Neurophobia among resident physicians in the emergency service

Ignacio Saldaña-Inda, Ana I. Cisneros-Gimeno, Álvaro Lambea-Gil

Introduction. Neurophobia is defined as the fear towards clinical neurology caused by the inability to apply theoretical knowledge to practical clinical situations. This phenomenon is not restricted to medical students and has never been studied before in the Emergency Department. We aimed to study how resident doctors perceive their knowledge in neurology and urgent neurological conditions as well as possible causes for said fears.

Materials and methods. Cross-sectional multicentric study using self-administered surveys sent to medical residents within the Aragon Health Service. They were questioned about their fear of neurology and other medical specialties, possible causes, and perception of knowledge in neurological pathologies and subareas in the emergency service.

Results. We obtained 134 responses. 27.6% (37) suffered from neurophobia. Despite neurology being considered the most difficult discipline, it did also arouse the third most interest among the students. The areas where they showed the most confidence were headaches and vascular pathology. The areas where they felt the most insecure were neuromuscular diseases, neuro-ophthalmology, and spinal cord injury. In none of the areas surveyed, the percentage of respondents who felt secure exceeded 50%.

Conclusions. Neurophobia is prevalent among trainee doctors working in the emergency department. Their confidence correlates with the degree of exposure to patients. Neurologist must play an active role in the education of new specialist and promote the collaboration with emergency departments.

Key words. Education. Emergency. Neurology. Neurophobia. Residency. Teaching.

Instituto de Investigación Sanitaria (IIS) Aragón (I. Saldaña-Inda, A.I. Cisneros-Gimeno, Á. Lambea-Gil). Department of Medicine, Psychiatry and Dermatology (I. Saldaña-Inda, Á. Lambea-Gil). Department of Anatomy and Histology. Universidad de Zaragoza. Zaragoza (A.I. Cisneros-Gimeno). Neurology Department Hospital Universitari Arnau de Vilanova. Lleida (I. Saldaña-Inda). Neurology Department. Hospital de la Santa Creu i Sant Pau. Barcelona, Spain (Á. Lambea-Gil).

Correspondence:
Dr. Álvaro Lambea Gil.
Departamento de Medicina.
Universidad de Zaragoza. Calle Domingo Miral, s/n. E-50010 Zaragoza.

E-mail:
alambea@unizar.es

Accepted:
24.11.23.

Conflict of interest:
Los autores manifiestan no tener ningún conflicto de interés.

How to cite this article:
Saldaña-Inda I, Cisneros-Gimeno AI, Lambea-Gil Á. Neurophobia among resident physicians in the emergency service. Rev Neurol 2023; 77: 285-91. doi: 10.33588/rn.7712.2023249.

Versión española disponible en www.neurologia.com

Introduction

Three decades ago, Professor Ralph F. Jozefowicz coined the term 'neurophobia' to refer to the fear or rejection towards clinical neurology shown by medical students. He argued it stems from the students' inability to apply their knowledge of basic sciences to clinical situations [1]. This phenomenon, not found in other areas of medicine, has been corroborated by several authors mostly in the anglosphere [2–6].

Said fear and rejection persists among junior doctors, albeit exhibiting certain distinct characteristics compared to the undergraduate stage [2,3,7]. This phenomenon has thus far received limited attention. A&E provide a privileged environment to study this phenomenon. Emergency medicine requires swift decision-making across various pathologies and tests doctors' ability to translate theoretical into their day-to-day practice. Neurological pathology is a frequent reason for consultation in emergency services [8,9]. It is essential to distinguish between potentially grave and time-dependent pathologies, where the application of theoretical knowledge for diagnostic and therapeutic decision-making must be swift, as is the case with stroke, status epilepticus, or infectious diseases of the central nervous system, among others.

The aim of our study was to ascertain the presence of neurophobia among medical residents who perform shifts in the emergency department. Additionally, we conducted a secondary analysis to explore whether their respective specialties (hospital specialties versus general medicine), training background (presence or absence of rotations in neurology), and type of hospital (hospitals with a physical presence of on-call neurologist versus those without) could play a role. Furthermore, we will delve into the concept of neurophobia and will evaluate the perception held by resident physicians of their performance across the various subspecialties within the field of neurology.

Materials and methods

We conducted a cross-sectional study. Between October and December 2022 self-administered surveys were sent to trainee medical residents undergoing specialized healthcare training within the Aragon Health Service (SALUD). We selected doctors whose specialty involved mandatory shifts in

Table. Characteristics of our sample and its distribution per years.

	Total (*n* = 134)
Age, M (IQR)	28 (26-29)
Exposure to neurological diseases, *n* (%)	70 (52.2)
Neurology rota during university years, *n* (%)	74 (55.2)
Neurology rota during residency, *n* (%)	58 (43.3)
Fear or rejection to neurology, *n* (%)	37 (27.6)
Year of training, *n* (%)	
First year	29 (21.6)
Second year	47 (35.1)
Third year	28 (20.9)
Fourth year	26 (19.4)
Fifth year	4 (3)
Alma mater, *n* (%)	
Universidad de Zaragoza	71 (53)
Other Spanish universities	55 (41)
Non-Spanish universities	8 (6)

M: mean; IQR: interquartile range.

hospital emergency departments during their training period.

The questionnaire was designed using Google Forms, we employed a modified and adapted version of that used by previous studies. It included demographic data, their perception of knowledge, interest, fear, or rejection towards neurology and other medical specialties, as well as their self-perceived knowledge in different neurological pathologies. The questionnaire, available in the Supplementary Material consisted of 22 questions. Likert scale responses from 1 to 5 were later dichotomized for analysis into 1-2 or 4-5, depending on the question. We defined 'neurophobia' as a high or very high level of fear or rejection towards neurology and related areas (responses 4-5 on the Likert scale). The forms were sent via email to the Teaching Committees of each of the eight training centres within Health's Aragon Service. In our region, 251 residents began their specialized healthcare training for the year 2022-2023, with a total duration of four or five years, depending on the specialty. According to their chosen specialty, they were divided between non-hospital-based (Family and Community Medicine; MdF) and hospital-based (all others).

For the descriptive analysis, the qualitative variables were presented by frequencies and their percentages for each category. In the case of quantitative variables, indicators of central tendency (mean or median) and dispersion (standard deviation or interquartile range) were used depending on whether they followed a normal distribution or not, which was determined by the Saphiro-Wilk test. For the inferential analysis, statistical significance was established as $p < 0{,}05$ and the following contrast tests were used: χ^2 or Fisher's exact test to compare proportions when both variables were qualitative; and in the case that one of them was quantitative, Student's *t* test or ANOVA for normal distributions, and Mann-Whitney U or Kruskal-Wallis for those that followed a non-normal distribution.

For statistical analysis, R-Studio (version R: 4.1.2.) [8] with the R package 'tableone' was used. Graphs and tables were created using Microsoft Excel 365 (Microsoft) and the R packages 'ggplot2,' 'ggpubr,' and 'likert.'

The study was approved by the Research Ethics Committee of our region.

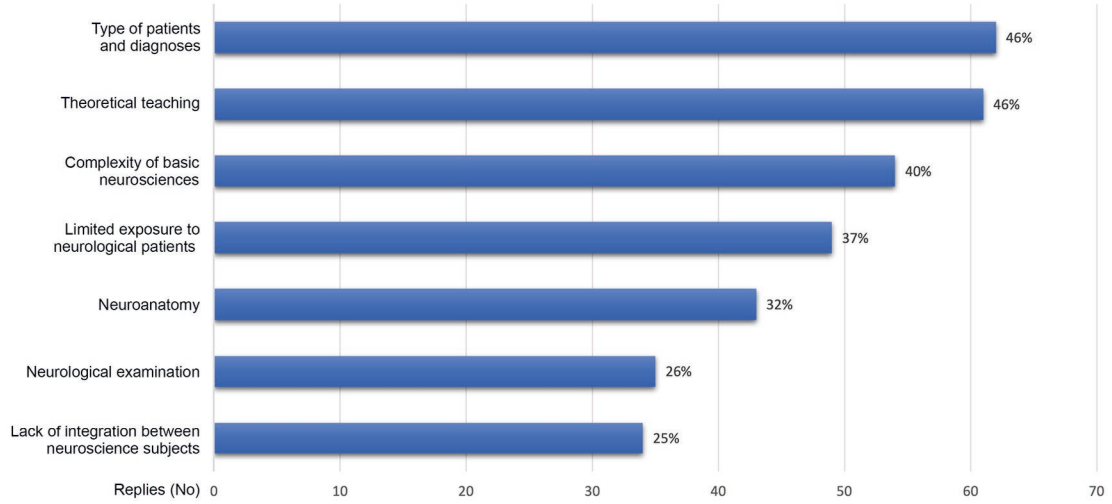
Results

We received responses from 134 Medical Interns distributed among the eight training hospitals in Aragon. The specialties with the highest number of responses were MdF (63; 47%) and internal medicine (10; 7.5%). The complete distribution by specialties can be found in the Supplementary material. The two main responding centres were the Miguel Servet University Hospital (58; 43.3%) and the Lozano Blesa University Clinical Hospital (37; 27.6%), which are the only tertiary centers in the region. The table provides details of the main variables analyzed and their distribution per years.

The mean age of the respondents was 28 years (IQR 26-29). Seventy residents (52.2%) reported close contact with neurological diseases, either firsthand or through supporting or caring for close family members or friends. Regarding neurology training, 74 (55.2%) had completed hospital rotations during their university years, while 58 (43.3%) had undertaken a specific rotation in a neurology department during their residency.

Thirty-seven respondents (27.6%) experienced a high or very high level of fear or rejection towards neurology (neurophobia). No statistically significant

Figure 1. Causes for neurophobia identified by medical residents as the cause of their difficulties, fear or rejection of neurology. Bar chart with multiple choice and open-ended answers. By 'Integration of teaching' we mean the fragmentation of neuroscience subjects during university years and their uncoordinated delivery.



differences were found between the presence of neurophobia and the medical school they attended, the specialty in which they were training, nor whether a 24-hour specific neurology shift existed at their centre. Those who had completed a rotation at a neurology service showed less neurophobia (22,4% vs. 34,5%). However, this difference was not statistically significant (p = 0,174).

The main reasons identified as causes for their fears and difficulties towards neurology were the type of patients and diagnoses (62; 46%), predominantly theoretical teaching during their university years (61; 46%), followed by the complexity of basic neurosciences (physiology, biology, and biochemistry) (54; 40%), and the limited exposure to neurological patients (49; 37%). These results are further elaborated on figure 1. We performed a sub-analysis comparing MdF residents with the hospital-based residents. Significant differences were found in those identifying limited patient exposure as a reason for their neurophobia (20.6% in MdF vs. 50.7% for hospital-based specialties; p < 0,01).

When asked about neurology and basic areas of neuroscience knowledge (neuroanatomy, histology, physiology, pharmacology, and medical pathology), 121 respondents (90.3%) considered their knowledge to be low or very low in at least one of these areas. Figure 2 visualizes the perception of all sub-areas and their relative frequencies. We found significant difference when comparing MdF with other specialties regarding their knowledge of neuropharmacology (low or very low) (25% MdF vs. 44% hospital-based specialties; p = 0,042).

Next, they were questioned about their interest, perceived difficulty, confidence in making a differential diagnosis, and comfort in conducting a targeted examination in the following specialties: cardiology, gastroenterology, neurology, respiratory medicine, endocrinology, oncology, psychiatry, nephrology, and hematology (Fig. 3). Neurology ranked third in terms of interest, behind cardiology and gastroenterology. Simultaneously, it was considered the most difficult (p < 0,05 compared to the rest). Both in terms of making a differential diagnosis and conducting a targeted examination, neurology was among those with the least confidence, with these differences being statistically significant compared to cardiology, gastroenterology, respiratory medicine, and endocrinology (p < 0,05).

Finally, residents were asked about their confidence in managing patients in emergencies with different neurological pathologies (Fig. 4). The areas where they showed the least confidence (Likert 1-2: 'insecure-very insecure') were neuro-ophthalmology (108; 81%), followed by neuromuscular pathology (100; 76%) and acute spinal cord injury (99; 75%). Conversely, they reported the highest confidence (Likert 4-5: 'confident-very confident') in headaches (59; 45%) and vascular pathology (54; 41%). When performing a sub-analysis comparing

Figure 2. Self-perception of knowledge in neurosciences. Likert scale chart (1 to 5). Extreme values are represented on the edges ('very poor-below average' [1-2] and 'above average-very high' [4-5]).

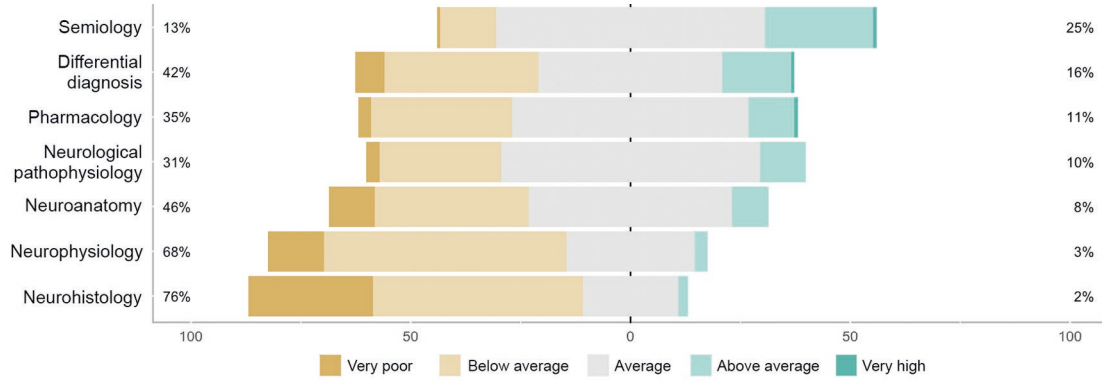
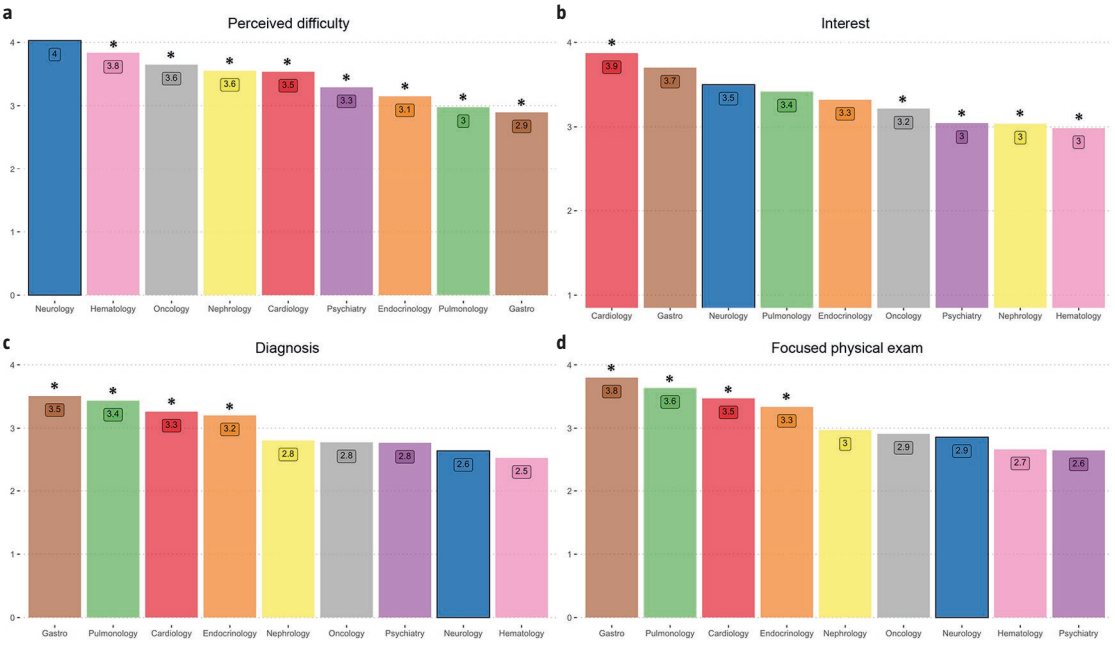


Figure 3. Bar chart of the perception medical interns regarding each medical specialty in terms of interest in the subject (a), perceived difficulty (b), confidence in making a diagnosis (c) and comfort in performing a focused physical exam (d). Mean score of responses on a Likert scale from 1 to 5. A comparison of neurology versus cardiology, endocrinology, gastroenterology (gastro), hematology, nephrology, pulmonology, neurology and psychiatry is provided; identifying with (*) when the p value is <0,05 versus neurology. The *p* value was calculated using the Mann-Whitney test between each pair of groups with significance correction.

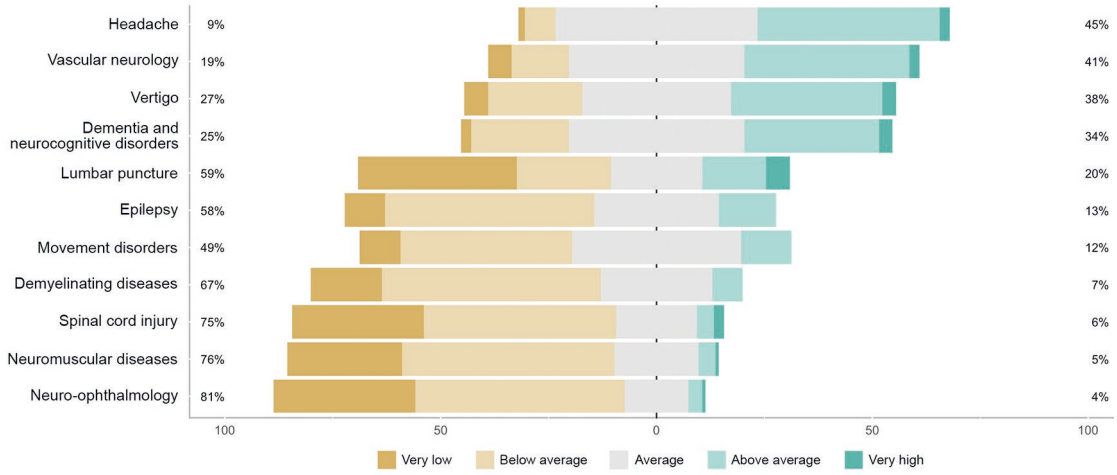


MdF residents with hospital-based specialties, significant differences were found in the insecurity when assessing patients with dementia and cognitive disorders (16% MdF vs. 33% hospital-based specialties; $p = 0,03$) and the confidence when evaluating patients with acute vertigo syndrome (52% MdF vs. 26% hospital-based specialties; $p < 0,01$).

Discussion

Studies centered on neurophobia and resident physicians are few, and so far, none has been conducted specifically in residents working in the emergency department. We have observed how neurophobia is prevalent not only among medical stu-

Figure 4. Confidence in managing neurological pathologies. Likert scale chart of each Neurology subarea (1 to 5). Extreme values are represented on the edges: 'very poor-below average' [1-2] and 'above average-very high' [4-5].



dents but among junior doctors too. Interestingly, the underlying causes for neurophobia exhibit a degree of variability. Of particular interest to us is their perception of the different neurological pathologies that they could potentially encounter in urgent care.

Over the course of our medical career, exposure to neurological pathology is unavoidable, regardless of one's specialty. Globally, neurological diseases are the leading cause of years of life lost due to disability and the second leading cause of mortality [9]. Additionally, they represent one of the main reasons for urgent medical consultations [10,11]. Within the current landscape marked by Primary Care overload, the pressure on the emergency department has further increased, thereby becoming the gateway to the healthcare system for many patients [12]. It is at this point that the first contact with the patient is made by resident doctors from various specialties, with their fears and insecurities. Neurophobia among these junior doctors can lead to misinterpretation of neurological symptoms and signs, resulting in incorrect and delayed diagnoses. Moreover, doctors grappling with neurophobia may feel uncomfortable managing neurological diseases, leading to unnecessary referrals and fragmented care for patients [1,6]. This places additional burden the healthcare system and increase the economic costs [13].

In our study, 27.6% of resident doctors reported suffering 'neurophobia.' No formal definition of neurophobia exits, so we are unable to directly compare with previous works. However, our findings are similar to those reported in other studies conducted among both students [14-16] and medical residentes [7]. A previous study conducted by our team found a neurophobia rate of 34.1% among medical students of the same region [17]. The few studies that tangentially compared neurophobia between students and resident doctors indicated a slightly lower prevalence among the latter, which is consistent with our findings [3,4,7]. This underscores how perception of neurophobia is in fact dynamic and can, therefore, be modified.

One might think that these fears might similarly extend to other pathologies encountered in emergency settings. However, upon comparing neurology with the other specialties, it became evident that neurology stands out significantly. It is perceived as the most challenging discipline and it is among the specialties where they felt the most uncertain when making a diagnosis or conducting a physical examination. Amusingly, it was also among the specialties that garner the highest interest from the residents. What is it then the cause for these fears and difficulties? As Jozefowicz pointed out, the genesis of neurophobia lies in the 'inability to apply basic neuroscience knowledge to specific clinical situations,' meaning the difficulty in translating theoretical knowledge into patient care [1]. However, there seem to be differences between undergraduate and postgraduate stages.

Main reasons identified in our survey for said fears were the type of patient and their diagnoses (46%) and predominantly theoretical teaching (46%), followed by the complexity of basic neuroscience (40%) and limited exposure to neurological patients (37%). These factors have been identified in other published studies as well [2,13,18,19]. Of particular significance is the role of neuroanatomy. Almost half of the residents (46%) regarded their knowledge in this are as scarce or very scarce, yet only a third (32%) acknowledged it as a contributing factor to their fear of neurology. This contrasts with the results observed in studies conducted exclusively on students, where neuroanatomy played a much more significant role (47,8% in our previous research [17]). This trend could be sensed in works that targeting last-year medical students and has been replicated in other studies [3]. As we face real clinical situations, we seem to give less weight to our basic science knowledge and place greater emphasis on its usefulness and application in daily practice.

We did not find differences in the rate of neurophobia between residents across different specialties or between those who completed a specific neurology rotation and those who did not. This reinforces our belief that the best time to address neurophobia lies at the beginning of medical education rather than in later training stages. Moreover, we observed no differences in the prevalence of neurophobia between residents who worked in emergency centers with 24-hour neurology coverage and those who did not. Hence, greater access to neurologists does not seem to mitigate nor favor neurophobia. Lastly, we did not find differences in the presence of neurophobia between those who studied medicine within our region, at other Spanish universities, or abroad (Spanish America). This further attest to the global dimension of neurophobia [3,7,14,20,21].

Of special interest is the perception of their knowledge in different neurological pathologies within the emergency room. Notably, the areas where residents showed the highest level of confidence encompassed headaches and neurovascular pathology, followed by dementia and vertigo/dizziness. Conversely, they felt the most insecure in relation to neuromuscular pathology and neuro-ophthalmology, followed by acute spinal cord injury. It is not surprising how they their comfort levels correlates with the prevalence of pathologies [22]. Upon comparing residents from different specialties, those in Family Medicine showed significantly less insecurity when evaluating patients with cognitive disorders and dizziness/vertigo, both of which are frequent reasons for ambulatory consultations. Likewise, fewer residents in Family Medicine attributed their neurophobia to limited exposure to patients or insufficient knowledge of neuropharmacology, which once again correlates to their continuous contact with a varied patient population. It is noteworthy that despite lumbar puncture being a routine and indispensable technique in emergency medicine, was the area of greatest individual insecurity, with no significant differences between specialties. This further reinforces the notion that the core of neurophobia lies in teaching and the lack of exposure to apply theoretical knowledge in clinical practice. Lastly, it is concerning that in none of the pathologies surveyed, the percentage of respondents who felt secure exceeded 50%. This illustrates how there is still much to do during postgraduate training.

Lastly, it should be pointed how most studies dealing with neurophobia among medical doctors have so far focused on the hospital level. New studies oriented at primary care practices would be of great significant to help us understand this phenomenon.

Limitations

The main limitations of the study are those inherent to the use of self-administered surveys. The surveys were distributed through the teaching comitee of each center, but it is not possible to ascertain with absolute certainty who responded to them, nor the level of information or commitment at the time of completion. This weakness is shared by studies with similar data collection methodologies. Moreover, the response rate from participants, although limited, has allowed for the availability of groups of similar size between primary care and hospital-based residents. Almost half our sample corresponded to primary care medical residents. This constitutes a selection bias; however, it is not unexpected and resembles the composition of emergency services.

Conclusion

Neurophobia is not exclusive to university students, and it is prevalent among residents working within the emergency departments. The demand for urgent care is ever rising, and the management of neurological emergencies has undergone significant changes in recent years. Neurophobia has an impact on the care and handling of these patients. Its prevalence seems to depend on the level of patient exposure. In words of the American philoso-

pher Will Durant, 'We are what we repeatedly do. Excellence, then, is not an act but a habit.' Therefore, potential solutions for neurophobia should focus on teaching and the practical application of acquired theoretical knowledge. Neurologists must play an active role in the training of new specialists and collaborate actively with emergency services.

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Neurofobia entre médicos residentes en los servicios de urgencias

Introducción. La neurofobia se define como el miedo hacia la neurología que surge de la incapacidad para aplicar los conocimientos teóricos a situaciones clínicas prácticas. Este fenómeno parece no limitarse únicamente a estudiantes de medicina, pero no se dispone de estudios previos en el ámbito de urgencias. Este trabajo valora la percepción de conocimientos en las distintas patologías neurológicas urgentes por parte de médicos en formación y posibles motivos de neurofobia.

Material y métodos. Es un estudio transversal multicéntrico mediante encuestas autoadministradas a médicos en formación de todo el Servicio Aragonés de Salud. Se interrogó sobre su miedo a la neurología y otras especialidades médicas, posibles causas y percepción de conocimientos en patologías neurológicas en el servicio de urgencias.

Resultados. Se obtuvieron 134 respuestas. El 27,6% (37) sufría neurofobia. La neurología fue la tercera disciplina que mayor interés despertó, pero se considera la de mayor dificultad. Las áreas en las que mayor seguridad mostraron fueron las cefaleas y la patología vascular. Donde mayor inseguridad existía fue en la neuromuscular, la neurooftalmología y la lesión medular aguda. En ninguna de las áreas hubo un porcentaje mayor del 50% que se sintiera seguro o muy seguro.

Conclusiones. La neurofobia está presente entre los médicos en formación que desempeñan su labor en los servicios de urgencias. Su distribución depende del grado de exposición a los pacientes. Los neurólogos debemos desempeñar un papel activo en la formación de nuevos especialistas y promover la colaboración con los servicios de urgencias.

Palabras clave. Educación. Enseñanza. Neurofobia. Neurología. Residencia. Urgencias.