

The role of residents in medical students' neurology education: current status and future perspectives

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Abstract

Background: Neurophobia, a well-described fear of Neurology affecting medical students worldwide, may be one of the causes of the decreased interest in neurology, which is leading to a shortage of neurologists in the United States. Within educational systems, residents play a key role in education of students, although often underrecognized. Here we formally investigate the impact of resident teaching on medical students' neurologic educational experience, analyze how this relates to students' confidence and interest in neurology.

Methods: Third year medical students (n=234) of UTHealth's McGovern Medical School rotating at Neurology as their core rotation completed two surveys regarding their rotation experiences; before and after their rotation in an anonymous manner to measure their interest and confidence in neurology and the impact of their interactions with the neurology residents on their rotation experience. Also residents underwent a workshop on small group teaching to improve their teaching effectiveness. Non-parametrical comparison and ordinal regression analyses were utilized for data analyses.

Results: Rotating medical students felt significantly more confident in managing neurological conditions more interested in pursuing neurology residency after their rotation. There was a significant association between the medical students' overall rotation experience and the residents' teaching effectiveness. Their overall rotation experience was also associated with their interest and confidence in neurology. There was a trend of increase in residents' teaching effectiveness and students' rotation experience after the workshop.

Conclusion: This study shows that resident led teaching efforts are important in improving the medical students' neurologic education. We also discuss future strategies to exploit "near-peer" teaching in a sustainable fashion to increase the medical students educational experience and competencies and how these could potentially mitigate neurophobia.

Background

Residents play a significant role in teaching the basics of Neurology during the third-year neurology clerkship where they have direct interactions with students and are at the opportune time to stimulate student interest in neurology. In conjunction with the high lifetime risk of disabling and fatal neurological conditions, such as stroke and neurodegenerative conditions,¹ and the rise of the aging population², the number of medical students pursuing neurology remains low³, hence a predicted shortage of neurologist is 19% by 2025.⁴ To counteract this shortage and revamp interest, it is pivotal to analyze putative causes beyond this and re-consider fundamental aspects of the neurological educational system.

One of the putative causes beyond the diminished interest in neurology is 'neurophobia', a term coined by Dr. Jozefowicz in 1994.⁵ Neurophobia is characterized as intimidation and boredom with neural sciences as well as difficulty grasping the main concepts in neurology, and the incidence among medical students

is as high as 50%.⁵ Over the last 25 years, several strategies have been proposed to mitigate neurophobia, increase medical students' interest in neurology^{6,7} and further increase the pursuit of neurology as a career path.

A recently proposed strategy is educating the educator, as resident-as-educator training might help with improving educational experiences for students.⁸ Moreover, a study from an obstetrics and gynecology clerkship revealed that a resident-driven mentoring program was beneficial for medical students career selection.⁹ The importance of daily interactions between medical students and neurology residents has been hypothesized to be a key component of the medical students' education during their neurology rotation.¹⁰

In this study, we hypothesize that residents can play a major role and impact on medical students' attitude towards Neurology. We also provided the neurology residents a workshop on teaching strategies in small groups and investigated its secondary effects on the medical students' overall experience.

Methods

Third year MMS students in their core Neurology rotation between May 2017 and October 2019 were asked to participate in this study. Participants completed two anonymous online survey regarding their perceptions of Neurology and then a survey regarding their experience, once before the rotation started and once immediately after the completion of the rotation. The Qualtrics© online forum was used for the administration of the surveys (<https://www.qualtrics.com/>).

Pre-rotation and post-rotation questionnaires included students' level of interest in pursuing neurology as career (scale: 1 = not interested at all, 2 = undecided, 3 = slightly interested, 4 = very interested) and confidence in managing neurological conditions (scale: 1 = not confident at all, 2 = not confident, 3 = somewhat confident, 4 = extremely confident). Post-rotation questionnaire also included students' perception of the adequacy of time residents took to teach (scale: 1 = no teaching at all, 2 = not a lot of time spent on teaching, 3 = limited time, 4 = adequate time), the effectiveness of resident teaching (scale: 1 = extremely ineffective, 2 = somewhat ineffective, 3 = effective, 4 = very effective), the impact of residents on overall rotation experience (scale: 1 = very negative, 2 = negative, 3 = positive, 4 = very positive), overall value of the rotation (1 = not valuable at all, 2 = not valuable, 3 = somewhat valuable, 4 = very valuable) and residents' bedside manner and professionalism (scale: 1 = definitely no, 2 = no, 3 = yes, 4 = definitely yes).

The neurology residents underwent an interactive hour-long workshop on small group teaching strategies led by a PhD educator from the Office of Educational Programs. The goal of the workshop was to introduce effective teaching strategies and improve residents' teaching skills. It included topics such as how learners process information, use of questioning skills, and the one-minute preceptor model. Descriptive statistics and Mann Whitney U test were used to analyze the change in the students' interest of neurology and their confidence level in neurology before and after the rotation. The pre-/post rotation

data is collected from the same students, as were collected anonymously. As the data was gathered using Likert scales, ordinal regression analysis was used to determine the correlates of students' overall experience during rotation, residents' impact on their rotation, their interest in neurology, and confidence in managing neurological conditions. The students rated residents' teaching effectiveness before and after the teaching workshop. Pre (n = 58) and post-workshop (n = 176) residents' teaching effectiveness and impact on students' rotation experience were compared by means of Mann Whitney U Test. False discovery rate (FDR) of 10% was performed for the correction of multiple comparison analyses, and R statistical software (<https://www.r-project.org/>) was used for statistical analyses.

Results

Among the students who completed the surveys (n=234), the confidence was 2.15 ± 0.03 in managing neurological conditions before the rotation and this increased to 3.12 ± 0.02 ($p=2.2e-16$) after the rotation (Figure 1A). The interest in pursuing neurology as a career increased from 1.84 ± 0.02 to 2.14 ± 0.05 ($p=0.001$) upon completion of the rotation (Figure 1A). The ordinal regression analyses showed significant association between the students' overall rotation experience and resident teaching effectiveness (Figure 1B and Table 1).

Although the residents' teaching effectiveness did not show significant association with students' interest in neurology and their confidence in managing neurological conditions, their overall rotation experience was associated with their interest (Figure 1C and Table 1) and confidence in neurology ($p=8.67e-05$ and $p=1.36e-06$ respectively). Residents' impact on the students' rotation experience was significantly associated with residents' teaching effectiveness, professionalism and bedside manner, and time spent by residents to teach (Table 1). Residents' teaching effectiveness (from 3.71 ± 0.55 to 3.75 ± 0.43) and their impact on students' rotation experience (from 3.68 ± 0.67 to 3.75 ± 0.42) showed a trend of increase after the workshop, but this did not reach statistical significance ($p>0.05$).

Overall Value of Rotation		
	Coef ± SD	p-val
Time spent by residents to teach	0.11±0.06	0.07
Residents' Teaching Effectiveness	0.36±0.08	0.00002
Residents' Professionalism and Bedside Manner	-0.09±0.08	0.3
Residents' Impact on Students' Neurology Experience		
Time spent by residents to teach	0.18±0.05	0.0003
Residents' Teaching Effectiveness	0.38±0.05	5.84e-09
Residents' Professionalism and Bedside Manner	0.47±0.06	3.80e-11
Students' Interest in Neurology		
Time spent by residents to teach	-0.42±0.79	0.59
Residents' Teaching Effectiveness	-0.02±0.14	0.87
Residents' Impact on Students' Neurology Experience	0.08±0.19	0.65
Residents' Professionalism and Bedside Manner	0.001±0.20	0.93
Overall Value of Rotation	0.62±0.15	8.67e-05
Students' Confidence in Managing Neurological Conditions		
Time spent by residents to teach	0.78±0.37	0.03
Residents' Teaching Effectiveness	0.10±0.07	0.15
Residents' Impact on Students' Neurology Experience	0.10±0.09	0.26
Residents' Professionalism and Bedside Manner	0.07±0.09	0.44
Overall Value of Rotation	0.36±0.07	1.36e-06

Table 1. Summary of the results of ordinal regression analyses.

Abbreviations: p-val: p-values, SD: Standard deviation. Significant results are shown in red font.

Discussion

Here we showed that the students' rotation experience had a significant association with their interest and confidence in neurology. Student rotation experience benefited significantly from the residents' efforts and teaching skills. Our study is limited by the lack of longitudinal follow-up of medical students' career choices, identifying the other factors that affected students' experience such as the impact of neurology faculty and objective measures of confidence in managing neurological conditions. However this study demonstrated that residents can provide additional value for the neurology education of medical students.

Near-peer teaching has the advantage of providing social and cognitive congruence between the learner and teacher.¹⁰ Our findings align well with previous studies showing that students benefit academically and professionally in a near-peer teaching setting.^{11,12} Students taught by peers do not have different outcomes to those taught by faculty.¹³

A training workshop on teaching strategies to the residents may potentially optimize medical students' experience during their neurology rotation and increase their confidence in managing neurological conditions. Although there was a slight increase in students' overall rotation experience after the workshop, the difference might not have reached to statistical significance possibly due to the fact that the workshop was provided only once. We believe that residents should be introduced to core educational concepts and minimal investments in residents can lead to significant improvement in medical student education.

As a future direction, other interventions, such as resilience skills training program¹⁴, arts-based curriculum for neurology residents¹⁵, and getting residents more actively involved in the design and development of the neurology clerkship rotation¹⁶ can be implemented to improve residents teaching skills.

Conclusion

Empowering residents to take an active teaching role during the core neurology clerkship, after properly equipping them with training, seems to be an effective method for improving medical students' third-year neurologic experience and education. This may have benefits at the societal level in terms of career-choice. The role of residents in medical students' neurology education is crucial and holds great promise, but it needs to be re-considered at national level to ensure proper high-quality standards on both the students' and the residents' side.

Abbreviations

MMS: McGovern Medical School, p-val: p-values, UTHealth: University of Texas Health Science Center at Houston, SD: Standard deviation.

Declarations

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Author Contributions

ZK drafted and revised the manuscript for intellectual content and analysis and interpretation of the data. YAR revised the manuscript for intellectual content. JT had a major role in the acquisition of data. PHH designed and conceptualized the study and revised the manuscript for intellectual content. LDM contributed to conceptualization of the study and revised the manuscript for intellectual content. SS contributed to drafting and revised the manuscript for intellectual content. EFS designed and

conceptualized the study and revised the manuscript for intellectual content. All authors have read and approved the manuscript.

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Availability of data and materials

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

Ethics and consent to participate

The study was registered with quality improvement registry of UTHealth Committee for the Protection of Human Subjects (CPHS) and it did not meet the regulatory definition of human subjects' research and therefore does not need to be submitted to the UTHealth CPHS for review and approval. Also CPHS waived the requirement of obtaining any informed consent from the students to fill voluntary and anonymous surveys.

Consent for Publication

Not applicable.

Competing Interests

The authors declare that they have no competing interests except Dr Sandrone receives royalties from Oxford University Press (USA). Also Dr. Sandrone is is a member of the editorial board (Associate Editor) of this journal.

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Figures

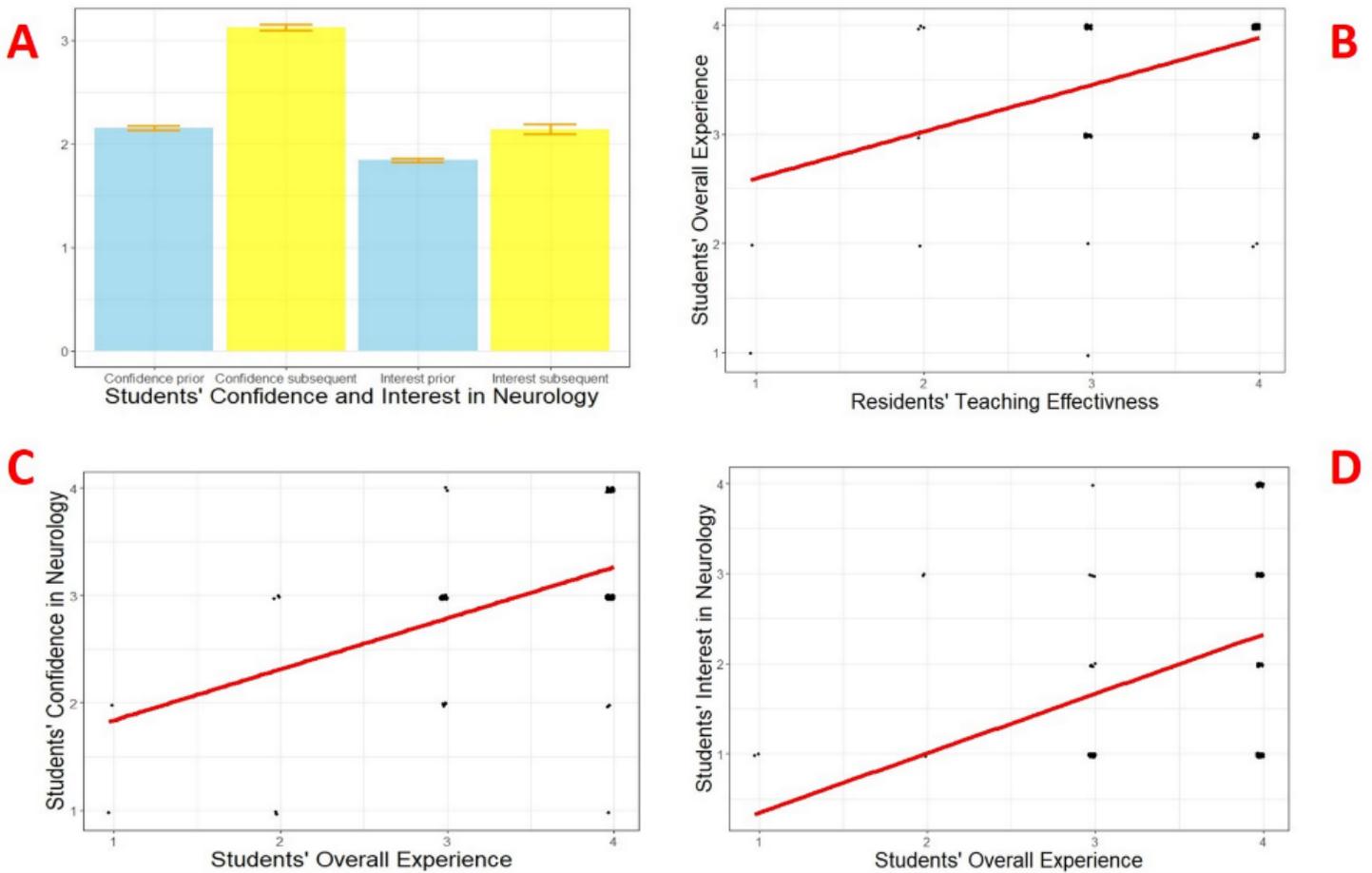


Figure 1

Change in students' interest and confidence in neurology after the clerkship rotation and their correlates. Bar-plot illustration of students' confidence in managing neurological conditions and interest in pursuing neurology residency before and after neurology clerkship as mean±2 SEM (standard error of mean) (A). Scatter-plot illustrations of the association between the overall value of the neurology rotation experience for medical students and the residents teaching effectiveness (B), students' confidence in managing neurological conditions (C) and interest in pursuing neurology residency (D). Of note, minimal random noise added to scatter plots to better illustrate number of data points. Scales for confidence and interest are as follows; 1= not interested/confident, 2= undecided, 3=somewhat confident/interested, 4=extremely confident/interested. Scale for overall rotation value is as follows; 1= not valuable at all, 2=not valuable, 3= somewhat valuable, 4= very valuable. Scales for residents' teaching effectiveness/residents' impact on students' rotation experience are respectively as follows; 1=very ineffective/affected very negatively, 2= ineffective/affected negatively, 3=somewhat effective/affected positively, 4=extremely effective/affected very positively.