

The Parkinson Alliance Survey Non-Motor Symptoms in Parkinson's Disease

Introduction

Although Parkinson's disease (PD) is diagnosed on the basis of motor symptoms, including slowness of movement, tremor, rigidity and difficulties with balance and walking, it is known that non-motor symptoms are highly prevalent and can even precede the manifestation of motor symptoms^{1,2}. In fact, studies have shown that non-motor symptoms of PD, such as depression, anxiety (such as excessive nervousness), psychosis (e.g., hallucinations; delusions), sleep disturbance and pain may have a greater adverse impact on quality of life (QOL), institutional rates, and health economics than do motor symptoms¹⁻⁹.

Non-motor symptoms can be divided into four domains: neuropsychiatric (e.g., depression, anxiety, apathy, hallucinations, dementia, etc.), autonomic (e.g., constipation, orthostatic hypotension, urinary changes, sweating abnormalities, etc.), sleep (e.g., insomnia, sleep fragmentation, excessive daytime sleepiness, rapid eye movement sleep behavioral disorder, restless leg syndrome, etc.), and sensory dysfunction (e.g., pain, changes in smell and taste, etc.)². Speech disturbance, which is highly prevalent in PD and is known to adversely impact quality of life,^{10,11} is also often considered a non-motor symptom due to the fact that it does not respond well to levodopa; in reality, speech disturbance can result from both motor (e.g., slurred speech) and non-motor dysfunction (e.g., word-finding difficulties).

Research has also found that patients with PD can develop a variety of behavioral problems known as impulse control disorders (ICDs)^{12,13}. ICDs are a group of psychiatric disorders that manifest in the failure to resist an impulse, drive, or temptation to perform an act harmful to either self or others¹⁴. Examples of ICDs include pathological gambling, hypersexuality, repetitive purposeless motor acts not distressing to the patient (called punding), and compulsive shopping and eating¹². Weintraub and colleagues¹² created a questionnaire to investigate and assist in the assessment of ICDs in PD; the questionnaire is entitled the *Questionnaire for Impulsive-Compulsive Disorders in Parkinson's Disease* (QUIP). "Frequencies of the different disorders and behaviors sometime during PD based on the diagnostic interview were: problem or pathological gambling (7.0%), compulsive sexual behavior (8.9%), compulsive buying (6.4%), compulsive eating (4.5%), punding (10.2%), and compulsive medication use (<1.0%)" (page 5).

Deep brain stimulation (DBS) is a well-established treatment for advanced, medication refractory PD. Despite the extensive documentation of the role of DBS in treating motor symptoms of PD, its role in ameliorating non-motor manifestations of the disease is less understood. Borgohain and colleagues (2012) provide a nice summary of the current knowledge on the impact of DBS and dopamine replacement therapy (DRT) on non-motor symptoms¹⁵. They conclude that "bilateral STN-DBS or GPi-DBS [two different targets in the brain where the DBS device is implanted] as well as DRT have significant effects on non-motor symptoms. On comparing DRT with DBS, the latter is more effective in reducing sensory, sleep, gastrointestinal, and urological symptoms. Bilateral STN-DBS or GPi-DBS have varying effects on cognitive, behavioral, and cardiovascular autonomic disturbances, with mild worsening in cognition noted with STN-DBS. STN-DBS may have a beneficial effect on cardiovascular autonomic and some behavioral disorders by decreasing the dopaminergic dose in patients" (page 34).

Demetriades, Rickards, and Cavanna (2011) conducted a literature search to address the effects of DBS on ICDs in patients with PD¹⁶. Data analysis from many studies did not identify a significant difference in ICDs between patients receiving dopaminergic medication and patients on DBS, but they noted that there have been case reports that showed up to 56% of patients undergoing DBS had poor outcomes that resulted in ICDs. They concluded that

the current research data is uncertain about the role of DBS on impulsivity in patients with PD. Moreover, there is evidence to show that DBS is an effective indirect treatment of ICDs, while other studies report worsening or development of ICDs after surgery.

Given the current gap of knowledge regarding the effects of DBS on non-motor symptoms in patients with advanced PD, we devised a survey with the main purpose to examine the prevalence of non-motor symptoms in People with Parkinson's (PWP), particularly as it relates to those who have undergone DBS (**DBS Group**) and those who have not had DBS (**Non-DBS Group**).

Objective

1. To examine the prevalence of non-motor symptoms in People with Parkinson's (PWP), as it relates to those who have undergone DBS (**DBS Group**) and those who have not had DBS (**Non-DBS Group**).
2. To identify the prevalence of symptoms related to ICDs in individuals with PD, and to identify similarities and/or differences in the experience of ICDs between the **DBS Group** and **Non-DBS Group**.
3. To compare and contrast non-motor symptoms and ICDs between a **Younger PD Group** and **Older PD Group**.
4. To compare and contrast non-motor symptoms and ICDs between participants who are earlier in the course of PD (**Early PD Group**) and those who are in more advanced stages of PD (**Advanced PD Group**).

Methods

The participants in this report included 636 individuals, including 217 participants with PD who underwent DBS (**DBS Group**) and 419 individuals with PD without DBS (**Non-DBS Group**). Please see Table 1 for the demographic characteristics of the participants. The participants were recruited from a variety of sources. Individuals were invited to participate in the current survey based on 1) previous survey participation; 2) response to study announcements in medical clinics around the country; 3) participation in local PD support groups advertising the study; or 4) response to survey announcements on The Parkinson Alliance website (www.parkinsonalliance.org) or our affiliate website devoted to DBS (www.dbs-stn.org). The participants either completed a paper-and-pencil survey or an on-line survey, depending on their preference.

Assessment Questionnaires: The participants in this study completed two questionnaires: (1) A questionnaire related to demographic data and non-motor symptoms in PD; and (2) The Questionnaire for Impulsive-Compulsive Disorders in Parkinson's Disease (QUIP).

The Demographic Questionnaire and Questions Related to Non-motor Symptoms: The demographic questionnaire included questions related to background information as well as questions related to a broad range of non-motor symptoms. Specific non-motor symptoms addressed included speech, swallowing, sleep (which included two items: general difficulties with night sleep and daytime somnolence), depression, anxiety, fatigue, apathy, hallucinations, memory, other thinking skills, urination (difficulties with bladder), constipation, smell, taste, light-headedness/dizziness during changes in position (e.g., sitting to standing), and pain. Participants were asked to what extent they currently experience the non-motor symptom: not at all, mild, moderate, or severe.

The Questionnaire for Impulsive-Compulsive Disorders in Parkinson's Disease (QUIP):¹²

The QUIP has 3 sections: Section 1 (5 questions) assesses four impulse control disorders (gambling, sexual behaviors, buying, and eating); Section 2 (5 questions) assesses other compulsive behaviors (punding–repetitive purposeless motor acts not distressing to the patient, hobbyism, and walkabout); and Section 3 (5 questions) assesses compulsive medication use. The version of the QUIP used in this study queries only about active behaviors that have occurred in the last 4 weeks. Cutoff points indicating clinical significance in this study were based on the QUIP validation study by Weintraub, et al.¹²

Definitions for QUIP items:

- Gambling: When the individual with PD believes he or she has an issue with too much gambling or when others think the individual with PD has an issue with too much gambling, such as when one engages in gambling at casinos, internet gambling, or gambling with lotteries, scratch tickets, betting, or slot or poker machines.
- Sex: When the individual with PD believes he or she has an issue with hypersexuality or when others think the individual with PD has an issue with hypersexuality, including any of the following: making sexual demands on others, promiscuity, prostitution, change in sexual orientation, masturbation, internet or telephone sexual activities, or pornography.
- Buying: When the individual with PD believes he or she has an issue with excessive buying or when others think the individual with PD has an issue with excessive buying, such as buying too much of the same thing or buying things that are not needed or used.
- Eating: When the individual with PD believes he or she has an issue with too much eating or when others think the individual with PD has an issue with too much eating, such as eating larger amounts or different types of food than in the past, eating more rapidly than normal, eating until feeling uncomfortably full, or eating when not hungry.
- Punding: When the individual with PD believes he or she engages in excessive repetition of certain simple motor activities or when others think the individual with PD engages in excessive repetition of certain simple motor activities, such as cleaning, tidying, handling, examining, sorting, ordering, or arranging objects.
- Hobbyism: When the individual with PD believes he or she spends too much time engaged in hobbies or other organized activities or when others think the individual with PD spends too much time engaged in hobbies or other organized activities such as writing, painting, gardening, repairing or dismantling things, collecting, using the computer, or working on projects.
- Walkabout: When the individual with PD believes he or she spends too much time engaged in walking or driving with no intended goal or specific purpose or when others think the individual with PD spends too much time engaged in walking or driving with no intended goal or specific purpose.
- Compulsive Medication Use: When the individual with PD believes he or she is exhibiting excessive and uncontrolled use of dopaminergic medications (such as levodopa) or when others think the individual with PD is exhibiting excessive and uncontrolled use of dopaminergic medications.

Results

There was a significant difference in age and duration of PD between the **DBS Group** and **Non-DBS Group**, with the **DBS Group** generally being younger (see Table 1 and Figure 1) and having a longer duration of PD (see Table 1 and Figure 2). For research purposes, the results below took into account age of the participants and duration of PD when running analyses and interpreting the findings.

Table 1. Demographics and Clinical Features of the Sample

Variable	DBS (N=217)	Non-DBS (N=419)
Average Age in Years * (Range)	65 (39-89)	70 (40-93)
Duration of PD in Years * (Range)	16 (2-43)	8 (0-33)
Average Age of PD Onset * (Range)	49 (21-72)	62 (32-87)
Male	61%	59%
Female	39%	41%
Married	75%	75%
Living with Someone	87%	85%
Age at Time of DBS in Years (Range)	60 (27-79)	n/a
Duration since DBS in Years (Range)	5 (0-14)	n/a
DBS Target		
Subthalamic Nucleus (STN)	87%	n/a
Globus Pallidus interna (GPi)	9%	n/a
Thalamus	4%	n/a
Bilateral Stimulation	85%	n/a
Unilateral Stimulation	15%	n/a

* Denotes significant differences between the groups

Figure 1. Age Categories for DBS and Non-DBS Groups

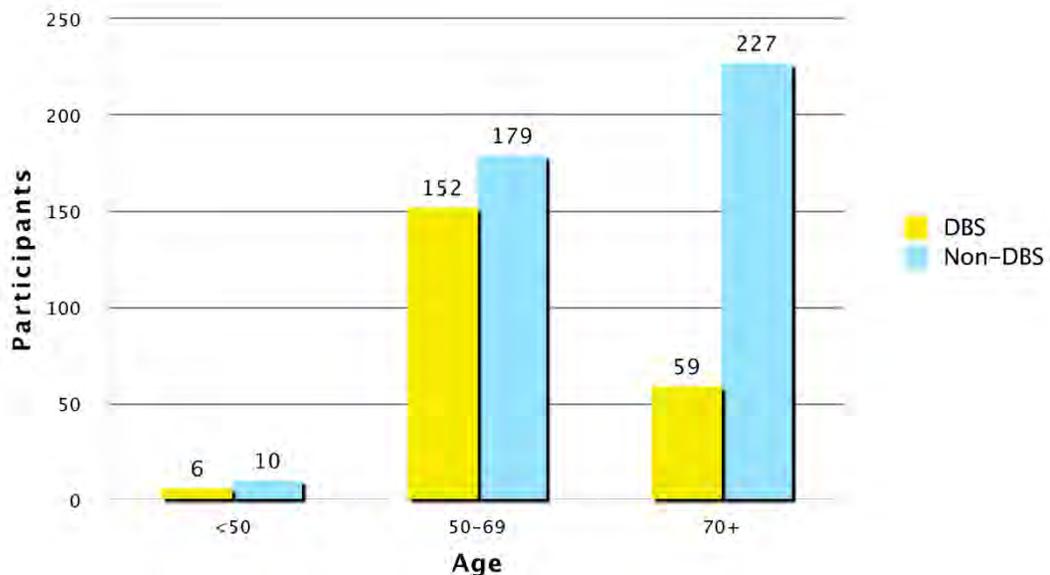
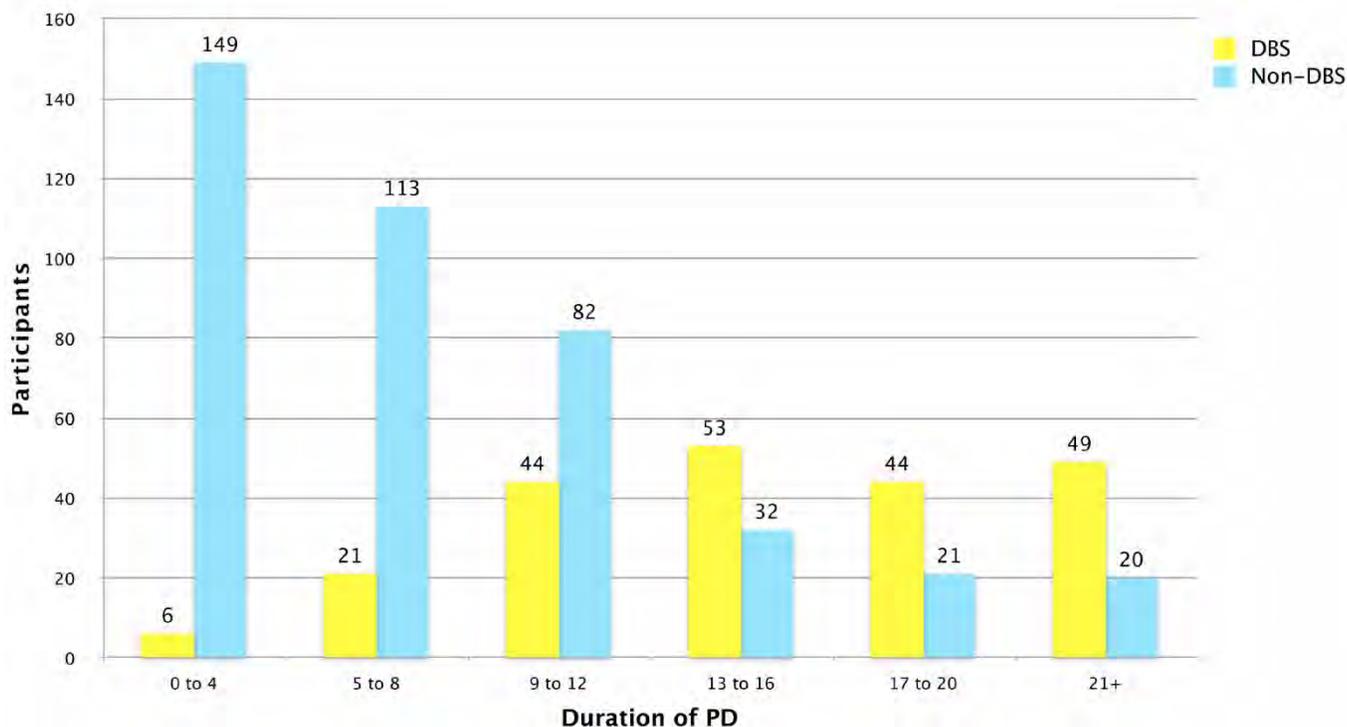


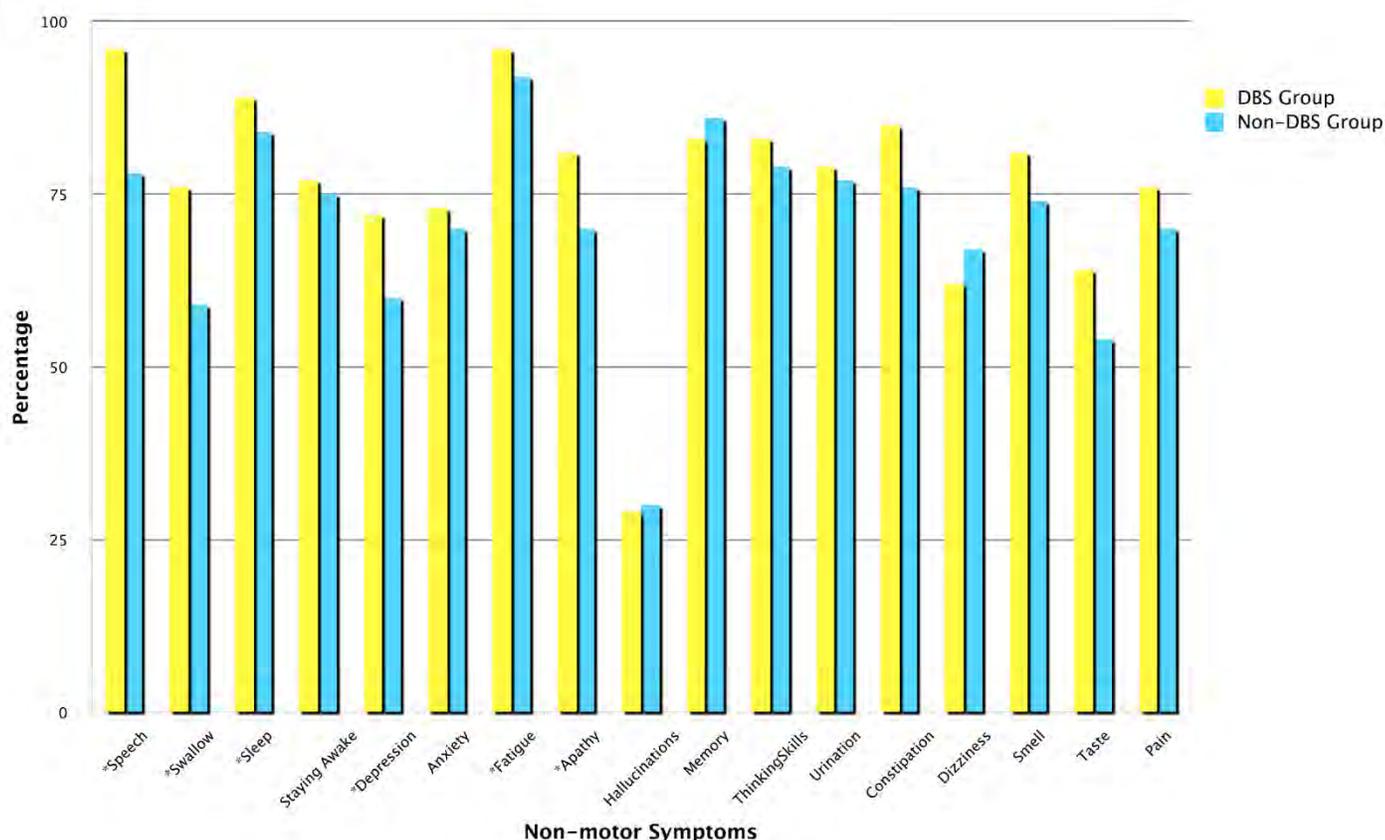
Figure 2. Disease Duration (in Years) for DBS and Non-DBS Groups



Non-Motor Symptoms (Comparing DBS and Non-DBS Groups):

- Non-motor symptoms were highly endorsed by all participants in this study, with 15 out of 16 non-motor symptoms occurring in more than 50% of all participants (See Figure 3). (Notably, “sleep” and [difficulties] “staying awake” were considered one “non-motor symptom” as they both relate to sleep disturbance, hence a reference of 16 items rather than the 17 items noted in Figures 3, 5, and 7.)
- For the **DBS Group**, more than 70% of the participants endorsed 13 out of 16 non-motor symptoms.
- For the **Non-DBS Group**, twelve out of 16 items were endorsed by > 70% of the non-motor symptoms.
- The top three most common symptoms for the **DBS Group** include: speech disturbance (96%), fatigue (96%), and sleep disturbance (89%).
- The top three most common symptoms for the **Non-DBS Group** include: fatigue (92%), difficulties with memory (86%), and sleep disturbance (84%).
- There was a statistically significant difference between the **DBS Group** and **Non-DBS Group** on several non-motor symptoms. The **DBS Group** more frequently endorsed difficulties with speech, swallowing, sleep, depression, fatigue, and apathy when compared to the **Non-DBS Group** (See Figure 3).

Figure 3. Non-motor symptoms endorsed by DBS (N=217) and Non-DBS (N=419) Groups



* Statistically significant difference between the **DBS** and **Non-DBS Groups**

** Note, the symptoms “sleep” and “staying awake” are both sleep disturbances; “staying awake” refers to difficulty staying awake during the day time.

Neuropsychiatric Difficulty (e.g., changes in mood, cognition, and behavior, such as depression, anxiety, memory or other thinking skills, hallucinations, fatigue, and apathy):

- As can be seen in Table 2, although there is a broad range of symptom severity, there is a large percentage of participants who experience moderate to severe neuropsychiatric symptoms.
- Fatigue, which relates to both physical and mental fatigue, is the symptom in this domain that has the highest severity ratings for both the **DBS** and **Non-DBS Groups** (See Table 2).
- As noted in Figure 3, the **DBS Group** more frequently endorsed difficulties with apathy, depression, and fatigue when compared to the **Non-DBS Group**.

Symptom		DBS (N=217)	Non-DBS (N=419)
Fatigue	Mild	37%	39%
	*Moderate to Severe	59%	53%
Apathy	Mild	46%	44%
	*Moderate to Severe	34%	26%

Memory	Mild	54%	55%
	*Moderate to Severe	29%	31%
Thinking Skills (Excluding memory difficulties)	Mild	47%	50%
	Moderate to Severe	35%	29%
Depression	Mild	44%	42%
	*Moderate to Severe	28%	18%
Anxiety	Mild	47%	44%
	Moderate to Severe	26%	26%
Hallucinations	Mild	22%	22%
	Moderate to Severe	7%	8%

* Statistically significant difference between the **DBS** and **Non-DBS Groups**

Autonomic Difficulty:

- As can be seen in Table 3, although there is a broad range of symptom severity, a large percentage of participants experienced moderate to severe autonomic disturbance.
- Constipation is the symptom in this domain that has the highest severity ratings for both the **DBS** and **Non-DBS Groups** (See Table 3).

Table 3. Percentage of individuals endorsing and severity classification of autonomic symptoms for the DBS and Non-DBS Groups

Variable		DBS (N=217)	Non-DBS (N=419)
Urination	Mild	39%	36%
	Moderate to Severe	40%	41%
Constipation	Mild	38%	34%
	Moderate to Severe	46%	42%
*Dizziness	Mild	40%	45%
	Moderate to Severe	22%	22%

*Dizziness was defined as experiencing dizziness, lightheadedness, and significant weakness during transitions, such as transitioning between sitting and standing or lying down and sitting up

Sensory Difficulty (e.g., smell, taste, pain):

- As can be seen in Table 4, although there is a broad range of symptom severity, there is a large percentage of participants who experience moderate to severe sensory disturbance.
- Smell is the symptom in this domain that has the highest severity ratings for both the **DBS** and **Non-DBS Groups** (See Table 4).

Table 4. Percentage of individuals endorsing and severity classification of sensory changes for the DBS and Non-DBS Groups

Variable		DBS (N=217)	Non-DBS (N=419)
Taste	Mild	44%	30%
	Moderate to Severe	20%	24%
Smell	Mild	24%	23%
	Moderate to Severe	56%	51%
Pain	Mild	41%	37%
	Moderate to Severe	35%	33%

Speech, Swallowing, and Sleep Difficulty:

- As can be seen in Table 5, although there is a broad range of symptom severity, a large percentage of participants experienced moderate to severe disturbance with speech, swallowing, and sleep.
- Sleep has the highest severity ratings for both the **DBS** and **Non-DBS Groups** (See Table 5).
- As noted in Figure 3, when compared to the **Non-DBS Group**, the **DBS Group** more frequently endorsed difficulties with speech, swallowing, and sleep.

Table 5. Percentage of individuals endorsing and severity classification of changes in speech, swallowing, and sleep for the DBS and Non-DBS Groups

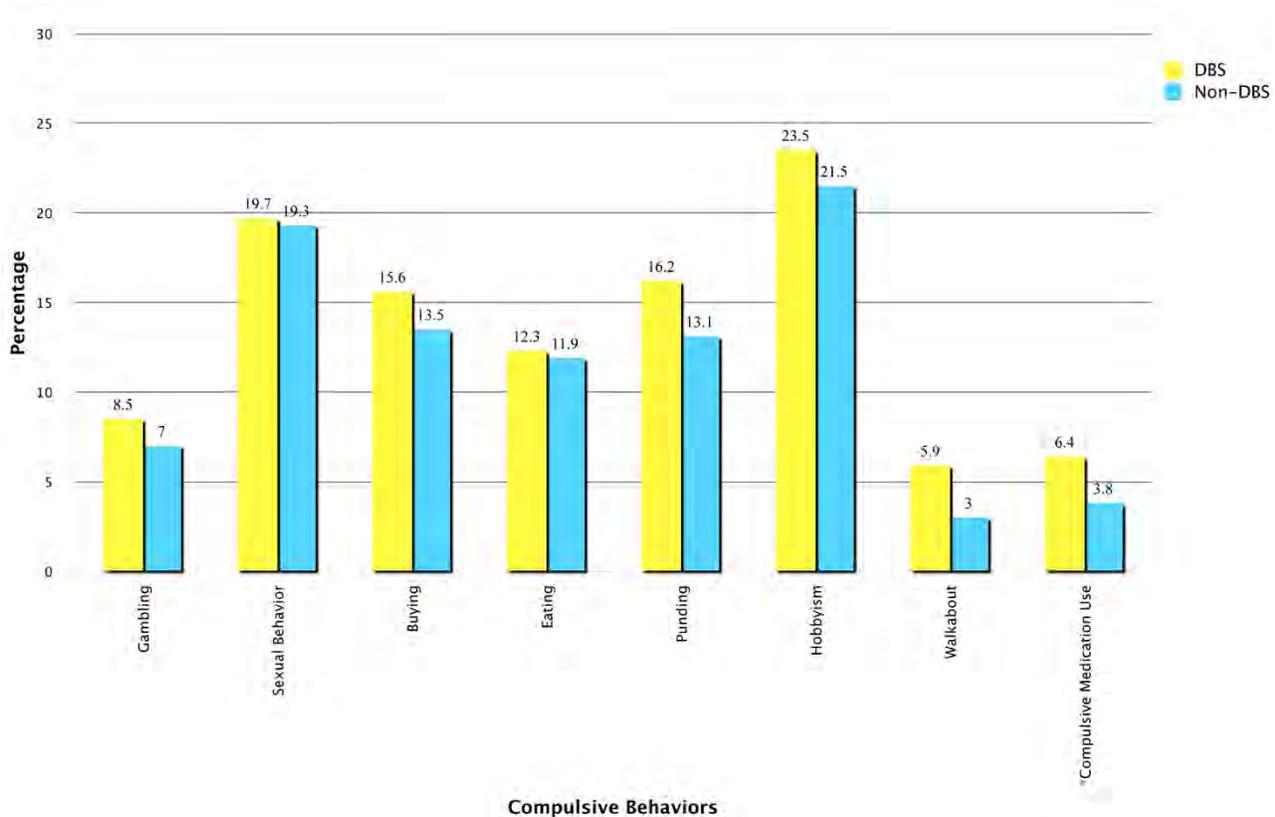
Variable		DBS (N=217)	Non-DBS (N=419)
Speech	Mild	36%	47%
	*Moderate to Severe	60%	31%
Swallowing	Mild	46%	42%
	*Moderate to Severe	30%	17%
Sleep (in general)	Mild	28%	31%
	*Moderate to Severe	61%	53%
Difficulty staying awake	Mild	48%	47%
	Moderate to Severe	30%	28%

* Statistically significant difference between the **DBS** and **Non-DBS Groups**

Impulse Control Disorders (ICDs) for DBS and Non-DBS Groups:

- As can be seen in Figure 4, a relatively large percentage of participants experienced behavioral problems associated with ICDs.
- Hobbyism and hypersexuality were the most frequently endorsed items on the QUIP for the **DBS** and **Non-DBS Groups** (See Figure 4).
- There was a statistically significant difference between the **DBS Group** and **Non-DBS Group** as it relates to compulsive medication use. The **DBS Group** more frequently endorsed items in this domain when compared to the **Non-DBS Group**. Otherwise, there were no significant differences between these two groups on other compulsive behaviors.

Figure 4. Compulsive behaviors endorsed by DBS (N=204) and Non-DBS (N=396) Groups



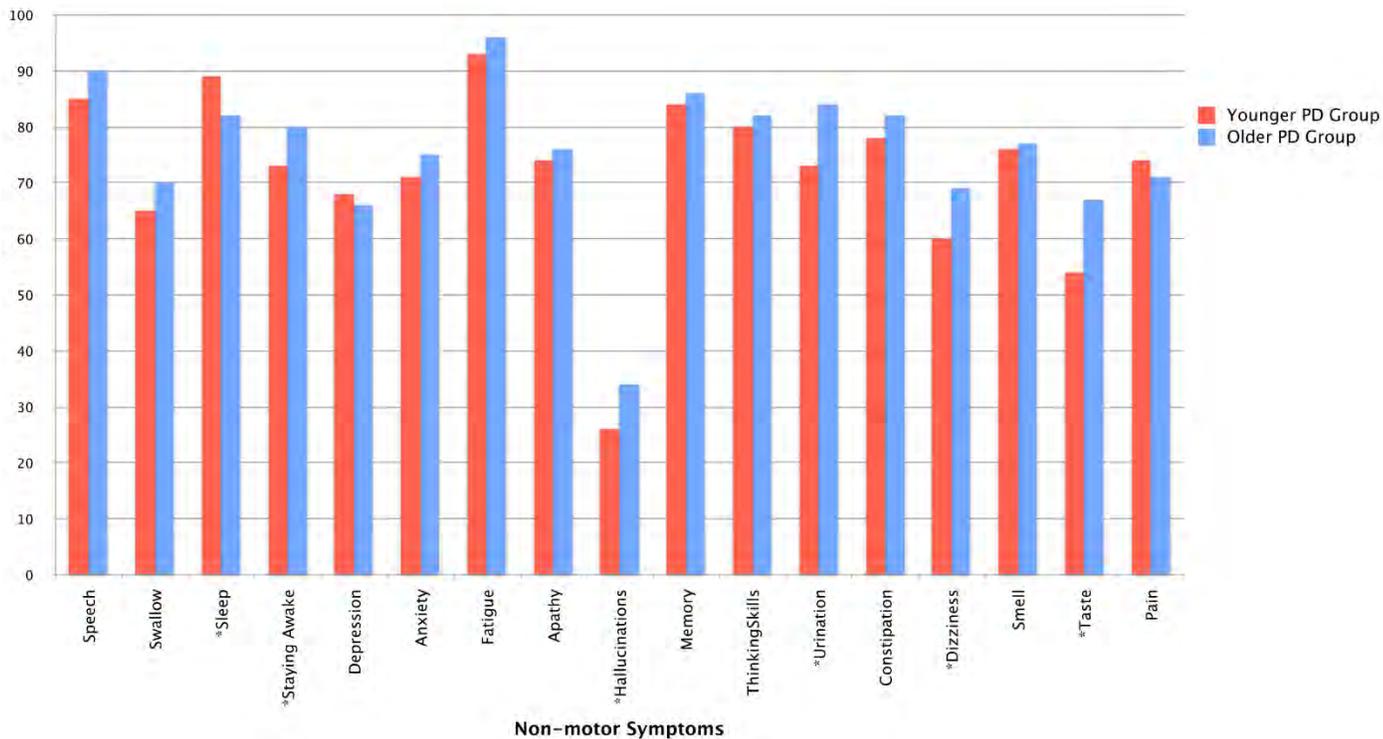
* Statistically significant difference between the **DBS** and **Non-DBS** Groups

Younger Versus Older PD Groups:

To look closer at the influence of age as it relates to non-motor symptoms, the participants were divided into a “**Younger PD Group**” and an “**Older PD Group**,” 50 to 69 years and 70 years and older, respectively.

- The top three most common symptoms for the **Younger PD Group** include: fatigue (93%), sleep disturbance (89%), and speech disturbance (85%; See Figure 5).
- As can be seen in Figure 5, the top three most common symptoms for the **Older PD Group** include: fatigue (96%), speech disturbance (90%), and difficulties with memory (86%).
- There was a statistically significant difference between the **Younger PD Group** and **Older PD Group** on the following non-motor symptoms: difficulties with sleep, difficulties staying awake during the day, hallucinations, urination, taste, and dizziness (See Figure 5); the **Older PD Group** endorsed these symptoms more frequently, with exception to general sleep difficulties, which the **Younger PD Group** had endorsed this item in greater frequency.

Figure 5. Non-motor symptoms endorsed by Younger (N=331) and Older (N=286) PD Groups

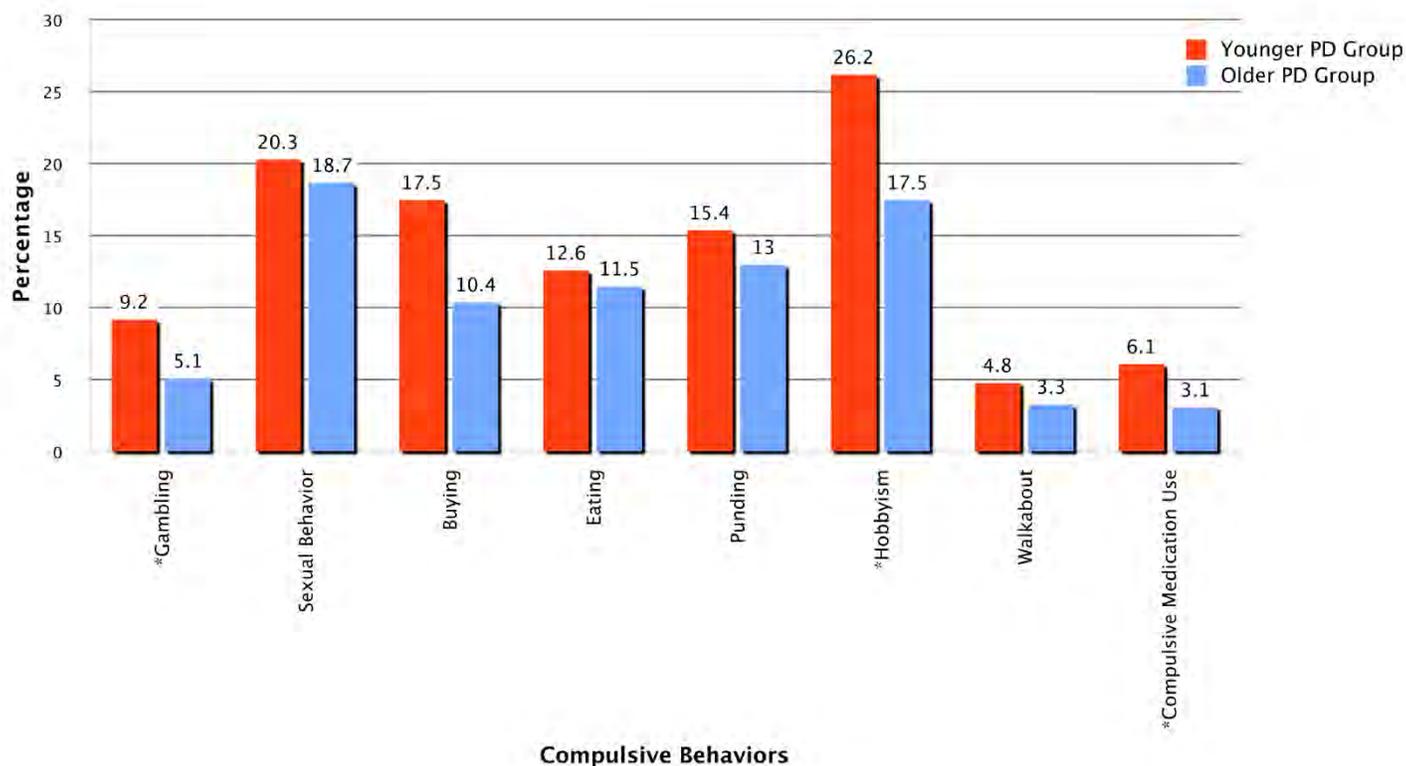


* Statistically significant difference between the Younger and Older PD Groups

Impulse Control Disorders For Younger And Older PD Groups:

- As can be seen in Figure 6, a relatively large percentage of participants experienced behavioral problems associated with impulse control disorders.
- Hobbyism and hypersexuality were the most frequently endorsed items on the QUIP for the Younger and Older PD Groups (See Figure 6).
- There was a statistically significant difference between the Younger PD Group and Older PD Group as it relates to gambling, hobbyism, and compulsive medication use. When compared to the Older PD Group, the Younger PD Group more frequently endorsed items in these domains.

Figure 6. Compulsive behaviors endorsed by Younger (N=332) and Older (N=279) PD Groups



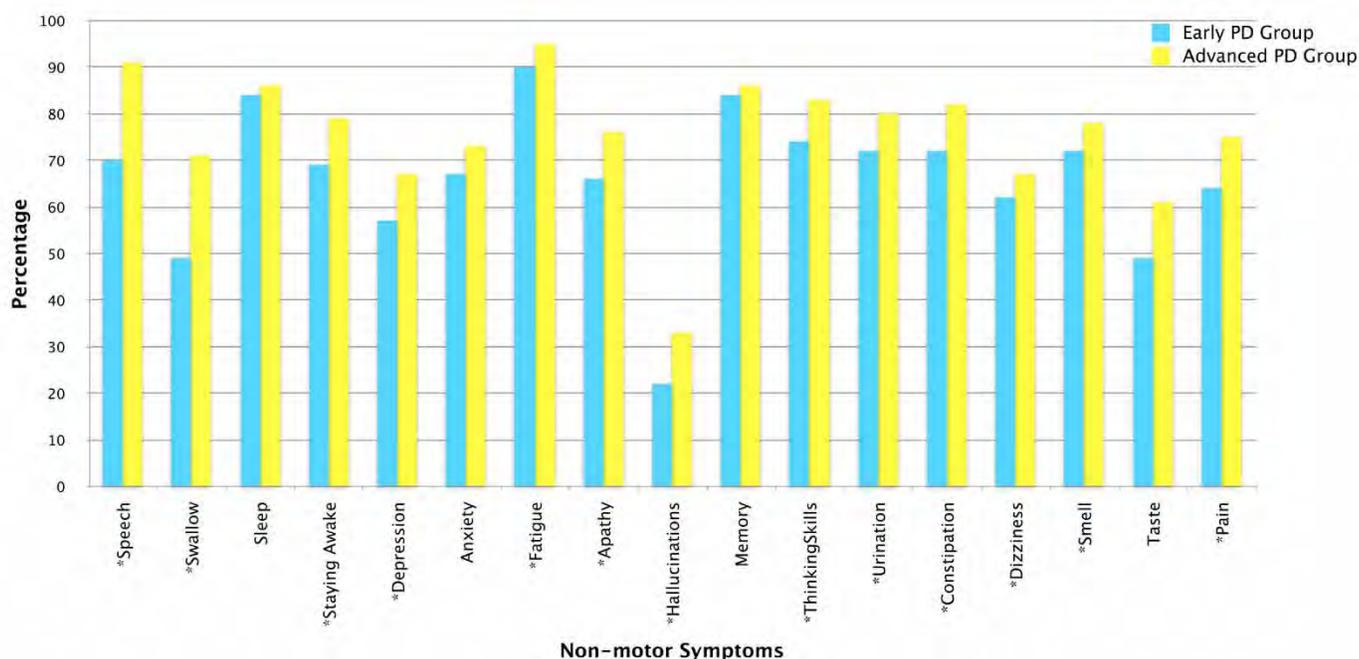
* Statistically significant difference between the **Younger** and **Older PD Groups**

Early Versus Advanced PD:

To look closer at the influence of disease duration on non-motor symptoms, the participants in this study were divided into the groups “**Early PD Group**” and “**Advanced PD Group.**” Previous research has found that in PD the average time from symptom onset to development of motor complications was 6 years^{17,18}. Based on previous research, 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^{17,18}.

- The top three most frequently endorsed symptoms for the **Early PD Group** include: fatigue (90%), sleep disturbance (84%), and memory disturbance (84%; See Figure 7).
- The top four most frequently endorsed symptoms for the **Advanced PD Group** include: fatigue (95%), speech disturbance (91%), sleep disturbance (86%), and difficulties with memory (86%).
- There was a statistically significant difference between the **Early PD Group** and **Advanced PD Group** on 13 of the 16 non-motor symptoms, including speech disturbance, swallowing, difficulty staying awake, depression, fatigue, apathy, hallucinations, thinking skills, urination, constipation, dizziness, smell, and pain (See Figure 7); the **Advanced PD Group** endorsed these symptoms more frequently than the **Early PD Group**.

Figure 7. Non-motor symptoms endorsed by Early (N=188) and Advanced (N=448) PD Groups

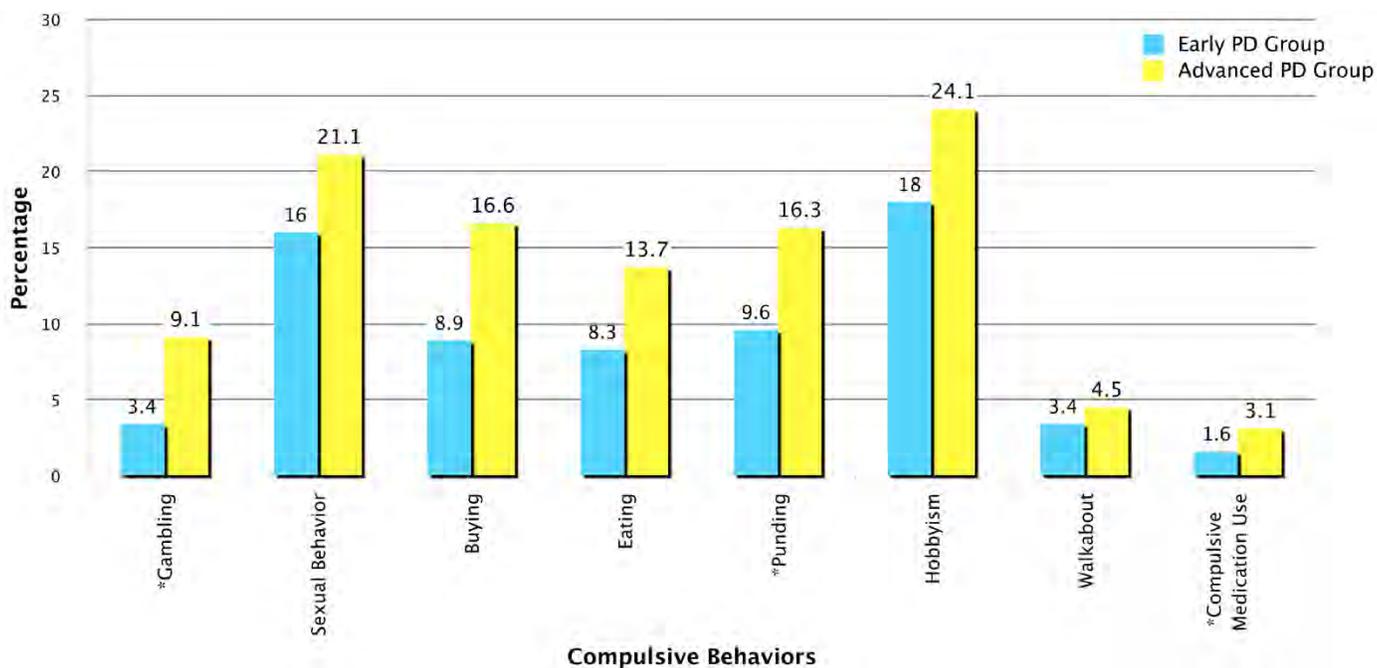


* Statistically significant difference between the **Early** and **Advanced PD Groups**

Impulse Control Disorders (ICDs) for Early (N=181) and Advanced (N=441) PD Groups:

- Hobbyism and hypersexuality were the most frequently endorsed items on the QUIP for the **Early** and **Advanced PD Groups** (See Figure 8).
- There was a statistically significant difference between the **Early PD Group** and **Advanced PD Group** in the domains of gambling, punning, and compulsive medication use; the **Advanced PD Group** more frequently endorsed these respective behaviors.

Figure 8. Compulsive behaviors endorsed by Early (N=181) and Advanced (N=441) PD Groups



* Statistically significant difference between the **Early** and **Advanced PD Groups**

Mental Health Treatments:

- Thirty-five percent of participants in this study participated in treatment with a mental health professional at some point in the past, and 16% are currently participating in treatment with a mental health professional.
- Table 6 provides the specific disciplines of mental health providers by whom some of the participants have been treated.

Table 6. Participants who have had or are currently receiving Mental Health Treatment		
Variable	Previous Treatment (N=639)	Current Treatment (N=639)
Treatment by a mental health professional	35%	16%
Psychiatrist	18%	7%
Psychologist/Neuropsychologist	18%	6%
Counselor	8%	3%
Social Worker (for counseling)	9%	3%

Expectations and DBS:

- 83% of the participants who have undergone DBS stated that the effectiveness of DBS has met their expectations (N=206).
- 92% of the participants reported that they would undergo the procedure again (N=207). This finding implies that even for a few individuals whose expectations were not met, they would still undergo the procedure again.
- For those whose expectations were not met, the reasons included:
 - Not having any benefit from DBS (4 participants).
 - Having minimal benefit from DBS (8 participants).
 - Having adverse side effects that lead to an undesirable outcome (4 participants).
 - The procedure is too complicated (3 participants)
 - Difficulties accessing follow-up treatment (5 participants)
 - There were no participants who indicated that they would not receive DBS therapy again due to the procedure taking too much time.

Summary and Conclusions

Non-motor symptoms, including difficulties with symptoms related to neuropsychiatric, autonomic, sensory, sleep, and speech functions, are highly prevalent in PD, and some non-motor symptoms may precede the manifestation of motor symptoms^{1,2}. Studies have shown that non-motor symptoms of PD, such as depression, anxiety, psychosis, sleep disturbance, and pain, may have a greater adverse impact on quality of life (QOL) than motor symptoms^{1,6-9}. The results of this study investigating non-motor symptoms in individuals with and without DBS are discussed below in the context of the main objectives of this report.

1. We examined the prevalence of non-motor symptoms in People with Parkinson's (PWP), particularly as it relates to those who have undergone DBS (**DBS Group**) and those who have not had DBS (**Non-DBS Group**).
 - Non-motor symptoms, including neuropsychiatric disturbance, autonomic dysfunction, sensory disturbance, and difficulties with sleep and speech, were highly prevalent in the participants in this study, with greater than 50% of the participants endorsing 15 out of 16 non-motor symptoms. Additionally, a significant number of the participants characterized the severity of their non-motor symptoms as moderate to severe.
 - A few of the most frequently endorsed non-motor symptoms by the **DBS** and **Non-DBS Groups** included sleep

disturbance, fatigue, speech disturbance, difficulties with urination and constipation, and difficulties with memory and other thinking skills.

- There was a statistically significant difference between the **DBS** and **Non-DBS Groups** on several non-motor symptoms. Specifically, the **DBS Group** more frequently endorsed difficulties with speech, swallowing, sleep, depression, fatigue, and apathy when compared to the **Non-DBS Group**.
 - Although there are mixed findings in the literature regarding the impact of DBS on some non-motor symptoms (from no difference between the **DBS** and **Non-DBS Groups** to DBS having either favorable outcomes or adverse outcomes¹⁵⁻¹⁸), there is inarguably enough evidence to warrant further attention to non-motor symptoms in PD in general and to the impact of DBS on specific non-motor symptoms, such as neuropsychiatric symptoms and sleep, speech and swallowing.
 - These results highlight the importance of using a multi-disciplinary treatment approach to patient care to help facilitate optimal management of non-motor symptoms in general and to ensure good candidacy for DBS intervention.
 - Coping with and adjusting to the complexity of motor and non-motor symptoms for PD can be quite challenging, for both the individuals with PD and those who share their lives. Even with the high percentage of psychological/ neuropsychiatric disturbance in PD (e.g., depression, anxiety, hallucinations, fatigue, apathy, changes in memory and thinking skills, etc.), there is a low percentage of individuals who are receiving services from mental health professionals. Moreover, even with a high prevalence of non-motor symptoms that are known to impact quality of life, mental health treatment that can assist individuals (and family members) with coping with and adjusting to PD seems to be underutilized. In this study, only 35% of participants have engaged in treatment with a mental health professional at some point in the past, and 16% are currently engaged in treatment with a mental health professional.
 - Thus, there is an opportunity to improve intervention for some non-motor symptoms by using a multi-disciplinary treatment team. Such an approach may indeed help improve the treatment for and/or management of the non-motor symptoms that patients with PD may experience, which in turn may improve their quality of life.
2. We examined the prevalence of symptoms related to ICDs in individuals with PD from the patient's perspective, and to identify similarities and/or differences in the experience of ICDs between the **DBS Group** and **Non-DBS Group**.
- Difficulties with impulse control for some patients with PD, as it relates to gambling, hypersexuality, buying, eating, punning, hobbyism, walkabout, and compulsive medication use, has been documented in the literature^{12,13}. The prevalence of difficulties with impulse control in this study is relatively high suggesting that a significant portion of individuals with PD with and without DBS perceive themselves as having difficulties with impulse control.
 - There was not a statistically significant difference between the **DBS** and **Non-DBS Groups** as it related to ICDs, with the exception to the **DBS Group** reporting compulsive medication use in greater frequency. The reasons for such a finding, aside from a longer duration of disease, remain unclear.
 - It is important to note that although endorsement of ICDs on the QUIP may indeed warrant further attention to such symptoms (e.g., formalized assessment and possibly treatment), the QUIP was designed to be a screening instrument. This measure in and of itself is not used to differentiate pathological behaviors from excessive behaviors that are not suited to be called a "disorder"¹².
 - ICDs can result from medication effects (particularly dopamine agonists) and/or DBS¹⁹⁻²¹. Broen et al. (in press) indicated that an intricate and systematic treatment approach to help reduce ICDs that includes modification of anti-parkinsonian medications and adjustment of the DBS parameter settings might be helpful¹⁹. For those individuals who are to undergo DBS therapy, they also recommended having a thorough psychiatric examination and a standard pre- and postoperative neuropsychological assessment to help assess for symptoms that may help with treatment.

3. We looked at similarities and differences between a “**Younger PD Group**” and “**Older PD Group**” as it relates to non-motor symptoms and impulse control disorders.
 - Not surprisingly, the **Older PD Group** endorsed some non-motor symptoms in greater frequency than the **Younger PD Group**. “Older individuals” are more vulnerable to experiencing difficulties with staying awake, hallucinations, autonomic dysfunction, and sensory problems²⁰⁻²².
 - Although older age had more non-motor symptoms than those of a younger age, many non-motor symptoms were still very common in younger patients.
 - Interestingly, as it relates to ICDs, the **Younger PD Group** seems to be more vulnerable to experiencing ICDs than the **Older PD Group**, particularly in the context of gambling, hobbyism, and compulsive medication use.
 - Consideration for the pathophysiology of PD for the **Younger** versus **Older PD Group**, disease duration, medication regimen, and functional capability may, in part, explain the more frequent endorsement of ICDs for the **Younger PD Group**. Moreover, the physiological differences between the **Younger** versus **Older PD Group**, the shorter disease duration of the **Older PD Group**, dosage differences in medications (which were not assessed in this study) and possibly greater capability to engage in or exhibit gambling and hobbyism for the **Younger PD Group** may be influential in these findings.
 - Further research is indicated to look at generalizability of such findings and to elucidate reasons for the increased vulnerability of experiencing ICDs in the **Younger PD Group**.
4. We investigated similarities and differences between participants who were earlier in the course of PD (**Early PD Group**) and those who were in more advanced stages of PD (**Advanced PD Group**) as it relates to non-motor symptoms and impulse control disorders.
 - It is known that as PD progresses, non-motor symptoms may also become more prevalent²²⁻²³. This study clearly reflects that the **Advanced PD Group** experiences non-motor symptoms to a greater degree than the **Early PD Group**.
 - There was a statistically significant difference between the **Early PD Group** and **Advanced PD Group** on 13 of the 16 non-motor symptoms, including speech disturbance, swallowing, difficulty staying awake, depression, fatigue, apathy, hallucinations, thinking skills, bladder difficulties, constipation, dizziness, smell, and pain; the **Advanced PD Group** endorsed these symptoms in greater frequency than the **Early PD Group**.
 - Although the **Advanced PD Group** endorsed non-motor symptoms in greater frequency when compared to the **Early PD Group**, many non-motor symptoms were still very common in those who are earlier in their disease course.
 - The implications are straightforward. Non-motor symptoms need to be assessed early in the disease process – vis-à-vis a multi-disciplinary treatment team - and re-assessed regularly with treatment being implemented accordingly by specialists.
 - As it relates to ICDs, the **Advanced PD Group** seems to be more vulnerable to experiencing ICDs than the **Early PD Group**, particularly in the context of gambling, punting (excessive repetition of certain simple motor activities, such as cleaning, tidying, handling, examining, sorting, ordering, or arranging objects, etc.), and compulsive medication use.
 - This finding may be influenced by physiological changes as it relates to disease duration and dosage effects (which were not assessed in this study). It may also be related to psychosocial variables, including a change in professional or social activities due to PD. Moreover, as engagement in previous activities becomes more difficult, new behaviors, even maladaptive behaviors, may emerge.
 - Further research is indicated to look at generalizability of such findings and to elucidate reasons for the increased vulnerability of experiencing ICDs in the **Advanced PD Group**.
5. We also inquired about expectations and DBS.
 - The vast majority of individuals who undergo DBS perceive that their expectations were met and would undergo the procedure again.

- For the few individuals whose expectations were not met, reasons included: not receiving benefit from the procedure, having minimal benefit from the procedure, having adverse outcomes, being concerned about the complexity of the procedure, and having difficulty accessing follow-up treatment.
 - It is of importance to undergo a multi-disciplinary evaluation to determine candidacy for DBS, as to ensure appropriateness to undergo such an intervention and to increase the likelihood of patient satisfaction and optimal outcomes.
 - Expectation management facilitated by the treatment providers is a necessary part of DBS therapy. Discussion of expectations prior to surgery and following surgery is indicated.
6. It is important to consider the following points when reading this report:
- This report addresses many common symptoms that individuals with PD may experience, but the data is not intended to suggest a “diagnosis” related to specific non-motor symptoms.
 - Although the QUIP is a validated instrument, the other questions regarding non-motor symptoms are not part of a validated instrument; the questions were simply designed to obtain a broad picture of non-motor symptoms that individuals with PD may experience.

Closing Remarks

Non-motor symptoms are highly prevalent in PWP and there is continued need for additional controlled, prospective research on and understanding about non-motor symptoms as it relates to the natural changes attributable to the progression of PD, as well as treatment effects (medications and DBS therapy) on non-motor symptoms. The effect of DBS on non-motor symptoms continues to be debated, as DBS therapy is still relatively in its infancy for PWP; researchers and clinicians continue to discover more about the impact of DBS on PWP.

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References

References are available on our website, DBS-STN.org, and can be found at the end of the electronic version of this report that is located in our section entitled “Survey Results.” Or, you can contact us at 1-800-579-8440 to inquire about or request the references for this report.