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Contribución Original

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Panorama de la neurofobia en México

Panorama of neurophobia in Mexico

Abstract

Background: Neurophobia is the fear of neurosciences and neurology due to an inability to apply knowledge of basic science to clinical scenarios. Neurology is found difficult among medical students. We compared the perception of neurology with other seven major medical disciplines and analysed the cause of neurophobia among mexican medical students.

Methods: We supplied questionnaires among third to sixth year medical students from the National University of Mexico. We evaluated difficulty, knowledge, confidence and interest in neurology compared to other disciplines; we asked why they found neurology difficult to learn and a solution to this problem.

Results: 252 questionnaires were completed. Neurology was perceived as: the most difficult subject ($p<0.05$) and the one with the least knowledge ($p<0.05$). Neurology was considered difficult due to the complexity of neuroanatomy. Participants suggested neurology teaching might improve with the early integration of clinical and basic sciences.

Conclusion: Despite the size of the sample, the pattern matches with studies previously published. Neurological disorders are emerging as important causes of morbidity and mortality. It is important to identify the contributing factors of neurophobia and correct them so physicians will be able to properly treat these patients.

Keywords

Neurophobia, medical education, neurology, learning

Resumen

Introducción: Neurofobia es el miedo a las neurociencias y la neurología debido a una incapacidad de aplicar conocimientos de ciencias básicas a escenarios clínicos. Neurología se percibe difícil entre los estudiantes de medicina. Nuestro propósito fue comparar la percepción de la neurología con otras siete disciplinas médicas importantes y analizar la causa de la neurofobia entre los estudiantes de medicina mexicanos.

Métodos: Aplicamos cuestionarios entre tercer a sexto año de la carrera de medicina de la Universidad Nacional Autónoma de México. Se evaluaron la dificultad, conocimiento, confianza e interés en la neurología en comparación con otras disciplinas y preguntamos por qué encontraron difícil de aprender neurología y si tenían una solución a este problema.

Resultados: Se completaron un total de 252 cuestionarios. La neurología se percibe como el tema más difícil ($p < 0.05$) y aquel con el conocimiento menor ($p < 0.05$). Adicionalmente, la neurología se consideró difícil debido principalmente a la complejidad de la neuroanatomía. Los participantes sugirieron que podría mejorar la enseñanza de la neurología con la temprana integración de ciencias básicas y clínicas.

Conclusión: A pesar del tamaño de la muestra, el patrón coincide con los estudios previamente publicados. Los trastornos neurológicos están emergiendo como causa importante de morbilidad y mortalidad, por lo que es importante identificar los factores de neurofobia y corregirlos para que los médicos sean capaces de tratar adecuadamente a estos pacientes.

Palabras clave

Aprendizaje, educación médica, neurología, neurofobia

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Background

In 1994, Jozefowicz recognized neurophobia as a condition among medical students and physicians. He defined it as *"the fear of neural sciences and clinical neurology due to an inhability to apply knowledge of basic science to clinical scenarios"*[1]. This fear leads to poor achievement among medical students during basic sciences featured by intimidation and boredom. As a consequence, during the neurology clerkship, students develop a cynical and even nihilistic attitude towards neurology. It is believed that the main cause of neurophobia is the lack of integration between basic and clinical sciences, which is partly due to reduced and unfocused teaching. Zinchuk et al [2] found out the main causes of neurophobia were the perception of neuroanatomy as a complex science, the limited practice with neurological patients, and inadequate teaching. These factors reveal the lack of integration we discussed before. In this way, students are unable to perform an adequate neurological examination, leading to an inhability to locate the site of lesion in the nervous system. There is a risk that this trend becomes a pattern, and the training of physicians who perform a poor neurological examination, or doctors who refer patients to the neurologist in order to avoid dealing with them, will become a common practice. Diseases of the nervous system are responsible of 28% of disability-adjusted life years[3]. As the population ages, the prevalence and impact of neurological disorders will continue rising, for this reasons it is important that current and future physicians have solid skills in neurology to enable them to competently handle such conditions.

Panorama of neurophobia in Mexico

There is little information regarding the perception of medical students towards neurology. The way medicine is taught in Mexico has been traditionally a memoristic process where the professor takes an active rol while the student takes a passive, receptive and professor-dependent role. This approach has changed in the last decade with many medical schools adopting the problem-based learning as part of their curricular program. In this case, the professor acts as a guide while the student takes a more active rol in the learning process. The current panorama of neurology residency programs in Mexico may mirror the situation among medical students[4]. There are 12 medical centers that offer residency programs in neurology and six in pediatrics neurology among the country. There is also a trend showing a higher number of vacancies in this programs. The teaching of neurology in Mexico is done during clinical clerkships, with an exclusive duration of 1 month, in most of the hospitals, and the less having 6 months to learn it along with other subjects, leading to approximately the same amount of time in both cases. Even worse is that some medical schools have a neurology course based on lectures and no interaction with patients. This pattern leads to the training of students uncapable to perform an adequate neurological examination, hence, an inadequate neurological diagnosis. As a result, we face medical students finishing their training with the impression that neurology is tedious and difficult. There are already signs of this problem, the number of candidates for the neurology residency is decreasing regardless the increasing number of neurological patients in the country. Apparently, the panorama we face in Mexico, is similar to reports from other countries where neurophobia was studied, as well.

Panorama of neurophobia around the world

Since Józefowicz' first definition of neurophobia, a rising number of papers have been published in the last decades. We searched PubMed and Medline for articles in english with the term *"neurophobia"*. We also conducted a search among not indexed journals for articles with the term *"neurophobia"*. We did not restrict articles by date of publication. We identified 24 potentially relevant articles. All titles were scanned and we selected 15 articles that analyse medical students' attitude towards neurology. *(Table 1)*

Methods

We conducted an observational, descriptive and transversal study. This study was conducted from July to September 2016 at the Faculty of Medicine of the National University of Mexico *(UNAM- Universidad Nacional Autónoma de México)*. The UNAM is the largest university in Mexico and harbors the largest medical school as well; it annually admits an average of 800 students to follow the 6.5-year MD program. We invited 252 medical students from third to sixth year to participate in a questionnaire survey. The questionnaire, modified from the original version used by Schon et al[5], was previously validated by 5 neurologists who imparted the neurology clerkship at different hospitals.

The questionnaire was designed to assess the degree of perceived knowledge, difficulty, confidence and interest in neurology as compared to other subjects. We considered the following 8 specialities: Cardiology, Endocrinology, Gastroenterology, Geriatrics, Nephrology, Neurology, Respiratory Medicine and Rheumatology. The participants were asked to rank the mentioned specialties on a likert scale for interest *('1'- not interested- to '5'- very interested)* knowledge *('1'- very poor- to '5'- very strong)*, difficulty *('1'- very difficult- to '5'- very easy)* and confidence *('1'- not confident- to '5'- very confident)* in each medical specialty.

In the remaining sections, we explored the contributing factors to the difficulty in learning neurology with a multiple choice question. The following options were provided 1) the complexity of neuroanatomy 2) the complexitiy of neurosciences 3) the difficulty of the neurological examination 4) bad neurology classes 5) the complexity of diagnosing in neurology 6) limited practice with patients 7) insufficient classes 8) other reason. We investigated the best resource for learning medicine (another multiple choice question) with the following options: 1) practice with the patient 2) classes 3) textbooks 4) electronic resources *(Journals, Uptodate, Medscape)* 5) other resources not mentioned above. Another issue we inquired was the best way to improve the teaching in neurology *(this was an open question)*; we also asked the quality of the neuroscience and neurology course *('1'- excellent- to '5' lousy)*. Finally, we asked if the person was familiar with the term *"neurophobia" (yes or no, if the answer was yes, we asked to write the definition)*.

The data were analyzed using SPSS v14 for Windows statistical software package. Comparisson and significance was done using one way ANOVA and the $p<0.05$ was considered statistically significant.

Results

Two hundred and fifty two medical students responded the questionnaire *(response rate – 100%)*. Respondents rated their knowledge in neurology as the lowest among the 8 medical specialties *($p<0.05$)*, for which the rating was not statistically significant *($p=0.08$)*. Neurology was also rated as the most difficult *($p<0.05$)* of the eight medical specialties, as well as the one with the least confidence when examinating a patient *($p<0.05$)* compared to eight other specialties. Interestingly, despite been considered the least in knowledge, difficulty and confidence, neurology was considered the third most interesting subject, next to cardiology and endocrinology; when students were asked specifically regarding neurology, the majority *(30.2%)* responded it was a very interesting subject. We also noticed, the level of knowledge was proportional to the year of training, the least knowledge was observed in third-year medical students, who were initially introduced to clinical clerkships; fourth-year medical students had a higher knowledge, presumably because it hasn't been too long since they took neurology clerkships. The highest peak in knowledge was gained during their sixth year, which is the final year before initiating their residency training and when they are supposed to

Author	Year	Country	Number of participants
Schon, et al [5]	2002	UK	186 medical students 100 senior house officers 59 general practitioners
Flanagan, et al [6]	2007	Ireland	411 medical students 40 junior doctors 29 senior house officers 7 medical registrars 6 unspecified 4 interns
Youssef [7]	2009	Trinidad & Tobago	167 medical students
Zinchuk, et al [2]	2010	USA	98 medical students 54 residents
Sanya, et al [8]	2010	Nigeria	302 medical students
Matthias, et al [9]	2013	Sri Lanka	148 medical students 100 non specialist doctors
Kam, et al [10]	2013	Singapur	158 medical students 131 junior doctors
Gupta, et al [11]	2013	India	243 residents
Moreno-Zambrano, et al [12]	2013	Ecuador	401 medical students
Lukas, et al [13]	2014	China	41 medical students
McCarron, et al [14]	2014	Northern Ireland	118 medical students
Fantaneanu, et al [15]	2014	Canada	187 medical students
Pakpoor, et al [16]	2014	UK	2877 medical students
Abulaban, et al[17]	2015	Saudi Arabia	422 medical students
Buonanotte, et al[18]	2016	Argentina	122 medical students and graduate physicians

Table 1.

Findings
Neurology had the least knowledge (p<0.005), confidence (p<0.001), most difficult (p<0.001) when compared to 7 other specialties. Major reasons neurology is difficult: Trouble understanding, neuroanatomy, the difficulty of the neurological examination. Ways to improve the teaching: More time of teaching and practice with the patient, integration of the basic and clinical subjects.
Neurology was ranked 4th place in knowledge (p<0.005), most difficult (p<0.001), least confidence (p<0.001 except for nephrology) when compared to 7 other specialties. Major reasons neurology is difficult: Little time for the course, insufficient practice. Ways to improve teaching: More time of teaching, practice with patient, mentoring, improving the teaching of neuroanatomy.
Neurology had the least knowledge (p<0.005) when compared to 7 other specialties. Major reasons neurology is difficult: Trouble understanding neuroanatomy and diagnosis in neurology. Ways to improve teaching: Integration of the basic and clinical subjects.
Neurology had least knowledge (p<0.001) and most difficult (p<0.001) when compared to 7 other specialties. Major reasons neurology is difficult: the complexity of neuroanatomy, limited patient exposure and insufficient teaching. Ways to improve teaching: 80% of respondents felt it could be improved through greater exposure to patients and more bedside tutorials.
Neurology had the least knowledge (p<0.05) when compared to 7 other specialties. Major reasons neurology is difficult: Trouble understanding neuroanatomy, insufficient exposure to neurological cases, too many complex diagnosis, inadequate neurology teachers. Bedside teaching was selected as the best way to learn neurology.
Neurology was ranked 3rd as the most favorite (p<0.05) subject, least interesting (p<0.01), least confidence (p<0.05), most difficult (p<0.01) and fifth in knowledge (p<0.01) when compared to 6 other specialties. Major reasons neurology is difficult: Need to know basic neuroanatomy and having a complex clinical examination. Best way to improve teaching: hospital/clinical based teaching, case discussions and teaching aids.
Prevalence of neurophobia in 47.51% of the students surveyed. Risk factors for developing neurophobia: Female gender, lack of interest, lack of knowledge, lack of clinical teaching.
Factors bringing students to choose neurology as a career: Intellectual challenge and logical reasoning (72%), inspired by role model teachers (63%), better quality of life (51%), independent practice without expensive infrastructure (48%). Factors preventing students choosing neurology as a career: Perception that most neurological diseases are degenerative (78%), neurology is mainly an academic specialty (40%), neurophobia (43%), lack of procedures (57%). Up to one third of students (31%) thought the level of neurological exposure given was below average, majority (70-80%) of the students felt they have not been taught enough neurological pharmacology, and 47% admitted they are not confident in managing neurological cases.
Neurology was the most difficult subject, 2nd with less confidence and 3rd least knowledge (p<0.001). The main reasons of neurophobia were lack of basic neuroscience knowledge and poor teaching.
Neurology was ranked 6th place in knowledge when compared to 7 other specialties. Best way to improve teaching: Enhance the practice with the patient.
Neurology had poorer knowledge (p<0.001), less confidence (p<0.001), less interest (p<0.001) and perceived more difficult (p<0.001) when compared to 6 other specialties. Hospital and community-based neurology teaching was graded as “poor” or “very poor” by over 60% of medical students. Multiple causes of neurophobia: Trouble understanding neuroanatomy, poor quality of teaching. Counter measures against neurophobia proposed: More organised clinical teaching and referral guidance.
24% of respondents were afraid of neurology, 32% were afraid of neuroscience and 46% thought neurology was one of the most dificult disciplines in medicine
Students found neurology to be more difficult and least confortable drawing up a neurological differential diagnosis compared to other 6 specialties (p<0.0001). Neuroanatomy was the most important factor contributing to neurology being perceived as difficult.
A 29.6% of students were not satisfied with their neurology teaching experience, 84.4% found neurology difficult, and 42.7% of the whole group thought that their neuroscience knowledge was insufficient. (p=0.001).
More than a half prefered to refer patients, rather than taking action in neurological clinical situations.

achieve the highest level of knowledge in general medicine.

In the remaining sections of the questionnaire, we inquired the major contributor to the difficulty in learning neurology, we distinguished three major contributors: the complexity of neuroanatomy *(36.6%)*, poor teaching *(25.5%)* and limited practice with patients *(12.5%)*. This last factor is really important, since, when we asked which was the best resource for learning medicine, they considered practice with the patient *(58.3%)* to be the best resource. When we asked which was the best way to improve teaching in neurology, the predominant answer was *"to improve the quality of clases" (26.6%)*; 25% suggested the early integration of basic sciences and clinical neurology was an effective method to improve the way neurology is taught.

In the last questions we asked the quality of their basic neurosciences and neurology classes, and we found that 42% of the students rated their basic neuroscience classes as average, followed by 36.9% who rated them as good. Six-percent rated them as excellent and 2.4% as lousy. We found the same pattern towards neurology classes where students rated them mainly as average *(36.1%)*, good *(27%)* and poor *(23.1)*. Only 8.3% found them as excellent and 4.8% lousy. Finally, when we asked if they were familiar with the term *'neurophobia'*, only 12% responded yes, but neither of them mentioned the concept of Josefowicz[1], they rather inferred an etimological definition of the word. *(Tables 2-5)*

	Mean score (±SD) (n=252)
Level of difficulty (1-5)	
Cardiology	2.66 (±0.99)
Endocrinology	3.16 (±0.99)
Gastroenterology	3.39 (±0.85)
Geriatrics	3.52 (±1.03)
Nephrology	2.71 (±1.03)
Neurology	2.30 (±1.12)
Respiratory medicine	3.19 (±0.88)
Rheumatology	3.17 (±0.96)
Level of knowledge (1-5)	
Cardiology	3.28 (±0.85)
Endocrinology	3.35 (±0.90)
Gastroenterology	3.48 (±0.85)
Geriatrics	3.22 (±0.99)
Nephrology	2.98 (±0.89)
Neurology	2.96 (±0.94)
Respiratory medicine	3.33 (±0.87)
Rheumatology	3.22 (±1.03)
Level of confidence (1-5)	
Cardiology	3.17 (±0.91)
Endocrinology	3.37 (±0.90)
Gastroenterology	3.63 (±0.84)
Geriatrics	3.28 (±0.97)
Nephrology	2.98 (±0.99)
Neurology	2.83 (±0.98)
Respiratory medicine	3.36 (±0.87)
Rheumatology	3.25 (±0.98)
Level of interest (1-5)	
Cardiology	3.78 (±1.13)
Endocrinology	3.70 (±1.10)
Gastroenterology	3.61 (±1.04)
Geriatrics	3.06 (±1.30)
Nephrology	3.58 (±1.16)
Neurology	3.60 (±1.23)
Respiratory medicine	3.51 (±1.01)
Rheumatology	3.57 (±1.15)

Table 2. Level of difficulty, knowledge, confidence and interest among medical students.

	% (n=252)
The complexity of neuroanatomy	34.9%
The complexity of neurosciences	11.5%
The difficulty of the neurological examination	v 2.4%
Poor neurology classes	25.4%
The complexity of diagnosing in neurology	6%
Limited practice with patients Insufficient clases	13.1%
Other reason	3.2%

Table 3. Reasons for neurology to be considered a difficult subject

	% (n=252)
Practice with patients	58.3
Classes	7.9
Textbooks	16.7
Electronic resources	15.5
Other resources	1.6

Table 4. Best resource for learning in medicine

	% (n=252)
Better classes	26.6%
Integration of basic sciences and clinical neurology	25%
More practice with the expert	21.4%
More time of clases	9.9%
More commitment from the tutor	8.7%
Other strategies	8.4%

Table 5. Strategies to improve teaching in neurology

Discussion

Data from the Global Burden of Disease 2010 study reported neurological disorders and cerebrovascular disease combined represent 7.1% of total global burden of disease. Within the combined burden, hemorrhagic stroke *(35.7%)* and *(22.4%)* ischemic stroke contribute the largest proportions to disability-adjusted life years *(DALY)*.[3] This findings confirm what previous reports were already announcing[19,20] Neurological disorders impact, especially in low- and middle-income countries, is an important matter of public health and will continue to rise in the future years. Countries will need physicians *(not only neurologists)* capable to perform an adequate assesment and management of neurological conditions.

Mexico has been experimenting a demographic and epidemiological transition for the past few decades, making degenerative and vascular diseases of the nervous system to increase their morbidity and mortality.There are few published reviews regarding the prevalence of neurological conditions in Mexico. The Manuel Velasco Suarez National Institute of Neurology and Neurosurgery, which is the most important neurological center in Mexico reported that the major neurological condition seen was epilepsy with a prevalence of 5.9% per 1,000 inhabitants; Parkinson's disease was the most representative among movement disorders, affecting 20% of the population aged >65 years. Other frequent conditions reported were depression and dementia, brain trauma, brain tumors and central nervous system infections.[21]

Since Józefowicz' definition of neurophobia, there have been published 15 studies regarding the perception of students towards neurology. Every region of the world has at least one publication regarding neurophobia *(4 in Asia, 3 in Europe, 1 in Africa, 6 in America)*. Results from all of the studies show there is a clear pattern regarding the issue of neurophobia and how neurology is being taught in medical schools all over the world. Neurology is always considered one the most difficult subjects and the one with least knowledge, when compared with other medical specialties. Furthermore, it is clear that the problem goes back to the earliest stages of medical training; neuroanatomy is frequently mentioned as a major contributing factor to neurophobia. It seems that for medical students who are not able to grasp the complexity of neuroanatomy from the begining, it will be harder to understand neurology during clinical clerkships. Poor neurology and basic neuroscience teaching are considered main contributors to neurophobia, however, our study did not resembled that trend fully, the majority of the students questioned, did not considered their neurology and basic neuroscience classes to be poor or lousy. Apparently the complexity of the subject makes it difficult for teachers to transmit the knowledge in a comprehensive way; the majority of the studies published revealed that among the solutions to stop neurophobia, medical students always refer that early exposition to clinical settings where they can correlate and apply the abstract concepts of the neuroanatomy course may be an effective way to achieve a better understanding of neurology.

The main limitation of our study was its restriction to a unique medical school. Although the UNAM harbors the biggest medical school in Mexico, it is not the only faculty; there are up to 83 medical schools, so we cannot generalize our results to the rest of the medical students in the country. However, as we mentioned early, our results match with those realized in other countries, so it is plausible to suggest our results may in fact represent the perception among medical students from Mexico. Aditionally, we developed a study that evaluates one single subject, however, our study may reflect the perception of medical students towards the whole medical teaching, particularly if we consider that the majority of the students disagreed with the way classes are imparted, and the most valuable resource in learning medicine was in fact, practice with patients.

Conclusion

Neurophobia is a generalized condition among medical students. Our results match with those from previously published studies in other countries. The main reason is the difficulty to understand basic neurosciences. Neurological disorders are emerging as important causes of morbidity and mortality and this trend will keep rising. It is important to identify the contributing factors of neurophobia and correct them so practising physicians will be able to properly treat these patients.

List of abbrevations:

1.- UNAM: Universidad Nacional Autónoma de México.
2.- DALY: Disability-adjusted life years

Competing interests

The authors declare that they have no competing interests

Authors`contributions

ASJ, RMR, RDP contributed to the conception, study design and data collection. ASJ, RMR refined the study design, statistical analysis and drafting the manuscript. CCB critically revised the manuscript. All authors read and approved the final manuscript.

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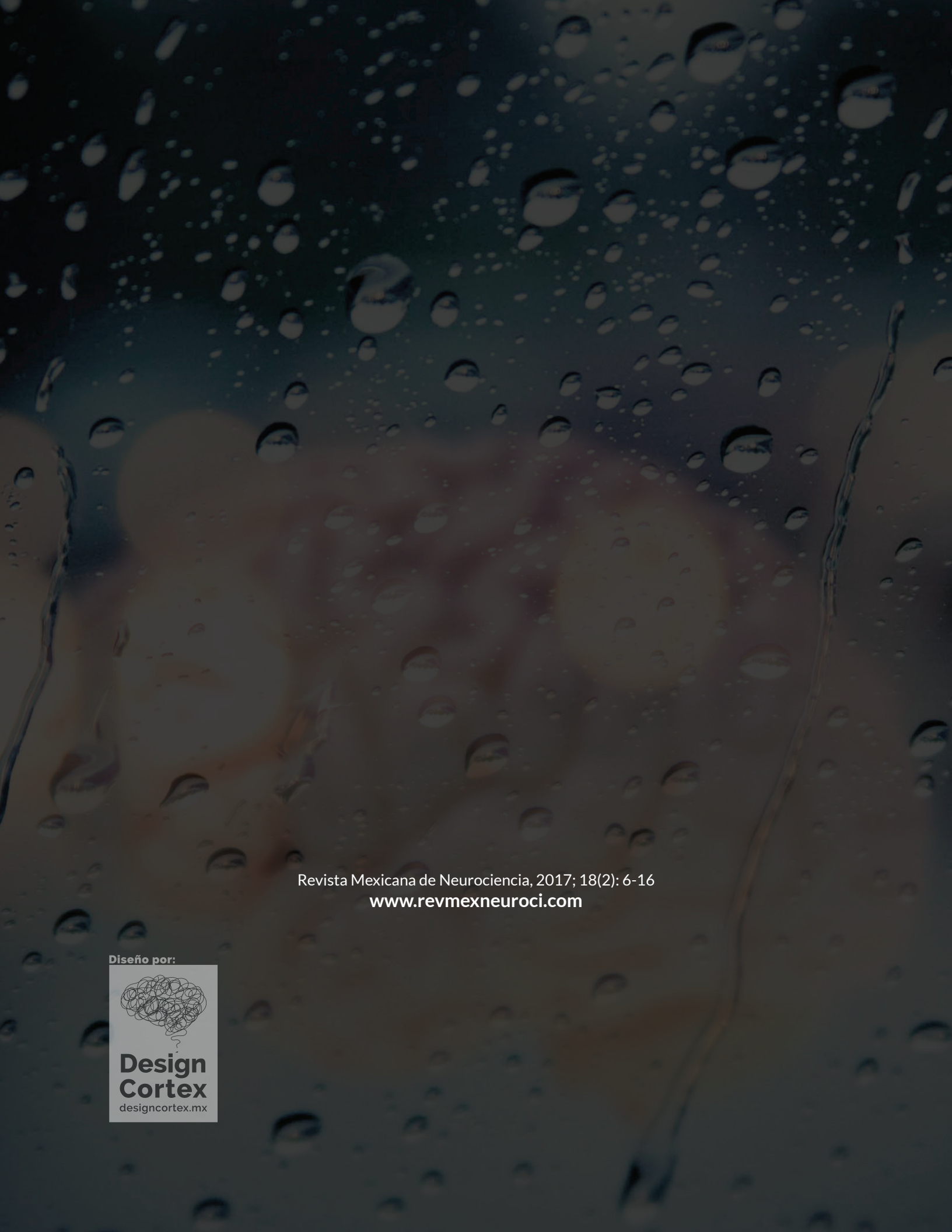

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