

Evaluating the knowledge, practice and experience about management of Parkinson's Disease among physiotherapists in Ghana: a cross-sectional survey

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Abstract:

Background: Parkinson's disease (PD) presents with numerous functional disabilities which require specific expertise for effective management.

Objective: To describe the level of PD-specific expertise among physiotherapists (PTs) in Ghana and establish the association between the level of expertise, practice duration and number of persons with PD treated annually.

Methods: A cross-sectional survey was conducted among PTs. A 25-item questionnaire was validated, piloted and distributed to PTs during an annual general meeting. Microsoft Excel 2016 and the Kruskal-Wallis test were used to perform descriptive statistical analysis and test for association respectively.

Results: There was a 70% (n=42/60) response rate. Overall, 50%-90% of the participating PTs had limited knowledge about the cardinal motor signs, non-motor symptoms, motor complications of PD and setting of treatment goals. There was no significant association between participants' level of PD-specific expertise and practice duration and number of persons with PD treated annually.

Conclusion: The PTs exhibited inadequate knowledge about PD and its management. This limitation was not influenced by PTs practice duration or number of persons with PD treated annually. The immediate need for PD-specific training for PTs in Ghana is crucial to enhance PTs' expertise in the management of persons with PD.

Keywords: Parkinson's disease; physiotherapy; professional knowledge.

DOI: <https://dx.doi.org/10.4314/ahs.v24i2.45>

Cite as: Agoriwo M. *Evaluating the knowledge, practice and experience about management of Parkinson's Disease among physiotherapists in Ghana: a cross-sectional survey.* *Afri Health Sci.* 2024;24(2). 445-457. <https://dx.doi.org/10.4314/ahs.v24i2.45>

Introduction

Parkinson's disease (PD) is the second most common neurological condition after Alzheimer's disease with an estimated worldwide prevalence rate of 1% of the population aged 60 years and above and increasing to 4% at 80 years¹. In Ghana, PD is reported among the three most common non-communicable diseases significantly contributing to the burden of neurological conditions², and the commonest hypokinetic condition reported at

the neurology clinic of the biggest teaching hospital in Ghana³. The prevalence of PD is estimated at a range of 65.6 to 12,500 per 100,000 and an annual incidence range of 5 to 346 per 100,000 people in Europe⁴. However, PD prevalence in sub-Saharan Africa is relatively lower, estimated at 7 to 20 per 100,000 people, compared to the western countries⁵. This could be as a result of underdiagnosis⁶.

PD is a complex neurological condition with a wide array of motor and non-motor symptoms which worsen with the disease progression⁷. The motor symptoms include bradykinesia, tremors and rigidity, which become apparent after a profound loss of dopaminergic cells in the substantia nigra pars compacta⁷. The non-motor symptoms which include autonomic system dysfunction, cognitive impairments, and behavioural disorders, usually precede the motor symptoms and persist with disease

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progression in most patients and could act as prodromal or pre-clinical markers for PD^{7,8}.

With the prolong use of Levodopa medication, most persons with PD (PwPD) experience fluctuating motor complications which include akinesia, dyskinesia, freezing of gait and dystonia^{9,10}. These complications persist once they appear and can be very challenging in managing, even with the available medical and surgical interventions¹⁰. The complications also have severe implications for patients' social functioning and quality of life^{11,12} caregiver burden^{13,14}, and economic burden¹⁵.

Over the years, studies conducted have established some benefits of physiotherapy in improving mobility, muscle strength, balance, gait, physical conditioning and brain function through neuroplasticity¹⁶. Nevertheless, effective rehabilitation requires specialised skills as the 2017 NICE guideline recommend early referral and management of PwPD by physiotherapists with PD-specific expertise¹⁷. These skills appear to be lacking among physiotherapists (PTs) as some studies have concluded that PTs in the Netherlands lacked PD-specific knowledge in the management strategies of PD resulting in dissatisfaction among patients^{18,19}. Also, the PTs perceive insufficient PD-specific expertise as one of the challenges to effective management of the disease.

In a special report on Africa, Cilia and colleagues recounted a general inadequacy of PD-specific expertise in the diagnosis and management of the disease among healthcare professionals²⁰. This results in poor quality of life and increased mortality rate as demonstrated in a longitudinal study conducted in Nigeria by Okubadejo and colleagues where PwPD recorded 25% mortality rate compared to 7% in an age- and sex-matched control group²¹. An approach to dealing with this challenge may include identifying the deficits and challenges of health professionals involved with PD care^{18,19}, to assess information on the content of continuous professional development training in PD. Therefore, this study aimed objectives were; (a) to describe the level of PD-specific expertise (clinical characteristics of PD and clinical expertise in PD management) among PTs in Ghana; (b) to establish the relationship between PD-specific expertise (non-motor symptoms, motor complications and setting treatment goals) and; (bi) PTs' practice duration and (bii) number of PwPD treated annually.

Materials and methods

Study design

A cross-sectional survey study design was used in the form of a paper-based survey among PTs in Ghana. The study was approved by the research ethics committee of Brunel University London (6318-LR-May/2017-7163-1) and further administrative permission obtained from the Ghana Physiotherapy Association (GPA). Informed consent was obtained from the participants.

Study Population and sampling

The study participants were drawn from the GPA by convenient sampling as all the PTs who were present at the association's annual general meeting and met the inclusion criteria were included in the study. GPA is the professional body for PTs, PT Technicians and PT Assistants in Ghana. It was founded in 1975 and has been a member of the World Physiotherapy (WPT) since 1999 and. GPA is its part of the WPT-Africa Region. The GPA currently has a membership of 217 PTs. The professional entry level of PTs in Ghana is Bachelor's degree but some PTs have Masters Degrees in physiotherapy and related fields. All PTs who are members of the GPA and licensed by the Allied Health Professions Council to practice in Ghana were eligible to participate in the study. Pilot participants and intern PTs were excluded.

Sample size

The sample size was calculated using the Yamane's formula ($n = N / (1 + Ne^2)$, where; N=population, $e=0.05$, at 95% confidence interval). A population size of 217 PTs members of GPA

Therefore, the minimum required sample size was 141 PTs. However, the response rate for the survey, was based on the number of PTs who were present at the GPA annual general meeting.

Questionnaire development and validation

The questionnaire (Supplementary material 1) was developed by the researcher through extensive literature review of available national and international clinical guidelines on PD and in consultation with experts in the field.

The questionnaire was designed in four sections with a total of 25 questions; 1) demographic information of the PTs; 2) PTs' knowledge about the clinical characteristics of PD; 3) PTs' practice and skills; and 4) PTs' experiences and training needs in PD management. A free

text box was included for any additional comments. The questionnaire was made up of closed-ended questions in the form of multiple choice and dichotomous Yes or No questions, and open-ended questions with a case vignette. The questionnaire was first validated by three experts for content validity. The experts rated each question on a 4-point Likert scale 1-4 (1=not relevant; 2=somewhat relevant; 3=quite relevant and 4=highly relevant) (22). The responses were dichotomised into relevant (2) for ratings of 3 or 4 and non-relevant (1) for ratings of 1 or 2. The overall content validity index of the scale was recorded as 0.99 with an item level content validity index (I-CVI) range from 0.67-1.00. (Supplementary material 2). Secondly, the questionnaire was piloted among thirteen PTs of which ten (five males and five females) PTs with an average age of 36.6 (± 7.9) years and average practice duration of 10.6 (± 6.3) years responded (Supplementary material 3). Pilot participants were purposefully selected across different practice settings, age groups and practice duration to ensure a representation of the target population. The respondents made suggestions for rewording of two questions for clarity and inclusion of additional comment box. These pilot participants were excluded in the main study.

Data collection process

During the 2017 annual general meeting of the Ghana Physiotherapy Association in June, a questionnaire, information leaflet and two consent forms, together with an A4-size envelope, were distributed to physiotherapists who were present at the meeting and met the inclusion criteria, at the point of registration. Questionnaires were to be completed and returned on the same day (latest by the close of the meeting) and took about 20 minutes to complete. PTs were encouraged not to discuss or consult any sources while completing the questionnaire. PTs were expected to return a completed questionnaire and one of the signed consent forms to the researcher in a sealed envelope to ensure data protection and anonymity. Prior to the general meeting, information about the survey was posted on the professional WhatsApp platform to create awareness and prepare therapists mind since, the survey was to be completed same day.

Data analysis

Descriptive statistical analysis was performed using Microsoft Excel 2016 and data presented in frequency (percentage), mean (standard deviation) and range. Data analysis for each question was based on the total number of respondents due to varying rate of completion. For the open-ended questions, qualitative content analysis facilitated by Microsoft Excel spread sheet and descriptive statistical analysis was performed. A participant (PT) was considered to have adequate knowledge in non-motor symptoms, motor complications of PD and setting of treatment goals if he/she provided 60% of the maximum range of responses and inadequate knowledge if less than 60%. This calculation was based on Abbott et al's (23) study where 60% score was the cut-off for adequate knowledge in the study variables. For instance, for a response range of (1-5), adequate knowledge is described as having provided three or more responses (ie. 60% of 5 or more) but will have insufficient knowledge if less than three responses were provided.

The Shapiro-Wilk's test showed that the variables were not normally distributed. Also, the Levene' ($F(3)=3.25$, $p=0.032$) and Bartlett's (Chi square, $X^2(3)=7.56$, $p=0.023$) tests showed that the assumption of homogeneity of variances was not met. Therefore, the Kruskal Wallis test was used to determine the association between PTs' Knowledge on non-motor symptoms, motor complications and treatment goals and , their practice duration and number of PwPD treated annually. Level of significance was set as $p \leq 0.05$.

Results

Response and Physiotherapists' Characteristics

A total of 60 PTs who attended the 2017 GPA annual general meeting and met the inclusion criteria were given questionnaires. However, 42 PTs returned the questionnaires resulting in 70% response rate (see figure 1). There were 25 males (59.5%) and 17 females (40.5%). The majority of the participating PTs had Bachelor's degree ($n=37/42$: 88.1%) and worked at the teaching hospital ($n=22/42$; 52.4%) (see Table 1).

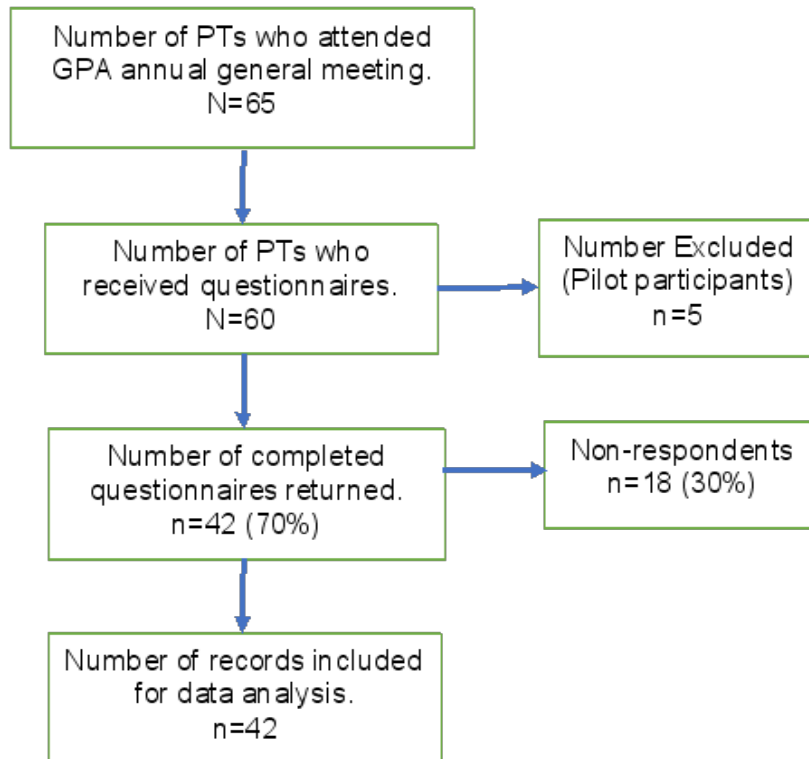


Fig 1: Flow of questionnaire distribution

Table 1: Demographic Characteristics of Survey Physiotherapists

Profile	Characteristics	Number of physiotherapists (n=42)	Percentages (%)
Gender	Male	25	60.0
	Female	17	40.0
Age	Less than 30years	17	40.5
	30-40years	23	54.8
	41-50years	0	0
	51-60years	2	4.8
	Over 60years	0	0
Duration of practice	Mean (SD)	5.4(3.0)*	
	Range	1-15*	
	Junior PT	10	23.8
	Senior PT	27	64.3
	Principal PT	3	7.1
	Deputy chief PT	2	4.8
Work facility	Teaching hospital	22	52.4
	Regional hospital	9	21.4
	District hospital	10	23.8
	Private hospital	1	2.4
Professional qualification	BSc.	37	88.1
	MSc.	5	11.9

Key: SD=standard deviation, PT=Physiotherapist, BSc.= Bachelor of science, MSc.=Master of science, *presented in years

Physiotherapists Knowledge about Parkinson's disease

Ninety percent of the PTs (n=38/42) indicated postural instability as a cardinal motor sign of PD. Only four (9.5%) PTs recorded bradykinesia, resting tremor and rigidity as the three main cardinal motor symptoms for the diagnosis of PD (Figure 2).

Thirty-four different non-motor symptoms were listed by

29 PTs in a range of 1-8. Overall, 89.7% (n=26/29) of PTs who answered this question had inadequate knowledge about non-motor symptoms of PD (listed <5 non-motor symptoms) and only 3 (10.3%) PTs exhibited adequate knowledge (listed >4 non-motor symptoms) (Figure 3). The top five non-motor symptoms recorded were depression, sleep difficulty, dementia, amnesia and anxiety.

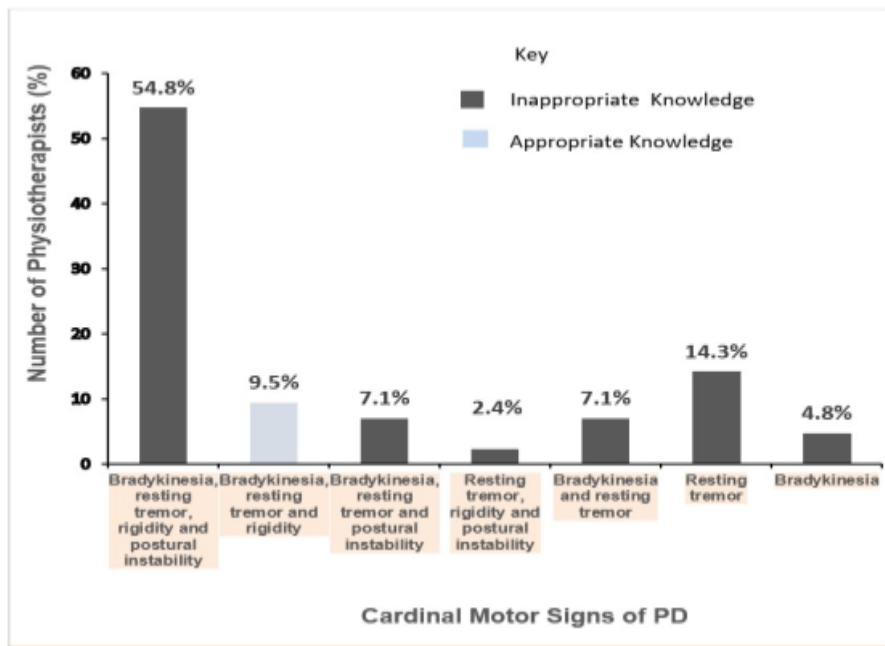


Figure 2: Knowledge about the cardinal motor signs of Parkinson's disease reported by the physiotherapists

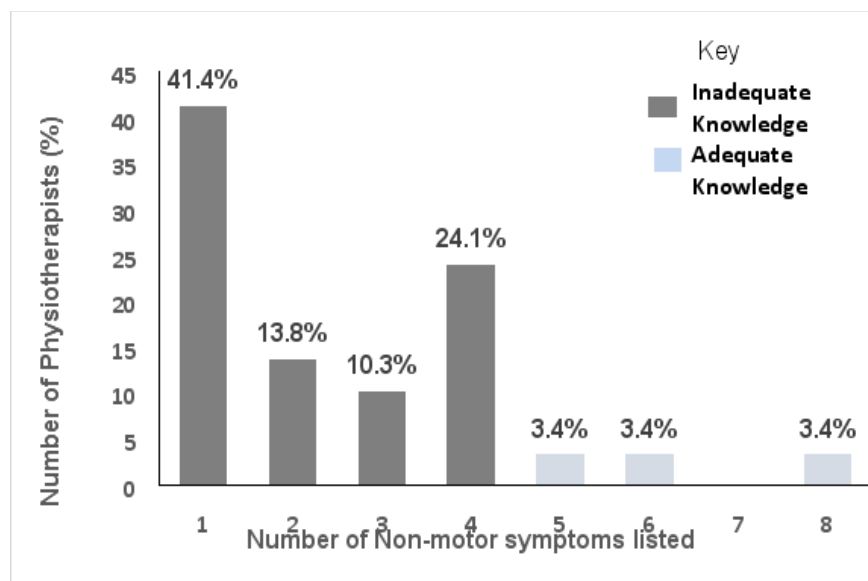


Figure 3: Number of non-motor symptoms of Parkinson's disease reported by the physiotherapists

The 34 (80.9%) PTs answered this question and listed 36 different motor complications in a range of 1-5. All 34 PTs exhibited inadequate knowledge (listed <3 motor complications) about motor complications of PD. Only 3 (8.8%) PTs listed dyskinesia and freezing of gait as mo-

tor complications of PD described by Fahn (10). The remaining 31 (91.2%) PTs listed symptoms, including stiffness, tremors and rigidity which are classified as motor symptoms but not motor complications of PD based on Morris model²⁴.

Knowledge about the Clinical Management of Parkinson's disease

This section describes the varying levels of clinical expertise among the PTs in managing PwPD. Table 2 presents details on number of respondents and responses to

questions on referral sources for PD, appropriate time to initiate and have physiotherapy, frequency and duration of treatment sessions, number of PwPD treated annually, engagement with other multidisciplinary team (MDT) members and setting of treatment goals.

Table 2: Physiotherapists' knowledge about the clinical management of parkinson's disease

Item	No. of total respondents	No. of PTs (%)	n	Response description
Sources of referral	42 (100)			PTs received referrals from;
		39 (92.9)		neurologists/doctors
		15 (35.7)		other PTs
		9 (21.4)		self-referred patients
		71(6.7)		physician assistants
		1 (2.4)		PD nurse
Time to initiate physiotherapy	42 (100)			PTs indicated beginning physiotherapy in the;
		36 (85.7)		early phase of PD
		5 (11.9)		mid-phase (balance impairments with limitation in physical activity)
		1 (2.4)		late-phase (confined to bed) of PD
When to have physiotherapy sessions	38 (90.5)			PTs believed that physiotherapy treatment was appropriate;
		17 (44.7)		only during the 'On' period
		12 (31.6)		after 1-2 hours of medication intake
		2 (5.3)		only during the 'Off' period
		2 (5.3)		within 1-2 hours of medication and during 'On' period
		2 (5.3)		within 1-2 hours of medication and during 'Off' period
		1 (2.6)		within 1-2 hours of medication and during 'On' and 'Off' periods
		2 (5.3)		No idea
Frequency of physiotherapy sessions	40 (95.2)			PTs reported physiotherapy session of;
		18 (45)		twice a week
		10 (25)		Once a week
		4 (10)		Once a month
		1 (2.5)		3 times a week
		3 (7.5)		Irregular intervals
		4 (10)		Never treated PwPD

Mode of therapy delivery	39 (92.9)		PTs delivered physiotherapy treatment on;
		30 (76.9)	individual basis
		2 (5.1)	group therapy basis
		7 (17.9)	both individual basis and in group
Physiotherapy treatment duration	40 (95.2)	55.7(±21.1)* minutes	Mean treatment duration
		30-120** minutes	Range of treatment duration at a teaching hospital and district hospital respectively
Number of PwPD treated annually	33 (78.6)	24 (72.7)	Treated <10 PwPD annually
		2 (6.1)	Treated 10 PwPD annually
		1 (3)	Treated 20 PwPD annually
		6 (18.2)	Treated no PwPD
		4 (±3)*	Mean number of PwPD treated annually.
PTs' referral to members of the multidisciplinary team (MDT)	37 (88.1)	33 (89.2)	Referred PwPD to other health professionals of the MDT
		4 (10.8)	Did not refer patients to any other health professional
		24 (64.9%)	Referred patients to the neurologists
		13 (35.1%)	Referred to dieticians, occupational therapists, speech and language therapists, clinical psychologists, social workers and physician specialists or a specialist in internal medicine.
Setting of treatment goals for a case vignette	38 (90.5)	34	Number of different treatment goals listed
		1-7**	Range of treatment goals listed
		top 5 treatment goals	Gait training, transfer training muscle strengthening, improving balance and co-ordination, and fall prevention
		34 (89.5)	Demonstrated limited knowledge (listed <5 treatment goals)
		4 (10.5)	Exhibited adequate knowledge (listed >4 treatment goals)
		7 (20)	Specifically planned to prevent falls and use cueing strategies to improve freezing episodes

*Mean values; **Range values; PD=Parkinson's disease; PwPD=Person with PD; PTs=Physiotherapists

Test of association

The Kruskal-Wallis (H) test showed no significant association between the groups for the number of patients treated annually (PTs who treated <10 PwPD annually, >10 PwPD annually or did not treat any PwPD) and PTs' level of knowledge about non-motor symptoms (H=0.92,

p=0.63), motor complications (H=1.41, p=0.49) and treatment goals (H=0.20, p=0.91) of PD. Also, there was no significant association between the PTs' practice duration and level of knowledge about non-motor symptoms (H=6.27; p=0.1), motor complications (H=4.02; p=0.26) and treatment goals (H=0.84; p=0.84). The degrees-of-freedom (df) =3.

Table 3: Physiotherapists' experience and training needs

Item	Number of total respondents n (%)	No. of PTs n (%)	Response description
Professional training	40 (95.2)	16 (40)	Had only theoretical lectures on the physiotherapy management of PD in the classroom
		15 (37.5)	Had both theoretical lectures and practical observation of PD management in the clinic
		9 (22.5)	Had theoretical lectures and practical demonstration of PD management in the classroom
Perceived PD-specific skills	38 (90.5)	28 (73.7)	Able to assess PwPD, plan and execute physiotherapy intervention without effective use of outcome measures
		6 (15.8)	Have difficulty with assessment, planning and implementation of physiotherapy intervention without the use of outcome measures
		4 (10.5)	Able to assess a PwPD, plan and execute evidence-based intervention using appropriate outcome measures
Use of outcome measures	2 (4.8)	2 (5.3)	Used three outcome measures each in practice (Hoehn & Yahr staging of PD, Unified PD Rating Scale (UPDRS), Schwab and England Activity of Daily Living, Functional Independent Measure (FIM), Berg Balance scale (BBS) and Parkinson's Activity Scale)

Specialized training in PD	39 (92.9)	37 (95)	Had not received any specialised training in PD management in the last five years
		2 (5)	Had training in the last five years
Need for specialized training in PD	39 (92.9)	38 (97.4)	Specialised training may be beneficial for PD management
Interest in PD management	38 (90.5)	20 (52.6)	Indicated interest in PD management
		18 (47.4)	Had no interest in PD management
Training duration	39 (92.9)	17 (43.6)	PTs preferred 2-3 days course/seminar in PD
		17 (43.6)	PTs preferred one-week course/seminar in PD
		5 (12.8)	Preferred an online course

PD=Parkinson's disease; PwPD=Person with PD; PTs=Physiotherapists

Discussion

The study findings reveal a limitation of knowledge about the clinical characteristics of PD and its management among participating PTs and that these deficits are not influenced by the PTs' practice duration or the annual number of PwPD treated.

The majority of the participating PTs included postural instability as a cardinal motor symptom for diagnosing PD. However, based on the MDS diagnostic criteria for PD²⁵, postural instability has been excluded from the cardinal motor symptoms of PD as its presence early in the disease is an indication for a different condition, like multiple system atrophy as reported by Kollenperger and colleagues²⁶.

About 90% of the PTs were unfamiliar with the presence of bradykinesia, resting tremor and rigidity as the three-main cardinal motor symptoms of PD per the MDS criteria for diagnosing PD²⁵. Again, 90% of the PTs were not adequately informed about the non-motor symptoms of PD. Although most of the PTs noted neuropsychiatric symptoms including depression, dementia, anxiety and amnesia, none of them recorded olfactory dysfunction, excessive daytime somnolence, erectile dysfunction, and symptomatic hypotension which are key non-motor symptoms that occur many years before motor symptoms and persist throughout the disease course⁸. The PTs (91%) had poor knowledge about motor complications

of PD. They listed loss of arm swing; walking difficulty and inability to stand upright which according to Morris²⁴ are classified as motor symptoms of PD. Only three of the PTs knew about dyskinesia and freezing of gait as confirmed motor complications of PD associated with prolonged use of dopamine medication which can be challenging to manage, either medically or surgically¹⁰. This general lack of knowledge about the clinical manifestation of PD identified among the PTs was in line with findings of previous studies which found similar deficits among PTs, general practitioners and neurologists^{18,19,23,27}.

The majority of the PTs considered initiating physiotherapy treatment at the early phase of PD which is in line with the 2017 NICE guidelines for physiotherapy management of PD¹⁷. This guideline recommends early referral of adults with PD to PTs with PD-specific expertise for assessment and education to help prevent or delay motor complications. The PTs demonstrated insufficient knowledge about the estimated time to achieve maximum medication effect. Only 5% of the PTs were aware that PwPD who experience 'ON' and 'OFF' motor fluctuating episodes appear to be active during 'On' period of medication or 1-2 hours after medication²⁸ where patients could achieve maximum effect with exercise.

Most of the PTs were found to provide twice a week treatment for PwPD. Treatment duration ranged from 30-120 minutes, in teaching and district hospitals respec-

tively, per session with a mean of 55.7 (± 21.1) minutes. Some intervention studies have achieved significant improvement in gait for PwPD with 30 to 50 minutes (three times a week) treatment durations within four and twelve weeks^{29,30}. However, in Ghana, patients' financial strength largely determines exercise frequency. Nevertheless, the disparity observed in the treatment durations could result from case overload in the teaching hospitals compared to the district hospitals.

About 89% of the PTs were aware of other health professionals that PwPD could benefit from their services. They referred PwPD to the neurologists and in turn, received referral from them. Also, PTs referred PwPD to doctors, physician specialist or specialist in internal medicine due to the limited number of neurologists in Ghana². Additionally, PTs referred PwPD to dieticians, occupational therapists, speech and language therapists, clinical psychologists, social workers and PD nurses when indicated.

In line with the findings of Keus et al.,¹⁸ and Nijkrake et al.,¹⁹, the majority of the PTs in this current study treated fewer than ten PwPD annually with an annual mean volume of 4 (± 3) PwPD per PT.

Again, about 90% of the PTs perceived themselves to have limited skills in the assessment, planning and execution of evidence-based interventions and the use of outcome measures. This confirms the limitation in knowledge exhibited by most of the PTs about setting treatment goals within the core areas of physiotherapy management of PD. Less than 10% of the PTs planned to prevent falls and use cueing strategies to improve freezing episodes for a patient with history of fall, transfer problems and freezing of gait. This is consistent with Keus et al's³¹ findings where PTs demonstrated inadequate ability in setting treatment goals for their referenced patients. Almost all the PTs had not received any specialised training in PD management and indicated the urgent need for training. The limitations in PD-specific expertise regarding non-motor symptoms, motor complications and setting of treatment goals were not significantly associated with the number of patients treated annually or the PTs' practice duration. This contradicts Keus and colleagues¹⁸ finding that inadequate PD-specific expertise among PTs could result from the few number of patients treated annually. The small size of this study could account for the disparity.

To the best of my knowledge, this is the first study con-

ducted to evaluate the level of PD-specific expertise among PTs in Ghana. The study findings are expected to inform the need for specialised training for PTs in PD care and emphasis on PD clinic rotation during professional training. The major limitations to this study were the small sample size, non-standardised survey tool and paper-based approach used, which could introduce bias into the study. However, the robust process involved in developing the questions, the expert validation and the piloting process provided some level of validity of the questionnaire.

Conclusion

About 50% to 90% of the participating physiotherapists had limited PD-specific expertise about the clinical presentation, practice, skills and experience in the management of PD.

Acknowledgement

Appreciation to Chevening Scholarship, the UK government's global scholarship program, funded by the Foreign and Commonwealth Office (FCO) and partner organizations for sponsoring the author's master's degree, during which this research was conducted.

Appreciation to my supervisor, Professor Lorraine DeSouza (Brunel University London), for her great guidance and corrections in making this work (dissertation) successful.

Appreciation to Dr. Beatrice E. A. Sankah. PhD (Southampton University) for her support and encouragement, in producing the manuscript.

Conflicts of interest

I have no conflict of interest.

Funding statement

This research formed part of my postgraduate studies for an MSc in Neurorehabilitation at Brunel University London. The study was funded by the British and Commonwealth Office through the Chevening Scholarship Award. However, there was no direct sponsorship to this research.

References

1. de Lau LML, Breteler MMB. Epidemiology of Parkinson's disease. *Lancet Neurol* [Internet]. 2006;5(6):525–35. Available from: [https://doi.org/10.1016/S1474-4422\(06\)70471-9](https://doi.org/10.1016/S1474-4422(06)70471-9)

2. Sarfo FS, Akassi J, Badu E, Okorozo A, Ovbiagele B, Akpalu A. Profile of neurological disorders in an adult neurology clinic in Kumasi, Ghana. *eNeurological Sci.* 2016;3:69–74. PubMed
3. Akpalu A, Adjei P, Nkromah K, Poku FO, Sarfo FS. Neurological disorders encountered at an out-patient clinic in Ghana's largest medical center: A 16-year review. *eNeurologicalSci.* 2021;24:100361.
4. Von Campenhausen S, Bornschein B, Wick R, Bötzel K, Sampaio C, Poewe W, et al. Prevalence and incidence of Parkinson's disease in Europe. *Eur Neuropsychopharmacol.* 2005;15(4):473–90.
5. Blanckenberg J, Bardien S, Glanzmann B, Okubadejo NU, Carr JA. The prevalence and genetics of Parkinson's disease in sub-Saharan Africans. *J Neurol Sci.* 2013 Dec 15;335(1–2):22–5.
6. Dotchin C, Msuya O, Kissima J, Massawe J, Mhina A, Moshy A, et al. The prevalence of Parkinson's disease in rural Tanzania. *Mov Disord.* 2008;23(11):1567–672.
7. Hely MA, Morris JGL, Reid WGJ, Trafficante R. Sydney Multicenter Study of Parkinson's disease: Non-L-dopa-responsive problems dominate at 15 years. *Mov Disord.* 2005 Feb;20(2):190–9.
8. Berg D, Postuma RB, Adler CH, Bloem BR, Chan P, Dubois B, et al. MDS research criteria for prodromal Parkinson's disease. *Mov Disord.* 2015;30(12):1600–11.
9. Rinne UK, Bracco F, Chouza C, Dupont E, Gershanik O, Masso JFM, et al. Early Treatment of Parkinson's Disease with Cabergoline Delays the Onset of Motor Complications Results of a Double-Blind Levodopa Controlled Trial. 1998.
10. Fahn S. How do you treat motor complications in Parkinson's disease: Medicine, surgery, or both? *Ann Neurol.* 2008;64(SUPPL. 2).
11. Chapuis S, Ouchchane L, Metz O, Gerbaud L, Durif F. Impact of the motor complications of Parkinson's disease on the quality of life. *Mov Disord.* 2005;20(2):224–30.
12. Perepezko K, Hinkle JT, Shepard MD, Fischer N, Broen MPG, Leentjens AFG, et al. Social role functioning in Parkinson's disease: A mixed-methods systematic review. *Int J Geriatr Psychiatry.* 2019;34(8):1128–38.
13. Mushi D, Rongai A, Paddick SM, Dotchin C, Mtuya C, Walker R. Social representation and practices related to dementia in Hai District of Tanzania. *BMC Public Health.* 2014;14(1).
14. Liu Z, Heffernan C, Tan J. Caregiver burden: A concept analysis. *Int J Nurs Sci.* 2020 Oct 10;7(4):438–45.
15. Yang W, Hamilton JL, Kopil C, Beck JC, Tanner CM, Albin RL, et al. Current and projected future economic burden of Parkinson's disease in the U.S. *NPJ Park Dis* [Internet]. 2020;6(1):1–9. Available from: <http://dx.doi.org/10.1038/s41531-020-0117-1>
16. Frazzitta G, Balbi P, Maestri R, Bertotti G, Boveri N, Pezzoli G. The beneficial role of intensive exercise on Parkinson disease progression. *Am J Phys Med Rehabil.* 2013;92(6):523–32.
17. NICE. Parkinson's disease in adults. *Natl Inst Heal Care Excell* [Internet]. 2017;(July 2017):1–14. Available from: <https://www.nice.org.uk/guidance/ng71/>
18. Keus SHJ, Bloem BR, Verbaan D, de Jonge PA, Hofman M, Van Hilten BJ, et al. Physiotherapy in Parkinson's disease: Utilisation and patient satisfaction. *J Neurol.* 2004;251(6):680–7.
19. Nijkrake MJ, Keus SHJ, Oostendorp RAB, Overeem S, Mulleners W, Bloem BR, et al. Allied Health Care in Parkinson's Disease: Referral, Consultation, and Professional Expertise. *Mov Disord.* 2009;24(2):282–6.
20. Cilia R, Akpalu A, Cham M, Bonetti A, Amboni M, Faceli E, et al. Parkinson's disease in sub-Saharan Africa: step-by-step into the challenge. *Neurodegener Dis Manag.* [Internet]. 2011 Jun 13 [cited 2022 Sep 14];1(3):193–202. Available from: <https://www.futuremedicine.com/doi/10.2217/nmt.11.28>
21. Okubadejo NU, Ojini FI, Danesi MA. Longitudinal study of mortality predictors in Parkinson's disease in Nigerians. *Afr J Med Med Sci.* [Internet]. 2005 Dec 1 [cited 2022 Sep 14];34(4):365–9. Available from: <https://europepmc.org/article/med/16752667>
22. Polit DF, Beck CT, Owen S V. Focus on Research Methods Handling Missing Data in Self-Report Measures. *Res Nurs Health.* 2007;30:459–67. PubMed
23. Abbott LM, Naismith SL, Lewis SJG. Parkinson's disease in general practice: Assessing knowledge, confidence and the potential role of education. *J Clin Neurosci* [Internet]. 2011;18(8):1044–7. Available from: <http://dx.doi.org/10.1016/j.jocn.2010.12.041>
24. Morris ME. Movement Disorders in People With Parkinson Disease: A Model for Physical Therapy. *Phys Ther* [Internet]. 2000 Jun 1 [cited 2022 Sep 14];80(6):578–97. Available from: <https://academic.oup.com/ptj/article/80/6/578/2842508>
25. Postuma RB, Berg D, Stern M, Poewe W, Olanow CW, Oertel W, et al. MDS clinical diagnostic criteria for Parkinson's disease. *Mov Disord.* 2015;30(12):1591–601. PubMed

26. Köllensperger M, Geser F, Seppi K, Stampfer-Kountchev M, Sawires M, Scherfler C, et al. Red flags for multiple system atrophy. *Mov Disord*. 2008;23(8):1093–9.
27. Li J, Chen D, Song W, Chen K, Cao B, Huang R, et al. Survey on general knowledge on Parkinson's disease in patients with Parkinson's disease and current clinical practice for Parkinson's disease among general neurologists from Southwest China. *Clin Neurol Neurosurg* [Internet]. 2014;118:16–20. Available from: <http://dx.doi.org/10.1016/j.clineuro.2013.12.009>
28. Contin M, Riva R, Martinelli P, Procaccianti G, Cortelli P, Avoni P, et al. Response to a standard oral levodopa test in parkinsonian patients with and without motor fluctuations. *Clin Neuropharmacol* [Internet]. 1990 Feb 1 [cited 2022 Sep 14];13(1):19–28. Available from: <https://europepmc.org/article/med/2306746>
29. Shulman LM, Katzel LI, Ivey FM, Sorkin JD, Favors K, Anderson KE, et al. Randomized Clinical Trial of 3 Types of Physical Exercise for Patients With Parkinson Disease. *JAMA Neurol* [Internet]. 2013 Feb 1 [cited 2022 Sep 14];70(2):183–90. Available from: <https://jamanetwork.com/journals/jamaneurology/fullarticle/1389386>
30. Yang YR, Tseng CY, Chiou SY, Liao KK, Cheng SJ, Lai KL, et al. Combination of rTMS and treadmill training modulates corticomotor inhibition and improves walking in parkinson disease: A randomized trial. *Neurorehabil Neural Repair*. 2013;27(1):79–86.
31. Keus S, Munneke M, Graziano M, Paltamaa J, Elisa P, Domingos J, et al. European physiotherapy guideline for Parkinson's disease: Development and justification. *The Netherlands: KNGF/ParkinsonNet*. 2014;191.