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Original Article

Exploring perceptions of neuroscience learning among medical students of Universidad Nacional Autónoma de Honduras

Explorando la percepción sobre el aprendizaje de neurociencias entre los estudiantes de medicina de la Universidad Nacional Autónoma de Honduras

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ABSTRACT. Introduction. There is an increase in the prevalence of neurological disorders. An adequate training of medical neurology personnel is an imperative task. The phenomenon of neurophobia can affect proper learning and even aspirations to be a neurology specialist. **Methods.** A cross-sectional study was carried out through a questionnaire to evaluate the perception of students about medical specialties and factors that contribute to the difficulty of neurology. The questionnaire was distributed through social media groups of medical students. Excel was used for the management and tabulation of the answers obtained and SPSS for data analysis. **Results.** In relation to an interest in specialties (high interest), the most frequent specialties were cardiology 37.3% (22) and neurology 20.3% (15). The complexity of neuroanatomy 42.4% (25) and little contact with neurological patients 40.7% (24) were the factors that contributed to the difficulty of neurology. **Conclusion.** The traditional teacher-centered teaching model is prone to neglect essential tools such as neurology laboratories, standardized patient simulation, and essential contact with neurological patients. There is an important need to implement new teaching methodologies in neurology and greater contact with neurological patients.

RESUMEN. Introducción. Existe un aumento en la prevalencia de los trastornos neurológicos. La formación adecuada del personal médico de neurología es una tarea imperativa. El fenómeno de la neurofobia puede afectar el aprendizaje adecuado e inclusive las aspiraciones a ser un especialista en neurología. **Métodos.** Se llevó a cabo un estudio transversal a través de un cuestionario para evaluar la percepción de estudiantes sobre especialidades médicas y factores que contribuyen a la dificultad de la neurología. El cuestionario fue distribuido a través de grupos en redes sociales de estudiantes de medicina. Se utilizó Excel para el manejo y tabulación de las respuestas obtenidas y SPSS para el análisis de datos. **Resultados**. Con relación al interés en las especialidades (mucho interés), las especialidades con más frecuencia fueron cardiología 37.3% (22) y neurología 20.3% (15). La complejidad de la neuroanatomía 42.4% (25) y el poco contacto con pacientes neurológicos 40.7% (24) fueron los factores que contribuyeron a la dificultad de la neurología. **Conclusión.** El modelo de enseñanza tradicional centrado en el docente es propenso a dejar de lado herramientas esenciales como laboratorios de neurología, simulación de pacientes estandarizados y el contacto esencial con pacientes neurológicos. Existe una necesidad importante para implementar nuevas metodologías de enseñanza en neurología y mayor contacto con pacientes neurológicos.

1. Introduction

The formation of medical staff in neurosciences and neurology areas is an imperative task due to the increased prevalence of neurological disorders in the population. A neurologist from Rochester University, New York (Jozefowicz, 1994) defined for the first time the term neurophobia. Jozefowicz described the term as: "Fear towards neural sciences and clinical neurology due to inability of students to apply their knowledge of basic sciences in clinical situations" (Jozefowicz, 1994, p. 328). Since this term was first defined, until now, a significant number of studies have been done to evaluate neurophobia

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in faculties of medicine worldwide. Moreover, neuroscience and neurology teaching in medicine faculty curriculums has been broadly studied (Kam et al., 2013; Matthias et al., 2013; Abulaban et al., 2015; Shiels et al., 2017; McGovern et al., 2021). The main contributing factors mentioned in literature usually are the lack of integration between basic sciences and clinical rotations, besides the complexity of neuroanatomy perceived by students. Likewise, it is important to recognize that modifiable and non-modifiable risk factors can contribute to the development of neurophobia.

Non-modifiable risk factors are previous clinical exposure to neurology, personal aspects, and education degree. Multiple modifiable risk factors have been identified, including teaching quality, use of complex terminology, lack of standardized patient simulators and separation of clinical and basic sciences. These factors must be approached appropriately to enrich teaching-learning processes (Abushouk & Duc, 2016).

Identifying the presence of neurophobia in students that will soon face a clinical setting with a continuous increase of patients with neurological disorders should be a stimulating factor to boost even more teaching reforms in this area in universities (Jozefowicz, 1994). The aim of this study was to know the perception among medical students from Universidad Nacional Autónoma de Honduras (UNAH) regarding neuroscience learning. The study findings can contribute to developing strategies that help overcome modifiable risk factors and provide decision makers with elements needed to create new neuroscience curricula.

2. Methods

A cross-sectional study was carried out using a questionnaire in medical students from UNAH, one of the three universities that offer medicine in Honduras. Non-probabilistic convenience sampling was used. At the time of data gathering, the medical students included in this study were receiving classes online. Therefore, data collection was conducted virtually.

The questionnaire was distributed through social networks, including the communication channels established for each academic year. Students who answered the questionnaire online (Google Forms) were included, obtaining 59 responses.

2.1. Interviewed population

Medical students of the Faculty of Medical Sciences of UNAH, Ciudad Universitaria campus, who were enrolled in the second year (morphological sciences) and fourth year, both considered pre-clinical years, and seventh year (internship) considered clinical year, during the second academic period of 2021.

2.2. Questionnaire

The questionnaire was designed and adapted from two questionnaires described by other authors; the first is the most widely used in published studies on the subject and has been adapted to multiple contexts and languages. The questionnaire is structured in two sections. The first assesses students' perception of seven medical specialties (cardiology, endocrinology, gastroenterology, geriatrics, neurology, respiratory medicine, and rheumatology), and the second section analyses the potential factors contributing to the difficulty of neurosciences (Schon, 2002).

The second questionnaire used was modified from the one proposed by Schon (2002), adding questions on learning methods (Zinchuk et al., 2010). Before distributing the questionnaire, a test was conducted with 10 students, not included in the study to ensure understanding and clarity of the questions. The responses to the first questionnaire were based on a Likert scale from 1 (Very limited) to 5 (Very good), regarding the variables on interest, knowledge, difficulty, and ability of the seven medical specialties. The responses of the second questionnaire about student perception on neurology and neurosciences were based on a scale from 1 to 4, being 1 = unimportant and 4 = very important.

2.3. Data analysis

Excel 2019 was used for the management and tabulation of the responses obtained, and the statistical program for social sciences SPSS was used for data analysis.

2.4. Ethical aspects

Prior to completing the online survey, students were notified that their participation was voluntary and anonymous and that completing and returning the survey implied consent. The study protocol was evaluated by the Biomedical Research Ethics Committee (CEIB) of the Faculty of Medical Sciences, UNAH, with registration number IRB 00003070.

3. Results

A total of 59 students filled out the online questionnaire, 44.1% (26) corresponded to fourth-year students, 30.5% (18) to seventh-year students (rotating internship), and 25.4% (15) to second-year students (morphological sciences). Of the students who participated in the study, 100% (59) belonged to the UNAH. Of the students, 52.5% (31) were female and 47.5% (28) were male. Of the seven specialties evaluated (Figure 1) concerning current interest in the specialty, the

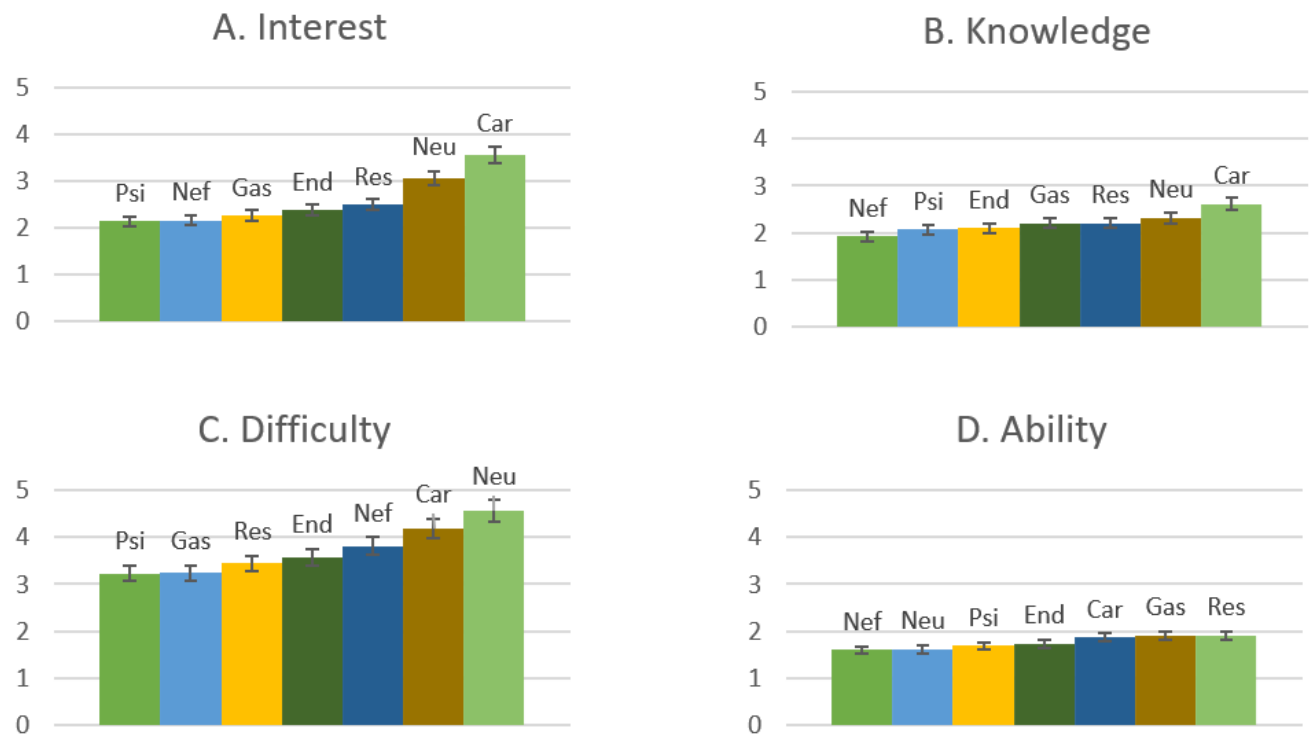

Figure 1. Comparison of average score obtained, on a Likert-type scale from 1 to 5, in Interest, Knowledge, Difficulty and Skills, of the seven medical specialties. Car, cardiology; End, endocrinology; Gas, gastroenterology; Res, respiratory medicine; Nef, nephrology; Neu, neurology; Psi, psychiatry.

two with the highest frequency of "very interested" were cardiology 37.3% (22) and neurology 25.4% (15). The specialty with the lowest frequency of interest was psychiatry 25.4% (15). Of the students in their fourth year, 46.2% (12) stated that they were quite or very interested in neurology, while only 33.3% (6) of the students in their seventh year stated the same.

When asked about their current level of knowledge in neurology, 39% (23) considered they had some knowledge, and 37.3% (22) had moderate knowledge. When evaluating the difficulty perceived by the student, the two specialties with the greatest perceived difficulty were neurology 67.8% (40) and cardiology 47.5% (28). Concerning the confidence students had when evaluating patients with neurological pathologies, 39% (23) of them stated feeling anxious or uneasy, and 37.3% (22) felt competent when evaluating them.

According to the students, the aspects that most contributed to the difficulty of neurology were the complexity of neuroanatomy 42.4% (25) and little contact with neurological patients 40.7% (24). The learning methods most highly rated by students were evaluation of real patients 88.1% (52), classroom/lectures 67.8% (40) and textbooks 61.0% (36). Students were asked about other methods they considered useful for learning such as "simulator techniques and clinical case approach in class," "interaction with patients and face-to-face classes," and "workshops and simulations." The neuroscience teaching methods that students considered most useful were more patient bedside teaching 64.4% (38), more exposure to patients (shifts, inpatient wards) 61% (36), and 54.2% (32) felt that neuroanatomy teaching should be improved. The majority of students 71.2% (42), considered neurosciences to be important for the practice of general medicine, and only 33.9% (20) of the students stated that they were satisfied with the amount of education received in neuroscience.

Forty-four responders (74.6%) reported that they did not have sufficient knowledge of neurosciences, 42.4% (25) stated that neurology is one of the most difficult disciplines in medicine, and 67.8% (40) felt that they had had limited exposure to neurological patients. When evaluating these parameters in students in their seventh year, 88.8% (52) agreed with the statement "I would like to have more exposure to neurological patients", and only 33.3% (20) were satisfied with their training in neurology (Table 1).

Table 1
Perception of neurology and neurosciences by students.

Item	Do not Know/Does not apply N (%)	Disagree a lot N (%)	Disagree N (%)	Agree N (%)	Agree a lot N (%)
I believe that neuroscience is important to general medicine practice.	0	1 (1.7)	2 (3.4)	14 (23.7)	42 (71.2)
I am satisfied with the amount of education I have received in neuroscience.	2 (3.4)	10 (16.9)	26 (44.1)	15 (25.4)	6 (10.2)
I am satisfied with my neurology education.	2 (3.4)	11 (18.6)	26 (44.1)	16 (27.1)	4 (6.8)
I feel comfortable with neuroscience topics.	3 (5.1)	9 (15.3)	24 (40.7)	18 (30.5)	5 (8.5)
I have adequate knowledge of neurology.	5 (8.5)	7 (11.9)	30 (50.8)	14 (23.7)	3 (5.1)
I think neuroanatomy is difficult.	1 (1.7)	4 (6.8)	18 (30.5)	22 (37.3)	14 (23.7)
I think neurology is difficult.	2 (3.4)	3 (5.1)	11 (18.6)	25 (42.4)	18 (30.5)
I think neurology is one of the most difficult disciplines in medicine.	0	2 (3.4)	12 (20.3)	20 (33.9)	25 (42.4)
I have had limited exposure to neurological patients.	8 (13.6)	1 (1.7)	10 (16.9)	13 (22.0)	27 (45.8)
I would like to have more exposure to neurological patients.	3 (5.1)	1 (1.7)	4 (6.8)	13 (22.0)	38 (64.4)
I'm afraid of neurology/neurosciences.	11 (18.6)	15 (25.4)	19 (32.2)	8 (13.6)	6 (10.2)

*Adapted from Schon (2002).

4. Discussion

Neurology is perceived by medical students and non-specialist physicians as the most difficult specialty almost globally. This endemic fear of neurological diseases appears mainly due to the perception of not having the necessary skills to identify and manage them adequately. The consequences of this perception are more evident when medical students and young physicians cannot apply their basic neurological concepts when approaching a neurological patient. Such a phenomenon is described by the term neurophobia (Chhetri, 2017).

In Honduras, a traditional teacher-centered teaching model predominates, which has as its main axis the teacher, who develops a curriculum, leaving aside, in some cases, essential tools such as neurology laboratories, standardized patient simulation and essential contact with neurological patients. In addition, there has been a slow process of evaluation and curricular redesign of healthcare careers. Together, these problems have represented a challenge in implementing new educational methods which could help solve phenomena such as neurophobia (Thiebaud et al., 2021).

Among the population studied, neurology was found to be the second most interesting discipline, second only to cardiology. However, despite this, neurology is by far perceived as the most difficult medical field by students and the second area in which they perceive they have the least skills. This goes hand in hand with findings reported in other studies also considering neurology as the most difficult specialty, and they also found it to be the area in which they enjoy the least knowledge (Youssef, 2009; Kam et al., 2013; Matthias et al., 2013; Abulaban et al., 2015; Shiels et al., 2017; McGovern et al., 2021).

In assessing factors contributing to the perceived difficulty in neuroanatomy, almost half of the students stated that it was due to the complexity of neuroanatomy. Other studies have already described the perceived difficulty of students with neuroanatomy; a national survey conducted in the United Kingdom found that 70% of students considered the complexity of neuroanatomy a significant factor for perceived difficulty in neuroscience (Pakpoor et al., 2014).

To further understand the perception of neuroanatomy, a study involving 383 Irish students described they found learning neuroanatomy more difficult than any other anatomy subject. For these students, the factors most influencing difficulty were those specific to neuroanatomy, such as visualization of structures in dissections of the central nervous system and appreciation of the three-dimensional relationship of structures (Javaid et al., 2017).

Interestingly, the perception of difficulty did not vary according to the teaching modality in which the students were, either being taught by systems or by regions. The

medical school included in this study uses a regional approach to neuroanatomy, where the subject of neuroanatomy is mostly taught using lectures. Another frequent factor in the student population was the lack of contact with neurological patients. This is consistent with a study conducted on Mexican students, which found that 12.5% considered little contact with neurological patients to influence the perceived difficulty of neurology (Sánchez-Jordán et al., 2017).

The ideal learning methods for neuroscience have been investigated in different contexts and realities. The students included in this study considered real patient assessment, face-to-face classes/lectures and textbooks to be the best learning techniques. This is consistent with other studies, such as the one conducted in Costa Rica that evaluated collaborative learning for neuroanatomy learning and found that more than 80% of students considered that the use of clinical cases improved their learning (Chang-Segura, 2019); the perception of United States students regarding learning methods is also consistent with what was found in this study (Zinchuk et al., 2010).

Clinical simulation is one of the most useful methods in medical education in undergraduate level learning, especially in the field of neurosciences (Abushouk & Duc, 2016). In a study conducted by Universidad Autónoma de Yucatán, Mexico, 34 students underwent a simulation course to develop neurological clinical competencies with an expert in neurology. A statistically significant improvement was seen from 0% to 26.47% among students in pretest and posttest, respectively. Likewise, an improvement was seen in the doctor-patient relationship, although it was not statistically significant (Álvarez-Sánchez et al., 2021).

It is important to recognize that neurophobia not only limits and affects the teaching-learning processes of neurology at different levels of medical training, but also influences the perspective that students have towards the specialty as a career choice (Gupta et al., 2013), which should motivate medical schools to implement new methodologies to improve students' experience when exposed to neurology.

On the other hand, there are limitations in resources that are often considered a challenge and an important cause that affects the process of implementing new methodologies that can mitigate the effects of neurophobia. However, some studies have been directed to be able to overcome these limitations (Kumar, 2018). Among these proposed approaches are videos and post-dissection slides that can help strengthen the understanding of the anatomy that represents the basis for understanding clinical neurology (Welch et al., 2020).

This study represents an exploration of the perception of second and fourth-year students (preclinical area) and rotating internship (clinical area) of UNAH about their learning in neurosciences, but it has some limitations; of the three medical schools, only one was included. In addition, although the distribution of students by years of study is equal, a relatively small sample was reached. However, the results coincide with similar studies with larger samples, which confirms our suspicion of neurophobia in the medical student population in Honduras. It is important to continue to conduct more studies evaluating the quality of medical education provided in the country to develop possible interventions and strategies to improve medical education in Honduras.

5. Conclusion

Neurology was the specialty perceived as the most difficult and one of the areas of knowledge in which students expressed the least skills, indicating that neurophobia is a reality not only in medical schools worldwide but also in Honduras. This is of particular importance due to the increasing prevalence of neurological disorders globally, which should force the implementation of new tools in medical education to overcome this phenomenon.

The students also expressed the need to implement new teaching methodologies in neurology and more contact with neurological patients. As previously indicated, it is necessary to facilitate these teaching methodologies, such as clinical simulation and promote collaborative learning, measures that would be easily implementable, low cost and have a high impact on the training of future physicians in our country. Additionally, consideration should be given to the inclusion of neurology outpatient attendance in the early stages of the career, facilitating access to neurology professors to mentor medical students, promoting a therapeutic approach over a conceptual one, and procedure-based learning, which commonly attracts students.

6. Author Contributions

MZG and FCC conceptualized the study. MZG coordinated data collection and analysis. JS supported the thematic and methodological process during the study. All authors conducted the literature review, wrote, read, and approved the final version of the manuscript.

7. Conflicts of Interest

The authors declare no conflict of interest.

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