found to be a statistically significant predictor of mFFABQ (p=.051). In the full model, disease duration (b=.402, *p*=.046), UPDRS III (b=.182, *p*=.029), 10MWT (b=-24.134, *p*<.001), and UPDRS 3.11 (b=-5.636, *p*=.014) were found to be significant predictors of mFFABQ. A complete description of the outcomes for Model 1 analysis can be found in table 2. (See Appendix)

**Model 2** was statistically significant, ($R^2$ = .522, $F_{(9,132)}$=18.18, *p*<.001), such that the full model accounted for 52.2% of the variability in mFFABQ. Both block 1 ($F_{(2,139)}$=13.56, *p*<.001) and block 2 ($F_{(8,133)}$=16.67, *p*<.001) were found to be significant predictors of mFFABQ, accounting for 16.3% and 35.9% of variability in mFFABQ, respectively (Table 2). In the full model, disease duration (b=.425, p=.033), UPDRS III (b=.181, *p*=.029), 10MWT (b=-23.799, *p*<.001), and UPDRS 3.11 (b=-5.645, *p*=.014) were found to be significant predictors of mFFABQ. A complete description of the outcomes for Model 2 analysis can be found in table 3. (See Appendix)

## DISCUSSION

Our findings suggest that while disease severity (i.e., disease duration and UPDRS motor scores) explains a significant portion of the variability of FFAB, the largest portion of variability in FFAB is explained by gait velocity (10MWT) after controlling for disease severity. However, gait velocity may also be a surrogate for disease severity. Interestingly, the 5STS, MBT, and TUG tests were not included in the final model; however, this may be explained by collinearity with the 10MWT. Taken together, as parkinsonisms advance, the impact of FOF results in more avoidance behavior which may potentiate more negative downstream consequences (Landers et al., 2021). Also, consistent with other studies, we found that fall history was not associated with the mFFABQ. This finding supports the notion that as one avoids more risky activities (i.e., more FFAB), their fall risk exposure decreases, and they fall less. Thus, the relationship between falls and avoidance behavior is non-linear (Landers & Nilsson, 2021). Further investigation in this area should consider using a more rigorous research design to determine if treatment addressing gait velocity in parkinsonisms can mitigate the negative downstream consequences associated with FFAB.

Other studies have shown that disease severity is associated with FFAB. People with PD whose symptoms are more involved are more likely to be categorized as “avoiders” due to their FOF (Landers et al., 2017). Additionally, they have been shown to score worse on the UPDRS III, have lower confidence in their balance abilities, and have poorer balance performance (Landers et al., 2017). Postural stability particularly has been shown to predict balance confidence as well as FFAB in people with PD (Jacobs, Horak, Tran, & Nutt, 2006; Landers et al., 2021). The more postural instability an individual has, the lower their balance confidence, and the more likely they are to exhibit avoidance behaviors due to fear of falling (Landers et al., 2021). Additionally, the relationship between postural stability and FOF has been shown to impact the performance of activities of daily living in those with PD (Mehdizadeh et al., 2019).

Gait velocity was predictive of FFAB, which further lends evidence of gait velocity as the sixth vital sign. First introduced in 2001 by Fritz et al., maintaining gait speed has been shown to be related to  health outcomes (Elbaz et al., 2013; Fritz & Lusardi, 2009). One study found that, of the six vital signs measured in adults over 65, only gait velocity was associated with better eight-year survival rates (Hardy, Perera, Roumani, Chandler, & Studenski, 2007). This shows the importance of maintaining age-matched gait velocity for older adults to prolong mortality. Furthermore, gait velocity has been shown to be  responsive to physical abilities and dopaminergic medication status in those with PD (Miller, Chou, Bohnen, Muller, & Seidler, 2018). It should also be noted that there is limited information regarding the relationship between FFAB and gait velocity. However, several studies have found a relationship between FOF, balance confidence, and gait velocity. Specifically, they found that as slower gait velocity was related to higher levels of FOF and lower levels of balance confidence (Chomiak et al., 2018; Christofoletti, McNeely, Campbell, Duncan, & Earhart, 2016; Nilsson, Hariz, Iwarsson, & Hagell, 2012). While the relationships between gait velocity and FOF has previously been demonstrated, to our knowledge, this is the first study to demonstrate that this relationship extends to the related domain of avoidance behavior. Further research is warranted to further explore this relationship.

Fall history was not a reliable predictor of FFAB in this study. However, it has previously been found that people with PD that are recurrent fallers exhibit significantly more FFAB than those with only a single fall or no falls, indicating a more extensive history of falls may be a better predictor of FFAB (Kader et al., 2016). These researchers found that more severe stages of PD also showed greater proportion of self-reported FFAB (Kader et al., 2016). It has also been shown that recurrent fallers have greater fear compared to those with a single fall, which supports the notion that a more extensive history of falls may have a strong relationship to FFAB in PD (Mak & Pang, 2010). Lastly, from a theoretical perspective, the more one exhibits avoidance behavior, the less they will fall because of less exposure to risky balance tasks (Landers & Nilsson, 2021). Therefore, fall history is not likely have a linear relationship with FFAB and, subsequently, may not be a good predictor of FFAB.

While FOG is thought to be associated with more FFAB, we found that more FFAB was associated with less FOG. One possible explanation for this unexpected result could be that individuals with elevated FFAB who avoid risky behavior have adaptively increased their attentional control strategies during activities that are most likely to trigger FOG. Previous studies have shown that as attention is allocated to a gait task, FOG is reduced (Maslivec, Fielding, Wilson, Norris, & Young, 2020; Spildooren et al., 2017). Additionally, Van Bockstaele et al. offer support for this theory noting a flexible, bidirectional relationship between attentional resource allocation and fear and anxiety (Van Bockstaele et al., 2014). White et al. also found that individuals with elevated FOF allocate attention during postural control tasks differently than individuals without FOF (White, Helfinstein, Reeb-Sutherland, Degnan, & Fox, 2009). However, others have found that elevated FOF and anxiety may result in attentional bias leading to a maladaptive allocation of attention or selection of improper motor strategy like stiffening (Young & Mark Williams, 2015). Further investigation is needed to elucidate the relationship between FFAB and FOG.

From a clinical perspective, clinicians should be assessing for a convergence of information to determine if patients are appropriately managing their activity levels in accordance with the actual balance and gait capabilities in people with parkinsonisms. When assessing FFAB in people with parkinsonisms, it is important to understand if the avoidance behavior is adaptive (appropriate based on their balance/physical capabilities) or maladaptive (inappropriate excessive activity avoidance and driven by fear and anxiety) (Landers et al., 2021). If the latter, then a different therapeutic approach may be needed to address the fear and anxiety. Additionally, clinicians can use these findings to address mitigable associated factors and to more efficiently choose standardized outcome measures that are associated with FFAB in this population. If patients are avoiding physical activity due to FOF, it can lead to deconditioning, reduced physical capacity, and worsening of postural instability (Landers et al., 2021) .Additionally, our results show that fall history alone is insufficient to provide a comprehensive picture of balance capability and fall risk, particularly as this relates to avoidance behavior. For this reason, fall history should consider how many falls someone has had per unit of FFAB or physical activity in the form of a ratio (e.g., fall-to-mFFABQ, fall-to-step count ratio, fall-to-metabolic equivalent ratio, fall-to-sedentary/avoidance behavior) as has been described by Del Din et al (Del Din et al., 2020). For example, someone who has not fallen in the last year but only walks 500 steps per day should not be considered more successful at avoiding falls than someone who fell twice in the last year but averaged 5,000 steps per day. Using the falls-to-activity level as a ratio would provide a more valuable clinical perspective and allow for a more accurate comparison of falls history in people with a parkinsonism.

There are a number of limitations in the current study. One of the most notable limitations is that of collinearity between variables resulting in potentially related variables not being included in the final model due to their high relatedness with other variables. There was no pattern or specific reasoning behind missing data points; however, there were a number of missing data points nonetheless. Although the threshold was met for preexisting data to perform imputation appropriately, bias may have been introduced by performing imputation to complete the data set. Finally, the participants in the current study were not a homogeneous group with PD. Participants were diagnosed with progressive neurological conditions ranging from progressive supranuclear palsy to Parkinsonism to PD. Clearly, this limits the generalizability for individual diseases but may increase the generalizability of parkinsonism collectively. Future research should focus on similar prediction models with homogeneous populations to arrive at a more definitive conclusion for those populations and diagnoses.

**CONCLUSION**

After controlling for parkinsonism disease severity, our study demonstrated that gait velocity and FOG were more associated with FFAB than measures of fall history, balance, functional lower extremity strength, and functional mobility. These results shed light on our understanding of the factors that contribute to avoidance behavior and offer potential targets for intervention if these relationships are causal. However, these data are not appropriate for causal inference at this time. Further investigation in this area is warranted to see if a more rigorous research design can help determine causality and determine if treatment addressing gait velocity and FOG in the parkinsonisms can mitigate the negative downstream consequences associated with fear of falling avoidance behavior.

**DECLARATION OF INTEREST:** The authors declare no conflicts of interest.

**APPENDIX**

**Table 1.** Participant Characteristics – Means, proportions, and standard deviations

| | Participants (n = 142) |
|---|---|
| Participant Characteristics | |
| Primary Diagnosis | Parkinson's Disease = 121 |
| | Lewy Body Disease = 8 |
| | Non-specified Parkinsonism = 6 |
| | Cortical Basal Syndrome = 1 |
| | Multiple System Atrophy = 1 |
| | Progressive Supranuclear Palsy = 5 |
| Age | 73.40 ± 8.92 |
| Sex (Missing, n = 1) | 88 males, 53 females |
| Years from diagnosis | 7.3 ± 5.1 |
| Falls in the last month | 1.0 ± 3.8 |
| Falls in the last year | 10.2 ± 84.8 |
| Injurious falls in the last year | .3 ± .7 |
| Hoehn and Yahr (Missing, n = 33) | 1.0 = 6 |
| | 1.5 = 7 |
| | 2.0 = 25 |
| | 2.5 = 17 |
| | 3.0 = 42 |
| | 4.0 = 9 |
| | 5.0 = 3 |
| MDS – UPDRS Part I | 9.9 ± 4.6 |
| MDS – UPDRS Part II | 14.3 ± 6.4 |
| MDS – UPDRS Part III | 30.0 ± 13.6 |
| MDS – UPDRS Part IV | 1.7 ± 3.1 |
| | |
| MDS – UPDRS Part III item 11 | .30 ± .66 |
| 5STS | 17.3 ± 19.2 |
| MBT | 18.8 ± 4.6 |
| TUG | 13.5 ± 12.6 |
| DT-TUG | 16.5 ± 12.7 |
| 10MWT | 0.92 ± .31 |
| FFABQ | 18.2 ± 14.6 |

MDS-UPDRS: Movement Disorder Society – Unified Parkinson's Disease Rating Scale, 5STS: 5 times sit to stand test, MBT: Mini Balance Evaluation System Test, DT-TUG: dual-task Timed Up and Go, 10MWT: Ten meter walk test, FFABQ: Fear of falling avoidance behavior questionnaire

**Table 2.** Outcomes for hierarchal multiple linear regression Model 1.

| Variable | *b* | SE | β | p value | $R^2$ | $\Delta R^2$ |
|---|---|---|---|---|---|---|
| *Block 1* | | | | <.001 | .163 | .163 |
| Disease duration | .703 | .263 | .245 | .010 | | |
| MDS-UPDRS III | .334 | .086 | .313 | <.001 | | |
| *Block 2* | | | | .063 | .189 | .026 |
| Disease duration | .599 | .269 | .209 | .030 | | |
| MDS-UPDRS III | .313 | .086 | .293 | <.001 | | |
| Falls injury | 3.596 | 1.975 | .164 | .072 | | |
| *Block 3* | | | | <.001 | .524 | .335 |
| Disease duration | .402 | .200 | .140 | .046 | | |
| MDS-UPDRS III | .182 | .082 | .171 | .029 | | |
| Falls injury | .911 | 1.853 | .042 | .626 | | |
| 5TST | -.117 | .097 | -.110 | .230 | | |
| MBT | -.269 | .342 | -.175 | .422 | | |
| TUG | .744 | .464 | .629 | .136 | | |
| DT-TUG | -.255 | .220 | -.322 | .326 | | |
| 10MWT | -24.134 | 5.694 | -.514 | <.001 | | |
| MDS-UPDRS III item 11 | -5.636 | 2.151 | -.264 | .014 | | |

MDS-UPDRS: Movement Disorder Society – Unified Parkinson's Disease Rating Scale, 5STS: 5 times sit to stand test, MBT: Mini Balance Evaluation System Test, DT-TUG: dual-task Timed Up and Go, 10MWT: Ten meter walk test, FFABQ: Fear of falling avoidance behavior questionnaire

**Table 3.** Outcomes for hierarchal multiple linear regression Model 2.

| Variable | *b* | SE | β | p value | $R^2$ | $\Delta R^2$ |
|---|---|---|---|---|---|---|
| *Block 1* | | | | <.001 | .163 | .163 |
| Disease duration | .703 | .263 | .245 | .010 | | |
| MDS-UPDRS III | .334 | .086 | .313 | <.001 | | |
| *Block 2* | | | | <.001 | .522 | .359 |
| Disease duration | .425 | .197 | .148 | .033 | | |
| MDS-UPDRS III | .181 | .086 | .170 | .029 | | |
| 5TST | -.110 | .098 | -.126 | .268 | | |
| MBT | -.320 | .302 | -.164 | .294 | | |
| TUG | .762 | .455 | .644 | .121 | | |
| DT-TUG | -.240 | .211 | -.344 | .275 | | |
| 10MWT | -23.799 | 5.399 | -.507 | <.001 | | |
| MDS-UPDRS III item 11 | -5.645 | 2.144 | -.264 | .014 | | |

MDS-UPDRS: Movement Disorder Society – Unified Parkinson's Disease Rating Scale, 5STS: 5 times sit to stand test, MBT: Mini Balance Evaluation System Test, DT-TUG: dual-task Timed Up and Go, 10MWT: Ten meter walk test, FFABQ: Fear of falling avoidance behavior questionnaire

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**CURRICULUM VITAE**

**Kameron Eckard, SPT, CSCS**
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**Education**

- Doctor of Physical Therapy, Graduation anticipated May 2022
  *University of Nevada, Las Vegas*
- Bachelor of Science: Kinesiology & Health Promotion, Graduation May 2018
  *University of Wyoming*

**Licensure**

- Nevada State Board of Physical Therapy Examiners - License Pending Graduation May 2022
  *Nevada Physical Therapy Board*

**Certifications**

- Certified Strength & Conditioning Specialist (NSCA)
    - June 2018-present
- Blood-borne Pathogens Training Certified
    - June 2019-present
- HIPAA Training Certified
    - June 2019-present
- Collaborative Institutional Training Initiative
    - March 2020-present
- “Health Care Provider” Basic Life Support Certified (AHA)
    - March 2020-present

**Clinical Experience**

- Sunrise Hospital and Medical Center (January 2022-April 2022) – *Las Vegas, NV*
    - Inpatient/acute rehabilitation with a focus on orthopedics
- St. Mary's Regional Medical Center (September 2021-December 2021) – *Reno, NV*
    - Inpatient/acute rehabilitation
- UFC Performance Institute (June 2021-September 2021) – *Las Vegas, NV*
    - Screening, evaluation, & treatment of high level mixed martial arts athletes
- Wright Physical Therapy (July 2020-August 2020) – *Twin Falls, ID*
    - Outpatient orthopedics specializing in joint, spine, and sport

**Related Employment**

- Rehab Technician- Momentum Physical Therapy (June 2018-May 2019) – *Gillette, WY*
    - Support of 2 physical therapists via patient exercise, application of appropriate modalities, and cleaning responsibilities to maintain efficient patient rehab
- Rehab Technician- Spine & Injury Clinic of Laramie (January 2017-August 2017) – *Laramie, WY*
    - Support of 1 physical therapist via patient exercise, application of appropriate modalities, and cleaning responsibilities to maintain efficient patient rehab as part of a larger team

**Membership in Professional Organizations**

- American Physical Therapy Association (2019 - present) Member #: 867397
- National Strength and Conditioning Association (2018 - present) Member #: 001049116

**Service / Volunteering**

- UNLVPT Faculty Position Interviews (03/25/2021); 1 hour
    - virtually attended the student/faculty interview of Dr. Jenny Kent & posed questions to facilitate discussion
- Fall Risk Screen- Nevada Goes Falls Free Coalition (09/15/2020 & 09/25/2020); 3 hours
    - Attended training on providing the fall risk screen, participated in a fall risk screen, provided recommendations to the participant, and helped to draft an informative email to send to the participant following the screening process
- UNLVPT Class of 2023 Interview Day (01/24/2020); 5 hours
    - Assisted to organize, prepare, and lead prospective students to their interviews with UNLVPT faculty & provided faculty tours to the prospective students

**Ryan B. Hammar**

Ryan.hammar@outlook.com

Education

DPT, Physical Therapy University of Nevada Las Vegas 2019-2022

Las Vegas, NV

B.S. Exercise Science, *Brigham Young University* December 2018

Provo, UT

Licensure

- Nevada Physical Therapy Board - License Pending Graduation May 2022

Certifications

- American Heart Association, BLS for Healthcare Providers (June 2020)
- HIPAA Training Certified (June 2019)
- Blood-borne Pathogens Training Certified (June 2019)

Employment / Clinical Experience

| | |
|---|---|
| January 2022 – April 2022 | **Clinical Experience –** Affilliated Physical Therapy, Pahrump, NV (Outpatient Orthopedic) |
| September 2021 – December 2021 | **Clinical Experience –** Southern Hills Hospital, Las Vegas, NV. (Acute Care) |
| July 2021 – September 2021 | **Clinical Experience –** Encompass Health Rehabilitation Hospital of Desert Canyon, Las Vegas, NV. (Inpatient Rehab) |

July 2020 – August 2020 | **Clinical Experience –** Family and Sports Physical Therapy, Las Vegas, NV. (Outpatient Orthopedic)

March 2018 – March 2019 | **Store Manager –** Standard Plumbing Supply/True Value Hardware/Sprinkler World, Springville UT.

Current Research Activity

- Landers **et al**. Factors Predicting Fear of Falling Avoidance Behavior in Parkinson Disease, 2021.

Membership in Professional Organizations

- Member American Physical Therapy Association (2019 – Present)
- Member Nevada Physical Therapy Association (2019 – Present)
- Member Sports Section of the American Physical Therapy Association (2019 – Present)

Service

- Youth Group Leader **–** Church of Jesus Christ of Latter-Day Saints (2019 – Present)
- Christmas Teddy Bear Stuffing – NSC Conference 2019
- Global PT Day of Service ( 2021-2022)

**Franjo Vukojević**

fvukojevic@sandiego.edu

**Education**

**Doctor of Physical Therapy** Estimated May 2022

University of Nevada, Las Vegas – Las Vegas, Nevada

**Bachelors of Science in Behavioral Neuroscience** 2016-2019

University of San Diego – San Diego, California

**Credits for transfer in Kinesiology** 2014-2016

San Diego Christian College – Santee, California

**Licensure**

- DPT License Pending Graduation

**Certifications**

- CPR Certified (2020)
- HIPPA Training Certified (2019)
- Blood-borne Pathogens Training Certified (2019)

**Employment / Clinical Experience**

**Student Physical Therapist** January 2022-April 2022

Select Physical Therapy San Diego 3737 Moraga Ave, Suite B117 San Diego, CA 92117

**Student Physical Therapist** September 2021-December 2021

University Of Utah Neilsen Rehabilitation Hospital 50 North Medical Drive, Salt Lake City, UT 84132

**Student Physical Therapist** July 2021-September 2021

Northern Nevada Medical Center, 2375 E Prater Way, Sparks, NV 89434

**Student Physical Therapist** July 2020-August 2020

Wright Physical Therapy, 1444 Falls Ave, Twin Falls, ID 83301

**Physical Therapist Aide** June 2018 – August 2018

Providence St. Johns, 2020 Santa Monica Blvd Suite 401, Santa Monica, California 90404

**Physical Therapist Aide** July 2017 – August 2017

Praxis Physical Therapy, 1360 W 6th St. Suite 210, San Pedro, California 90732

**Physical Therapist Aide** June 2016 – August 2016

Marina Sports Medicine, 28633 S Western Ave Suite 200, Rancho Palos Verdes, California 90275

**Membership in Professional Organizations**

- Member American Physical Therapy Association Nevada Chapter
  - 2019-2021
- Member Sports Section of the American Physical Therapy Association
  - 2020-2021

**Service / Volunteer Activity**

- Nevada Fall Prevention Awareness Screen
  - September 25, 2020 Las Vegas, Nevada
- Educate high school baseball players using the "Thrower's Ten Method"
  - July 7, 2020 Kimberly High School, Kimberly, ID
- Sigma Phi Epsilon/Red Cross Blood Drive
  - 2016-2019 University of San Diego

**Continuing Education Attended**

- Michael Skovdal Rathleff, MHSc, PhD "Examination and History Taking of the Athlete with Non-Traumatic Knee Pain" (12/2/2020)
- Catherine Lang, PT, PhD, FAPTA "Wearable Sensors are Changing How We Think About Movement and Rehabilitation" (11/5/20)
- Greg Nordfelt "Adventures in Traumatic Brain Injury" (10/2/2019)
- Anthony Delitto, PT, PhD, FAPTA "The Time for Implementation is Now" (9/13/19)
- Anthony Delitto, PT, PhD, FAPTA "Finishing the Job of Evidence Based Practice" (9/12/2019)