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Original Article

Knowledge and Attitudes towards Parkinson Disease: A Survey of College Students

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Purpose Parkinson disease (PD) is reported to be the fastest-growing neurological condition worldwide. By 2030, more than 1.2 million people are expected to have PD. Although the mean age of onset is 60 years, many younger individuals may sometimes develop young-onset forms of PD in their 30s or 40s. In addition, the current young generation are often close family members or relatives of people with PD. There is limited research on college students' perceptions and knowledge of PD in the United States. Therefore, the current study examined knowledge and attitudes about PD among college students enrolled at a university in the midwestern United States.

Methods Participants included 206 undergraduate students (females= 121; males= 85) with an average age of 21. Participants represented different ethnicities, background majors, and years of study. All participants completed a three-part online survey comprising a demographic survey, a knowledge survey, and an attitudes survey.

Results The study found that participants were more aware of externally observable PD symptoms than the nonmotor symptoms. The results also indicated that participants had a positive overall attitude towards individuals with PD.

Conclusions In summary, the current study's findings indicated a strong need for additional educational programs to address the current lack of knowledge about different symptoms and to replace misconceptions and negative attitudes with current facts and knowledge about PD and its possible management.

Keywords Parkinson disease, College students, Knowledge, Attitudes, Societal perceptions

INTRODUCTION

PD prevalence and incidence across the globe

Parkinson disease (PD) is reported to be the fastest-growing neurological condition worldwide. More than 1.2 million people will have PD by the year 2030. Although the mean age of onset is 60 years, many younger individuals may develop young-onset forms of PD in their 30s or 40s. A comprehensive review published by the GBD 2016 Parkinson's disease collaborators focused on the global and regional prevalence of PD from 1990 to 2016. The findings showed that over the past generation, the prevalence of PD has more than doubled to over six million globally [1]. Although much of this could be attributed to the fact that people are living longer lives, there are other factors, such as lifestyle habits or the improved understanding of symptoms of PD, that could also explain the increased worldwide prevalence of PD. Of all the neurological disorders studied in this extensive review, PD has been reported to be the fastest-growing neurological condition [1].

Specific to the United States, a study found the overall incidence rates of PD increased by 24% per decade from

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1976 to 2005 in men but not to the same extent in women [2]. The authors attributed this gender difference to several factors. The increase in incidence could result from a better understanding of the different symptoms, improved clinical assessment, and an overall increase in awareness over the decades. The fact that it occurs primarily in men may imply that the habits and lifestyles men have maintained contribute to PD development [2]. A similar study conducted by Marras and colleagues investigated the prevalence of PD across the United States and Canada. This longitudinal study evaluated the prevalence of PD over 4 years among men and women aged 45 years or older [3]. The results showed that for women, the number of cases increased from 109 in the first year to 3,204 in the fourth year. The number of cases for men increased from 207 in the first year to 3,728 in the fourth year [3]. Similar to the study by Savica et al. (2016), this study also reported a higher prevalence in men than in women [3].

Further, in South Korea, a similar increase in PD prevalence and incidence occurred nationwide over the five-year study [4]. In contrast to previous studies, both incidence and prevalence of PD were greater among women than men. There was a steady increase in the incidence of PD. For women, the increase was 27.7 cases per 100,000 individuals, and among men, it was 20.0 cases per 100,000 individuals for five years. Several factors contribute to the greater incidence and prevalence among females in South Korea. For example, the authors discussed behind the increased prevalence of PD among Korean women were increased age, exposure to pesticides and toxins, and possible dietary deficiencies [4]. In conclusion, existing studies suggest gender differences in PD prevalence across geographical regions. Further, the progressive nature and recent increase in the incidence of PD worldwide make it even more critical that people receive a timely diagnosis of PD, begin treatment and management of their symptoms as early as possible, and work towards delaying the progression of the condition.

There has been marked progress in the social and pharmacological interventions available for newly diagnosed and those with an existing PD diagnosis in recent decades [5]. However, many people with PD still do not have or reach out to local agencies and resources as often as they should. Often, people with PD experience negative perceptions or attitudes from the public due to limited awareness and knowledge of the PD symptoms, which further exacerbates feelings of social isolation and depression, thereby impacting the quality of life of people with PD as well as their close family members [5]. Parkinson disease causes motor and nonmotor symptoms and individuals with PD may not always know that the nonmotor symptoms are related to PD and thus not proactively volunteer to share their concerns with their physicians or family members [6,7]. Existing research also suggests impact of PD on a person's speech functioning including alterations to respiration, voice, articulation, prosody, swallowing, and overall quality of life with around 90% of people with PD reporting changes in their communication over the course of the disease progression [8,9]. Therefore, it is important to determine the current gaps in knowledge among different communities, including young adults who often have relatives living with PD.

PD awareness–knowledge, attitudes, and stigma

One key component to ensure people receive timely treatment once diagnosed with PD relies on the level of knowledge and awareness people have about PD. Multiple researchers have examined levels of knowledge and awareness of PD symptoms over the last two decades [10-13]. Among studies on older adults' perceptions of PD, Pan and colleagues' study stands out. The authors investigated the knowledge and attitudes about PD among neurologically healthy older adults in Philadelphia (USA). The authors discovered that traditionally underserved minorities are more likely to delay diagnosis of PD and less likely to

receive the care necessary to treat their disease. One explanation is that these communities lack knowledge and awareness due to limited resources and educational programs. About one-third of the members had little to no knowledge of the disorder, as many did not correctly identify the possible symptoms of PD. In addition to a lack of knowledge, many cultural groups and populations exhibited negative attitudes toward PD. Further, the study by Pan et al.(2014) found that some of the Chinese American and African American participants held certain attitudes that could discourage health-seeking behavior should they begin to present signs of PD [13].

Similar findings of low awareness of different PD symptoms among people with and without PD based in Australia by Moore [12]. Although only four of the 200 participants had PD, 62.5% of the study participants thought that PD was common. In contrast, participants also demonstrated several misperceptions, including 99% of the participants indicating that PD is contagious, 91% indicating that PD is a form of insanity, and 79% suggesting that people cannot work with PD. Further, more than half of the participants were restricted in the disclosure of their diagnosis if they were to develop PD, thereby showing the stigma associated with a diagnosis of PD [12].

The results revealed that participants were more likely to view PD with stigma when they held more negative attitudes toward the disease. The author discussed the importance of increased awareness about PD to help reduce the social stigma and discrimination against those who have a PD diagnosis. Although some participants without PD demonstrated an adequate level of knowledge, as suggested by correctly identifying PD symptoms on the questionnaire, others had many misconceptions about PD that contributed to its stigma [12]. The author noted that some of the different stigmas reported in the study could be attributed to lower levels of community and informal social support and fewer work and leisure opportunities for people with PD. The authors concluded that the importance of greater public knowledge about PD is in reducing misperceptions about the disease. Further, educational programs for people with young-onset PD can also help maximize positive psychosocial outcomes among younger adults [12].

In a separate study investigating knowledge and attitudes toward PD in South Africa, Mokoya and colleagues surveyed 16 people with PD, 83 people without PD, and 31 traditional healers (THs) regarding their perceptions and stigmas associated with PD [11]. The authors discussed that although participants with PD had a high level of knowledge, they still lacked an understanding of key features of PD, such as its etiology. In addition, the results showed that people without PD had more positive attitudes toward the disease than those with PD, as they expressed less concern when presented with 15 different aspects of the disorder. In contrast, participants with PD had relatively negative attitudes compared to people without PD, and this correlated with lower levels of knowledge regarding PD symptoms. Approximately 68% of the participants thought that PD was extremely rare [11].

It was also interesting to note that the participants without PD, who demonstrated higher levels of knowledge about PD symptoms, also had more negative attitudes than those with relatively less knowledge about the disorder [11]. An explanation could be that individuals with relatively higher levels of knowledge about symptoms of PD may feel less encouraged about the long-term outcomes, may have more realistic expectations, and may hold more negative attitudes as a result when compared to those who are less knowledgeable about the possible manifestations of PD. In conclusion, previous studies indicated there is an overall low level of knowledge when it comes to PD and its symptoms among both those who have PD and those who are neurologically healthy, often resulting in misconceptions and stigma surrounding the disorder.

More recently, Choo and colleagues examined the knowledge and perceptions of people with PD and their family members based in Malaysia [10]. The study included 221

participants with PD and 273 caregivers. As in prior studies, both participants with PD and their caregivers reported better recognition of motor symptoms than of nonmotor symptoms. Both groups of respondents recognized a similar number of motor (4 out of 5) and nonmotor (6 out of 11) symptoms. The five most frequently recognized motor symptoms included bradykinesia (slowness of movement), tremors, walking problems, balance deficits/tendency to fall, and rigidity (muscle stiffness).

In contrast, some of the least frequently recognized nonmotor symptoms were reduced sense of smell, urinary problems, visual hallucinations, pain, and swallowing difficulties. The participants also demonstrated certain misconceptions, such as the onset of PD being linked to doing something in the past and that the PD medications could cause internal organ damage. The participants were also asked about the social and financial toll of PD, and two-thirds of the respondents indicated a heavy financial toll linked to the PD diagnosis. Specific to the PD treatment option, half of the respondents were apprehensive about deep-brain stimulation, tube feeding, or other invasive ventilation. Regarding access to community support, only 50% of respondents reported good access. Approximately 80% of participants reported good access to reliable information about PD [10]. In conclusion, the study provided evidence of better recognition of motor symptoms than of non-motor symptoms among both participants with PD and their family members.

Existing studies about older adults' knowledge and attitudes towards PD

Specific to PD, existing research has focused on older adults' knowledge and perceptions of PD symptoms. To the best of our knowledge, limited studies exist on the perceptions and attitudes of young adults (or those attending college) regarding PD [5,13-18]. The following sections summarize the key findings from selected studies.

Among existing studies, Pan and colleagues investigated knowledge and attitudes toward PD among neurologically healthy older adults [13]. The authors discovered that traditionally underserved minorities are more likely to delay diagnosis of PD and less likely to receive the care necessary to treat their disease. One explanation is that these communities lack knowledge and awareness due to limited resources and educational programs. About one-third of the members had little to no knowledge of the disorder, as many did not correctly identify the possible symptoms of PD. In addition to a lack of knowledge, many cultural groups and populations exhibited negative attitudes toward PD. Further, the authors found some of the Chinese American and African American participants held certain attitudes that could discourage health-seeking behavior should they begin to present signs of PD [13].

Similar trends of lack of understanding of key symptoms of PD were reported among older adults with and without PD and traditional healers (THs) based in South Africa [11]. Although the participants demonstrated a significantly high level of knowledge about PD symptoms, they still lacked an understanding of key features of PD, such as its etiology. Specific to beliefs, approximately 68% of people without PD and 94% of THs thought that they were unlikely ever to develop PD. In addition, more than half of the participants believed that PD could be treated by traditional healing medicine. Regarding attitudes, the results showed that people without PD had more positive attitudes toward the disease than those with PD, as they expressed less concern when presented with 15 different aspects of the disorder. In contrast, participants with PD had relatively negative attitudes compared to people without PD, and this correlated with lower levels of knowledge regarding PD symptoms. It was also interesting to note that the participants without PD, who demonstrated higher levels of knowledge about PD symptoms, also had more negative attitudes than those with relatively less knowledge about the disorder [11].

Similar findings of significantly better knowledge of PD symptoms among people with PD compared to people

without PD were reported in an earlier study [17]. An explanation could be that individuals with relatively higher levels of knowledge about symptoms of PD may feel less encouraged about the long-term outcomes, may have more realistic expectations, and may hold more negative attitudes as a result when compared to those who are less knowledgeable about the possible manifestations of PD. In conclusion, previous studies indicated there is an overall low level of knowledge when it comes to PD and its symptoms among both those who have PD and those who are neurologically healthy, often resulting in misconceptions and stigma surrounding the disorder.

In a separate study, Jitkritsadakul and his colleagues examined the level of PD knowledge among 108 participants with PD in Thailand [14]. Participants were grouped into working (<60 years) and retired (>60 years) subgroups. Results showed that the working-age group had significantly greater knowledge of PD symptoms, diagnosis, and therapeutic aspects. However, participants with PD still demonstrated significant gaps in knowledge in terms of disease symptoms, progression, diagnosis, and treatment. The participants demonstrated the most common misconceptions about drug efficacy for symptom management and slowing disease progression, onset of motor symptoms, and possible disease progression for different phenotypes. In addition, the study concluded that younger age at recruitment (<60 years), female gender, and increased disease duration (less than or equal to 4 years) are the most important predictors of PD knowledge. In conclusion, the authors suggested minimizing knowledge gaps to enable a timely diagnosis and effective management of PD.

Most recently, Parveen and Moore surveyed the perception of adults with PD and their communication partners about PD-related symptoms based in Oklahoma, Texas, Kansas, and Arkansas [15]. The study included 39 adults with PD and 11 communication partners. As in prior studies, participants with PD and their communication partners (including spouses or other family members) more frequently identified motor symptoms than nonmotor and communication symptoms. However, there were subtle differences in the motor changes that participants with PD reported compared to the communication partners. Specifically, 93% of participants with PD reported changes in handwriting, while only 50% of the communication partners selected it as a possible symptom of PD. The authors concluded that participants with PD and their communication partners were less aware of the nonmotor symptoms and possible speech, voice, and swallowing changes associated with PD than the motor changes [15].

Around the same time, Crooks and her colleagues reviewed 23 studies worldwide and shared a growing interest in public awareness about PD [5]. The authors discussed three main themes emerging from these articles: public knowledge of PD symptoms, including understanding different aspects of PD; the social consequences of PD; and the lack of educational resources. Regarding public knowledge of PD, four studies found that participants were often significantly more aware of motor symptoms, such as rest tremors, than of non-motor symptoms. In addition, participants demonstrated variable knowledge of possible treatments for PD. The authors concluded relatively poor awareness among participants with and without PD regarding the nonmotor symptoms of PD and advanced/device-assisted medical interventions for PD [10].

Existing studies about PD knowledge among young adults

Multiple studies have examined the knowledge, attitudes, and stigmas about PD among older adults. However, such studies among younger adults are fewer in comparison. The study by Youn and colleagues stands out among the limited existing studies [16]. The authors surveyed the knowledge and perceptions of 1000 participants based in South Korea. Among the different age groups, partic-

ipants aged 40-59 years and with more than 12 years of education showed greater awareness of PD. In addition, the younger participants had the least knowledge compared to participants aged 40-59 and those aged more than 60 years. The authors noted that lower socio-economic status is associated with poorer knowledge of PD. The authors concluded that there is a need for education strategies and approaches tailored to specific subgroups to improve public awareness and knowledge of PD.

In a different study, Alyamani and colleagues surveyed 2,609 adults, including 291 caregivers of people with PD based in Saudi Arabia, about their level of awareness about PD-related symptoms [18]. The mean age of the participants was 26.13 years, and 59% were female. Regarding educational background, 74% of participants had a university-level education, and 21% had a high school degree. Similar to prior studies, about 86% of the respondents identified rest tremors as a possible symptom of PD. However, only 4.1% of the participants identified loss of smell as a possible nonmotor symptom of PD. Overall, the respondents identified PD motor symptoms significantly better than nonmotor symptoms. In addition, the respondents recognized the motor symptoms more significantly than the nonmotor symptoms, as the motor symptoms are more physically observable. Further, the survey found that more than half of the respondents incorrectly believed that PD is usually familial [18].

Similar reports of improved recognition of PD motor symptoms and the incorrect assumption that PD is familial were reported by Tan and colleagues. Participants included 1,258 adults from different community groups, including Chinese, Indian, and Malay communities living in Malaysia [17]. The authors found significant differences between the Chinese and Malay community groups in recognition of non-motor symptoms. Overall, existing studies indicate that younger adults often have limited awareness of the different symptoms of PD and may not clearly understand the etiology and disease progression. The authors concluded that educational programs aimed at public awareness of PD-related symptoms, assessment, and treatment.

Around the same time, Khalifa and his colleagues collected survey responses from 150 college students enrolled in a university based in Saudi Arabia [19]. Approximately 65% of the respondents were between 21 and 25 years old, while 2.7% were between 31 and 35 years old. Participants represented medical, pharmacy, respiratory therapy, nursing, and information systems disciplines. The survey included yes-no questions about familiarity, origin, possible age group, and self-knowledge of PD. Sixty-two percent of the participants believed that PD more commonly affected the elderly, and 76% of the participants answered correctly that PD is a neurological disorder. Only a minority of the respondents (i.e., 18.7%) self-rated their PD knowledge as good, while 39.3% indicated poor knowledge about PD. The study did not include detailed questions about the PD symptoms to assess the respondents' knowledge. The authors concluded that future research is needed to assess the behavior and stigma associated with PD across different communities [19].

In Canada, two studies surveyed young adults across different communities about their knowledge of PD symptoms. Participants included both those under and above 18 years [20,21]. Most participants did not have any family members with PD. However, responses were similar for those with a family member and for those without. Half of the participants correctly noted that PD has an unknown cause, and 71% noted that there is currently no cure for PD. The authors acknowledged the small sample size and concluded that larger studies are needed [20,21].

Finally, Chow and Viehweger conducted a meta-analysis of existing studies on awareness of PD among young adults [22]. The meta-analysis included eight studies with 167 participants based in London, Ireland, the United States, Asia, and Canada. About 59% of the participants were aged between 18 and 19 years, 23% were between 20 and 22 years, 12% over 22 years, and 7% under 18 years. The meta-analysis included about 75% of female

participants. 90% of participants correctly responded that PD does not always affect older adults. About 50% of participants reported being unfamiliar, 34% reported having satisfactory knowledge, and only 16% reported being knowledgeable about PD symptoms. The authors did not report any statistically significant differences in PD knowledge among participants aged 20 or older or by gender. Personal experience with PD did not affect PD knowledge among young adults, as there were no statistically significant differences between the two subgroups [22].

Purpose of the study

Research on college students' knowledge and awareness of different disorders is not new. However, there is a significant gap in research on college students' awareness of PD [19-21]. It is well known that PD is the second most common disorder affecting older adults. As the average human lifespan has increased, more people are likely to be affected by this condition in the future. Therefore, it is crucial to begin spreading awareness of PD, to increase knowledge about different aspects of PD among people of all age groups, and to reduce the stigma associated with its many symptoms. To the best of our knowledge, there is limited published literature on the level of knowledge and attitudes toward PD among college students in the United States. Therefore, the purpose of this study was to use surveys to examine current perceptions and attitudes toward PD among college students enrolled at a mid-sized university in the Midwest region of the United States. The findings from this study can help identify current gaps in knowledge about PD, which, in turn, will allow for a more curated development of community-based education programs. The three research questions of the study were as follows:

Research Question 1: What is the level of knowledge among college students regarding different symptoms of PD?

Research Question 2: What type of societal perceptions and attitudes do college students have regarding living with PD and knowing someone with PD?

METHODS

Study design and IRB approval/ ethics

A quantitative study of online questionnaires was conducted among undergraduate students enrolled in a University in the midwestern region of the United States. The Institutional Review Board approved the study before data collection.

Recruitment

Participants were recruited through campus emails, class presentations, and snowball sampling. The campus emails were sent twice during data collection to 1000 randomly selected students each time enrolled at the University. The inclusion criteria included being 18 years or older and enrolled as an undergraduate student at the specific University during research participation.

Demographics

Participants included college students aged 18 years or older. Data were collected online between March and May 2021, following Institutional Review Board approval. There were 206 undergraduate participants (Males=85; Females=121) representing different disciplines and ethnic backgrounds (Average age=21 years; Range=18-49 years). Among the participants, 34.8% were seniors, 25.84% were juniors, 12.36% were sophomores, 25.84% were freshmen, and 18% did not specify their major. Specific to ethnic backgrounds, 78% of participants were White/ Caucasian, 6% were Hispanic/Latino, and 5% were Asian. About participants' educational backgrounds, 9.7% of participants were in the College of Education and Human

Sciences, 13.6% were from the College of Engineering, Architecture, and Technology, 13.6% were from the College of Agriculture, 14.6% were from the College of Business, and 30% were from the College of Arts and Sciences.

Study surveys and measures

The current study included questionnaires adapted from existing PD knowledge survey [15,23-26]. All participants completed an online survey that included informed consent, a demographic questionnaire, a knowledge survey of PD-related symptoms, and a survey examining perceptions and attitudes toward PD. The PD attitudes survey consisted of a Likert scale with six categories related to personal relationships, social limitations, perceived susceptibility and benefits, and possible self-actions. The knowledge and attitude surveys are included as Appendices A and B, respectively.

RESULTS

Participants' knowledge of PD symptoms

The current study aimed to identify the levels of knowledge, perceptions, and attitudes toward PD among undergraduate students in the midwestern region of the United States. Based on the available literature, the PD knowledge survey included approximately 67 possible PD symptoms: 19 motor, 17 communication (speech, voice, and swallowing), and 21 nonmotor. Results indicated that the college students identified externally observable physical symptoms, such as rest tremors and gait changes, more frequently than other speech and cognitive symptoms. In addition, college students demonstrated a lack of awareness or knowledge of nonmotor symptoms, such as changes in smell, sleep, and vision, which are often associated with PD [24]. It was encouraging to observe that more than 50% of the college students correctly identified changes in speech and swallowing as possible symptoms following PD. Table 1 summarizes the five most common and five least common PD symptoms identified by college students.

In addition to the possible 67 symptoms of PD, the questionnaire also included three false symptoms (neologisms and palilalia associated with aphasia and remission and relapse of symptoms associated with multiple sclerosis) that are not typically associated with PD. This was done to determine whether college students knew about the specific symptoms or were checking 'yes' to all listed symptoms. Among the three false symptoms, about 62.6% of participants chose "relapse and remission of symptoms"

Table 1. Summary of Five Most and Five Least Commonly PD Symptoms Identified by the Participants

PD Symptoms	Percentage (correctly identified)
(A) Most commonly identified symptoms	
Rest Tremor	96.39
Lack of dexterity (holding tools such as a brush or pen with hands)	80.72
Changes in physical gait (reduced steps, shuffling, freezing)	77.11
Changes in handwriting	75.30
Dyskinesias (out-of-control movements of hands and legs)	73.49
(B) Least commonly identified symptoms	
Change in taste	13.86
Excessive Sweating	13.25
Intense or vivid dreams	12.65
Double vision	12.65
Vomiting	10.24

as a possible symptom of PD. However, this is more likely for another neurological disorder, multiple sclerosis. In conclusion, most college students in the current study were most aware of the externally observable motor symptoms compared to the nonmotor and speech-related changes and the different aspects of the symptom occurrence.

All participants answered a question following the symptom questionnaire about their confidence in identifying possible PD symptoms. Approximately 32% of the survey respondents were somewhat confident about their responses. In contrast, only 13% were highly confident, and another 23% were less confident about their responses. Further, 14% of the respondents were neutral, and the remaining 9% had no idea if their responses were correct. About 45% of respondents were somewhat to highly confident, and the remaining 55% hovered between staying neutral, being less confident, having no idea, or missing responses regarding their knowledge of PD symptoms. In conclusion, participants in the current study showed varying levels of confidence in their knowledge of PD symptoms.

Perceptions and attitudes toward PD

The current study also aimed to identify the attitudes and perceptions regarding PD among college students. College students demonstrated diverse perceptions and feelings about various aspects of PD. The attitudes survey consisted of six categories, each with 23 statements. The categories were Perceived Barriers: (A) Personal Relationship, (B) Perceived Barriers: Social Limitations, (C) Perceived Severity, (D) Perceived Susceptibility, (E) Perceived Benefits, and (F) Cues to Action. A Likert scale was used to measure participants' attitudes toward each statement. The possible responses for each statement ranged from strongly disagree to agree strongly.

Approximately 84% of the participants indicated that PD could have an impact on one's mental health. Additionally, about 87% of participants considered PD to be a serious disease. It was interesting to note that 61% of the college students either strongly disagreed or disagreed that they were likely to receive a diagnosis of PD in later life. This specific response indicates that a large majority of participants did not think they may be at risk of developing PD symptoms, or most likely associated PD with old age. However, about 92% of participants indicated that if they were to develop PD, they would go to a healthcare professional and get educated on the disease, a finding that is encouraging.

Regarding knowledge of PD treatment, 28% of participants either strongly agreed or agreed that PD treatment is not effective, while half chose the "neutral" option to

Table 2. Summary of Selected Responses to the PD Attitudes Survey

Category	Statements	Percentage who Strongly Agreed or Agreed
Perceived Barriers: Personal Relationships	*Individuals who have Parkinson disease become very lonely.*	64%
Perceived Barriers: Personal Relationships	*It would be easy to accept having Parkinson disease.*	7%
Perceived Barriers: Social Limitations	*There is a high stigma surrounding Parkinson disease.*	51%
Perceived Severity	*Having Parkinson disease affects one's physical mobility.*	63%
Perceived Severity	*Having PD affects one's mental health.*	84%
Perceived Susceptibility	*Most people with Parkinson disease are in their 60s and 70s.*	37%
Perceived Benefits	*Parkinson disease symptoms cannot be effectively managed by a combination of physical therapy, speech, therapy, and psychological support*	15%
Cues to Action	*If I had Parkinson disease signs and symptoms, I might want to find answers on my own first*	29%

the statement. In summary, the current study shows that there are gaps in knowledge and biases among college students about how a person's life and prognosis may vary following the diagnosis of PD. Table 2 summarizes key findings from the PD attitudes survey.

DISCUSSION

The current study examined levels of knowledge, societal perceptions, and attitudes toward PD among college students. Due to the long lifespan of humans over the past decades, PD will be increasingly seen in the population in the coming years. Because of this, increased awareness, and knowledge of different PD symptoms among adults can help improve attitudes, minimize misconceptions, and encourage early diagnosis and intervention. Like prior studies [18-21], college students demonstrated greater knowledge of PD motor symptoms when compared to the nonmotor symptoms. These findings are not surprising, as the symptoms of PD most frequently depicted in the media and taught in academic contexts are often motor-related and more externally visible to a person.

The present study's findings of awareness of visibly observable symptoms and low awareness of nonmotor symptoms among younger neurologically healthy adults match those from existing reports among older adults with and without PD [10,11,15-17]. Based on these findings, community-based education and awareness programs must include both nonmotor and motor changes in PD and their implications for overall understanding of PD pathophysiology.

Another interesting finding of the current study is that most college students correctly identified several speech and voice changes associated with PD. These included voice tremors (61.45%), loss of speech clarity (60.84%), and changes in swallowing (58.43%). The increased awareness of different PD-related speech changes may also be due to many informational brochures and current PD programs covering these domains. Overall, the college students demonstrated an understanding of the effects of a PD diagnosis on one's mental health, including the onset of depression and other life changes. The current study findings agree with a prior study [22], where young adults understood the possible relationship between depression and PD and the role of exercise in slowing disease progression. With the current rise in mental health disorders across the lifespan, this finding is especially encouraging, as participants understood the difficulties that come with a PD diagnosis as well as how isolating it can be mentally for a person. In conclusion, the study adds data points about knowledge and attitudes towards PD among college students who may be current or future family members of people with PD or may communicate with people with PD sometime in their workplace or in their communities in the future. More than 85% of the participants identified externally observable motor symptoms (including rest tremor or lack of dexterity). It was also encouraging that more than half of the college students correctly identified the speech and swallowing symptoms of PD accurately, which suggests greater awareness about these symptoms.

Although participants demonstrated a strong understanding and openness to the effects PD has on an individual, there were mixed opinions on some aspects of PD. For example, there was a difference in willingness to associate with an individual with PD depending on the type of relationship. Many were willing to be friends with someone with a young-onset PD, but three-fourths of participants were not willing to marry someone with a young-onset PD. In conclusion, the current study identifies specific areas where healthcare professionals, including physicians, nurses, speech-language pathologists (SLPs), and physical therapists, can educate families of people with PD and increase awareness of the multidimensional symptoms of PD. Patient and caregiver education during early stages of PD diagnosis and can help make maximum impact and facilitate with the support

that may be required with disease progression [6]. Speech-language pathologists often are one of the primary healthcare professionals who work with people with PD and their families following the diagnosis. Therefore, continued education and awareness led by SLPs and other healthcare professionals through community-based educational events, online websites, and resources at medical settings (including hospitals, clinics, and nursing homes) about different symptoms of PD among newly diagnosed or those with an existing diagnosis can aid in early diagnosis and timely management of different PD symptoms.

Study limitations and future directions

Some of the study limitations included data collection during the COVID-19 pandemic in 2020-21 and major changes in students' schedules and in-person interactions. Thus, participant recruitment relied on emails and flyers distributed directly to students and course instructors. Another limitation was that many participants did not take a specific stand and instead chose the "neutral" option, thereby preventing a clear picture of their viewpoint. A final limitation was the inclusion of only three false symptoms. Studies similar to the current study often include many more "incorrect" or "false" answers to alleviate participants' assumption that almost all the symptoms are correct. Some participants may have chosen these false symptoms because they did not look closely at every listed symptom.

The current study was exploratory in nature where we utilized descriptive statistics to determine the knowledge and attitudes of college student population regarding different symptoms of PD. Additional studies can survey a larger population of college students from different majors, personal and academic experiences and determine relationship between the participant variables and their knowledge and attitudes regarding PD. Further, future studies can focus on developing informational and educational programs for adults of different ages to increase awareness and reduce societal and cultural misconceptions about various aspects of PD.

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Appendix A. PD knowledge survey

Instructions: Please review the checklist below with a list of different PD symptoms. Some of the symptoms may or may not be related to PD. Please check ALL of the symptoms that you think may be related to Parkinson disease (PD).

Check all the boxes that you think are related to Parkinson Disease	*Possible Changes*	
	I. Motor Changes	
	i.	Rest tremors (shaking of hands, fingers, legs)
	ii.	Dyskinesias (out-of-control movements of hands and legs)
	iii.	Changes in physical gait (reduced steps, shuffling, freezing)
	iv.	Reduced arm swing
	v.	Changing positions (e.g., from sitting to standing, from lying to sitting)
	vi.	Relapsing and remitting of symptoms (some weeks with severe symptoms and some weeks with less or no motor symptoms)
	vii.	Walking outside home (walking on pavements/walking surfaces outside home)
	viii.	Muscle ache
	ix.	Muscle cramps
	x.	Fine movements (buttoning, tying shoelaces)
	xi.	Changing position in bed
	xii.	Ability to clip one's own nails using a clipper
	xiii.	Dressing self
	xiv.	Getting in/out of bed
	xv.	Toileting/ Difficulty toileting
	xvi.	Morning stiffness
	xvii.	Eating problems
	xviii.	Changes in swallowing
	xix.	Changes in handwriting
	xx.	Lack of dexterity (holding tools such as brush, pen with hands)
	Ⅱ. Communication Changes	
	i.	Quiet voice (reduced loudness)
	ii.	Monopitch (same pitch across all sentences)
	iii.	Voice getting husky
	iv.	Voice getting deeper
	v.	Voice getting quieter
	vi.	Voice tremors
	vii.	Constant throat clearing
	viii.	Mumbling
	ix.	Imprecise consonants
	x.	Tight mouth
	xi.	Slowness of speech
	xii.	Loss of clarity
	xiii.	More effort to maintain intelligible speech
	xiv.	Neologisms (meaningless or nonsensical words in a language)
	xv.	Palilalia (repetition of words)
	xvi.	Reduced breath support
	xvii.	Reduced control of exhalation
	xviii.	Shallow breathing
	xix.	Mild changes in nasality (extra air coming out)

Check all the boxes that you think are related to Parkinson Disease	*Possible Changes*	
	Ⅲ. Non-motor Changes	
	i.	Dribbling of saliva
	ii.	Change in taste
	iiii.	Change in smell
	iv.	Vomiting
	v.	Nausea
	vi.	Constipation
	vii.	Bowel incontinence
	viii.	Incomplete bowel emptying
	ix.	Urinary urgency
	x.	Nocturia (or excessive nighttime urination)
	xi.	Unexplained pain
	xii.	Unexplained weight loss
	xiii.	Memory changes
	xiv.	Loss of interest
	xv.	Hallucinations (experience something that really doesn't exist such as seeing a person, animal, or an object)
	xvi.	Difficulty in concentrating
	xvii.	Feeling sad
	xviii.	Feeling anxious
	xix.	Change in sexual interest
	xx.	Sexual dysfunction
	xxi.	Orthostatic dizziness or hypotension (sudden drop in blood pressure when standing up from sitting or lying down)
	xxii.	Daytime sleepiness
	xxiii.	Insomnia
	xxiv.	Intense, vivid dreams
	xxv.	Sleep talking and moving
	xxvi.	Restless legs
	xxvii.	Swelling of legs
	xxviii.	Excessive sweating
	xxix.	Double vision
	xxx.	Delusions (false beliefs)
	xxxi.	Onset of bipolar disorder (a mental disorder marked by alternating periods of elation and depression)

Rate your level of confidence about your responses to the above-mentioned questionnaire.
a.) I'm highly confident
b.) I'm somewhat confident
c) Neutral
d.) I'm less confident
e.) I have no idea
f.) Other (please specify)_____

Appendix B. PD attitudes survey

Please respond to the statements below based on your experiences at this time. Please rate each question on a scale of strongly agree (SA), somewhat agree (SWA), neutral (N), somewhat disagree (SWD), and strongly disagree (SD).

Perceived Barriers

Personal Relationship:

1. Individuals who have Parkinson disease become very lonely.
2. It would be easy to accept having Parkinson disease.
3. Having Parkinson disease does not affect one's personality.
4. Parkinson Disease causes people to lose their independence.

Social Barriers:

5. There is a high stigma surrounding Parkinson disease.
6. I am open to marrying someone with young onset Parkinson disease (30s-40s).
7. I would prefer not to be friends with someone who has young onset PD.

Perceived Severity

8. Parkinson disease is a very serious disease.
9. People with Parkinson disease have the same lifespan as people without PD.
10. Having Parkinson disease affects one's physical mobility.
11. Having Parkinson disease does not affect one's ability to communicate effectively.
12. Having Parkinson disease does not affect one's mental health.

Perceived Susceptibility

13. I feel I am very likely to get Parkinson disease.
14. As long as I eat well and exercise, I can prevent Parkinson disease.
15. I have no family history of Parkinson disease, therefore I will not get it.
16. Most people with PD are in their 60s and 70s.

Perceived Benefits

17.) Treatment for Parkinson disease is not very effective.
18.) The progression of Parkinson disease can be managed by early intervention therapy.
19. Parkinson disease symptoms cannot be effectively managed by a combination of physical therapy, speech therapy, and psychological support.
20. People with Parkinson disease can reduce their disease progression with early diagnosis and receive timely treatment and management.

Cues to Action

21. If I had Parkinson disease signs and symptoms, I might want to find answers on my own first (look online, read books, search research articles, talk to professionals or family members).
22. If I had Parkinson disease, I would go to a healthcare professional and get educated on the disease.
23. If I developed signs and symptoms of Parkinson disease, I would not talk to my doctor immediately.

Rate your level of confidence about your responses to the above-mentioned questionnaire.

a. I'm highly confident
b. I'm somewhat confident
c. Neutral
d. I'm less confident
e. I have no idea
f. Other (please specify)_____