

Neurophobia: How Do Sudanese Medical Students Perceive Neurology- A Cross-sectional Study.

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Abstract

Background: The fear of neuroscience by medical students is a global issue known as neurophobia which has been detected in medical schools from both developing and developed countries. It may contribute to the decreased number of neurologists that is already found to be low globally and augment the growing burden of neurological disorders. This study aimed to evaluate this issue among Sudanese medical students.

Methods: A cross-sectional study was conducted on medical students from 8 medical schools using an online form questionnaire and responses were collected.

Results: A total of 338 responses with 90.4% response rate were collected. Neurology was reported as the most difficult subject to learn (mean \pm SD = 3.88 ± 0.90)($P < .01$), the second least subject in drawing up differential diagnosis (3.32 ± 1.07)($P = .000$), the third least regarding confidence in clinical examination (3.23 ± 1.24)($P = .000$), the third poorest quality of teaching (3.12 ± 1.26)($P = .000$), and the third favorite subject as a career option (3.41 ± 1.4)($P > .004$). Neuroanatomy was the biggest contributor to the difficulty of neurology (have a very large or large contribution by 51.5% of students) and More/Improved peer discussions were the most factor that could improve neurology teaching (mean \pm SD = 3.47 ± 1.39). Students perceive a career in neurology to be associated with good travel and research opportunities and poor job satisfaction and work/life balance. Ability to make a significant difference in a patient's life was the most factor encouraging students to chase a career in neurology (21.6% of students) and job satisfaction was the most discouraging factor (20.7%). On performing logistic regression, caring for a friend or relative suffering from neurological disease and increased confidence in knowing exactly what neurologists do were found to have a significant effect on increasing the possibility of pursuing a career in neurology ($P = .01$ and $P < .005$ respectively).

Conclusion: Students' perception of neurology is almost the same worldwide and didn't change over decades in contrast to the growing burden of neurological diseases and population aging. So, a lot of work should be done globally to investigate and manage this issue.

Introduction:

It's recognized that medical students have a fearful perception toward neurology and neuroscience in general and last years have seen many attempts to describe and explain this fear. Jozefowicz was the first to describe this condition in medical students as Neurophobia in 1994 (1). Symptoms of Neurophobia among medical students were reported to vary from confusion to impatience during classes (1). However, many studies have tested the neurophobia definitions and symptoms in junior doctors and general practitioners too. For example, a study in Singapore spotted the light on neurophobic junior doctors as they feel unconfident toward their neurology knowledge and practice (2), also another study identified more perceived difficulty and less knowledge of neurology compared with other specialties among resident doctors (3).

Neurophobia has been noticed in both developed and developing world medical schools. According to Gutmann et al, only 2.8% of the US medical students who graduated during the period of 2014 to 2017 were planning to enter neurology (4), and reasons such as more perceived difficulty and lack of confidence in diagnosing, examining and treating patients with neurological disorders were reported among US medical students and doctors in another study (3). In the United Kingdom, a national survey was distributed to medical students and findings such as significant more perceived difficulty for neurology and least comfort with finding a differential diagnosis for cases with neurological signs and symptoms were reported among medical students (5). Moreover, many neurophobia symptoms were clear among students from developing countries like Saudi Arabia (6), Sri Lanka (7) and Nigeria (8). In Sudan, a single study has identified fearful perception of neurology among medical students at Bahri University (9).

Meanwhile, the global prevalence of Neurological diseases is dramatically increasing due to the aging of the world's population (10). According to World Health Organization in 2013, one in four people in the world will have a neurological or mental disorder (11) and In 2016 neurological diseases were the leading cause of disability and the second leading cause of death globally (12). Sudan recorded a 25% increase in Disability-adjusted life years (DALY) of neurological diseases between 1990 and 2016 (12). All of these alerting numbers are emerging as more problematic by the limited number of neurologists. In 2004, the median number of neurologists per 100000 populations was recorded to be 0.03 in Africa, 0.32 in Eastern Mediterranean, 0.07 in South-East Asia, 0.89 in the Americas and 4.84 in Europe (13). In 2005, some data revealed that only three neurologists are active in Sudan (14). However, few additional neurologists have joined the practice in the coming years.

Building on that, many researchers investigated and tried to reveal the causes behind the negative perception of neurology among medical students and junior doctors which leads to the shortage of neurologists. Many studies put the difficulty to know basic neuroscience especially neuroanatomy at the top of the causes (8)(15)(16)(17)(7). Kam et al identified the poor teaching of neurology and teaching by non-neurologists as risk factors (2). Also, insufficient teaching and limited exposure to clinical neurology scenarios were reported (18). In Bahri university in Sudan, unsatisfactory teaching of neurology, the difficulty of neuroanatomy and neurological diagnosis, limited provided treatments and poor outcomes have been suggested as risk factors for neurophobia(9). However, still little is known about neurophobia in Sudan since it hasn't been studied in many universities. So, in this study, we aimed to assess last year's medical student's perception toward neurology and shed the light on factors governing this perception in eight different Sudanese medical schools.

Methods:

This cross-sectional study was conducted in the period from October to December 2019 including Final - year medical students from all eight governmental Sudanese medical schools located at Khartoum state. Those medical schools are faculty of medicine University of Khartoum, Faculty of Medicine Elneleen university, Faculty of medicine Alzaeim Alazhari University, Faculty of Medicine International University of

Africa, Faculty of Medicine National Ribat University, Faculty of Medicine Omdurman Islamic University, College of Medicine University of Bahri, faculty of Medicine University of Karrari. Some of these medical schools have a five-years medical courses (2 pre-clinical and 3 clinical years) and some have six-years medical courses (3 pre-clinical and 3 clinical years). The number of students taken from each university was determined according to their contribution to the total population.

Data was collected through an electronic form using a questionnaire taken from a previous study (5), containing 4 sections, the first one containing the demographic data and assessing the level of difficulty in learning neurology, quality of the teaching given in neurology, comfort in the clinical examination and drawing up a differential diagnosis for patients with neurological symptoms and likeliness in pursuing a career in neurology compared to other six medical subspecialties. The second section dealt with the amount of teaching given in neurology, personal experiences in caring for neurological patients, opportunities taken as part of the medical course regarding neurology, and the factors that could contribute to the difficulty in neurology and that would most improve neurology training. The third section assessed student's perception of a career in neurology and the factors that would most persuade or dissuade them from pursuing a career in neurology. And the fourth section asked about opportunities outside medical course and confidence in knowing what neurologists do. The Electronic form link was sent to the students through a coordinator from each batch in October 2019 and responses were collected for 9 weeks with reminders sent every week after the initial request.

The analysis of data was performed using Statistical Package for Social Sciences (SPSS version 25; SPSS Inc, Chicago, IL). Mean values were calculated for Likert scales and the comparison between mean scores for neurology versus other specialties was done using one-way ANOVA with considering a P value of less than .05 to be a statistically significant one. Ordinal logistic regression was performed and the likeliness of pursuing a career in neurology was the dependent variable of choice.

Results:

Achieving a response rate of 90.4%, a total of 338 students (35.5% males and 64.5% females) responded to the form with varying percent of students from each university convenient with their contribution to the total population. 55.6% of the respondent were from the 5-year medical schools and 44.4% from the 6-year ones. The mean and median age for the respondents was 23 years. Overall, Neurology was reported as the most difficult subject to learn when compared to the other subspecialties (mean \pm SD = 3.88 ± 0.90) ($P < .01$). (Fig. 1A). It is also found to be the third least regarding confidence in clinical examination (3.23 ± 1.24) ($P < .001$) (Fig. 1B), the second least in drawing up differential diagnosis (3.32 ± 1.07) ($P < .001$) (Fig. 1C), and the third poorest quality of teaching (3.12 ± 1.26) ($P < .001$) (Fig. 1D). Interestingly neurology was ranked as the third favorite subject as a career option (3.41 ± 1.4) ($P > .004$) being only preceded by cardiology and gastroenterology (Fig. 1E).

More than half of students (54.1%) reported that they had the opportunity to carry out research related to neurology as part of their medical course (but only 24% of them took that opportunity), 51.8% of students

had the opportunity to receive additional neurology teaching beyond course curriculum (31.4% of them took this opportunity), 72.2% had the opportunity to discuss neurological cases through problem-based learning or case presentation (64% of them took it), 53.6% had the opportunity to do a clinical placement in neurology (and only 47% took it) while 57.4% of the students had the opportunity to meet a neurologist who had inspired them (51.5% took that opportunity). However, only 5.6% of students strongly agreed that they had sufficient opportunity to get involved in activities related to neurology outside their medical course (such as conferences, journal clubs, invited speakers, etc.), while 13.6% strongly disagreed with this.

Neuroanatomy was found to be the biggest contributor to the difficulty of neurology (being rated to have a very large or large contribution by 51.5% of students) (Fig. 2), followed by poor quality/lack of teaching (42.6%) and basic neuroscience (38.7%). Other factors reported by students in the open section were short course time, people exaggerating its difficulty and the rumors behind it, lack of definitive treatment for neurological diseases, lack of good doctors, neurophysiology, no integration between basic neuroscience and clinical neurology, poor knowledge about the human brain and poor facilities in Sudan. 35.5% of 186 students who admitted that they had completed both basic neuroscience and medical neurology as part of their medical course said that the amount of teaching, they received was too little. More/Improved peer discussions were rated as the most factor that could improve neurology teaching and training (mean \pm SD = 3.47 \pm 1.39), followed by More/Improved beside teaching (mean \pm SD = 3.39 \pm 1.40), and More/Improved lectures (mean \pm SD = 3.24 \pm 1.44) (Fig. 3). Other factors mentioned in the open section were More/Improved clinical practice, giving the subject enough time, raising the knowledge about a career in neurology, and integration between basic neuroscience and clinical neurology.

Regarding career in neurology (Fig. 4), students perceive it to be associated with good travel and research opportunities (being rated as very good or good by 66.6% and 41.1% of the students respectively), but the ability to make a significant difference in patient's life and financial stability were the most factors persuading students to chase neurology as a career (21.6% and 16.9% of students respectively). On the other hand, a career in neurology was perceived to have poor job satisfaction and work/life balance (rated as very poor and poor by 31.6% and 29% respectively) and these factors along with the inability to make a significant difference in patient's life were found to be the most factors discouraging students from pursuing a career in neurology (job satisfaction for 20.7% of students, inability to make a significant difference in patient's life for 19.8%, and work/life balance for 17.2%). Also, 43.5% of students strongly agreed or agreed that they feel confident in knowing what neurologists do, while 28.7% strongly disagreed or disagreed with that.

On performing an ordinal logistic regression, we found that there is no effect of gender, personal experience in caring for a neurological patient through volunteer or paid work or getting involved in activities related to neurology outside medical course on the likeliness of pursuing a career in neurology. But caring for a friend or relative suffering from neurological disease and more interestingly, increased confidence in knowing exactly what neurologists do were found to have a significant effect on increasing the possibility of pursuing a career in neurology (P = .01 and P < .005 respectively).

Discussion:

This is the second study investigating the issue of neurophobia in Sudan as the first one was conducted in 2019 at University of Bahri, one of the universities included in our study (9). Our findings support the evidence that medical students find neurology as the most difficult specialty to learn as reported in seven other previous studies(17)(7)(18)(5)(15)(3)(16). We also found it to be the second least regarding comfort in drawing up differential diagnosis and third least regarding the clinical examination and the third worst quality of teaching received, whereas it was found to be the least in comfort for drawing differential diagnosis in the national study conducted in the UK (5), and the least in comfort regarding examination in the studies made in Ireland, Brazil, UK, US (18)(17)(15)(3) and the worst quality of teaching received in the study at Brazil (17). Interestingly, in our study geriatrics was found to be the least subject regarding comfort in the clinical examination and drawing a differential diagnosis and the least quality of the teaching given among other subspecialties with 34.2% of students reported that they didn't receive teaching in geriatrics suggesting poor teaching of geriatrics in Sudan.

Neuroanatomy played the biggest role in the difficulty perception of neurology in our study and it is also the top contributor in many other previous studies (17)(7)(5)(3)(9)(8). Other high rated contributors in our study were poor teaching of basic neuroscience, being identified as top factors making neurology difficult in other studies (15)(16). All these findings from the literature suggest that the reasons behind neurophobia are mostly modifiable and rise the need for considering changes in the way of teaching neurology all around the world. A lot of studies including ours revealed the factors -as rated by students- that would most improve the teaching in neurology and those factors were more peer discussions, more bedside teaching(17)(19)(3)(9), more lectures(17)(9), more clinical-based learning(7)(3), more tutorials(18) and just more teaching of neurology (8). A lot of studies moved toward studying the effect of implementing new teaching methods and training programs on improving neurology training and decreasing the issue of neurophobia. Of those, a study conducted in Chicago, USA revealed that implementation of an interactive electronic textbook in addition to the regular neurology lectures increased student's satisfaction about neurology teaching(20), and another one in Australia concluded that Implementing case-based teaching helped students to integrate basic neuroscience to clinical neurology and improved their clinical skills(21). Also, Videotapes were found to be a useful tool in increasing medical communication skills and clinical knowledge in a study done in Singapore(22). Some studies also recommended different ways of teaching neurology like the up-down approach for neurology teaching which starts by teaching the clinical neurological signs and phenomena followed by teaching the scientific base behind it as this would help in integration and increase student's attention to neurological signs and diseases (23). Another way of teaching was the one recommended by the association of British neurologists emphasizing the simplification of teaching by using a core curriculum focusing on common neurological disorders and using the problem-based approach as the best method for teaching (24). This core curriculum approach was implemented in GTK medical school, London with some modifications and continuous feedbacks from students throughout a 13-week program and resulted in significant findings in decreasing the difficulty perception about neurology and increasing the interest regarding the subject among medical students (25). All these mentioned recommendations and

interventions in neurology teaching and more were emphasized in the nine evidence-based strategies recommended by the author Abushouk for curing neurophobia (26). It should be noted that the system of education in Sudan is similar to the British one and hence we suggest that UK techniques might be more appealing in improving neurology teaching and solving Neurophobia in Sudan.

Despite the perceived difficulty in neurology, it is still a favorite career option being rated as the third favorite subspecialty in our study and this is going with the findings from the previous studies that also found students interest in neurology is not affected by the perceived difficulty of it (17)(7)(5) (15) suggesting that students will be welcoming any intervention devastating the issue of neurophobia and actually they want those interventions in order to increase their understanding about the subject that is interesting to them. In order to get a deep understanding about of factors affecting student's interest in a career in neurology we investigated factors that would most persuade or dissuade students from choosing neurology as a career. Ability to make a significant difference in patient's life - which is also found to be a significant factor in studies conducted in the UK and University of Bahri, Sudan (5)(9) - and financial stability were the most factors encouraging students to choose a career in neurology reported in our study, other top factors that drive students towards neurology described in previous work were interest on the subject (4), increased opportunities for research in neurology (9), increased job satisfaction (5), the challenging nature of neurology and the effect of inspiring role models or good teachers in the profession (27). Instead, job satisfaction, work/life balance and also ability to make a significant difference in a patient's life were the top factors discouraging students from neurology career in our study. It is obvious that some students think of neurology as a way through which they can improve patients' life and many others have the opposite idea that neurological diseases have poor outcome and there is no way to improve neurological patient's life, this thought about neurological diseases being associated with bad outcomes and no definitive treatment was found to be the most factor discouraging students from neurology in previous studies (27)(3). A reason behind such a thought could be that students get their clinical training and skills at hospital yards which are full of patients with complex disorders who need admission or those who can't be diagnosed simply in outpatients' clinics (25). This thought can be changed by increasing student's exposure to outpatients' clinics and advocating them about the new technologies and research evidence that widened the range for curing and treating neurological disorders. The fact that work/life balance was one of the top reasons for not choosing neurology as a career – which is also reported as the top reason for dismissing career in neurology in a study conducted in the UK (5) reveals that there is an apparent misconception among students about the nature of neurology work and this misconception can be corrected by raising the awareness about neurology career by means of career fairs and talks(5).

In general, the perception of students about the subject of neurology and career on it should be investigated by every medical school as the literature suggests that the state of neurophobia develops early in medical schools which are considered as the major cause of it (25). There is also evidence that teaching development in neurology that is made in accordance to students' assessments and feedbacks can reduce the development of neurophobia (25) so it is essential that the reasons behind students fear of neurology and the perceptions turning them away from chasing a career in neurology should be

identified and corrected early in their medical course at a time when impressions are formed and students are more likely to change perceptions (25). It should also be noted that medical students are the ones who will be the future general practitioners who are responsible for dealing with common neurological symptoms such as headache, epilepsy and neuropathies (as a result of diabetes, alcohol, nutritional deficiencies and entrapment) that present to primary health care facilities (13), the ones who should deal with the chronic neurological illnesses like Parkinson's disease at primary care level (28) and among whom neurophobia was also reported in other studies(7)(18)(15). So, it is important to ensure that all medical students are confident in dealing with neurological symptoms not only the ones who would like to pursue a career in the subject as depending on primary health units in dealing with neurological complaints is the most cost-effective method to decrease the increasing burden of neurological disorders and referral to specialized neurologists - whom numbers were found to be low in relation to the population they serve globally (13) - and the best way to ensure neurological services in underserved areas in both developing and developed countries (13).

The limitations of this study were the inclusion of medical schools from only one state due to the lack of facilities and contact with other states and also the inclusion of medical students only at their final year so these results cannot be generalized to all Sudanese medical students. Thus, we recommend that other studies should be conducted in Sudan investigating this issue among all medical students and general practitioners. On the other hand, the response rate was good enough representing 90.4% of that targeted population and the institutional bias was dissipated by taking candidates from each medical school in accordance with their contribution to the total targeted population. Response bias was also decreased as much as possible by the inclusion of options like "neither agree nor disagree" and "don't know".

Conclusion:

We conclude that the perception of neurology remained unchanged over decades with neurology still being considered as a difficult subject and that neuroanatomy was a major contributor to this difficulty. This going in contrast to the rapidly changing demands for neurological services due to population aging and the increased burden of neurological illness on health systems. Thus, we encourage medical schools to take actions in this regard like adopting new teaching techniques that are linked to students needs and assessment feedbacks in order to ensure a greater understanding of the subject by students and to generate qualified general practitioners who are competent in dealing with neurological complaints at primary health care level.

Declarations:

Ethics approval and consent to participate:

The authors confirm that all methods were carried out in accordance with relevant guidelines and regulations in the Ethics approval and consent to participate section of BMC Medical Education.

The ethical approval for this study was obtained from the “Technical and Ethical at Community Medicine Department Board” Faculty of Medicine, the University of Khartoum (approval letter serial number is 1/2019). Informed consent was taken from all participants as part of the online form.

Consent for publication

Not applicable

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests report no.

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Not applicable

Authors' contributions

HA contributed to the study design and planning, conducted the literature search, collected the data for the study, analyzed the statistical data and participated in writing the manuscript. MA conducted the literature search, analyzed and interpreted the statistical data and wrote the majority of the manuscript. YHYB contributed to the study design and planning, data processing, and revised the manuscript.

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Figures

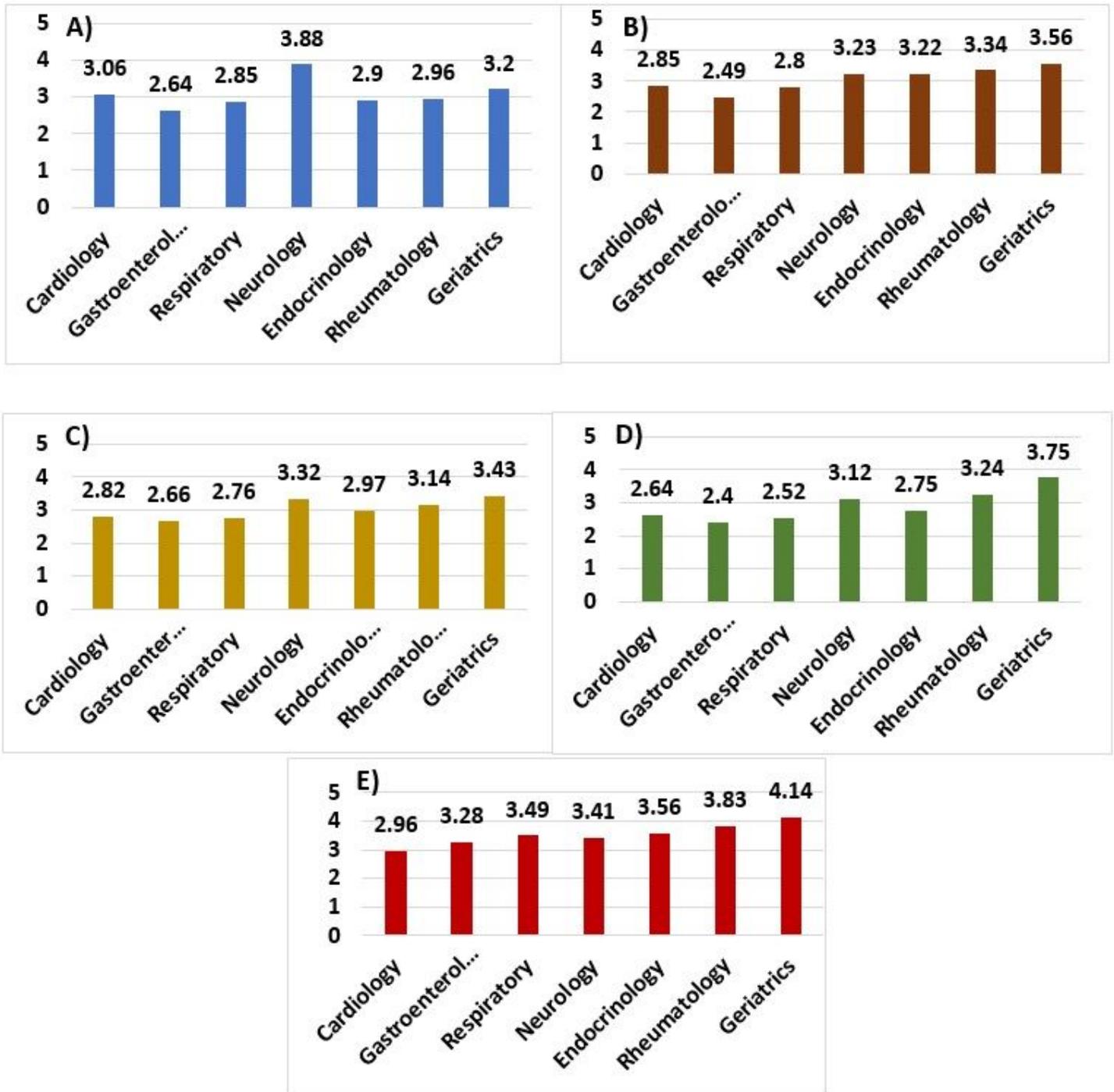


Figure 1

Comparing mean scores for different subspecialties. A) difficulty perception. B) comfort in clinical examination. C) comfort in drawing up differential diagnosis. D) quality of teaching. E) likeliness of career persuasion. 1= very easy/very comfortable/very good/ very likely, 2= easy/comfortable/good/likely, 3= moderate/satisfactory, 4= difficult/uncomfortable/poor/unlikely, 5= very difficult/very uncomfortable/very poor/very unlikely.

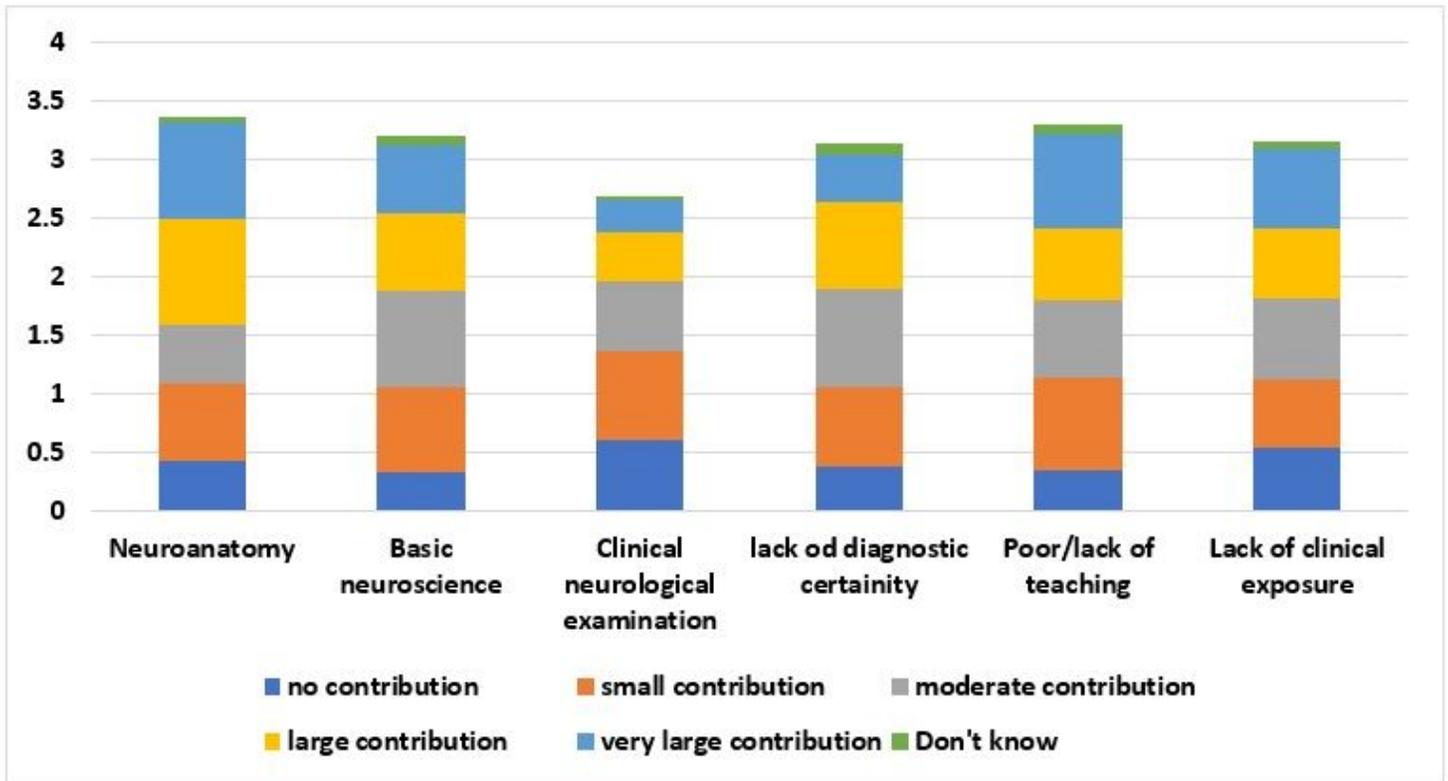


Figure 2

Factors contributing to the difficulty of neurology.

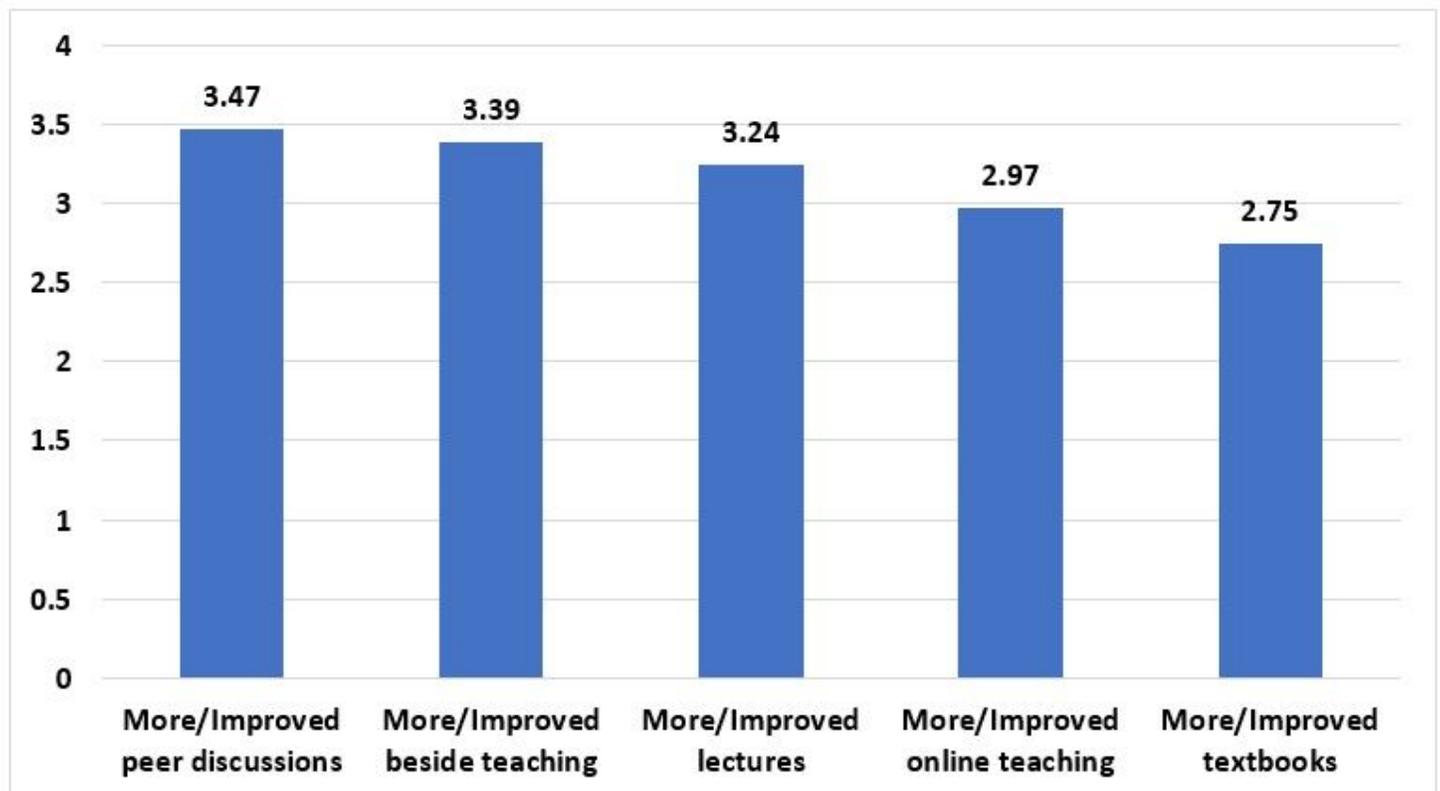


Figure 3

Factors that could improve neurology teaching.

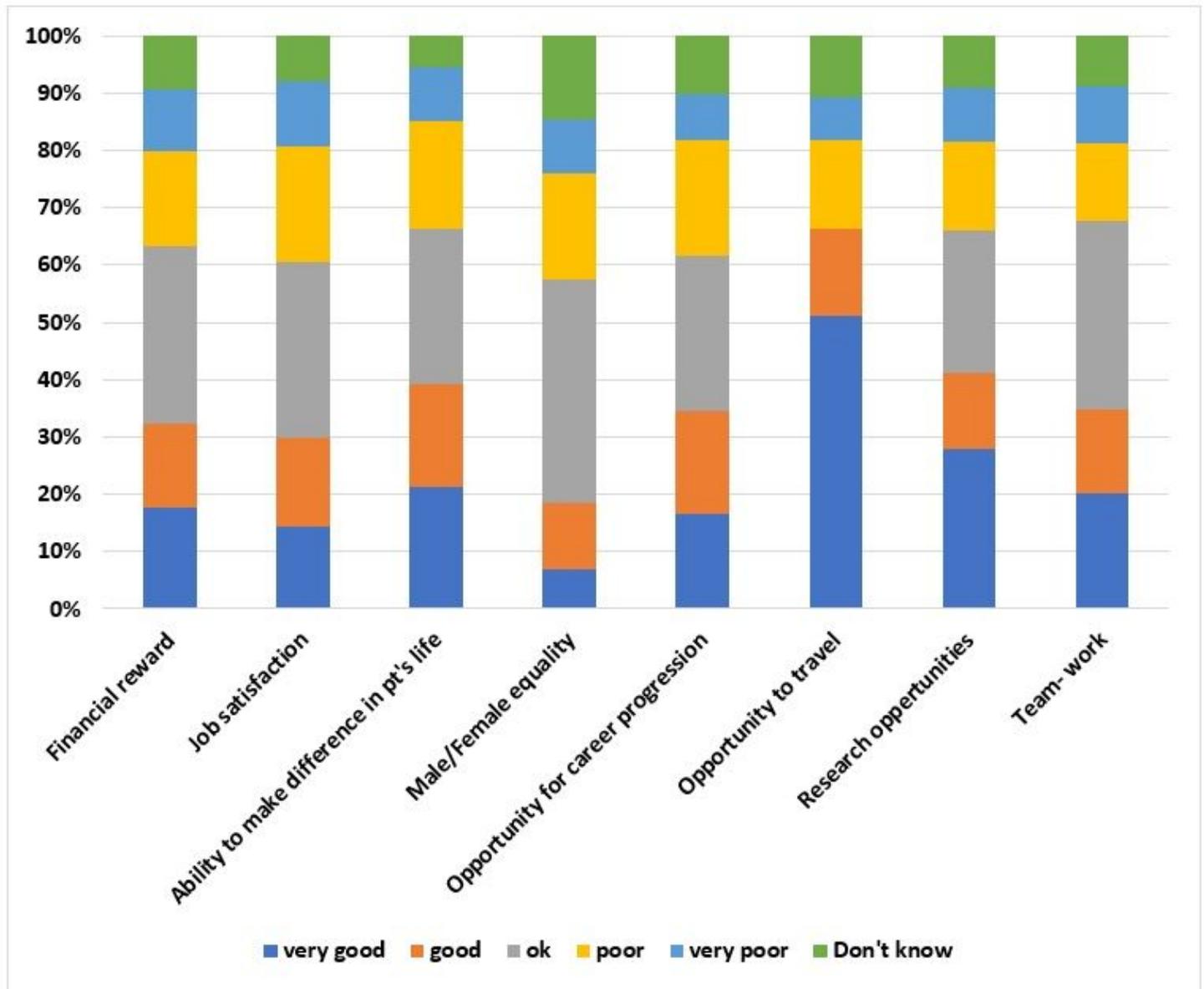


Figure 4

The perception of students about a career in neurology