

## NEUROLOGY IN PRACTICE

# Neurophobia among family medicine specialist trainees in Malaysia

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### Abstract

**Background:** Neurophobia is defined as the fear of neural sciences and clinical neurology. Our study aims to determine the prevalence and factors associated with neurophobia among family medicine specialist trainees in Malaysia. **Methods:** A cross-sectional study was conducted among family medicine specialist trainees. Multiple logistic regression analysis was used to determine the factors associated with neurophobia. **Results:** A total of 415 subjects were enrolled into this study. The prevalence of neurophobia was 66% (n=274/415). In multivariate logistic regression analysis, having poor knowledge in neurology (odds ratio [OR] 3.85, 95% confidence interval [CI] 1.87-7.94), those with self-declared phobia toward neurology or neuroscience subject (OR 2.56 95% CI 1.30-5.03); those whose practice were in government sector (OR 1.78, 95% CI 1.09-2.88); those who perceived basic neuroscience (OR 1.95, 95% CI 1.03-3.67) and the complex clinical examination were important (OR 2.10, 95% CI 1.19-3.72); and those who perceived textbooks were not a useful method of learning (OR 1.78, 95% CI 1.05-3.02) were more prone to have neurophobia.

**Conclusion:** Two-thirds of family medicine specialist trainees in Malaysia found neurology a difficult subject. Among the factors associated with neurophobia were those with poor knowledge in neurology, and those who self-declared to have phobia toward neurology or neuroscience subject.

**Keywords:** Neurology, family medicine specialist, Malaysia, neurophobia

### INTRODUCTION

The term “neurophobia” was originally coined by Jozefowicz in 1994 to refer to ‘the fear of neural sciences and clinical neurology that originates from the students’ inability to apply their basic science knowledge to clinical practice leading to paralysis of thinking or action’.<sup>1</sup> It has huge implications in the primary care setting as neurological illness are the third most common reason for consultation at the primary care level.<sup>2,3</sup> There is an apparent shortage of neurologists and neurosurgeons in Malaysia and compared to other countries like the United States. To date, there are

approximately 115 neurologists registered with National Specialist Registry for a population of 32 million.<sup>4</sup> According to the current service demands, Malaysian neurologists and neurosurgeons are overloaded with neurological cases as a result of an imbalance in the patient-provider ratio.<sup>5</sup> Based on a study, the ratio for neurosurgeons per population ranged from 1:55,000 in 2000 to 1:65580 in 2008 in the United States.<sup>7</sup> In Malaysia the ratio for neurologist per population is 1:301,852 and the ratio for neurosurgeons per population is 1:271,667 in 2019.<sup>4,7</sup> Furthermore, neurological cases seen in primary care vary from simple cases like headache disorders to complicated

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cases such as dementia, epilepsy, Parkinson's disease and stroke.<sup>8</sup> Thus, it is important that primary care physicians are competent and not having neurophobia during their encounters with neurological cases to avoid unnecessary referrals<sup>9,10</sup> and delays in diagnosis.<sup>9-13</sup>

There are multiple contributing factors to neurophobia, including the need to know the anatomy of the brain; complexity of neurology examination; the wide range of diagnoses in neurology; inadequate teaching at medical school level; limited exposure to neurological patients; little opportunity to work with a neurologist; and general practitioners' (GP) postgraduate neurology being badly taught.<sup>14-16</sup> One reason for the primary care physicians having difficulty in managing patients with neurological illness may be limited exposure during preclinical and clinical postings.<sup>16</sup>

Studies have shown that neurophobia is more likely to be found in females<sup>16</sup> and it is associated with poorer knowledge, more difficulty and less confidence in neurology compared with other medical specialties.<sup>17</sup> Neurophobia studies were mainly conducted among medical students, junior doctors and primary care physicians.<sup>14</sup> United Kingdom doctors, specifically GP trainees, also showed neurophobia.<sup>14,18,19</sup> Also, a new study has shown that GP trainees find neurology less interesting than other medical specialties. This suggests a real and urgent need to improve neurology education for GP trainees.<sup>14</sup> A Singaporean study on neurophobia reported a lack of neurology posting to be associated with neurophobia.<sup>16</sup> To date, no study has examined the prevalence and factors associated with neurophobia among family medicine trainees in Malaysia. We hope that this study will aid future educational research and improve neurology education in Malaysia.

## METHODS

### *Study setting*

This was a cross sectional study among family medicine specialist trainees from 2016 to 2018 under the Academy of Family Physicians Malaysia. The training is divided into Graduate Certificate in Family Medicine (GCFM) and Advanced Training in Family Medicine (ATFM) programmes. Each takes two years and students can enrol in ATFM after completing the GCFM programme, preparing them for postgraduate qualification of the MAFP/FACGP which is recognised as a specialist qualification under the National Specialist Registry Malaysia.

### *Inclusion criteria*

All trainees of ATFM aged 18 years old and above and currently attending the workshops were eligible to participate in this study. The workshop was compulsory for all trainees of the GCFM or ATFM program from 2016 to 2018.

### *Sample method*

The sample size was calculated using Epi Info 7 based on the reported prevalence of neurophobia of 27.0% among US medical trainees<sup>20</sup> with 95.0% confidence interval (CI) and power of 80.0% and statistical significant level ( $\alpha$ ) at 5 percent. The total number of respondents needed was 396, after taking into account a non-respondent rate of 10.0%. A universal sampling method was used to recruit participant using a self-administered questionnaire.

### *Study instrument*

Self-administered questionnaires for neurophobia were adapted from McCarron *et al.*<sup>14</sup> and Kam *et al.*<sup>16</sup> (Supplement) The questionnaires were also reviewed by neurology consultants from Universiti Putra Malaysia for content validation, which led to some further minor revisions. To ensure suitability and clarity of the questionnaire, the questionnaires were piloted with 30 general practice trainees not previously involved in its design. The reliability of the questionnaire was calculated using SPSS IBM version 22.0 and the Cronbach's alpha value was 0.716. The questionnaire is available as supplement. The self-administered questionnaires consisted of two part. A five-point Likert scale was used in Part 1 and 2, except question 9, which was offered on a 4-point Likert scale for rating the possible reasons why Neurology may be difficult. The final questionnaires were distributed to family medicine specialist trainees from Malaysia pursuing a postgraduate qualification of the MAFP/FACGP. Responses were collected from 22nd July, 2017, to 22nd March, 2018. Approval of the study was obtained from the Ministry of Health (NMRR-16-2510-33237).

### *Statistical analysis*

The data was analyzed using Statistical Package for the Social Sciences (SPSS) version 21.0 software. Prevalence was described in frequencies and percentages. The associations among the categorical data were analyzed using Univariate analysis. Multiple logistic regression analysis was

used to identify the predictors of Neurophobia in family medicine specialist trainees in Malaysia. Independent variables with the p-value of less than 0.25 in Table 1 and 2 were entered into multiple logistic regression. A higher p value of < 0.25 was chosen to ensure the inclusion of potentially important clinical variables into the logistic regression model.<sup>21</sup> All analyses were performed with a 95% confidence intervals (CI), and the level of significance was set as  $p < 0.05$ .

#### *Operational definition*

Perceived difficult experience in neurology was the dependent variable. Sociodemographic factors, level of interest, level of knowledge, clinical reasoning were the independent variables. (Supplement) "Perceived difficult experience in neurology" was measured using a Likert scale ranging from 1 to 5. The operation definition for "neurophobia" is a score  $\geq 4$  while a score of < 4 means "perceived easy" in neurology subjects.<sup>18</sup> Level of interest was also measured using a Likert scale. The scores ranged from 1 to 5. The level of interest is further categorized into "uninterested" for a score <4 while "Interested" was a score  $\geq 4$ . Level of knowledge was measured using a Likert scale. The level of knowledge is further categorized into "Poor" if the score <4 and "Good" if the score  $\geq 4$ . Clinical reasoning was measured using a Likert scale. The scores ranged from 1 to 4. The clinical reasoning was further categorized into "unimportant" if the score was 1 or 2, and "important" if the score was 3 or 4. Level of phobia towards neuroscience and neurology was measured using Likert scale. Score 1 was little, score 2 was some, score 3 was moderate, score 4 was fair and score 5 was great. The level of phobia was further categorized into "No" if the score <4 and "Yes" if the score  $\geq 4$ . The level of difficulty in managing various neurological conditions was measured using a Likert scale. The score ranged from 1 to 5. The level of difficulty was further categorized into "easy" if the score was <4 while "difficult  $\geq 4$ ". We have chosen those neurological conditions to be assessed based on a previous study by Nicholl and Appleton (2015).<sup>22</sup> Methods of learning were measured using a Likert scale. The score ranged from 1 to 4. The method of learning was further categorized into "Not useful" if the score was 1 or 2 while "Useful" if the score was 3 or 4.

## RESULTS

A total of 600 subjects were eligible in the original cohort; 185 of them refused to be enrolled into the study due to time constraints, as those participants from the second year of GCFM program were preparing to sit for their examination at the end of the workshop. In the end, 415 of family medicine trainees enrolled into this study, for a response rate of 69.2%.

Table 1 shows the association between the neurophobia and socio-demographic factors among family medicine trainees using univariate analysis. The respondents were predominantly female (72.0%) with median age of 32 years (Inter Quarter Range (IQR) = 42). The median years in medical practice was 4 (IQR=27), and two-thirds of the respondents (73.7%) were practicing in the government sector. A majority (88.2%) had no neurology attachment during their undergraduate or postgraduate training. From the study, 141 of the respondents (34%) perceived neurology as an easy subject, while 274 of the respondents (66%) perceived neurology as a difficult subject.

Table 2 describes a significant association between neurophobia with level of interest ( $p=0.004$ ), level of knowledge ( $p < 0.001$ ) and phobia ( $p < 0.001$ ).

Table 3 describes a significant association between neurophobia and clinical reasoning among family medicine trainees using univariate analysis. The three significant reasons were: trainees need to know basic neuroscience ( $p = 0.02$ ); neuroanatomy ( $p = 0.049$ ); and the nature of the complexity of clinical examination in neurology ( $p = 0.01$ ).

Table 4 shows that there is significant association between neurophobia and methods of learning towards neurology subjects using univariate analysis. Perceived difficulty was associated with learning by textbook ( $p = 0.003$ ).

Table 5 shows predictors of neurophobia among family medicine specialist trainees using multiple logistic regression. Poor level of knowledge (OR=3.854, 95% CI=1.870-7.941), phobia towards neurology and neuroscience (OR=2.561, 95% CI=1.303-5.033), practice in government setting (OR=1.775, 95% CI=1.093-2.883), the need to know basic neuroscience is important (OR=1.945, 95% CI=1.030-3.673), the complexity of clinical examination (OR=2.102, 95% CI=1.188-3.719) and text book as not useful method of learning (OR=1.781, 95% CI=1.052-3.016) have higher odds to perceive neurology as a difficult subject.

**Table 1: Association between Neurophobia and socio-demographic factors among family medicine trainees using univariate analysis (n=415)**

Socio-demographic factors	Overall, n (%)	Perceived easy, n (%)	Perceived difficult, n (%)	p-value
<b>Gender</b>				
Male	115 (28)	44 (38.0)	71 (62.0)	0.150
Female	300 (72)	97 (32.0)	203 (68.0)	
<b>Age</b>				
21-30	104 (25.1)	29 (20)	75 (27.3)	0.430
31-40	280 (67.5)	98 (70)	182 (66)	
41-50	21 (5.1)	9 (6.4)	12 (4.4)	
51-60	8 (1.9)	4 (2.8)	4 (1.5)	
>61	2 (5)	1 (0.8)	1 (0.8)	
<b>Place of Practice</b>				
Private	109 (26.3)	95 (87.0)	46 (13.0)	0.020*
Government	306 (73.7)	211 (69.0)	63 (31.0)	
<b>Training</b>				
Overseas	210 (50.6)	71 (50)	139 (50.1)	0.510
Local	205 (49.4)	70 (50)	135 (49.9)	
<b>Neurology attachment</b>				
Yes	49 (11.8)	19 (39)	122 (37)	0.270
No	366 (88.2)	30 (61)	244 (63)	
<b>Years of Practice in Primary Care</b>				
1 to 10	388 (93.5)	131 (33.8)	247 (66.2)	0.100
≥11	27 (6.5)	10 (37.0)	17 (63.0)	

There is a significant association if p value < 0.05 \* N=number

Table 6 describes among family medicine trainees who perceived neurology to be difficult subjects, relative difficulties of the various neurological conditions. The most challenging neurological conditions were movement disorder and neuromuscular disorders.

## DISCUSSION

Our study shows that two third (66%) of our

respondents perceived neurology as a difficult subject. Lack of interest in neurology (OR=3.854, 95% CI=1.870-7.941) and phobia toward neurology (OR=2.561, 95% CI=1.303-5.033) increased the odds of Neurophobia. This results are consistent with findings from previous studies on the perceived difficulty of neurological subjects.<sup>20</sup>

Our study has shown that neurophobia was also significantly associated with poor level of knowledge of neurology. This finding is in

**Table 2: Association between Neurophobia and level of interest, knowledge and phobia towards neurology and neuroscience among family medicine trainees using univariate analysis (n=415)**

Reasons	Perceived Easy, n (%)	Perceived Difficult, n (%)	p-value
<b>Level of interest</b>			0.004
Uninterested	96 (30.3)	221 (69.7)	
Interested	45 (45.9)	53 (54.1)	
<b>Level of knowledge</b>			<0.001
Poor	166 (30.9)	260 (69.1)	
Good	25 (64.1)	14 (35.9)	
<b>Phobia</b>			<0.001
No	129 (37.9)	211 (62.1)	
Yes	12 (16.0)	63 (84.0)	

There is a significant association if p value < 0.05 \*

**Table 3: Association between Neurophobia and clinical reasoning among family medicine trainees using univariate analysis (n=415)**

Reasons	Perceived Easy, n (%)	Perceived Difficult, n (%)	p-value
<b>The need to know basic neuroscience</b>			0.020*
Unimportant	25 (48.1)	27 (51.9)	
Important	116 (32.0)	247 (68.0)	
<b>Neuroanatomy</b>			0.049*
Unimportant	22 (46.8)	25 (53.2)	
Important	119 (32.4)	249 (67.6)	
<b>The complex clinical examination</b>			0.010*
Unimportant	35 (52.2)	32 (47.8)	
Important	106 (30.5)	242 (69.5)	
<b>Neurology's reputation as difficult subject</b>			0.870
Unimportant	74 (33.6)	146 (66.4)	
Important	67 (34.4)	128 (65.6)	
<b>Neurology covers such a large number of diagnoses</b>			0.090
Unimportant	54 (39.7)	82 (60.3)	
Important	87 (31.2)	192 (68.8)	
<b>Not enough teaching</b>			0.500
Unimportant	62 (35.8)	111 (64.2)	
Important	79 (32.6)	163 (67.4)	
<b>Limited exposure to neurological patients</b>			0.300
Unimportant	45 (37.8)	74 (62.2)	
Important	96 (32.4)	200 (67.6)	
<b>Little opportunity to work with a neurologist</b>			0.240
Unimportant	47 (38.2)	76 (61.8)	
Important	94 (32.2)	198 (67.8)	
<b>GP postgraduate neurology is badly taught</b>			0.100
Unimportant	82 (36.8)	141 (63.2)	
Important	59 (30.7)	133 (69.3)	

There is a significant association if p value < 0.05 \*

**Table 4: Association between Neurophobia and methods of learning towards neurology subjects using univariate analysis (N=415)**

Methods	Perceived Easy n (%)	Perceived Difficult n (%)	p-value
<b>Online Resources</b>			0.060
Not useful	29 (27.4)	77 (72.6)	
Useful	112 (36.2)	197 (63.8)	
<b>Textbook</b>			0.030*
Not useful	28 (25.9)	80 (74.1)	
Useful	113 (36.8)	194 (63.2)	
<b>Lectures</b>			0.270
Not useful	21 (30.0)	49 (70.0)	
Useful	120 (34.8)	225 (65.2)	
<b>Bedside tutorials</b>			0.560
Not useful	10 (33.3)	20 (66.7)	
Useful	131 (34.0)	254 (66.8)	
<b>Peers</b>			0.100
Unuseful	40 (29.4)	96 (70.6)	
Useful	111 (36.2)	178 (63.8)	

There is a significant association if p value < 0.05 \*

**Table 5: Predictors of neurophobia among family medicine specialist trainees using multiple logistic regression (n=415)**

Clinical variables	odds ratio	95% C.I. lower	Upper	p-value
Level of knowledge				
Poor	3.854	1.870	7.941	<0.001
Good	1			
Phobia				
Yes	2.561	1.303	5.033	0.006
No	1			
Place of practice				
Government	1.775	1.093	2.883	0.020
Private	1			
The need to know basic neuroscience				
Important	1.945	1.030	3.673	0.040
Unimportant	1			
The complex clinical examination				
Important	2.102	1.188	3.719	0.011
Unimportant	1			
Method of learning by text book				
Not useful	1.781	1.052	3.016	0.032
Useful	1			
Method of learning from Peers				
Not useful	1.429	0.881	2.316	0.148
Useful	1			
Level of interest				
Uninterested	0.677	0.400	1.146	0.146
interested	1			
Neurology covers such a large number of diagnoses				
Important	1.272	0.786	2.058	0.328
Unimportant	1			
Method of learning from online resources				
Not useful	1.219	0.699	2.126	0.485
Useful	1			
Gender				
Female	1.119	0.690	1.813	0.648
Male	1			
Neuroanatomy				
Unimportant	1.265	0.596	2.682	0.540
Important	1			
Little opportunity to work with a neurologist				
Unimportant	1.125	0.680	1.863	0.647
Important	1			
GP postgraduate neurology is badly taught				
Unimportant	1.025	0.627	1.647	0.921
Important	1			
Year of practice				
≤ 10 years	0.957	0.286	2.372	0.925
≥ 11 years	1			

**Table 6: Description of difficulty of various neurological conditions among family medicine trainees who perceived neurology to be a difficult subject (N=274)**

Neurological conditions	Perceived Difficult, n (%)
<b>Stroke</b>	
Easy	261 (95.3)
Difficult	13 (4.7)
<b>Cognitive Disorder</b>	
Easy	148 (54)
Difficult	126 (46)
<b>Coma</b>	
Easy	148 (54)
Difficult	126 (46)
<b>Epilepsy</b>	
Easy	197 (71.9)
Difficult	77 (28.1)
<b>Movement Disorder</b>	
Easy	74 (27.0)
Difficult	200 (73.0)
<b>Neuromuscular disorder</b>	
Easy	74 (27.0)
Difficult	200 (73.0)

agreement with findings reported by Zinchuk *et al.* that medical students, postgraduate students in internal medicine and GPs perceived neurology as the subject they least knew and were less confident in dealing with, compared to other specialties in practical clinical situations.<sup>20</sup> These findings are important, as a rising number of patients with neurological complaints are being seen in family practice, and the neurophobia may result in suboptimal management of these patients.

We found the doctors from public section were more likely to perceive neurology as a difficult subject compared with doctors from the private sector (OR=1.775, 95% CI=1.093-2.883). A possible explanation for this may be the fact that majority of patients with the complicated problems would visit the government clinic due to budget constraints, whereas the patients with simple problems would attend a private clinic.<sup>23,24</sup> In Malaysia, the cost of care in the government clinic is heavily subsidized, whereas in the private clinic, the payment is often out of pocket. This explains why the doctors from government sector perceived neurology as a more difficult subject when compared with doctors from the private sector.

Our study also found that several clinical factors, such as the belief that the need to know basic neuroscience is important (OR=1.945, 95% CI=1.030-3.673) and the complexity of clinical examination (OR=2.102, 95% CI=1.188-3.719),

increased the odds of neurophobia. Furthermore, three significant reasons were found for the neurophobia: the need to know basic neuroscience ( $p = 0.02$ ), neuroanatomy ( $p = 0.049$ ) and the nature of complexity of clinical examination in neurology ( $p = 0.01$ ). These reasons are slightly different from the study done by Schon *et al.* amongst internal medicine trainees and GPs, in which poor teaching of neurology was selected as one of the main reasons, second to the need to know basic neuroscience.<sup>18</sup> The need to know neuroanatomy was more often selected as one of the main reason amongst medical students as compared to residents.<sup>18</sup> Their findings suggest that detailed knowledge of neuroanatomy may not be essential for the practical management of patients with basic neurological problems. Basic neuroscience and complexity of neurological assessment were also found to be the other reasons in studies done in the UK, the USA and Ireland.<sup>18-20</sup> Many physicians consider examining the nervous system as one of the most difficult parts of physical examination. The neurological examination is often thought of as time-consuming and complicated, as it is expected to be accurate and thorough.

Additionally, several neurological conditions such as cognitive disorders, coma, epilepsy, movement disorders and neuromuscular disorders, were significantly associated with perceived difficulty among GPs in Malaysia. Most people

who develop symptoms will want to know their causes. Explaining the diagnosis in a clear and logical way in regard to the neurological complaints is thought to be challenging for GPs. Multiple modalities are needed to investigate certain neurological conditions which sometimes makes it difficult to manage in clinic settings. While stroke and epilepsy are the common neurological conditions managed by non-neurologist in Malaysia<sup>25</sup>, however, epilepsy was found to be the most difficult to manage. Stroke, known to be one of the leading causes of death worldwide, demands that all GPs are competent to manage it.

Learning neurology through a textbook was found to be ineffective, leading to perceived difficulty in neurological studies (OR=1.781, 95% CI=1.052-3.016). In contrast, a study done in the USA found the textbook to be useful in learning medicine.<sup>20</sup> Javaid *et al.* found that traditional tools such as notes and textbook were found to be less important to improve neuroanatomy learning.<sup>26</sup> Also, understanding of neuroanatomy could be enhanced using purposefully-designed computer assisted learning (CAL). Other studies also concluded that there is a need for more neurology teaching to overcome the Neurophobia. It should be noted there were several limitations in this study. This study was conducted under single institution where by respondent are family medicine trainees undertaking ATFM and GCFM under Academy of Family Physicians Malaysia, thus our findings may be difficult to generalize to other university institution in Malaysia which also offers family medicine training under master program pathway, where variability in curricula and teaching may lead to different results. Definitions such as “basic neuroscience”, “lectures”, “complex clinical examination” may vary between family medicine trainees, creating bias in rating their utility and exposure, respectively.

United States has smaller ratio in neurologist per population in comparison to Malaysia. The medical training for neurologist is also shorter as the postgraduate training programme is directly after internship.<sup>27</sup> However, despite the numbers, the existing neurologists are usually overworked due to more complicated management than other specialties.<sup>6</sup> Malaysia on the contrary, is facing a problem of neurologist shortage mostly due to the long training pathway and lack of interest to pursue neurology as subspecialty. Furthermore, there is a maldistribution of neurologists in the country. Of the 115 neurologists in Malaysia, a

large proportion are practicing in the capital region of Klang Valley, this is not only true in the private practice, but also in the public service. Currently, of the 28 neurologists practicing in the public universities, 25 (89%) are practicing in the Klang valley, although the Klang valley only accounts for 20% of the Malaysian population. Of the 29 neurologists working under the Ministry of health, 11 (38%) are also working in the Klang valley.<sup>4</sup> Furthermore, half of the 115 neurologists are in private practice serving the private hospitals<sup>4</sup>, mainly catering to patients with medical insurance which is not universal. Thus, there is limited access to specialist neurology consultation for many of the primary care centers from all over the country. The country needs at least another 200 neurologists to handle neurology case especially patients with stroke<sup>28</sup>, with a better distribution of services.

Another factor is that some graduates sent abroad for neurology training may not return home to practice.<sup>29</sup> Some may find that their training has not equipped them to deal with the home situation, and the support services available for the practice.<sup>30</sup> Neurologists are needed in not only as practitioners but as educators, researchers, health policy advisors and advocates.

This study showed that family medicine trainees in Malaysia find neurology to be a difficult subject. Studies on GPs, medical practitioners in health clinics and family medicine trainees undergoing other training programs in Malaysia are needed to confirm this result. Understanding of neuroanatomy, basic neuroscience, and the ability to perform complete neurological examination accurately are the main reasons for perceived difficulty amongst our respondents. Further studies are also required to quantify the effects of these interventions on family medicine trainees.

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## DISCLOSURE

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## REFERENCES

1. Jozefowicz RF. Neurophobia: the fear of neurology among medical students. *Arch Neurol* 1994;51:328-9.
2. Kale R, Menken M. Who should look after people with Parkinson's disease? *BMJ* 2004; 10:328(7431):62-3.
3. Ridsdale L. No more neurophobia: welcome neurology in general practice. *Br J Gen Pract* 2009; 59 (565): 567-9.
4. <https://www.nsr.org.my/list1pview.asp?page=1> NSR
5. Abdullah JM, Hussin AM, Tharakan J, et al. National response to neurological diseases in Malaysia: planning for the future. *Southeast Asian J Trop Med Public Health* 2006;37:798.
6. Rosman J, Slane S, Dery B, Vogelbaum MA, Cohen-Gadol AA, Couldwell WT. Is there a shortage of neurosurgeons in the United States? *Neurosurgery* 2013;73:354-66.
7. Current population estimates, Malaysia 2018-2019. July 15, 2019 ed: Department of Statistics, Malaysia.
8. MacDonald BK, Cockerell OC, Sander JW, Shorvon SD. The incidence and lifetime prevalence of neurological disorders in a prospective community-based study in the UK. *Brain* 2000;123(4):665-76.
9. Blank L, Baxter S, Woods HB, Goyder E, Lee A, Payne N, Rimmer M. What is the evidence on interventions to manage referral from primary to specialist non-emergency care? A systematic review and logic model synthesis. *Health Services and Delivery Research* 2015; 3:24
10. Knottnerus JA. Between iatrotropic stimulus and interiatric referral: the domain of primary care research. *J Clin Epidemiol* 2002;55:1201-6.
11. Croskerry P. From mindless to mindful practice—cognitive bias and clinical decision making. *N Engl J Med* 2013;368:2445-8.
12. Bradford A, Kunik ME, Schulz P, Williams SP, Singh H. Missed and delayed diagnosis of dementia in primary care: prevalence and contributing factors. *Alzheimer Dis Assoc Disord* 2009;23:306-14.
13. Van Such M, Lohr R, Beckman T, Naessens JM. Extent of diagnostic agreement among medical referrals. *J Eval Clin Pract* 2017;23:870-4.
14. McCarron MO, Stevenson M, Loftus AM, McKeown P. Neurophobia among general practice trainees: the evidence, perceived causes and solutions. *Clin Neurol Neurosurg* 2014;122:124-8.
15. Matthias AT, Nagasingha P, Ranasinghe P, Gunatilake SB. Neurophobia among medical students and non-specialist doctors in Sri Lanka. *BMC Med Educ* 2013;13:164.
16. Kam K-Q, Tan G, Tan K, Lim E, Koh NY, Tan N. Neurophobia in medical students and junior doctors—blame the GIK. *Ann Acad Med Singapore* 2013;42:559-66.
17. Loftus AM, Wade C, McCarron MO. Primary care perceptions of neurology and neurology services. *Postgrad Med J* 2016;92:318-21.
18. Schon F, Hart P, Fernandez C. Is clinical neurology really so difficult? *BMJ* 2002;557-9.
19. Flanagan E, Walsh C, Tubridy N. 'Neurophobia'—attitudes of medical students and doctors in Ireland to neurological teaching. *Eur J Neurol* 2007;14:1109-1112.
20. Zinchuk AV, Flanagan EP, Tubridy NJ, Miller WA, McCullough LD. Attitudes of US medical trainees towards neurology education: "Neurophobia"—a global issue. *BMC Med Educ*. 2010;10:49.
21. Bursac Z, Gauss CH, Williams DK, Hosmer DW. Purposeful selection of variables in logistic regression. *Source code Biol Med* 2008;3:17.
22. Nicholl DJ, Appleton JP. Clinical neurology: why this still matters in the 21st century. *J Neurol Neurosurg Psychiatry*. 2015;86:229-233.
23. Mimi O, Tong S, Nordin S, et al. A comparison of morbidity patterns in public and private primary care clinics in Malaysia. *Malays Fam Physician* 2011;6:19.
24. Uchendu O, Ilesanmi O, Olumide A. Factors influencing the choice of health care providing facility among workers in a local government secretariat in south western Nigeria. *Ann Ibadan Postgrad Med* 2013;11:87-95.
25. Yusof MR. Profile of neurological practice in Malaysia. *Neurol J Southeast Asia* 1996;1:15-7.
26. Javaid MA, Chakraborty S, Cryan JF, Schellekens H, Toulouse A. Understanding neurophobia: Reasons behind impaired understanding and learning of neuroanatomy in cross-disciplinary healthcare students. *Anat Sci Educ* 2018;11:81-93.
27. Weggemans MM, Van Dijk B, Van Dooijeweert B, Veenendaal AG, Ten Cate O. The postgraduate medical education pathway: an international comparison. *GMS J Med Educ* 2017;34(5):2017;34.
28. Neurologist shortage hampering stroke treatments. Sunday, 21 Apr 2019. <https://www.thestar.com.my/news/nation/2019/04/21/neurologist-shortage-hampering-stroke-treatments/>.
29. Mejia A. International migration of professional health manpower. *Who Chronicle* 1980;34:346-55.
30. Chin JH, Vora N. The global burden of neurologic diseases. *Neurology* 2014;83:349-51.

## SUPPLEMENT

### Questionnaire

Your participation in this survey is voluntary and anonymous. We are attempting to determine areas of difficulty among family medicine trainees in an effort to improve medical training.

### Demographic data:

Age: .....

Gender: M / F

Undergrad training? overseas/ local

Where do you practice? government/ private

How many years you are in primary care practice:.....

Do you have any neurology attachment? Yes / No

Do you have any mental health disorder? Yes / No

1. What is your current level of interest in Neurology?

Little/ no interest	Some interest	Moderate interest	Quite interested	Very interested
1	2	3	4	5

2. What is your current level of knowledge in Neurology?

Little/ none	Some	Moderate	Fair	Great
1	2	3	4	5

3. Do you think the Neurology is easy or difficult?

Very easy	Quite easy	Moderate	Quite difficult	Very difficult
1	2	3	4	5

4. When you see a patient in your clinic with a not straightforward complaint in Neurological case, what do you feel?

Very uneasy	uneasy	Averagely competent	Confident	Very confident
1	2	3	4	5

5. Neurology maybe difficult for a number of reasons. Please score the importance of the possible reasons.

Reasons	Unimportant	Possible	Important	Very important
The need to know basic neuroscience	1	2	3	4
Neuroanatomy	1	2	3	4
The complex clinical examination	1	2	3	4
Neurology's reputation as difficult subject	1	2	3	4
Neurology covers such a large number of diagnoses	1	2	3	4
Not enough teaching	1	2	3	4
Limited exposure to neurological patients	1	2	3	4
Little opportunity to work with a neurologist	1	2	3	4
GP postgraduate neurology is badly taught	1	2	3	4

6. Do you think you are phobia towards neuroscience and neurology?

Little	Some	Moderate	Fair	great
1	2	3	4	5

7. Which neurological conditions you find most difficult to manage?

	Very easy	Quite easy	Moderate	Quite difficult	Very difficult
Stroke	1	2	3	4	5
Cognitive disorders	1	2	3	4	5
Coma	1	2	3	4	5
Epilepsy	1	2	3	4	5
Movement disorder	1	2	3	4	5
Neuromuscular disorder	1	2	3	4	5

8. How useful do you find each of the following methods in learning neurology?

Method	Not useful	Somewhat useful	Very useful	Extremely useful
Online resources	1	2	3	4
textbooks	1	2	3	4
lectures	1	2	3	4
Bedside tutorials	1	2	3	4
peers	1	2	3	4
Other (leave blank if not applicable)	1	2	3	4