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Improving the Quality of Life
in the Parkinson's Community

**Falls and Fear of Falling
in Parkinson's Disease
with and without
Deep Brain Stimulation**

Fall 2013

Introduction

Falls in Parkinson's disease (PD) are highly prevalent¹⁻³. Individuals with PD have 3 times the falls when compared to age-matched individuals who do not have PD⁴. In a review of the literature reporting on falls and PD, participants who fell at least once ranged from 35% to 90%, with an average of 60.5%. Recurrent fallers (falling more than once) accounted for between 18% and 65% of participants (average 39%)³. There are several risk factors known to be associated with falls in people with PD, including a history of falls, disease severity, increased motor impairment, postural instability, freezing of gait, leg muscle weakness, cognitive impairment (impaired attention), and medication effects^{1,3,5-9}.

The clinical significance for falls for individuals with PD is associated with injuries, reduced mobility, high medical costs, reduced independence, adverse psychological consequences such as depression and anxiety, reduced quality of life, and caregiver stress^{4,10-13}. Further, fear of falling is a common experience in individuals with PD, and may lead to self-imposed restriction of daily activities, immobility, social isolation, and depression^{12,13}. Previous studies had asked whether or not patients were afraid to fall, and almost 50% indicated that they had such fear¹⁴.

There remains some debate as to whether or not deep brain stimulation (DBS), particularly subthalamic nucleus DBS (STN-DBS), results in higher fall frequency as compared to individuals with PD without DBS (Non-DBS). For example, one study that assessed 20 individuals at different points before and after STN-DBS found that "near falls" and fear of falling (FOF) was reduced for individuals one year after DBS, although a reduction in the number of falls could not be supported². The results also showed that fewer activities were avoided owing to the risk of falling, and fear of falling during more complex activities had improved. In another study, a randomized controlled trial assessing differences between DBS or best medical therapy (optimal medication regimen) for individuals with PD, there were significantly more falls for the deep brain stimulation group than the best medical therapy group within a 6 month period¹⁵.

Given that falls are a substantial problem for people with PD, falls and related factors within specific cohorts of individuals with PD (Age: Younger and Older; Disease Duration: Early and Advanced PD; DBS and Non-DBS groups) warrants further attention.

Objective

To investigate the prevalence of falls and fear of falling for individuals with PD **with** and **without DBS** in the context of age and disease duration.

Methods

There were 1,153 individuals who participated in this survey, including 334 participants with PD who underwent **DBS** and 819 individuals with PD without DBS (**Non-DBS group**; see Table 1 for demographics). Since the majority of participants in this study were STN-DBS, and to reduce confounding variables when interpreting the results related to the impact of DBS on falls, only participants with **STN-DBS** comprised the **DBS group** in the results below ($N=263$). Participants were recruited from previous participants in surveys conducted by The Parkinson Alliance (PA), advertisements at PD support groups, announcements in medical clinics, The PA website, or a DBS-focused affiliate website to The PA (DBS4PD.org). For the **DBS group**, 82% of the surveys were completed independently, whereas 18% of participants required writing assistance. For the **Non-DBS group**, 86% of the surveys were completed independently, and 14% of participants required writing assistance. Participants represented 50 states,

primarily from California (20.1%), Florida (8.9%), Arizona (8.8%), Texas (8.8%), New York (8.6%), New Jersey (8.1%), Colorado (6.9%), Virginia (5.4%), Pennsylvania (3.6%), and Michigan (2.9%).

The Demographic Questionnaire and Questions Related to Falls and Fear of Falling:

The demographic questionnaire included questions related to background information as well as questions related to a broad range of variables related to falls and fear of falling. Specifically, in addition to asking typical questions pertaining to demographic information, questions related to falls, mobility, freezing, balance, assistive devices, fatigue, cognition, emotional well-being (depression and anxiety), exercise, and the impact of DBS on falls (for those who have had DBS) were included. For this study, a fall was defined as an unintentional or unexpected event that resulted in the person coming to rest on the ground or another lower level. The term “**frequent, recurrent faller**” (defined as more than one fall within a one-month period) was used in this report.

The Falls-Efficacy Scale¹⁶:

The Falls-Efficacy Scale is an instrument that measures fear of falling, particularly in the context of low self-confidence at avoiding falls during essential, nonhazardous activities of daily living. Specifically, the measure assesses how worried an individual is about falling in situations including getting dressed and undressed, getting in and out of a chair, getting to the telephone before it stops ringing, preparing a simple meal, cleaning the house, going up or down stairs, simple shopping, taking a bath or shower, reaching for something in a deep, low closet, and walking nearby the house. There are 10 items with responses ranging from 1 (*Not Worried*) to 4 (*Very Worried*), with total scores ranging from 14 (*no fear of falling*) to 40 (*the greatest fear of falling*).

Parkinson’s Disease Questionnaire-8 (PDQ-8)¹⁷:

The PDQ-8 has eight items and measures health-related problems or difficulties that are commonly experienced by individuals with PD. This instrument is often thought of as a measure assessing health-related quality of life, which simply illustrates the level of difficulty one is experiencing in a specific functional domain. The PDQ-8 has eight domains and one single index, an aggregate score for the domains. The eight domains include: Mobility, Activities of Daily Living (routine activities that people tend to do everyday), Emotional Wellbeing, Stigma (felt embarrassed in public due to having PD), Social Support, Cognitions, Communication, and Bodily Discomfort. Scores range from “0” (*Never* [no difficulties]) to “4” (*Always* [“I”] *Cannot do at all* [greatest level of difficulty]). Higher scores reflect greater difficulties/problems.

* Sample sizes noted in the sections below may vary somewhat within specific groups (e.g., younger, older, early, advanced, DBS, Non-DBS etc.), since some individuals may not have responded to a specific question (e.g., frequency of falls).

Results

There was a statistically significant difference in age and duration of PD between the **DBS group** and **Non-DBS group**, with the **DBS group** being younger and having a longer duration of PD on average. Thus, the data are analyzed separately for age (younger, older) and duration of disease (early, advanced).

Table 1. Demographics and Clinical Features of the Sample

Variable	STN-DBS (N=263)	Non-DBS (N=819)
Average Age in Years * (Range)	65 (40-91)	71 (38-101)
Duration of PD in Years * (Range)	15 (1-44)	7 (0-37)
Average Age of PD Onset * (Range)	50 (20-78)	63 (30-89)
Average Age at Time of DBS in Years (Range)	60 (24-85)	n/a
Average Duration since DBS in Years (Range)	5.4 (0-18)	n/a
Bilateral Stimulation	91%	n/a
Unilateral Stimulation	9%	n/a
Male	62%	57%
Female	38%	43%
Married	76%	76%
Living with Someone	88%	84%
Education: ≤ High School	13%	13%
Some College	22%	24%
College	28%	27%
Graduate/Advanced Degree	37%	36%
Dominant Hand - Right	88%	89%
Left	9%	10%
Ambidextrous	3%	1%
Symptoms First Appeared – Right Side	45%	45%
Left Side	46%	39%
Not Sure	9%	16%

* Denotes significant differences between the groups

FALL RISK RATIO AS IT RELATES TO THE DBS AND NON-DBS GROUPS:

- After taking into account age and disease duration, individuals who have **DBS** have 2.52 times the risk of falling compared to the **Non-DBS group**.

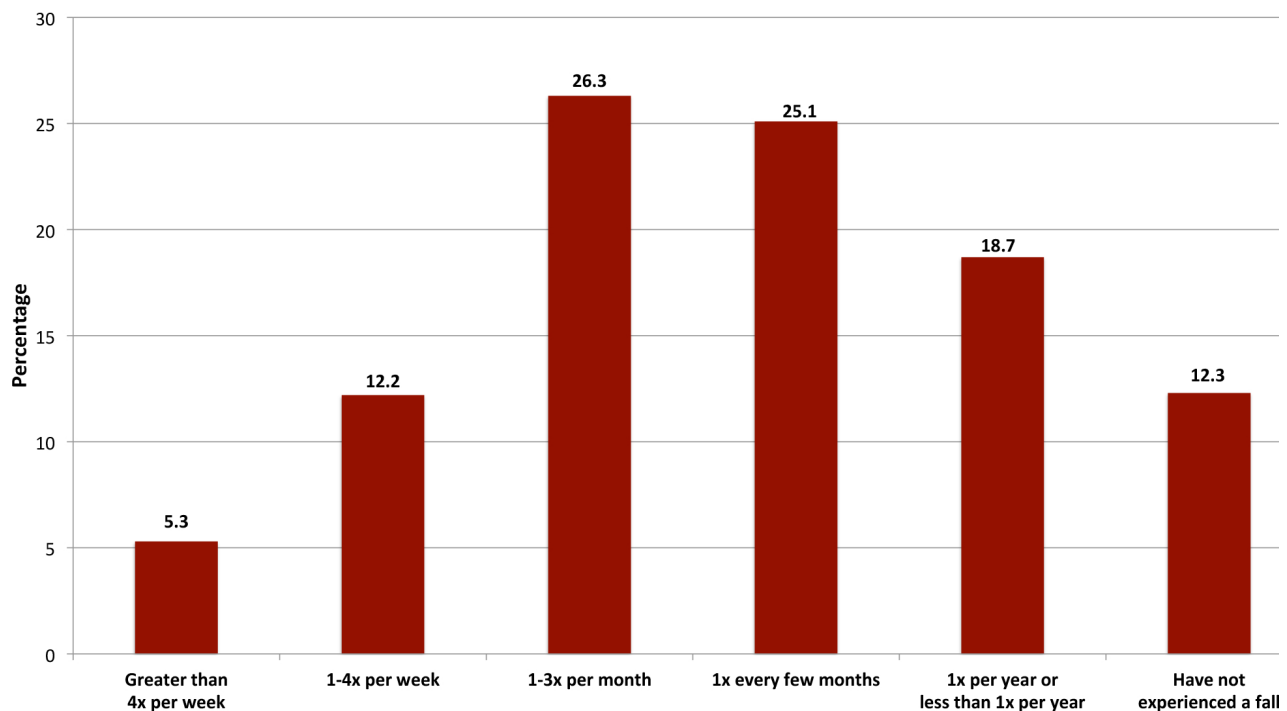
For both the DBS and Non-DBS groups:

- The most commonly reported factor contributing to a participant having a fall was balance problems. Additional factors contributing to falls included fatigue, shuffling gait, freezing, festination (rapid steps), vision problems, difficulties with cognition, elevated levels of depression and anxiety, and decreased arm swing.
- Freezing spells were highly prevalent for the participants in this study, ranging from 42% to 81% within specific groups as noted below.
- Freezing spells most frequently occurred in small spaces, in crowded areas, when getting out of a chair, and when getting out of bed, and to a lesser extent in open spaces, and when starting new tasks.
- The methods reported to be most effective in stopping/breaking the freezing spell include taking “big steps,” shifting body weight, and positive self-talk. Conversely, using tape or laser light beams (e.g., on a cane), attempting to step over an imaginary line, marching, listening to music, or singing were minimally endorsed as helpful.

FALLS AND FEAR OF FALLING FOR THE YOUNGER DBS GROUP (N=173):

- **YOUNGER DBS GROUP** includes participants between 50-69 years of age.
 - 88% of the **Younger DBS group** have a history of at least one fall (see Figure 1).
 - As for frequent, recurrent fallers, 44% of the **Younger DBS group** experienced at least one fall per month.
 - Of those who had a fall, medical attention was required for 30%.
 - 74% of the **Younger DBS group** reported having freezing spells.
 - On the Falls Efficacy Scale, which measures fear of falling, 42% of the **Younger DBS group** reported being “fairly worried” to “very worried” about falling.
 - 76% of the **Younger DBS group** indicated that fear of falling restricts their engagement in activities.

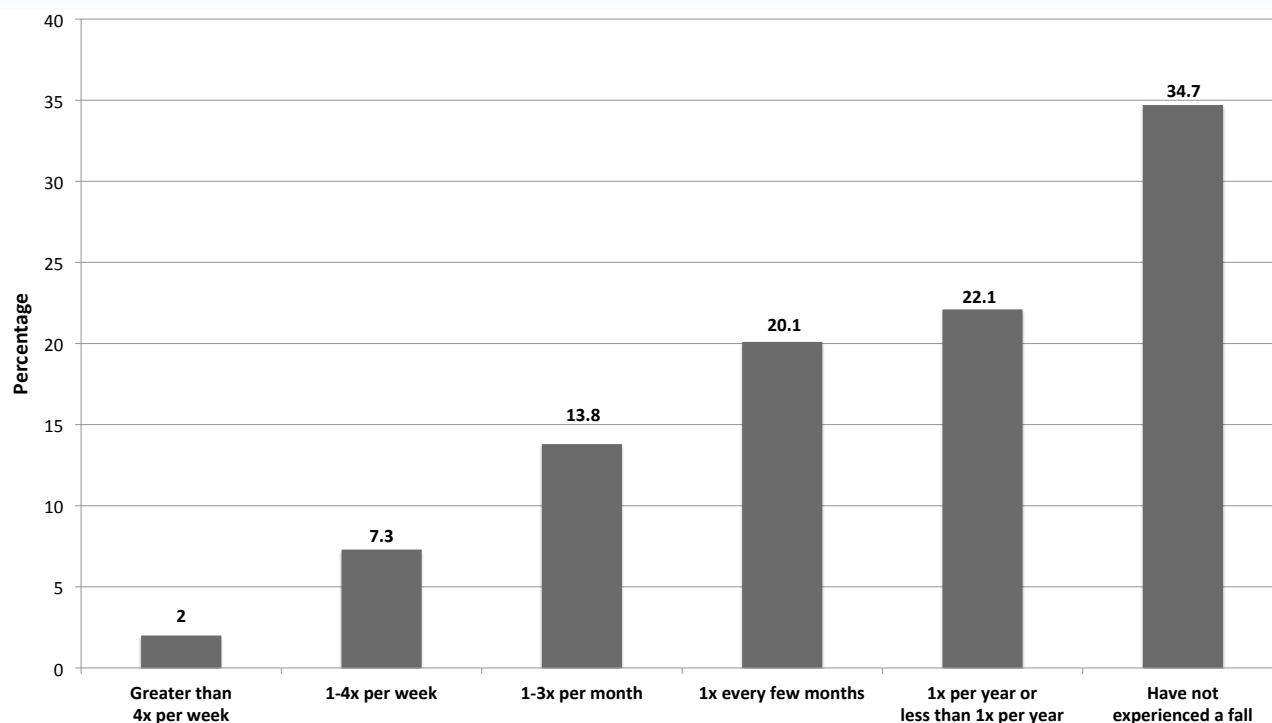
Figure 1. Frequency of Falls in the Younger DBS Group (50-69 Years of Age; N=171)



FALLS AND FEAR OF FALLING FOR THE YOUNGER NON-DBS PD GROUP (N=312):

- **YOUNGER PD GROUP** includes participants between 50-69 years of age.
 - 65% of the **Younger Non-DBS group** have a history of at least one fall (see Figure 2).
 - As for frequent, recurrent fallers, 23% of the **Younger Non-DBS group** experienced at least one fall per month.
 - Of those who had a fall, medical attention was required for 25% of the **Younger Non-DBS group**.
 - 51% of the **Younger Non-DBS group** reported having freezing spells.
 - On the Falls Efficacy Scale, which measures fear of falling, 25% of the **Younger Non-DBS group** was “fairly worried” to “very worried” about falling.
 - 62% **Younger Non-DBS group** indicated that fear of falling restricts their engagement in activities.

Figure 2. Frequency of Falls in the Younger Non-DBS Group (50-69 Years of Age; N=303)



FALLS AND FEAR OF FALLING FOR THE OLDER DBS GROUP (N=80):

- **OLDER DBS GROUP** includes participants who are 70+ years of age.
 - 95% of the **Older DBS group** have a history of at least one fall (see Figure 3).
 - As for frequent, recurrent fallers, 49% of the **Older DBS group** experienced at least one fall per month.
 - Of those who had a fall, medical attention was required for 37% of the **Older DBS group**.
 - 81% of the **Older DBS group** reported having freezing spells.
 - On the Falls Efficacy Scale, which measures fear of falling, 55% of the **Older DBS group** was “fairly worried” to “very worried” about falling.
 - 86% of the **Older DBS group** indicated that fear of falling restricts their engagement in activities.

FALLS AND FEAR OF FALLING FOR THE OLDER NON-DBS PD GROUP (N=485):

- **OLDER PD GROUP** includes participants who are 70+ years of age.
 - 73% of the **Older Non-DBS group** have a history of at least one fall (see Figure 4).
 - As for frequent, recurrent fallers, 23% of the **Older Non-DBS group** experienced at least one fall per month.
 - Of those who had a fall, medical attention was required for 34% of the **Older Non-DBS group**.
 - 57% of the **Older Non-DBS group** reported having freezing spells.
 - On the Falls Efficacy Scale, which measures fear of falling, 29% of the **Older Non-DBS group** was “fairly worried” to “very worried” about falling.
 - 65% of the **Older Non-DBS group** indicated that fear of falling restricts their engagement in activities.

Figure 3. Frequency of Falls in the Older DBS Group (70+ Years of Age; N=76)

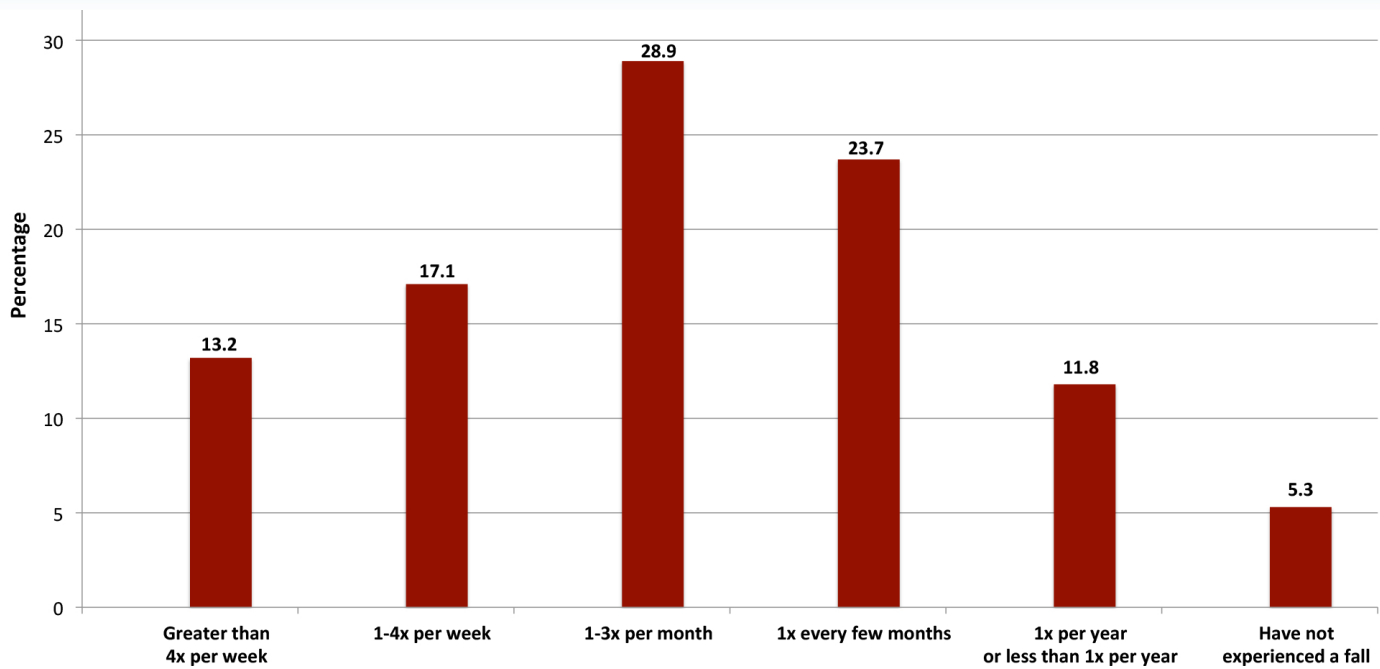
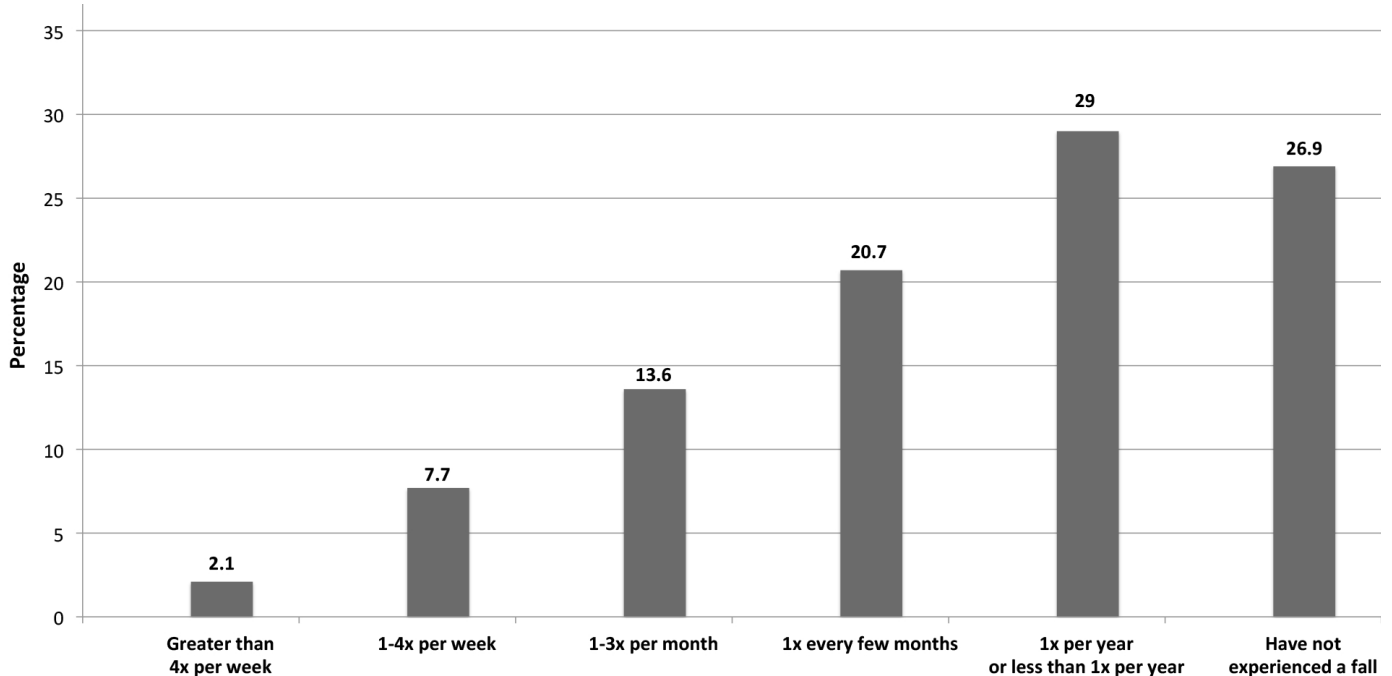


Figure 4: Frequency of Falls in the Older Non-DBS Older Group (70+ Years of Age; N=469)



FALLS AND FEAR OF FALLING AS IT RELATES TO EARLY VERSUS ADVANCED PD:

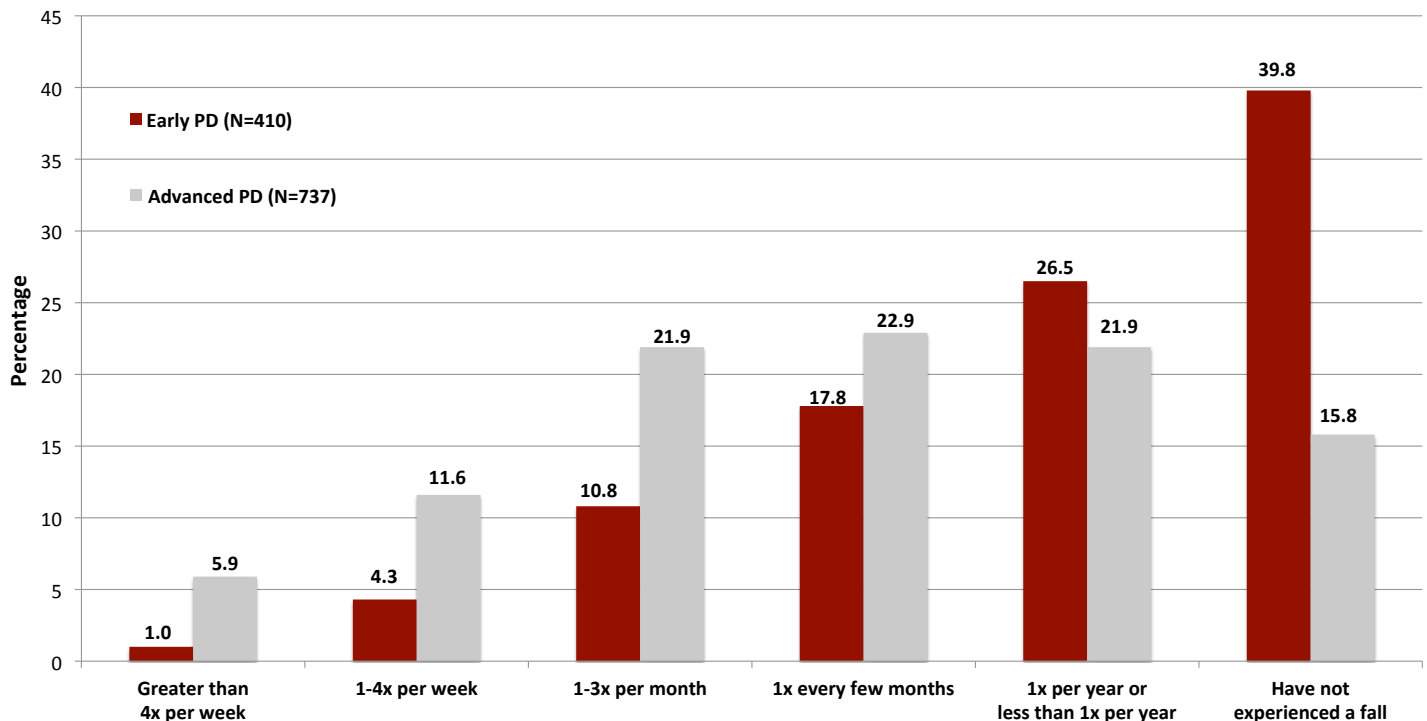
The participants in this study were divided into the groups **Early** versus **Advanced PD**, <6 years and 6+ years, respectively, to define a valid partition between early and advanced disease states.

- **Early PD Group** includes participants who have had PD for less than 6 years (**Early PD Group: N=410**)
- **Advanced PD Group** includes participants who have had PD for 6 years or more (**Advanced PD Group: N=737**)

Early and Advanced PD Groups:

- The **Advanced PD group** had significantly greater frequency of falls than the **Early PD group** (see Figure 3).
 - 84% of the **Advanced PD group** and 60% of the **Early group** have a history of at least one fall.
 - As for frequent, recurrent fallers, 39% of the **Advanced PD group** and 16% of the **Early PD group** experience at least one fall per month.
 - Of those who had a fall, medical attention was required for 34% **Advanced PD group** and 26% of the **Early PD group**.
- A significantly greater percentage of participants in the **Advanced PD group** (72%) reported having freezing spells when compared to the **Early PD group** (42%).
 - For the **Advanced PD Group**, freezing spells most frequently occurred in small spaces (41%), when getting out of a chair (37%), in crowded areas (35%), and when getting out of bed (28%), and to a lesser extent when starting new tasks (12%) and being in open spaces (8%).
 - For the **Early PD group**, freezing spells most frequently occurred when getting out of a chair (28%), in small spaces (21%), when getting out of bed (17%), and in crowded areas (15%), and to a lesser extent when starting new tasks (11%) and being in open spaces (4%).
- On the Falls Efficacy Scale, which measures fear of falling, a significant greater number of individuals in the **Advanced PD group** were “fairly worried” to “very worried” about falling as compared to the **Early PD group** (**Advanced PD group**=39%; **Early PD group**=20%).
- 72% of the **Advanced PD group** and 61% **Early PD group** indicated that fear of falling restricts their engagement in activities.

Figure 5: Frequency of Falls in the Early PD group and Advanced PD group



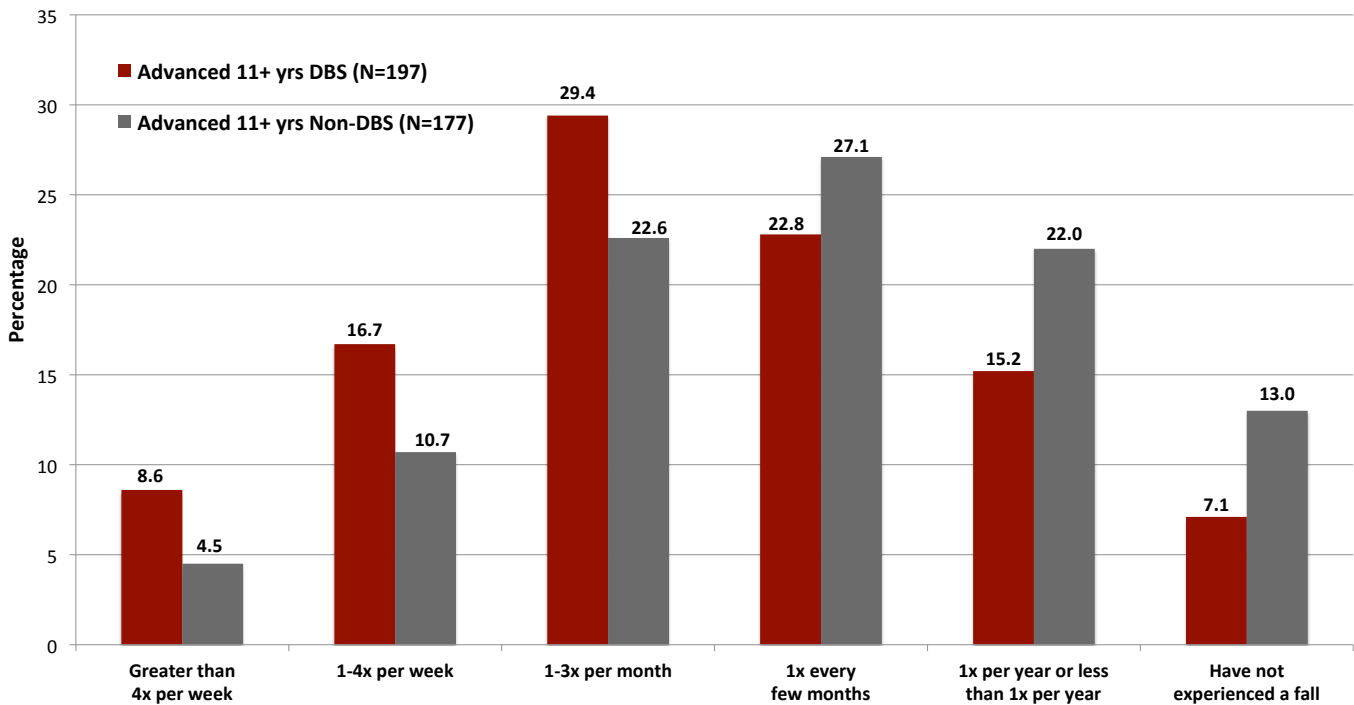
FALLS AND FEAR OF FALLING FOR DBS AND NON-DBS GROUPS AS IT RELATES TO DISEASE DURATION:

Individuals with PD are typically not considered a candidate for **DBS** until they have had PD for at least five years¹⁸. This sample has few **DBS** participants with PD for five years or less. Consequently, analyses comparing **DBS** versus **Non-DBS** participants in the **Early PD group** were not conducted. The majority of **STN-DBS** participants have had PD for at least 11 years. Thus, to examine the impact of disease duration on falls and fear of falling as it relates to **DBS** and **Non-DBS** groups, the group of individuals with PD for 11 or more years (**Advanced PD 11+ years**) was analyzed.

DBS and Non-DBS Groups in ADVANCED PD 11+ Years Group (DBS: N=197, Non-DBS: N=177):

- Falls were highly prevalent for **DBS** and **Non-DBS** participants who are in the **Advanced PD 11+ years group**. In the **Advanced PD 11+ years group**, the **DBS group** had significantly greater frequency of falls than the **Non-DBS group** (see Figure 6).
 - 93% of the **Advanced PD 11+ years DBS group** and 87% of the **Advanced PD 11+ years Non-DBS group** have a history of at least one fall.
 - As for frequent, recurrent fallers, 55% of the **DBS group** and 38% of the **Non-DBS group** experienced at least one fall per month.
- Of those who had a fall, medical attention was required for 33% of the **DBS group** and 35% **Non-DBS group**.
- 81% of the **DBS group** and 74% of the **Non-DBS group** reported having freezing spells.
 - For the **DBS group**, freezing spells most frequently occurred in small spaces (53%), in crowded areas (47%), when getting out of a chair (38%), and when getting out of bed (23%), and to a lesser extent in open spaces (10%), and when starting new tasks (9%).
 - For the **Non-DBS group**, freezing spells most frequently occurred in small spaces (40%), when getting out of a chair (36%), in crowded areas (33%), and when getting out of bed (31%), and to a lesser extent when starting new tasks (14%) and in open spaces (10%).
 - The methods reported to be most effective in stopping/breaking the freezing spell include taking “big steps,” shifting body weight, and positive self-talk. Conversely, using tape or laser light beams (e.g., on a cane), attempting to step over an imaginary line, marching, listening to music, or singing were minimally endorsed as helpful.
- Responses to the Falls Efficacy Scale, which measures fear of falling, revealed a significant difference between the **DBS group** and the **Non-DBS group**, with the **DBS group** having higher ratings of fear of falling.
 - A significant greater number of individuals in the **DBS group** were “fairly worried” to “very worried” about falling as compared to the **Non-DBS group** (**DBS group**=50%; **Non-DBS group**=36%).
- 83% of the **DBS group** and 69% **Non-DBS group** indicated that fear of falling restricts their engagement in activities.

Figure 6. Frequency of Falls in the DBS and Non-DBS Advanced 11+ Years Group



USE OF ASSISTIVE DEVICES FOR DBS AND NON-DBS ADVANCED PD GROUP 11 + YRS

- A large percentage of the **DBS** and **Non-DBS groups** use assistive devices (see Table 2).
- The percentage of individuals within the **DBS group** and the **Non-DBS groups** were generally comparable.
- Not surprisingly, there was a significant relationship between falls and fear of falling for those participants who used a cane or walker, but not a wheelchair or electric scooter. The individuals who use a cane or walker were more likely to experience a fall and experienced greater fear of falling than those who used a wheelchair or scooter.

Table 2. Percentage of Individuals in the Advanced PD Group 11 + Years who Use of Assistive Devices

Use of Assistive Devices	Advanced PD	
	DBS	Group 11+yrs Non-DBS
Cane?	(n=77)	(n=68)
Always	26%	29%
Sometimes	43%	40%
Rarely	18%	22%
Never	13%	9%
Walker?	(n=96)	(n=80)
Always	25%	30%
Sometimes	52%	49%
Rarely	18%	9%
Never	5%	13%

Wheelchair?	(n=63)	(n=60)
Always	16%	23%
Sometimes	41%	25%
Rarely	22%	25%
Never	21%	27%
Electric scooter?	(n=51)	(n=39)
Always	4%	10%
Sometimes	28%	15%
Rarely	22%	15%
Never	47%	59%

FALLS, FEAR OF FALLING, AND HEALTH-RELATED QUALITY OF LIFE (PDQ-8):

- There was a significant difference between the **DBS group** and the **Non-DBS group** as it relates to some health-related quality of life domains. Specifically, after taking into account age and disease duration, the **DBS group** reported greater difficulties with Mobility, Speech, and Stigma (felt embarrassed in public due to having PD) when compared to the **Non-DBS group** (see Table 3).
- Of all health-related quality of life domains (see Table 3), Mobility and Activities of Daily Living had the strongest relationship to falls and fear of falling for both the **DBS** and **Non-DBS group**.
- The greater difficulty an individual has with Mobility and completion of Activities of Daily Living, the greater number of falls and greater report of fear of falling for both the **DBS** and **Non-DBS group**.

Table 3. Parkinson's Disease Questionnaire-8: Health Related Quality of Life for the DBS and Non-DBS Groups

Domain	DBS (N=263)	Non-DBS (N= 810)
* Mobility		
No difficulty	17%	39%
Occasional or some difficulty	54%	47%
Often or always having difficulty	28%	14%
Activities of Daily Living		
No difficulty	36%	43%
Occasional or some difficulty	52%	43%
Often or always having difficulty	12%	13%
Depression		
No Depression	28%	33%
Occasional to sometimes experiencing depression	58%	56%
Often or always experiencing depression	14%	11%
Social Support		
No difficulties with social support	34%	49%
Occasional to sometimes experiencing a lack of support	52%	43%
Often or always experiencing a lack of support	14%	8%

Cognition		
No difficulty	30%	36%
Occasional or some difficulty	61%	53%
Often or always having difficulty	9%	11%
* Speech		
No difficulty	10%	31%
Occasional or some difficulty	55%	53%
Often or always having difficulty	35%	16%
Pain		
No pain	27%	31%
Occasional or some pain	52%	53%
Often or always having pain	21%	16%
* Stigma		
No feelings of stigma	31%	48%
Occasional or sometimes feeling stigma due to PD	53%	44%
Often or always feeling stigma due to PD	16%	8%
* Statistically significant difference between the DBS and Non-DBS groups		

DBS SPECIFIC QUESTIONS:

Even though individuals with DBS may experience a high rate of falls, individuals who have DBS therapy report satisfaction with the effectiveness of the device, and indicate that DBS has improved quality of life.

- How satisfied was the patient with the effectiveness of DBS?
 - 81% satisfied with DBS
 - 39% Completely satisfied
 - 42% Somewhat satisfied
 - 3% Indifferent/Neutral
 - 9% Somewhat dissatisfied
 - 7% Completely dissatisfied

- To what extent was quality of life improved by DBS?
 - 97% indicated that DBS has improved quality of life
 - 58% indicated “extreme” improvement
 - 39% indicated “mild” to “moderate” improvement
 - 3% indicated “not at all”

Summary and Discussion

Falls in Parkinson's disease (PD) are highly prevalent. The experience of increased occurrence of falls for individuals with PD particularly as it relates to the impact of DBS on falls, continues to be investigated. Given that falls are a substantial problem for people with PD with health, social and psychological implications, further research on falls and related factors within specific cohorts of individuals with PD (Age: Younger and Older; Disease Duration: Early and Advanced PD; DBS and Non-DBS groups) is warranted.

Take home points from this study:

- Falls are highly prevalent for individuals with PD for both individuals with and without DBS. There is a considerable number of frequent, recurrent fallers (as defined by one or more falls per month):
 - 44% of the **Younger DBS group**
 - 23% of the **Younger Non-DBS group**
 - 49% of the **Older DBS group**
 - 23% of the **Older Non-DBS group**
 - 39% of the **Advanced PD group**
 - 16% of the **Early PD group**
 - 55% of the **Advanced PD 11+ years DBS group**
 - 38% **Advanced PD 11+ years Non-DBS group**
- Falls increase in frequency as PD progresses. It should be recognized that falls do occur early in the disease course for some individuals.
- The most common factor contributing to falls was balance problems. Other factors contributing to balance problems include shuffling gait, freezing, festination (rapid steps), fatigue, vision problems, difficulties with cognition, elevated levels of depression and anxiety, and decreased arm swing.
- For the **Advanced PD 11+ Years group**, the individuals with **DBS** experienced a greater frequency of falls than the **Non-DBS group**.
- After controlling for age and disease duration, individuals who have **DBS** have 2.52 times the risk of falling compared to individuals with PD who do not have **Non-DBS**.
- Fear of falling is highly prevalent for individuals with PD, and fear of falling was greater in the **DBS group** than the **Non-DBS group**.
- In the large majority of the participants in this study, the fear of falling restricts their engagement in activities.
- On Health-Related Quality of Life domains, the **DBS group** endorsed greater difficulties with mobility, speech, and stigma secondary to PD than the **Non-DBS group**.
- The greater difficulty an individual has with mobility and completion of activities of daily living (routine activities that people tend to do everyday), the greater number of falls and increased fear of falling for both the **DBS** and **Non-DBS group**.
- Use of assistive devices is common for individuals with PD. Not surprisingly, there was a significant relationship between falls and fear of falling for those participants who used a cane or walker, but not a wheelchair or electric scooter. The individuals who use a cane or walker were more likely to experience a fall and experienced greater fear of falling than those who were in a wheelchair or scooter.

- For the **DBS group**, in general, 97% indicated that DBS has improved quality of life, and 81% indicated that they are satisfied with the effectiveness of DBS.

IMPLICATIONS:

- As noted in previous research, falls are highly prevalent in PD (with vulnerability to falls throughout the disease course) and may result in increased medical attention and expense, psychological distress, and restriction in engagement of activities and reduced quality of life^{4, 10-13}. Increased assessment and monitoring of factors that may contribute to falls is indicated.
 - Falls are also the second leading cause of traumatic brain injury¹⁹, which could result in additional neurologic injury, cognitive impairment, and damage to DBS hardware. Thus, fall prevention is particularly important for individuals with PD with and without DBS.
- Fall prevention programs should be discussed regularly and routinely with individuals with PD.
- For individuals with a high fall risk, increased assistance and/or supervision may be required.
- One hypothesis to explain the increased fall rate for individuals with DBS is that they can move better due to the significant benefits resulting from DBS therapy (for example, reduced rigidity, tremor, and/or dyskinesias, etc.), but associated balance reactions, sympathetic nervous system integration mechanisms (mechanisms involved in fight or flight responses), and response times are not addressed (or improved) by DBS. In other words, individuals with DBS therapy may have extra ability to move without functional impairment, but lack the feedback and control to do so safely.
 - Individuals may be more confident or capable to increase engagement in activities due to the reduced motor symptoms, but may neglect to attend to or take into account the continued difficulties related to PD (such as poor balance). Moreover, even though DBS therapy benefits some motor functions, the body/functional capability may still be constrained by other factors that may result in increased falls.
- For individuals who are considering or who are receiving DBS therapy, increased education about and intervention for fall prevention should be incorporated into expectation management protocol and revisited during each follow-up visit with their doctor.
- Since freezing episodes are common, limit functionality, and increase fall risk, addressing techniques to reduce freezing spells and/or to “manage” freezing episodes is indicated.
 - There are common techniques that have been helpful: using “big steps,” shifting body weight, and using positive self-talk.
 - Treatment by a Physical Therapist and/or Occupational Therapist may prove helpful in learning how to manage freezing spells.
- A referral to a Physical Therapist (e.g., when increased balance and/or mobility difficulties become apparent) and/or Occupational Therapist (e.g., when difficulties performing activities of daily living emerge) may also help to reduce falls through physical therapy or occupational therapy techniques and education pertaining to fall prevention.
- Given the high rates of self-reported emotional difficulties and cognitive changes in individuals with PD and their relationship to falls, continued monitoring of and treatment for such symptoms is recommended (e.g., a referral to a neuropsychologist). Such intervention may directly and/or indirectly reduce falls and reduce fear of falling. Specifically, a neuropsychologist can help teach

cognitive strategies to increase general vigilance towards fall risk factors. Additionally, participating in cognitive-behavioral therapy can be provided to reduce symptoms of depression and anxiety that may relate to falls and fear of falling.

- Falls and fear of falling can result in restricting social engagement, which may result in further emotional disturbance, such as depression and/or anxiety. Psychotherapy may help to address the difficulties adjusting to PD and the feelings of isolation, depression, and anxiety.
- Medications and co-morbidities (other medical problems such as hypotension, other bodily injuries, etc.) were not formally assessed in this study. These factors also need to be taken into consideration when assessing fall risk and providing treatment/intervention.

Factors to consider when interpreting the results:

When interpreting the results, this study used a survey-based methodology, which may result in limited generalizability secondary to a bias related to responders and the representation of one DBS target. Furthermore, participants have different surgeons and neurologists, which may result in diverse outcomes and management of symptoms.

Acknowledgements

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