







Into the Neuroscape: Perceptions of Pakistani Medical Students and Recent Graduates toward Neurosurgery

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Abstract

Introduction Neurosurgery receives several applicants every year, but the decreasing size of the neurosurgery workforce in Pakistan despite evidence of initial student interest is perplexing. Therefore, it is vital to evaluate the perspective of medical students and recent graduates to get a holistic view of perceptions toward neurosurgery.

Materials and Methods A nationwide cross-sectional study was conducted on a sample of medical students and recent graduates from different medical colleges. Their perceptions were gauged by multiple choice questions and barriers identified using Likert scale questions. Statistical analyses were carried out using the IBM Statistical Package for Social Sciences (SPSS) version 26.

Results A total of 2,481 responses were recorded from study participants. Neurosciences and neurosurgery were a part of a medical school curriculum for the majority (64.9%) of the participants. However, a significant number (65.4%) of the participants do not have the opportunity to rotate in the field of neurosurgery. The respondents' perception of neurosurgery is shaped by various factors, such as university lectures (21.9%), digital media (16.7%), and social media (15.2%). Known patients (5.7%) and known neurosurgeons (4.8%) were considered the least influential sources. The top three characteristics associated with neurosurgery were consistent for both male and female students: difficult, interesting, and brain. Male respondents (25.22%) predominantly described neurosurgery as difficult, while female respondents (21.98%) found it interesting. Many females perceived neurosurgery as a male-dominated specialty, with 64% female participants agreeing with gender bias compared to 36% of males.

Conclusion This study uncovers that medical students' views on neurosurgery are shaped by lectures, digital media, and social media, leading to preconceived ideas.

Keywords

- ▶ image of a neurosurgeon
- ▶ medical students' perspective
- ▶ Pakistan
- ▶ education
- ▶ LMIC

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These notions, including extended working hours, limited work–life balance, competition, gender bias, and stereotypes, impede their interest and comprehension of neurosurgery as a profession. To address this, students should have more opportunities to familiarize themselves with the field, allowing them to challenge these misconceptions and discover the captivating world of neurosurgery.

Introduction

Neurosurgery is consistently rated as one of the most competitive specialties. While neurosurgery garners significant admiration, it is not among the top choices of medical students, as evidenced by observations over the years.¹ Several reasons have been identified for the limited interest in neurosurgery. In a study from the United Kingdom, students highlighted poor work–life balance and competitiveness serving as deterrents,² whereas data from the United States revealed a decline in neurosurgery residency applications as lifestyle and long work hours significantly influenced the decision.³ Literature originating from Saudi Arabia suggests that medical students find neurosurgery to be the most challenging specialty when deciding on their areas of specialization.⁴ Another study from Canada cited lack of adequate exposure to neurosurgery during their undergraduate years, longer duration of residency, and higher degree of skills to significantly influence the decision of medical students to opt neurosurgery as a potential future specialty.⁴ It is evident from studies that multiple factors contribute to the decision-making process regarding the pursuit of a career in neurosurgery. On the other hand, students who were attracted toward neurosurgery mentioned factors such as intellectually stimulating work, interest in neurosciences, effect on patients, innovation, new technology, and prestige as the motivating factors.²

A recent study from Pakistan highlighted that only 13.6% students considered neurosurgery as their career choice and a greater proportion of intention to pursue neurosurgery as a career was found in earlier medical school years.⁵ However, the current density of neurosurgeons in Pakistan is only 0.14/100,000. The two big provinces, Punjab and Sindh, have 42.3 and 35.8% neurosurgeons, respectively.⁶ This glaring deficit in the field contributes to the growing burden of neurosurgical care and underscoring the need for an expanded workforce to mitigate the burden of disease. The declining attraction of students toward neurosurgery, juxtaposed with the surging demand for neurosurgeons, highlights a perplexing incongruity. Given the pressing demand for neurosurgeons, one must ponder why students' interest in the field of neurosurgery has waned. Moreover, considering the pivotal role neurosurgeons play in addressing emergency trauma cases, their presence is indispensable even in remote medical facilities. Hence, the scarcity of neurosurgeons emerges as a paramount concern, given its potential impact on health care accessibility and outcomes.

Our study aims to evaluate medical students' and recent graduates' perspectives and attitudes toward neurosurgery

in Pakistan. Despite existing literature suggesting a particular image of a career in neurosurgery, the reasons behind the disparity in medical students' perceptions remain a subject of debate. By assessing the perception of medical students toward neurosurgeons, our study intends to identify and understand the factors that influence these perceptions.

Materials and Methods

Study Design and Population

A cross-sectional survey via the Internet was conducted among medical students and recent graduates in Pakistan from March 6 to April 20, 2023. This study received ethical clearance from the Ethical Review Committee of the Aga Khan University, Pakistan

The target population for this study was medical students studying in Pakistan across all sectors and in all provinces of Pakistan including recent graduates who have not started their professional training.

Sample Size Calculation

Previous studies from Pakistan involving medical students were used as a reference and the minimum sample size calculated for this study was 384 assuming a precision of 5% and confidence interval of 95%.^{7–9} OpenEpi software was utilized to calculate the sample size.¹⁰

Sampling Strategy

Since there is no formal platform in Pakistan for distributing surveys to medical students nationwide, we used the only accessible convenience sampling and snowball sampling methodologies.

Data Collection Tool

The questionnaire was self-designed by the research team in close association with faculty with expertise in student surveys and neurosurgery research at the Section of Neurosurgery and Department of Surgery at the Aga Khan University as there was no previously validated survey suitable for our population.

The final questionnaire included questions on demographics, educational institute details, opportunities available to them for neurosurgery, perception toward neurosurgery and its training, barriers to neurosurgery, attitude toward pursuing a career, and career choices and reasons for it.

A pilot study of 50 medical students was conducted to critically assess the validity of our questionnaire. According to the results of the pilot study, the questionnaire was altered

in a way to make the questions easier to understand, and the options were made sufficient such that all participants could answer them.

Data Collection

Distribution of the questionnaire was undertaken by an anonymous Google Form survey, which included a consent form explaining the scope of the study.

Interested participants were sourced through an ambassadorship program created by the research team who recruited data collectors from all over Pakistan. The ambassadorship program for our study yielded an approximately equal distribution of data collectors from all the provinces in Pakistan. Data were gathered using a variety of methods, including face-to-face interactions, Internet distribution through social media platforms, and recruitment of surgery and neurosurgery interest groups within medical schools.

Statistical Analysis

Statistical analyses were run using International Business Machines (IBM) Statistical Package for Social Sciences (SPSS) version 26. Descriptive statistics were used to report the demographic characteristics revealed in the study. Normally distributed continuous data were reported as mean ± standard deviation, whereas categorical data were reported as frequencies and percentages (n; %). Categorical data were compared using chi-squared tests. A p-value less than 0.05 was considered significant for all analyses.

Ethical Considerations

Participants were provided with a detailed explanation of the study, including procedures and rights. They could ask questions about the study and receive an informed consent document. Participation was voluntary and withdrawal had no repercussions. Anonymity was ensured by not collecting names or personal identifiers. Only the lead investigator and coinvestigators had access to the secure data file.

Results

A total of 2,481 responses were recorded from study participants from medical colleges and hospitals across all provinces of Pakistan including Islamabad Capital Territory, Gilgit Baltistan, and Azad Jammu Kashmir. They included medical students from all years of medical schools and recent graduates. The distribution of participants based on gender, seniority, region, sector, and monthly income is illustrated in ►Table 1. Most of the survey respondents are females (61.8%). The majority participants are from Punjab (58%) and Sindh (24.9%). There is a comparatively equal participation from public and private sector institutions. Most participants belong to the lower and middle socioeconomic classes.

Medical school information of respondents is seen in ►Table 1. Most (65.4%) of the participants did not rotate in neurosurgery rotation and 72.7% of respondents said yes to their medical school affiliated institutes and hospitals having a neurosurgery department. Neurological surgery programs are being offered at most institutions and hospitals

Table 1 Sociodemographic and medical school information

Variable	Total N = 2,481
	n (%) / $\bar{X} \pm SD$
Age (y)	21.38 ± 2.3
Gender	
Male	948 (38.2)
Female	1,533 (61.8)
Year of medical school	
1st year	311 (12.5)
2nd year	527 (21.2)
3rd year	591 (23.8)
4th year	271 (10.9)
5th year	452 (18.2)
Intern	146 (5.9)
Medical officer	89 (3.6)
Recent graduate/transition year	94 (3.8)
Sector	
Public	1,068 (45.4)
Private	1,178 (50.1)
Semi-government	107 (4.5)
Province	
Punjab	1,439 (58)
Sindh	619 (24.9)
Islamabad	125 (5.2)
Balochistan	35 (1.4)
Khyber Pakhtunkhwa	227 (9.1)
Azad Jammu and Kashmir	35 (1.4)
Gilgit Baltistan	1 (0.0)
Monthly household income in PKR	
< 100,000	819 (33.3)
100,000–150,000	511 (20.8)
150,000–200,000	313 (12.7)
200,000–300,000	265 (10.8)
300,000–400,000	159 (6.5)
400,000–500,000	127 (5.2)
> 500,000	266 (10.8)
Medical school information	
Does your medical school have a curriculum that includes neurosurgery?	
No	870 (35.1)
Yes	1,607 (64.9)
Does your medical school affiliated institute/hospital have a neurosurgery department?	
No	270 (10.9)
Yes	1,804 (72.7)
May be	406 (16.4)

(Continued)

Table 1 (Continued)

Variable	Total N = 2,481
	n (%) / $\bar{X} \pm SD$
Is there a neurosurgery training/residency program offered at your institute?	
No	398 (16.0)
Yes	1,272 (51.3)
May be	810 (32.7)
Have you had the opportunity to rotate in neurosurgery?	
No	1,622 (65.4)
Yes	859 (34.6)
Does your institute provide opportunities to take part in neurosurgery research?	
No	523 (21.1)
Yes	1,032 (41.6)
Not sure	926 (37.3)
Does your institute have a neuroscience or neurosurgery interest group?	
No	961 (38.7)
Yes	601 (24.2)
May be	919 (37.0)

(51.3%); however, only 24.2% of respondents confirmed that they have neurosurgery interest groups at their institutions.

The perception of the respondents about neurosurgery develops through many different factors, as illustrated in the

frequency percentage graph. The major contributions are from university lectures (21.9%), digital media (16.7%), and social media (15.2%). The least important sources are known patients (5.7%) and known neurosurgeons (4.8%; **Fig. 1**).

Male and female participants' responses regarding neurosurgery are shown **Fig. 2**. Most of the male respondents (25.22%) described neurological surgery as something difficult, while most of the female respondents (21.98%) described it as something interesting.

Fig. 3 shows the participant responses to the characteristics of a neurosurgeon. The majority felt hard work (25%) was the most important characteristics, followed by dedication, knowledgeable, skillful, passion, and patience.

The gender difference in the responses to the statement that "the potential gender bias is a significant barrier to pursue a career in neurosurgery" was huge ($p=0.000$). Females had an overall unfavorable opinion of the neurosurgery specialty. Most of the females considered neurological surgery as a male-dominated specialty. In all, 36% of the male respondents agreed or strongly agreed to the statement, whereas 64% of the females agreed with the gender bias within neurological surgery. There is a significant difference in the responses of participants from public and private sector institutions regarding different deterring factors of neurosurgery. A higher number of participants from private sector institutions (61.3%) than those from public sector institutions (55.9%) agreed or strongly agreed that the competitive environment was a strong barrier to the specialty ($p < 0.000$). Similarly, more private sector participants (46.1%) than public sector participants (39.6%) agreed to the statement: "The perceived attitudes or behaviors of neurosurgeons presents a significant barrier to pursue a

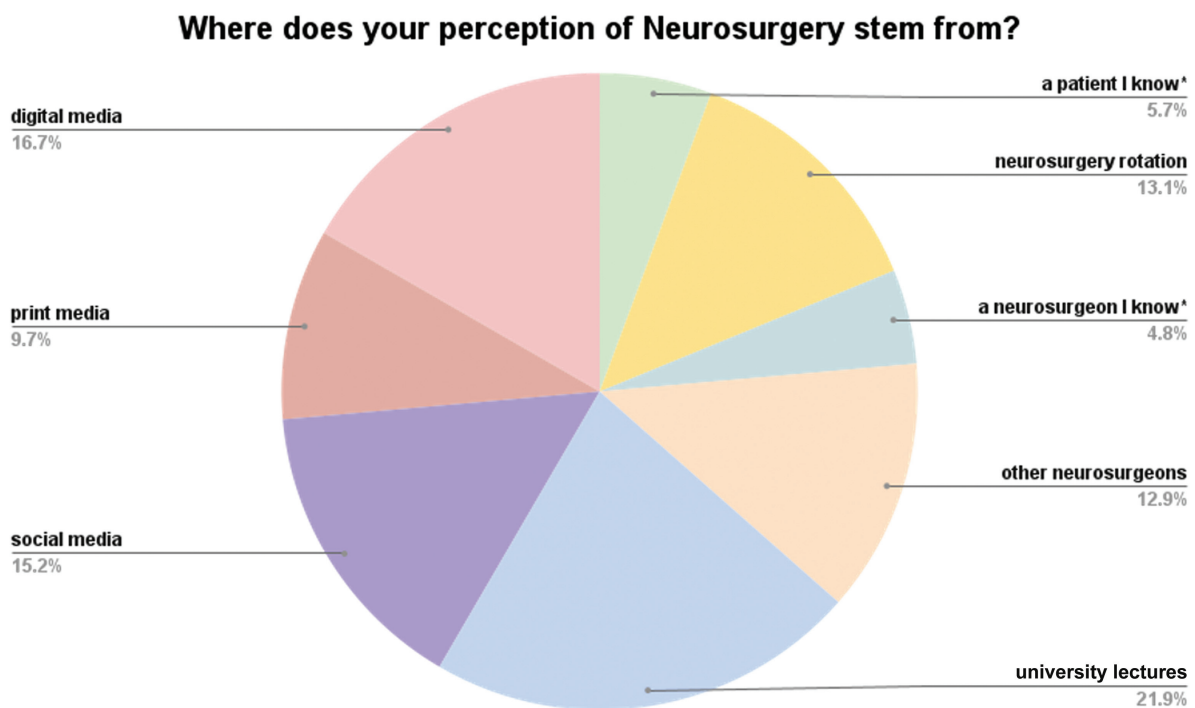


Fig. 1 Sources of perceptions toward neurosurgery.

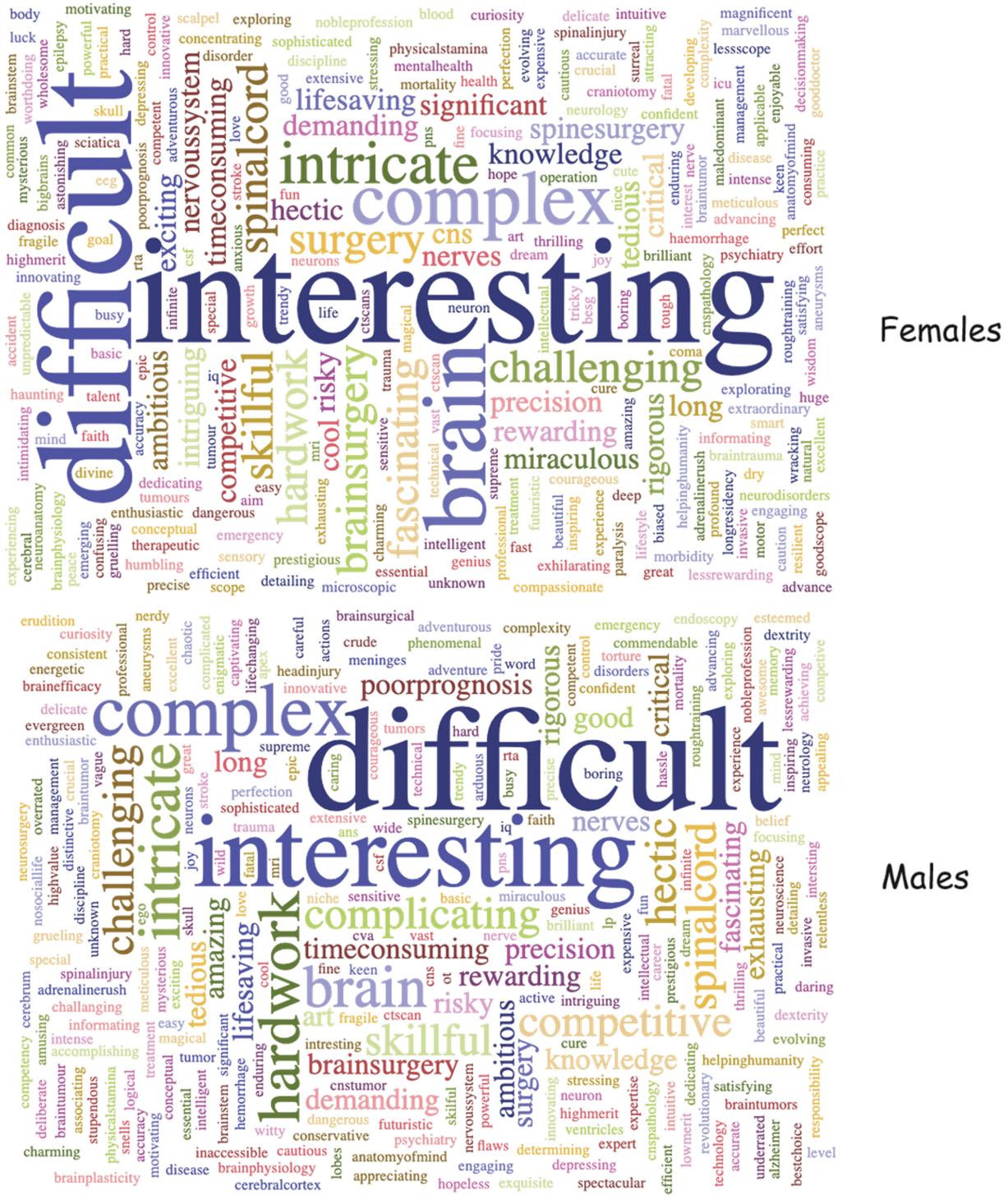


Fig. 2 Responses to describe neurosurgery.

career in neurosurgery” ($p < 0.001$). The financial burden and inadequate resources are also major barriers to neurosurgery. In total, 47.5% participants disagree with the statement that there are adequate resources to be trained in neurosurgery in Pakistan. For 64.1% participants, financial burden is also a major barrier to pursuing a career in neurosurgery. Medical students’ perceptions to barriers toward neurosurgery are shown in ►Fig. 4.

Discussion

This study captures some of the perceptions of the medical students in Pakistan toward neurosurgery and the prevailing image of neurosurgeons, with the intention of shedding light on any potential factors that influence these perceptions. Neurosurgery is considered a complex and skill-based field that involves studying a wide range of diseases and

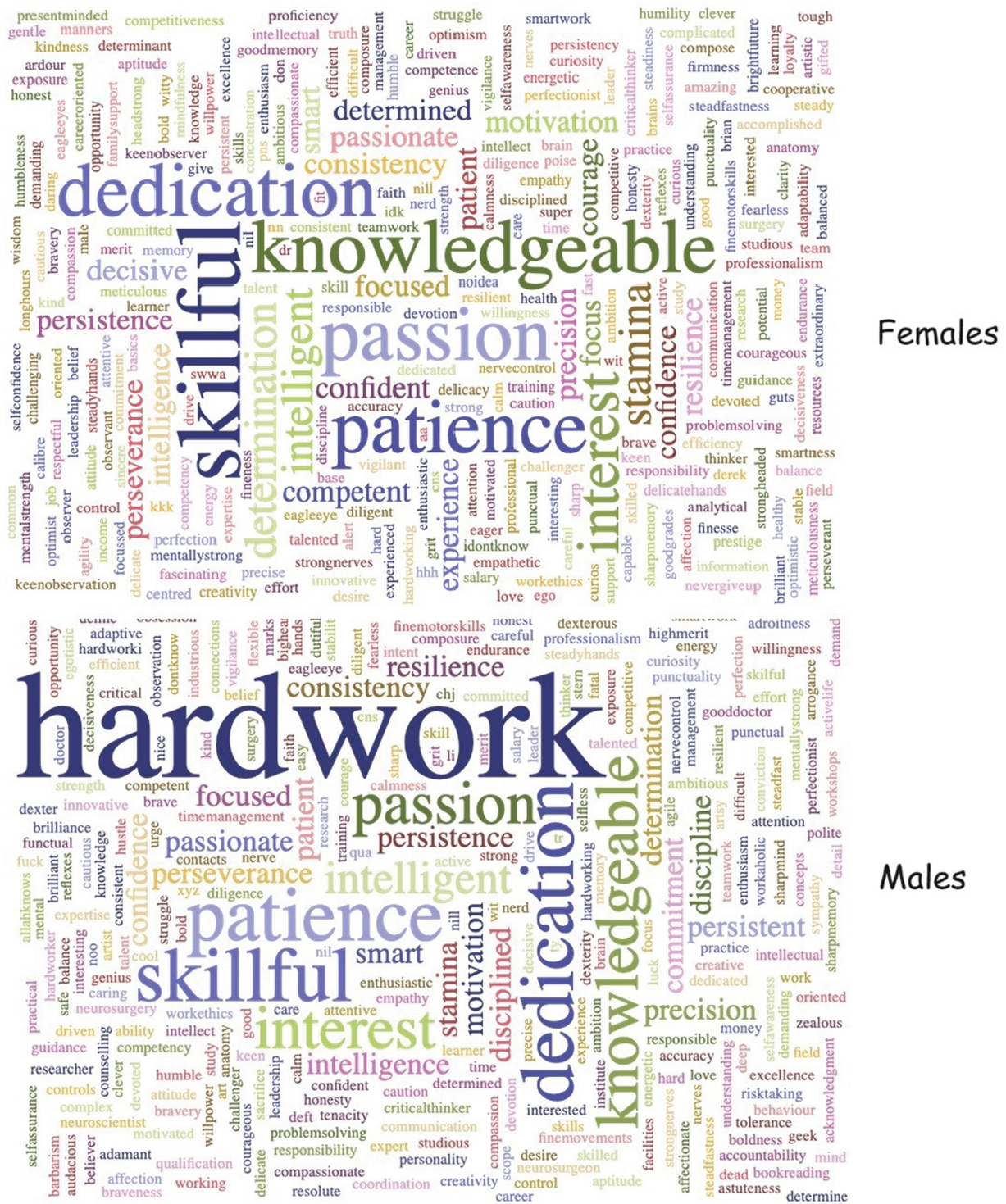


Fig. 3 Responses to characteristics of a neurosurgeon.

lesions of the nervous system, utilizing advanced imaging techniques, and constantly improving methods of diagnosis and surgical treatment.¹¹ In both male and female respondents of our study, the predominant attributes attributed to neurosurgery were found to be “difficult” and “interesting.” Notably, a significant proportion of male respondents (25.22%) characterized neurological surgery as difficult, whereas most female respondents (21.98%) characterized it as intriguing.

In our study, 55% of the students who refrained from choosing a career in neurosurgery perceived neurosurgery and neuroscience as difficult, with a total of 76.7% agreeing it was hard or extremely hard to study neurosurgery. The intensity of the training and the perceived absence of work-life balance were identified as significant factors deterring students from pursuing a career in neurosurgery. In a study conducted in Korea, little work-life balance and a high degree of work pressure and stress were noted among neurosurgeons

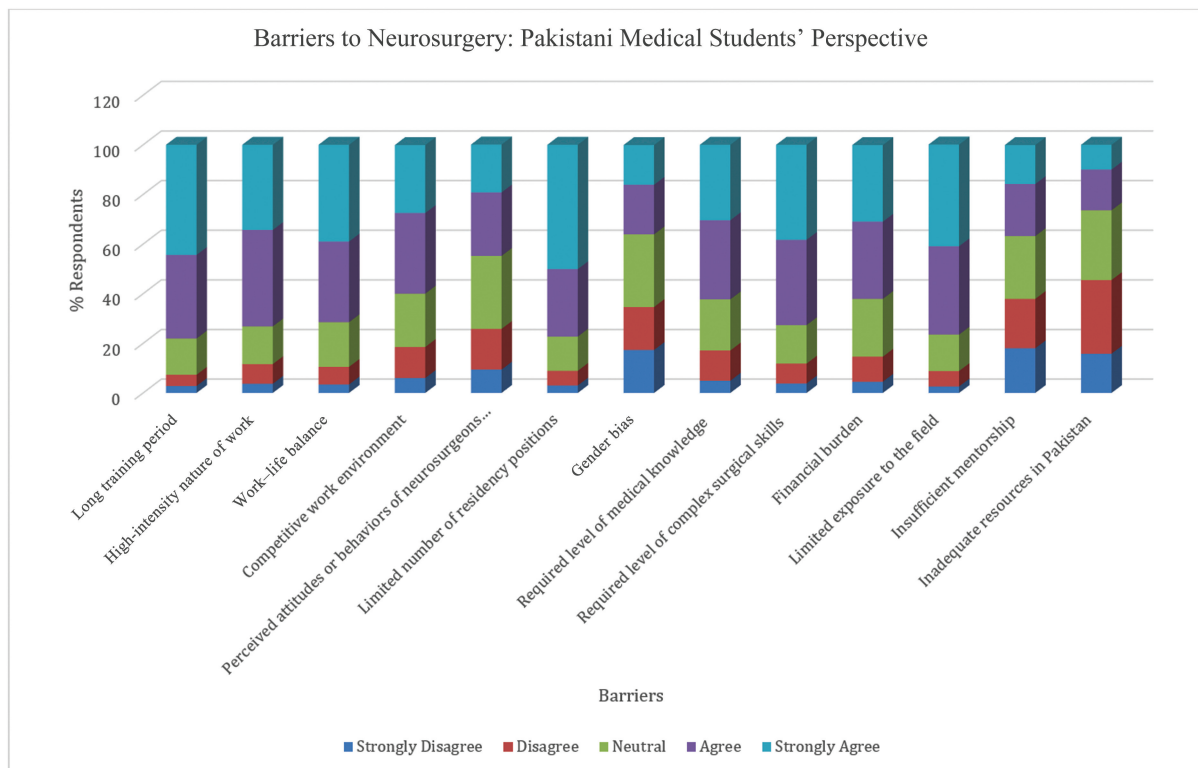


Fig. 4 Barriers to neurosurgery according to medical students.

employed in training hospitals. In addition, it was shown that 280 (62.1%) of 451 neurosurgeons had burnout due to issues with work intensity, work-life balance, stress at work, and satisfaction with interpersonal connections.¹² In another study conducted in China, all levels of neurosurgeons were observed to have a significant workload, lengthy working hours, a high incidence of burnout, and a low degree of job satisfaction.¹³ The findings of our study are consistent with these studies as a high number (71%) of survey respondents agreed with the fact that high-intensity training presents a significant challenge to pursue a career.¹³

Choice of residency among medical students has been found to be greatly influenced by lifestyle and working hours.¹⁴ Students' lack of enthusiasm in pursuing a profession in surgery has been linked primarily to lifestyle difficulties.¹⁵ Neurosurgery is perceived by students as a specialty with a low level of "controllable lifestyle" that is incompatible with the work-life balance.¹⁶ Many students from a previous study believed that neurosurgery as a profession could interfere with family life due to its demanding and time-consuming duties that result in poor relations with family and friends.¹⁷ According to studies, the main causes of the decline in neurological surgery are related to lifestyle choices and an imbalance between work and personal life.¹⁶ Our study's findings about the connection between neurosurgery and work-life balance were in line with those of another study from Saudi Arabia in which 97.8% of participants thought that neurosurgery might make family life more difficult.¹⁸ Of survey respondents, 72.8% respondents believe that work-life balance is a major barrier to a career in

neurosurgery. A huge majority of the poll participants (78.8%) agreed that an extended training term is a major barrier to pursuing a career in neurosurgery. The same percentage of respondents (78.8%) also agreed that one notable obstacle to entering the field of neurosurgery is the lack of residency seats.

The media indeed plays a significant role in shaping the perception of neurosurgery among medical students. The modern glamorization of the medical profession in television series has inspired a new generation of neurosurgeons.¹⁹ More recently, social media platforms like Twitter have been employed in higher education to boost participation and provide a welcoming online community for the study of difficult subjects including neuroanatomy.²⁰ In our study, the respondents' perception of neurosurgery was also majorly shaped by various factors such as university lectures (21.9%), digital media (16.7%), and social media (15.2%). Known patients (5.7%) and known neurosurgeons (4.8%) were considered the least influential sources. In our study, the perception of neurological surgery also developed from the university lectures and neuroscience educational exposure during medical school for most of the survey respondents (21.9%). During neurosurgical clerkships, an engaging environment with suitable teaching strategies and mentoring are crucial for motivating medical students to pursue a career in neurosurgery. The impression and desire of medical students toward a career in neurosurgery are significantly influenced by their experience of neurosurgical exposure.²¹ Only with appropriate exposure can the cycle of false stereotypes be broken.

When compared to freshmen, we discovered a general trend of senior medical students having less interest in neurosurgery.²² According to a study in Saudi Arabia, respondents' interest in neurosurgery decreased as they grew older. Compared to freshmen, interns and fifth- and sixth-year medical students showed decreased interest in continuing their education in neurosurgery. Almost 56% of second-year medical students expressed interest in neurosurgery, compared to only 11% of interns.²² According to a 2013 survey by the New Jersey School of Medicine, among medical students who first expressed interest in neurosurgery, only a third (29.5%) started their residency programs in neurological surgery after finishing medical school.¹⁴ Similarly, in our study, students agreed that high-intensity training is a barrier to neurosurgery.

This is the first assessment of perceptions and attitudes of medical students toward neurological surgery in the Pakistani setting. Further studies and surveys are needed to reinforce our findings; enhanced mentorship and exposure in neurological surgery are essential for drawing new candidates to pursue a career in neurosurgery.

A major limitation of the study is that despite being the largest survey of students about neurosurgery in Pakistan, our data may not be the actual representation of the student perspective on neurosurgery within the country, for a multitude of reasons. Being a cross-sectional quantitative study, the perceptions of respondents were limited to the options presented. Though a text-based input was collected to gather data about how students would describe neurosurgery, a larger, exploratory research would help better understand challenges to pursuing a career in neurosurgery and uncover secrets into students' perceptions of the field. Focused group discussions or in-depth interviews of students from a diverse subset of institutes from private and public sectors representing a variety of Pakistan's regions would provide greater insight into students' ideas about neurosurgery.

Moreover, many of the survey respondents belong to two provinces of Pakistan: Punjab and Sindh. Though these are the largest provinces by population, numerous medical schools of the other provinces are underrepresented in our data. In future studies, there should be increased participation from the remaining provinces including Islamabad Capital Territory, Gilgit Baltistan and Azad Jammu Kashmir. Second, there were more female participants than male participants. There should be a comparatively equal participation from both genders to achieve findings and conclusions without any gender bias.

Conclusion

In conclusion, our study reveals that medical students hold preconceived notions about neurosurgery, influenced by lectures and digital and social media. These perceptions, such as long working hours, lack of work-life balance, competition, gender bias, and stereotypes, hinder their understanding and inclination toward neurosurgery as a career. Many students feel neurosurgery is difficult but also find it interesting.

Therefore, with adequate exposure to the field in medical schools, more students can develop informed notions about the field. Through our study, which highlights the perspectives of Pakistani medical students, an initial viewpoint is obtained, which shows differences among provinces and genders. Therefore, strategies to overcome the preconceived notions about the field of neurosurgery can also be developed by using the findings in our study.

Authors' Contributions

M.S., H.A.I., and A.E. conceptualized the study and contributed significantly to the methodology along with A.S. A.A., A.H.K., and E.A.A. also contributed to the methodology and the protocol approval process. A.A., M.S., H.A.I., A.S. contributed significantly to data collection. H.A.I., M.S., and A.H.K. held a vital role in cleaning the data and along with H.A.I. analyzed the data. A.S. and H.A.I. contributed significantly to the initial draft of the manuscript while, M.S. and A.E. worked significantly on the final draft. All authors approved submission of the manuscript and reviewed the final submission documents.

Conflict of Interest

None declared.

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