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### Abstract

**Background:** Several educational strategies have been suggested to alleviate neurophobia. This study seeks to evaluate the influence of a hands-on clinical rotation in a neurology department on the levels of neurophobia experienced by medical students in Abidjan. **Methods:** This study employed a prospective, analytical, and descriptive research design. At the start and conclusion of each practical internship, students were required to complete an anonymous questionnaire that included two sections: sociodemographic data and the Neuro-Q score. Students were identified as neurophobic if their neuro-Q score was above 16. This threshold is validated for medical trainees, such as our population. **Results:** The analysis of proportion demonstrates a significant difference at the 5% significance level between the pre-internship and post-internship proportions of individuals with neurophobia across the surveyed population ( $p < 0.05$ ). Further examination by educational level reveals significant differences in proportions for specific levels of study. The significant difference in neurophobic subjects is observed exclusively among Master 1 students ( $p < 0.05$ ). **Discussion:** The findings of our study indicate that practical training in neurology may contribute to a decrease in neurophobia among students, with the extent of this effect differing among various subgroups. **Conclusion:** It is imperative to introduce strategies designed to mitigate neurophobia in medical students during the initial stages of their training.

**Keywords:** neurophobia, hands-on training, Abidjan

## INTRODUCTION

Neurophobia represents a worldwide issue [1, 2], with initial reports indicating that it affects 50% of medical students [3]. However, more recent studies suggest that this figure has decreased to around 30% [4, 5]. The origins of neurophobia are multifaceted. Research from the United States indicates that the problem is not merely a result of insufficient exposure and education, but also relates to the lack of effective integration of basic neuroscience and clinical neurology, which creates barriers for students. Several educational strategies have been proposed such as a more patient exposure, a more bedside teaching and a mandatory rotation in neurology were reported to be the most helpful. Moreover, teaching options including case-based teaching, team based learning, and problem based learning can also alleviate

neurophobia [1]. A review of the literature did not reveal any work on neurophobia in Africa. What would be the impact of the neurology internship on neurophobia in a context with limited educational resources? The internship would improve students' perception of this problem. It therefore seemed appropriate to us to carry out this study, whose main objective was to evaluate the effects of practical internships in a neurology ward on the prevalence of neurophobia among medical students in Ivory Coast. More specifically the goals were to present the socio demographical aspects of our population, then to evaluate neurophobia in the students both before and after the internship experience with neuro Q score and to evaluate effect of internship by comparisons.

## METHODS

This is a prospective, analytical, and descriptive study, carried out during the academic year 2022-2023. It was conducted within the neurology departments of the University Hospitals of Cocody and Treichville. The subjects of the study were students in their third year of undergraduate studies, first-year master's programs, and first-year doctoral programs at the Faculty of Medical Sciences in Abidjan. At the beginning of each practical neurology internship, students completed an anonymous questionnaire. This was divided into two parts: the first part collected sociodemographic information, while the second part featured the Neuro-Q questionnaire, which is a validated instrument for evaluating neurophobia. The practical training primarily involved hands-on instruction in semiology and pathology in neurology, conducted in small groups at the patient's bedside. The duration of the practical training was two months for third-year undergraduate and

first-year master's students, whereas first-year doctoral students underwent a three-month training period. The sessions were conducted in the mornings over five weekdays, with students allocated to various wards based on patient bed availability. Thus, each student, according to their academic level, was tasked with the care of a patient under the guidance of a senior neurologist. Upon completion of the internship, students were asked to complete the same questionnaire. We evaluated neurophobia in the students both before and after the internship experience. A student was deemed neurophobic if their Neuro-Q score was greater than 16. We undertook univariate and bivariate analyses to provide a comprehensive view of the variable distributions in the samples collected before and after the internship. Following this, we conducted tests to compare proportions in order to assess the effect of the practical neurology internship on neurophobia.

## RESULTS

### Prior to the internship

85 responses were recorded. The sample consisted of 63% male and 36% female respondents. Participation rates by educational level were 44.71% for Master 1 students, 35.65% for Bachelor 3 students, and 17.65% for Doctorate 1 students. The proportion of neurophobic individuals was found to be 23.35% (illustrated in Figure 1). Gender distribution among neurophobic subjects showed that 36.84% were female and 63.16% were male. Additionally, the educational level distribution indicated that 36.84% of neurophobic subjects were from both Bachelor 3 and Master 1, while 26.32% were from Doctorate 1.

### Following the internship

77 responses were collected. The demographic breakdown of the survey indicated that 61% of the respondents were male, while 39% were female. A notable

finding was that 6.49% of the respondents were identified as neurophobic (refer to Figure 2). Among the neurophobic individuals, the gender distribution was 40% female and 60% male. In terms of educational attainment, 80% of the neurophobic subjects were in their third year of undergraduate studies, 20% were in their first year of master's programs, and there were no participants enrolled in their first year of doctoral studies.

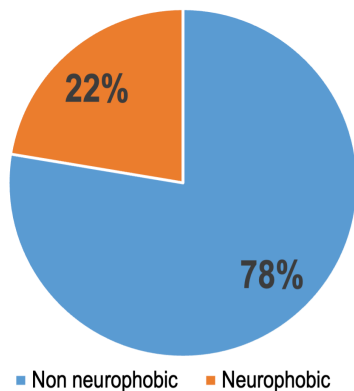
### Comparison

An analysis of proportions conducted prior to and following the internship indicated a statistically significant difference at the 5% level in the prevalence of neurophobia among all surveyed participants ( $p < 0.05$ ), as presented in Table 1. Further examination by educational level showed that significant differences in the proportions before and after the internship were observed only in Master 1 students ( $p < 0.05$ ).

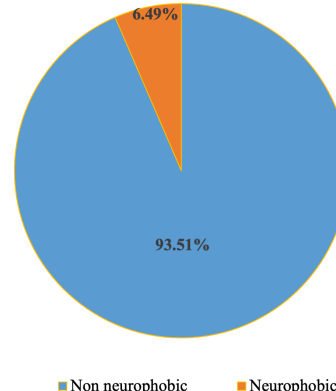
**Table 1: Test table for comparing pre- and post-internship proportions**

		P-value	P-value	P-value	P-value
Variables		$H_0$ : Diff = 0	$H_a$ : Diff < 0	$H_a$ : Diff != 0	$H_a$ : Diff > 0
Sex	Globally	0.005***	0.9977	0.0045***	0.0000***
	Men	0.026**	0.9872	0.0256**	0.0100**
	Women	0.080	0.9601	0.0798	0.0300**
Class level	Bachelor	0.320	0.8399	0.3202**	0.1600
	Master	0.027**	0.9863	0.0275**	0.0100**
	Doctorate	0.065	0.9675	0.0649	0.0300**

Legend: \*\*\* P-value < 0.01; \*\* P-value < 0.05; P-value < 0.1; p-values are interpreted at the 5% threshold. Diff: represents the difference between the proportion before and after the internship.



**Figure 1:** Distribution of students according to the state of neurophobia in the pre-internship phase



**Figure 2:** Distribution of students according to the state of neurophobia in the post-internship phase

## DISCUSSION

The concept of Neurophobia, as articulated by Jozefowicz in 1994, refers to the apprehension surrounding the fields of neuroscience and clinical neurology. This fear arises from students' inability to effectively apply their foundational scientific knowledge in clinical environments [3]. Findings from an American study [1] suggest that the obstacles faced by trainees are not only linked to a lack of exposure and teaching but also to the failure to adequately integrate fundamental neuroscience with clinical neurology.

In his framework, Miller [7] introduced a four-level pyramid model that delineates the journey of a medical student from a beginner to an expert. The foundational level of the pyramid consists of "knowledge," which is measured through written tests and conventional multiple-choice questions (MCQs). The next tier represents "application of knowledge," assessed through essays, clinical problem-solving tasks, and extensive MCQs. The third level pertains to "clinical skills," evaluated through practical exercises, simulations, and standardized patient examinations. At the top of the pyramid is "clinical performance," which is gauged through direct observation in authentic clinical environments.

Engaging in a clinical internship at the patient's bedside in the field of neurology allows students to encounter authentic clinical situations early in their training, guided by a senior neurologist. This experience is instrumental in enhancing students' clinical skills and in bridging theoretical knowledge from fundamental neuroscience with practical applications in clinical neurology. Research focused on educational strategies to mitigate neurophobia among medical students indicated that a majority perceived case-based learning (76%), collaborative learning (56%), and problem-based learning (66%) as advantageous. However, only case-based learning exhibited a statistically significant difference ( $p = 0.026$ ) when analyzed for self-reported reductions in neurophobia. In summary, the results suggest that hands-on experience in neurology could play a role in diminishing neurophobia among students, with the degree of impact varying among different subgroups. Engaging exclusively with hospitalized patients who have particularly severe or rare neurological conditions may inadvertently heighten neurophobia [9]. It is recommended that students participate in rotations at outpatient clinics to familiarize themselves with the common neurological disorders they will likely encounter in their future medical practice [10].

Additionally, the instruction of neurological semiology in medical schools could benefit from the incorporation of innovative and engaging educational techniques [11]. Several educational approaches have been proposed to alleviate neurophobia [8, 9, and 11]. The role-playing simulation known as "The Move" may be an effective resource for training medical students in neurological semiology and for helping them to overcome neurophobia [11]. In France, a substantial proportion of students (87%) and faculty members (95%) expressed the opinion that The Move should be included in the medical training curriculum.

While our research has suggested that engaging in practical internships could contribute to a decrease in neurophobia, it is crucial to consider the possible limitations of our study. These limitations include the sample size within specific subgroups, the

overall representativeness of the sample, and various other factors, such as the length of the internship, which may influence the finding.

## CONCLUSION

Neurophobia is a widespread issue that has the potential to become a public health challenge, particularly as neurological disorders become increasingly common in our work environments. As such, it is crucial to initiate interventions aimed at decreasing neurophobia among medical students from the outset of their studies. Practical training at the bedside in neurology should be emphasized as the primary educational strategy in our context. In addition, various teaching methods could be combined with this practical training to enhance its effectiveness in combating neurophobia among medical students.

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