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Knowledge, Attitudes and Practices of Physicians on Diagnosis and Management of Diabetic Peripheral Neuropathy at the University of Santo Tomas Hospital

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Abstract

Background. Diabetic peripheral neuropathy (DPN) is a prevalent chronic complication of diabetes, resulting in significant morbidity and mortality. Despite its impact, DPN remains an underdiagnosed and undertreated entity, further underscoring the need for improved physician awareness and timely intervention.

Objective. The study aimed to determine physicians' knowledge, attitudes and practices (KAP) in the diagnosis and management of DPN and the association between knowledge and attitude to practice.

Methodology. This was a cross-sectional study involving 211 physicians from the University of Santo Tomas Hospital (USTH). Chi-square test was employed to compare physician characteristics based on KAP. The association of knowledge and attitude with practice regarding DPN was analyzed using multiple logistic regression analysis.

Result. Median knowledge level was 81.3%, indicating good knowledge on DPN diagnosis and management. Most had favorable attitude and reported appropriate practice. Only attitude was shown to be significantly associated with practice.

Conclusion. Despite good knowledge about DPN, attitude was the only key influencer on appropriate practice. Enhancing positive attitudes in screening and management is essential to improve patient care and outcomes.

Key words: diabetic neuropathy; diabetes complications, knowledge, attitudes, practice, peripheral neuropathy

INTRODUCTION

Based on the International Diabetes Federation estimate in 2021, the prevalence of diabetes mellitus (DM) in the Philippines was 7.5%, affecting 4,303,899 individuals.[1] It continues to be the fourth leading cause of death in the country based on 2022 statistics.[2]

Diabetic peripheral neuropathy as a complication of DM significantly contributes to morbidity and mortality. Approximately one in two patients with diabetes suffers from symptoms of DPN; 80% remain undiagnosed and untreated despite being symptomatic.

Early screening is of utmost importance to allow timely intervention. Patients may be unable to recognize symptoms of DPN and these may remain unreported to their healthcare providers. Up to 50% of these patients may not experience any noticeable symptoms.[3] A study by Tanirlar, et. al., on the knowledge, attitudes and practices of primary health care institutions in Turkey showed there were deficiencies in the knowledge level and approaches of physicians regarding DPN.[4] Assessing the adequacy of knowledge of physicians to provide comprehensive care in terms of prevention and treatment will help reduce morbidity and mortality. Educating patients about DPN will help them understand signs and symptoms and ensure timely intervention. The role of specialists is essential in the management of diabetes, particularly early complicaiton detection and intervention.

To our knowledge, there is a paucity of studies done on DPN in the Philippines. Consequently, the objective of this research was to assess the knowledge, attitude, and practices of physicians and identify gaps in the diagnosis and management of DPN. It also aimed to compare the characteristics of physicians between good and poor knowledge levels; favorable and unfavorable attitudes; and appropriate versus inappropriate practices; to identify barriers to the diagnosis and management of diabetic

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peripheral neuropathy. Lastly, this study also aimed to determine the relationship of knowledge and attitude of physicians to their practice in diagnosis and management of diabetic peripheral neuropathy (Appendix A).

Data obtained will allow identification of barriers in early diagnosis and appropriate management of patients with DPN. Understanding the KAP related to DPN can facilitate development of strategies to improve these domains, and ultimately patient management.

The results of this study will further strengthen measures to ensure adequate knowledge of physicians in providing comprehensive care to patients with DM. Understanding the KAP of physicians may also foster collaboration with other healthcare professionals in terms of timely referrals, ultimately leading to a more comprehensive and coordinated approach regarding DPN management. This will also benefit the institution since determining KAP of physicians helps the healthcare systems identify gaps that may require additional training. Hence, proper allocation of resources, such as educational programs or workshops, can be directed towards addressing these gaps and enhancing physician competence. Continuous assessment also allows quality improvement in the management of DPN. Data that may be provided by this research may also strengthen research on healthcare practices, contributing to the development of evidence-based guidelines.

METHODOLOGY

This research was an analytical, cross-sectional, questionnaire-based study done at the University of Santo Tomas Hospital. Research ethics committee approval was obtained.

This study included residents, fellows and consultants from the Departments of Internal Medicine, Family Medicine, Neurology and Psychiatry, Dermatology, ENT-HNS, Obstetrics and Gynecology, Ophthalmology, Rehabilitation Medicine and Surgery who completed at least one year residency in their respective specialties to ensure adequate patient experience. Residents, fellows and consultants from the Department of Anesthesiology, Clinical and Anatomic Pathology, Nuclear Medicine, and Radiological Sciences were excluded from the study since they were not expected to participate in the direct management of patients with DM, such that recognition and diagnosis of diabetes and diabetic neuropathy are beyond their area of focus (Figure 1).

OpenEpi sample size calculator was used to calculate the minimum sample size requirement. Based on a previous study, the proportion of good knowledge, favorable attitude and appropriate practice were 48.3%, 66.7% and 43.3%, respectively.[5] Using a maximum tolerable error of 5%, alpha of 0.05 and a finite population of 466, the sample size requirement was calculated as 198 to 211.The largest sample size obtained was used for this study. To account for 10% potential non-response, the minimum sample size was increased to 235.

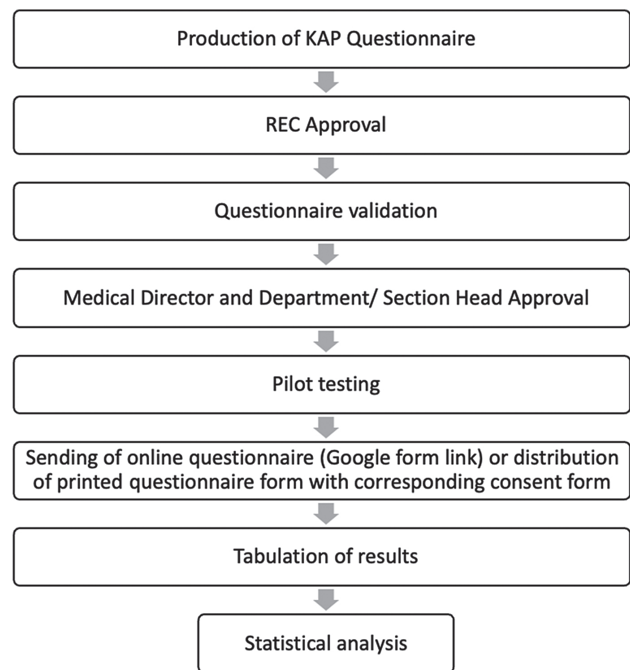

Figure 1. Flowchart of the study

Since *a priori* sample size computation for the objective examining the association of knowledge and practice was not available due to the lack of similar studies, *post hoc* power analysis using PASS 2021 software was performed instead. *Post hoc* power analysis revealed low statistical power for the regression analysis: only 77% for attitude and 8% for knowledge.

Stratified random sampling proportional to sample size was employed to select study participants. The strata consisted of residents, fellows and consultants. This ensured that the study population was a sample that is proportionally representative to the target population based on designation (Appendix C). OpenEpi Random Number Generator was used to create the list of random numbers per strata. The list of all trainees and consultants in USTH fulfilling inclusion criteria obtained from the Medical Director's Office and the UST Department of Medical Education and Research were used as the sampling frame.

Data gathering

A Knowledge, Attitudes and Practices questionnaire was formulated by the investigators. Questions were formulated based on the 2022 American Diabetes Association (ADA) clinical compendia on the Diagnosis and Treatment of Painful Diabetic Peripheral Neuropathy and the ADA Standards of Care 2023.[5,6] These guidelines discuss the recommendations on comprehensive diabetes management strategies for complications like DPN. These emphasize appropriate screening, diagnosis and management of DPN based on evidence and practice.

Content validity of the questionnaire was done by three content experts, consisting of two endocrinologists and

a neurologist. They were given a standardized form to determine the relevance of each item of the tool. The item-content validity index (I-CVI) was calculated (range: 0-1), and was categorized as follows: item is relevant (I-CVI >0.79), item needs revisions (I-CVI 0.70 to 0.79), and item is removed (I-CVI <0.70). The average of the I-CVI scores for all items on the scale (S-CVI/Ave) and the proportion of items on the scale that achieved a relevance scale of 3 or 4 by all experts (S-CVI/UA) was calculated. Excellent content validity was defined as S-CVI/UA ≥ 0.8 and S-CVI/Ave ≥ 0.97. Content validity and Cronbach's alpha was calculated to determine the validity and reliability of the tool (Appendix D).

The study was started following approval from the research ethics committee. The questionnaire was reproduced, and a pilot study was conducted among 10% of the total population. The questionnaire was finalized after the modification of the questions based on the pilot study. Appropriate correspondence with hospital administration and training committees were done to secure permission in distribution of questionnaires. Once informed consent was obtained, and questionnaires were then distributed both via paper form and Google form based on the preference of participant. Demographic characteristics were also collected: including age, gender, years in practice, specialty, designation, total number of patients seen per week, additional training in DPN (if applicable) and attendance in update lectures on DPN.

Data were encoded in Microsoft Excel by the researcher. Stata/MP version 17 software was used for data processing and analysis. Continuous variables were presented as median/interquartile range (IQR) due to the non-normal data distribution based on the Shapiro-Wilk test. Categorical variables were expressed as frequencies and percentages. Comparison of physician characteristics based on KAP was performed using Mann -Whitney U test for continuous variables, and chi-square test or Fisher's Exact test for categorical variables. To determine the association of knowledge and attitude with practice regarding DPN, multiple logistic regression analysis was performed. Screening of potential confounders was based on the p<0.20 criteria, and significant confounders were identified based on the change-in-estimate criteria of >10%.[7] P values ≤0.05 were considered statistically significant. Missing data were neither replaced nor estimated.

RESULTS

Table 1 illustrates the demographic characteristics of the included participants. A total of 235 physicians were invited initially to participate in the study, of which 211 agreed. The median age was 34 years, and more than half were male. The median years in practice was six years. Most were non-internal medicine (IM) physicians, and about half of the participants were consultants. The median number of patients with DM seen per week for all physicians was eight.

Table 1. Characteristics of included physicians (n = 211)

Characteristic	Frequency (% or IQR[a])
Age (in years), median	34 (30-41)
Gender	
Male	119 (56)
Female	92 (44)
Years in practice, median	6 (3-10)
Specialty	
General practitioner	0
General IM[b]	13 (6)
IM[b] sub-specialist	66 (31)
Non-IM[b]	132 (63)
Designation	
Consultant	101 (48)
Fellow	41 (19)
Resident	69 (33)
Number of patients with DM per week, median	8 (4-12)
Additional training, % yes	76 (36)
Attendance on update lecture regarding DPN	
0-5 months ago	27 (13)
6-11 months ago	25 (12)
12-23 months ago	40 (19)
2-5 years ago	20 (9)
More than 5 years ago	15 (7)
Never attended	84 (40)

[a] IQR, interquartile range; [b] IM, internal medicine

Table 2. KAP on DPN diagnosis and management (n = 211)

Domain	Frequency (% or IQR[a])
Knowledge level, median	81.3 (71.9-90.6)
Good	204 (97)
Poor	7 (3)
Attitude score, median	80 (75.6-88.9)
Favorable	130 (62)
Unfavorable	81 (39)
Practice score, median	73.3 (53.3-86.7)
Appropriate	157 (74)
Inappropriate	54 (26)

[a] IQR, interquartile range

More than a third had additional training/attended lectures in DPN management. The most common source of additional information were books (72%). Other sources of information were clinical practice guidelines (66%), journals (58%), social media resources (57%), continuing medical education/workshops/conferences/webinars (51%), colleagues (45%), pharmaceutical representatives (41%), undergraduate training (38%), postgraduate training (38%), UpToDate® (33%) and Medscape (4%). On the other hand, most of the participants (40%) had never attended an update lecture on management of DPN.

Table 2 presents the knowledge on DPN diagnosis and management among included physicians. Median knowledge level was 81.3%. Only three were noted to attain a perfect score. Except for seven participants, all had good knowledge about DPN diagnosis and management. Median attitude level was 80%. 12% attained an attitude score of 100% and most had favorable attitude towards DPN diagnosis and management. Median practice score was 73.3%. Majority had appropriate practice of DPN diagnosis and management.

Table 3 compares the characteristics of physicians with good versus poor knowledge on DPN diagnosis and management. Analyses showed that between the two groups, only additional training was significantly different between the two groups. A higher proportion of physicians with good knowledge had additional training in the management of DPN compared to those with poor knowledge. Among the 132 non-IM physicians, 65 did not attend lectures on DPN. Of these, 89% had good knowledge.

Table 4 compares the characteristics of physicians with favorable and unfavorable attitude towards DPN diagnosis and management. Gender, specialty and additional training significantly differed between the two groups. Compared to those with unfavorable attitude, a higher proportion of those with favorable attitude were males, non-IM and had additional training in management of DPN.

Table 5 compares the characteristics of physicians with appropriate versus inappropriate practice of DPN

Table 3. Characteristics of included physicians: good vs. poor knowledge about DPN diagnosis and management (n = 211)

Characteristic	Good knowledge (n = 204)	Poor knowledge (n = 7)	*P* value
	Frequency (% or IQR[a])		
Age (year), median	34 (30-41)	35 (32-55)	0.3441[b]
Gender			
Male	114 (56)	5 (71)	0.473[c]
Female	80 (44)	2 (29)	
Years in practice, median	6 (3-10)	6 (5-20)	0.4811[b]
Specialty			
General IM	13 (6)	0	0.179[c]
IM sub-specialist	66 (32)	0	
Non-IM	125 (61)	7 (100)	
Designation			
Consultant	97 (48)	4 (57)	0.679[c]
Fellow	39 (19)	2 (29)	
Resident	68 (33)	1 (14)	
Number of patients with DM per week, median	8 (4-15)	8 (5-10)	0.7948[b]
Additional training, % yes	76 (37)	0	0.050*[c]
Attendance on update lecture regarding DPN			
0-5 months ago	27 (13)	0	0.142[c]
6-11 months ago	25 (12)	0	
12-23 months ago	40 (20)	0	
2-5 years ago	20 (10)	0	
More than 5 years ago	15 (7)	0	
Never attended	77 (38)	7 (100)	

[a] IQR, interquartile range; [b] Mann-Whitney U test; [c] Fisher's exact test

Table 4. Characteristics of included physicians: favorable vs. unfavorable attitude towards DPN (n = 211)

Characteristic	Favorable attitude (n = 130)	Unfavorable attitude (n = 81)	*P* value
	Frequency (% or IQR[a])		
Age (in years), median	33 (30-38)	34 (31-49)	0.0691[b]
Gender			
Male	84 (65)	35 (43)	0.002*[c]
Female	46 (35)	46 (57)	
Years in practice, median	6 (3-10)	7 (4-20)	0.0672[b]
Specialty			
General IM	5 (4)	8 (10)	0.044*[c]
IM sub-specialist	36 (28)	30 (37)	
Non-IM	89 (68)	43 (53)	
Designation			
Consultant	60 (46)	41 (51)	0.607[c]
Fellow	28 (22)	13 (16)	
Resident	42 (32)	27 (33)	
Number of patients with DM per week, median	10 (4-15)	6 (4-12)	0.2376[b]
Additional training, % yes	57 (44)	19 (23)	0.003*[c]
Attendance on update lecture regarding DPN			
0-5 months ago	19 (15)	8 (10)	0.245[c]
6-11 months ago	20 (15)	5 (6)	
12-23 months ago	21 (16)	19 (23)	
2-5 years ago	11 (8)	9 (11)	
More than 5 years ago	8 (6)	7 (9)	
Never attended	51 (39)	33 (41)	

[a] IQR, interquartile range; [b] Mann -Whitney U test; [c] chi-square test

diagnosis and management. Only additional training and attendance in update lectures regarding DPN were significantly different between the two groups. A higher proportion of physicians with appropriate practice had additional training in management of DPN than those with inappropriate practice. On the other hand, a higher proportion of physicians with inappropriate practice had never attended an update lecture regarding DPN compared to those with appropriate practice.

Based on the univariate analysis, the following were considered as probable confounders (i.e., satisfied $p<0.20$ criteria) and were entered into the multivariable model together with knowledge and attitude: age, years in practice, number of diabetic patients per week, additional training and attendance on update lecture regarding DPN (Table 6). However, based on the change-in-estimate criterion of >10% during multivariable analysis, only attendance in lectures regarding DPN was retained. Thus, this was

Table 5. Characteristics of included physicians: appropriate vs. inappropriate practice regarding DPN (n = 211)

Characteristic	Appropriate practice (n = 157)	Inappropriate practice (n = 54)	*P* value
	Frequency (% or IQR[a])		
Age (in years), median	34 (30-40)	35 (31-47)	0.0691[b]
Gender			
Male	86 (55)	33 (61)	0.418[c]
Female	71 (45)	21 (39)	
Years in practice, median	6 (3-10)	7.5 (4-15)	0.0672[b]
Specialty			
General IM	11 (7)	2 (4)	0.680[c]
IM sub-specialist	49 (31)	17 (31)	
Non-IM	97 (62)	35 (65)	
Designation			
Consultant	73 (47)	28 (52)	0.756[c]
Fellow	32 (20)	9 (17)	
Resident	52 (33)	17 (31)	
Number of patients with DM per week, median	10 (4-15)	5 (2-10)	0.2376
Additional training, % yes	63 (40)	13 (24)	0.034*[c]
Attendance on update lecture regarding DPN			
0-5 months ago	24 (15)	3 (6)	0.001*[c]
6-11 months ago	22 (14)	3 (6)	
12-23 months ago	36 (23)	4 (7)	
2-5 years ago	14 (9)	6 (11)	
More than 5 years ago	11 (7)	4 (7)	
Never attended	50 (32)	34 (63)	

[a] IQR, interquartile range; [b] Mann -Whitney U test; [c] chi-square test

Table 6. Association of knowledge and attitude towards DPN diagnosis and management and appropriate practice

	Crude OR[a] (95% CI)	*P* value	Adjusted OR[a] (95% CI)	*P* value
Knowledge about DPN diagnosis and management				
Poor	Ref	Ref	Ref	Ref
Good	1.17 (0.22-6.21)	0.854	0.53 (0.09-3.00)	0.471
Attitude towards DPN diagnosis and management				
Unfavorable	Ref	Ref	Ref	Ref
Favorable	2.34 (1.25-4.37)	0.008*	2.49 (1.29-4.83)	0.007*
Age (in years), median	0.98 (0.97-1.01)	0.183	-	-
Gender				
Male	Ref	Ref	-	-
Female	0.77 (0.41-1.45)	0.419	-	-
Years in practice, median	0.98 (0.95-1.01)	0.173	-	-
Specialty				
General IM	Ref	Ref	-	-
IM sub-specialist	0.52 (0.11-2.61)	0.430	-	-
Non-IM	0.50 (0.11-2.39)	0.388	-	-
Designation				
Consultant	Ref	Ref	-	-
Fellow	1.36 (0.58-3.22)	0.479	-	-
Resident	1.17 (0.58-2.36)	0.655	-	-
Number of diabetic patients per week, median	1.06 (1.01-1.11)	0.026*	-	-
Additional training, % yes	2.11 (1.05-4.26)	0.036*	-	-
Attendance on update lecture regarding DPN				
Never attended	Ref	Ref	Ref	Ref
Attended	3.64 (1.91-6.94)	<0.0001*	3.78 (1.95-7.32)	<0.0001*

[a] OR, odds ratio

Table 7. Barriers to DPN screening and management (n = 211)

Barrier	Yes	No	Not applicable
	Frequency (%)		
1. Lack of doctor-patient time	146 (69)	59 (28)	6 (3)
2. Inaccessibility of tools such as 10 g monofilament or tuning fork	184 (87)	17 (8)	10 (5)
3. Patients' coexisting multiple medical conditions that need more priority	180 (85)	29 (14)	2 (1)
4. Patients' refusal for screening and management	124 (59)	77 (36)	10 (5)
5. Others	4 (2)	28 (13)	179 (85)

the only variable that was considered as a significant confounder. Knowledge was not significantly associated with appropriate practice. Attitude was significantly associated with practice. Participants with favorable attitude towards DPN diagnosis and management had two times higher odds of appropriate practice than those with unfavorable attitude. Even after controlling for the effects of significant confounder, attitude remains significantly associated with practice.

The most commonly cited barrier to DPN screening and management was the inaccessibility of tools, such as 10 g monofilament or tuning fork (87%), followed by patients' coexisting multiple medical conditions that need more priority (85%) (Table 7). There were a few participants who also cited other barriers including financial issues, patients believing in Google, and cost of tests (e.g., nerve conduction velocity, electromyography, physical therapy occupational therapy).

DISCUSSION

The outcomes of this research have provided insight into the knowledge, attitudes and practices of physicians regarding DPN. The most common source of additional information/training regarding DPN were books (72%) and CPGs (66%), followed by journals (58%) and social media resources (57%). A study by Tanirlar, et. al. on the knowledge, attitudes and practices of primary health care institutions in Turkey showed there were deficiencies in the knowledge level and approaches of physicians regarding DPN.[4] In our study, most (40%) reported to have never attended an update lecture on management of DPN. Consequently, additional training was consistently associated with good knowledge, favorable attitude and appropriate practice. This was similar to the results in a study by Tanirlar et al., wherein the knowledge score of family physicians who underwent specialty training was statistically higher than those who did not.[4] This was attributed to more exposure to the care of patients with diabetic neuropathy during their residency training. The median knowledge level determined in the current study was 81.3% which showed a markedly higher level of proficiency in comparison to the clinical gaps identified by Al-Geffari[8] where only a small minority of practitioners were found to be knowledgeable in using screening tools.

In contrast, these were better than the results in a study by Peimani et al. which reported good knowledge scores in only 29% among the total number of physicians involved in the study.[9]

In the item analysis on knowledge about screening, all participants were able to attain a knowledge score of more than 50% regarding screening tools for DPN. One of the screening tests mentioned included monofilament testing. In contrast to our results, Tanirlar et al. reported that only 4.6% of the physicians in their study had knowledge about this specific test.[4]

In the attitude domain, 84% of the participants agreed that all patients with DM will benefit from DPN screening. Despite this, 64% of the participants claimed to have never screened patients with DM for DPN in their daily practice. Only 46% of the participants were confident in performing screening tests for DPN. Tanirlar et al. reported more than half of their participants were not confident in screening and managing diabetic neuropathy themselves.[4] Overall, our study showed that 74% had appropriate practice regarding DPN diagnosis and management.

In a study by Malik et al., the diagnosis and treatment of DPN were regarded as low priority by physicians, indicating a lack of awareness regarding DPN.[10] Inaccessibility of tools, such as 10 g monofilament or tuning fork, was the most identified barrier to DPN screening and management.

While there was good knowledge among most physicians, this did not translate to attitudes and practice. Good knowledge may be due to the wide availability of resources such as online materials and conferences. Aside from continuing medical education seminars and training courses to further strengthen knowledge, workshops may also done so as to empower physicians in adapting appropriate practice. Since one of the barriers identified includes unavailability of tools or materials for screening, it is important for the stakeholders to ensure availability of such resources (e.g., 10 g monofilament, questionnaires, tuning fork) for the physician to utilize to encourage regular screening for patients with DM.

Although this is the first study assessing the knowledge, attitudes and practices of physicians regarding DPN in the Philippines, there are still limitations to this research. These include the potential for recall bias and possible social desirability bias. Given its reliance on self-reported

data, there is a possibility of overestimation in terms of favorable attitude and good practice. Due to the lack of similar studies, *a priori* sample size computation was mainly based on assumptions. *Post hoc* power analysis revealed low statistical power for the regression analysis, especially for knowledge (8%). The findings that were not statistically significant for knowledge could have been due to the high beta error attributed to the low power. Moreover, the comparison of characteristics by knowledge, attitudes and practice was purely exploratory. The non-significant findings could be due to the low statistical power. Since this was a single-center study, characteristics, knowledge, attitudes and practices of physicians from other institutions may be different. A multi-center study may capture variations across different demographics, which would help in making the results more generalizable.

CONCLUSION

This study showed that majority of the participants involved had good knowledge, favorable attitudes and appropriate practice. It was also seen that attitude was significantly associated with practice. Hence, interventions aiming to improve health practices should focus on enhancing positive attitudes, as they may significantly influence practice outcomes. Strategies focused on attitudes may be key mediators in translating knowledge into practice.

Similarly, additional training was seen to significantly influence attitude and clinical practice. Regular updates and training, whether via literature, CPGs or confe-rences will help further strengthen knowledge and empower application in practice to address gaps in the comprehensive management of DPN patients.

This is the first study to assess knowledge, attitude, and practices of physicians in the Philippines regarding DPN. Although the findings demonstrate generally good knowledge and favorable attitudes, there are certain limitations that must be considered. This includes use of self-reported date that introduces potential for recall and social desirability bias, which may have resulted to overestimation of positive attitude and reported practices. As a single-center study, the results may not have been representative of other institutions.

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Statement of Authorship
All authors certified fulfillment of ICMJE authorship criteria.

CRediT Author Statement
SBR: Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data curation, Writing – original draft preparation, Writing – review and editing, Visualization, Supervision, Project administration, Funding acquisition; **DVT:** Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data curation, Writing – original draft preparation, Writing – review and editing, Visualization, Supervision, Project administration, Funding acquisition; **DVB:** Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data curation, Writing – original draft preparation, Writing – review and editing, Visualization, Supervision, Project administration, Funding acquisition; **BJM:** Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data curation, Writing – original draft preparation, Writing – review and editing, Visualization, Supervision, Project administration, Funding acquisition.

Data Availability Statement
Datasets are not publicly available because participants in the study did not give written consent for their data to be shared.

Author Disclosure
The authors declared no conflict of interest.

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None.

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APPENDICES

Appendix A. Operational definition of variables

Variable	Operational Definition	Categories
Knowledge about DPN	Measured using a questionnaire composed of 10 items. Each correct answer is given a score of 1. Knowledge score is the percentage of correct answers for knowledge items.	• Good knowledge level ≥50% correct answers • Poor knowledge level <50% correct answers
Attitude towards DPN	Measured using a questionnaire composed of 10 items, answerable using a 5-point Likert Scale. The following points will be applied, and the total attitude score will be calculated: 5=strongly agree, 4=agree, 3=neutral, 2=disagree, 1=strongly disagree. Attitude score is the percentage of correct answers for attitude items.	• Favorable attitude ≥80% of total score • Unfavorable attitude <80%
Practice of DPN screening and management	Measured using 3 general questions that are composed of a 4-point Likert scale. The following points will be applied, and the total practice score will be calculated: 3=always, 2=often, 1=seldom, 0=never. Practice score is the percentage of correct answers for practice items.	• Appropriate practice ≥60% of total score • Inappropriate if <60%
Specialty	Field of chosen specialization/subspecialization	• General Practitioner: Licensed medical doctor by the PRC[a], not currently undergoing residency training • General IM[b]: currently undergoing residency training in IM, or finished at least 3 years residency in IM and certified by the PCP[c], not undergoing fellowship training in any subspecialty • Sub-specialist: currently undergoing fellowship training in chosen field of sub-specialty (cardiology, pulmonology, endocrinology, nephrology, gastroenterology, hematology, oncology, rheumatology, infectious diseases; or completed fellowship training inchosen sub-specialty • Non-IM: Other services not included in internal medicine (family medicine, neurology and psychiatry, surgery, dermatology, ophthalmology, ENT-HNS[d], rehabilitation medicine
Years of practice	Years since licensed MD[e]	

[a] PRC, Professional Regulation Commission; [b] IM, internal medicine; [c] PCP, Philippine Colege of Physicians; [d] ENT-HNS, ear nose and throat - head and neck surgery; [e] MD, medical doctor

Appendix B. Sample size computation

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Tests for One Coefficient Alpha

Numeric Results
Hypotheses: H0: CA = CA0 vs. H1: CA ≠ CA0

Power	Sample Size N	Number of Items K	Coefficient Alpha|H0 CA0	Actual Coefficient Alpha CA1	Alpha	Beta
0.90743	16	39	0	0.7	0.05	0.09257

References

Bonett, Douglas. 2002. 'Sample Size Requirements for Testing and Estimating Coefficient Alpha.' Journal of Educational and Behavioral Statistics, Vol. 27, pages 335-340.
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Report Definitions
Power is the probability of rejecting a false null hypothesis.
N is the total sample size.
K is the number of items or raters.
CA0 is the value of coefficient alpha under the null hypothesis.
CA1 is the value of coefficient alpha at which the power is computed.
Alpha is the probability of rejecting a true null hypothesis. It should be small.
Beta is the probability of accepting a false null hypothesis. It should be small.

Summary Statements
A sample of 16 subjects each responding to 39 items achieves 91% power to detect the difference between the actual coefficient alpha of 0.7 and the coefficient alpha under the null hypothesis of 0 using a two-sided F-test with a significance level of 0.05.

Appendix C. Sample size determination per study objective

Objective	Parameter	Sample size
Proportion of good knowledge level about DPN, including diagnosis and management	P[a] = 48.3% d[b] = 5% alpha = 5% finite population = 466	211
Proportion of favorable attitude towards DPN, including diagnosis and management	P[a] = 66.7% d[b] = 5% alpha = 5% finite population = 466	198
Proportion of appropriate practice regarding DPN, including diagnosis and management	P[a] = 43.3% d[b] = 5% alpha = 5% finite population = 466	209
Association of knowledge and attitude with practice	Cohens f^2 (effect size) = 0.15 Power = 90% Alpha = 5%	91

[a] P, prevalence; [b] d, maximum tolerable error

Stratified distribution of population and sample size

Strata	Total number	% of population	Sample size
Resident	137	29.4%	78
Fellow	85	18.2%	48
Consultant	244	52.4%	138
Total	466	100%	264

Appendix D. Reliability of the questionnaire domains

Domain	Cronbach's alpha	
	Version 1	Version 2
Knowledge	0.79	0.79
Attitude	0.66	0.71
Practice	0.73	0.73
Barrier	0.64	0.70