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Factors Influencing the Choice of Neurology as a Specialty among Medical Students and Physicians in Saudi Arabia: A Cross-Sectional Study

Muhammad A. Alahmadi¹, Moath M. Alomairi¹, Aseel O. Banasir^{1*}, Abdulaziz M. Almehmadi¹, Nawaf H. Aljafari², Abdulrahman E. Alraddadi³, Sara S. Al-Zahrani², Omar Babateen⁴

¹Department of Medicine and Surgery, Faculty of Medicine, Umm Al-Qura University, Makkah, Saudi Arabia

²Department of Medicine and Surgery, Faculty of Medicine, Umm Al-Qura University, Al-Qunfudhah, Saudi Arabia

³ICU Resident Doctor, King Faisal Specialist Hospital & Research Centre (KFSH&RC)

⁴Associate Professor of Neurophysiology & Intraoperative Neurophysiologist, Department of Physiology, Faculty of Medicine, Umm Al-Qura University, Makkah, Saudi Arabia

* Correspondence: assseelpremium@gmail.com; Tel: +966580800490 ORCID: <https://orcid.org/0009-0003-2362-8351>

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Abstract

Neurological disorders represent a substantial global health burden and contribute to the rising demand for neurologists. In Saudi Arabia, the shortage of neurologists underscores the importance of understanding how medical students and physicians perceive neurology as a career. This study aimed to explore the level of interest in neurology and identify factors influencing specialty selection. This cross-sectional study was conducted between November and December 2024 among undergraduate medical students and medical graduates (residents, fellows, specialists, and consultants) in Saudi Arabia. First-year students and those without prior exposure to neurology were excluded. Data were collected through a structured online questionnaire distributed via social media platforms. The survey included demographic information, motivations for choosing neurology, and reasons for avoiding it. Data was analyzed using SPSS version 26 with descriptive statistics, chi-square tests, and logistic regression, with significance set at $p < 0.05$. A total of 937 participants were included. Of these, 38% expressed interest in neurology, 33% were uninterested, and 27% remained undecided. Interest in neurology was significantly associated with higher GPA and being in clinical years. The most frequently reported motivators were general interest in the specialty (65.1%), perceived financial benefits (31.9%), and prestige (28.7%). Conversely, the main deterrents included the difficulty of neuroanatomy and neuroscience (50.3%), poor prognosis of neurological diseases (42.2%), and limited procedural opportunities (20.7%). While many Saudi medical students view neurology as intellectually stimulating and prestigious, widespread neurophobia and concerns about prognosis and limited interventions discourage others. Targeted educational interventions and mentorship may help mitigate barriers and strengthen the future neurology workforce in Saudi Arabia.

Keywords: Neurology; Specialty choice; Medical students; Neurophobia; Career preference; Saudi Arabia; Medical education

1. Introduction

Neurology is a specialized branch of medicine dedicated to diagnosing and managing disorders of the nervous system, encompassing both its central and peripheral components [1]. These disorders may affect the brain, spinal cord, cranial nerves, peripheral nerves, nerve roots, neuromuscular junctions, muscles, and the autonomic nervous system. Globally, neurological diseases represent a significant source of disability and reduced quality of life. According to the World Health Organization (WHO), the ten leading neurological conditions contributing to disease burden in 2021 included stroke, meningitis, epilepsy, diabetic neuropathy, migraine, dementia, neonatal encephalopathy, and autism spectrum disorder [2]. Together, these disorders affect more than one-third of the world's population and contribute significantly to morbidity and mortality [2]. Over the past three decades, their prevalence has steadily risen, mainly due to demographic transitions such as population aging and longer life expectancy [2–4]. This upward trend underscores the growing importance of neurology as a medical discipline and highlights the urgent need for an adequate workforce to meet patient needs.

Despite the increasing demand for neurological care, many countries face persistent challenges in expanding the neurology workforce. Even in high-income settings such as the United States, shortages of neurologists relative to population needs have been documented [4]. In Saudi Arabia, this challenge is particularly relevant given the country's rapidly evolving demographic and epidemiological profile. The Saudi population is aging, and the prevalence of non-communicable diseases such as diabetes, hypertension, and cardiovascular disease—major risk factors for stroke, neuropathy, and cognitive disorders continues to rise, leading to increased demand for neurological services.

Available workforce data indicate that the supply of neurologists in Saudi Arabia remains limited relative to population needs. Earlier regional assessments reported that Saudi Arabia had approximately 61–81 practicing neurologists, corresponding to one neurologist per 328,000–430,000 people [5]. Although the absolute number of neurologists has increased in recent years with the expansion of residency training programs, more recent reports suggest that neurologist density in Saudi Arabia remains substantially below that of many high-income countries and international

recommendations, particularly outside major urban centers. This imbalance raises concerns regarding timely access to specialized neurological care, continuity of services, and the ability of the healthcare system to manage the growing burden of chronic neurological disorders.

The choice of neurology as a career is influenced by multiple factors. International evidence highlights that medical students are often drawn to neurology for its intellectual challenges, the diversity of clinical cases, the distinctive role of detailed physical examinations, and abundant opportunities for research in neuroscience [6]. A large U.S. study analyzing more than 2,400 personal statements for neurology residency programs revealed recurring motivations, including fascination with the brain's complexity, intellectual depth, personal or family encounters with neurological illness, and the potential for academic discovery [7].

In Saudi Arabia, broader research on specialty selection has identified income, job security, patient diversity, and professional creativity as major determinants [8]. However, limited studies have examined neurology-specific motivations. Addressing this gap aligns closely with national healthcare priorities. Under Saudi Vision 2030, strengthening the healthcare workforce and improving access to specialized care are central objectives, with an emphasis on developing national talent and reducing reliance on international recruitment. Understanding factors that influence medical students' and physicians' specialty choices—particularly in high-need fields such as neurology is therefore critical to informing workforce planning and educational reforms.

In this context, examining motivations, perceptions, and barriers related specifically to neurology is essential. While broader Saudi studies have explored determinants of specialty selection, neurology remains underrepresented in this literature. Moreover, the high prevalence of “neurophobia” among Saudi medical students, reported in up to 84% of respondents in some studies, suggests that educational and perceptual barriers may further constrain recruitment into the specialty [9]. Identifying these factors is a necessary step toward developing targeted interventions to attract and retain future neurologists and to ensure a sustainable neurology workforce in Saudi Arabia. Therefore, this study aimed to assess factors

influencing the choice of neurology as a medical specialty among medical students and physicians in Saudi Arabia. It sought to explore motivations, perceptions, and perceived barriers related to pursuing neurology as a career. Additionally, the study aimed to identify educational and systemic factors that may inform strategies to strengthen the national neurology workforce.

2. Materials and Methods

Study design and setting

This cross-sectional study was conducted between November 2024 and December 2024 to examine the level of interest in neurology and the factors influencing specialty choice among medical students and physicians in Saudi Arabia. The study population included all undergraduate medical students as well as graduated medical professionals (residents, fellows, specialists, and consultants) residing in Saudi Arabia. First-year medical students and those who had not yet studied neurology were excluded, along with individuals who declined to participate. This ensured that respondents had adequate exposure to neurology and could provide informed perspectives.

Sample size determination and sampling strategy

The sample size was estimated using a 95% confidence level and the known population of undergraduate and graduate medical students in Saudi Arabia. Based on these parameters, the minimum required sample size was calculated to be 300 participants. A convenience sampling strategy was employed. The survey link was disseminated online through social media platforms and academic networks commonly used by medical students and healthcare professionals in Saudi Arabia. Trained data collectors facilitated dissemination and encouraged participation. Participation was voluntary, and no incentives were provided.

Survey instrument development

Data were collected using a self-administered online questionnaire developed via Google Forms. The survey instrument was adapted and modified from a previously validated questionnaire used in studies assessing medical specialty choice [10]. Modifications were made to reflect the Saudi medical education and healthcare context. The final questionnaire comprised three sections:

(i) sociodemographic characteristics (age, gender,

university, academic year, GPA, and professional status);

(ii) factors influencing the choice of neurology as a career; and

(iii) perceived reasons for not pursuing neurology as a specialty.

Content validation and pilot testing

To establish content validity, the draft questionnaire was reviewed by a panel of experts consisting of neurologists and medical education faculty members. The panel assessed item relevance, clarity, and appropriateness, and minor revisions were made based on their feedback. The revised questionnaire was pilot-tested among a small group of internal team eligible participants ($n = 10$) who were not included in the final analysis. Pilot testing confirmed clarity of items, suitability of response options, and an acceptable completion time. Internal consistency reliability of the questionnaire domains related to perceptions and influencing factors was assessed using Cronbach's alpha. The overall Cronbach's alpha coefficient was ≥ 0.70 , indicating acceptable internal consistency of the survey instrument.

Statistical analysis

Data were analyzed using IBM SPSS Statistics version 26 (IBM Corp., 2019). Descriptive statistics, including frequencies and percentages, were used to summarize categorical variables, while means and standard deviations were calculated for continuous variables. Associations between interest in neurology and categorical factors such as age, gender, academic level, and GPA were assessed using the chi-square test. A p -value < 0.05 was considered statistically significant.

To further explore predictors of interest in neurology, multiple logistic regression analysis was performed. Independent variables included age, gender, academic level, and GPA. Odds ratios (OR) with 95% confidence intervals (CI) were calculated to quantify the strength of associations. Graphs and figures were generated using Microsoft Excel. Frequency distributions with percentages were also used to present responses related to influencing factors and reasons for not selecting neurology as a career.

Ethical consideration

Ethical approval for this study was obtained from the Biomedical Research Ethics Committee (Approval

No. **HAPO-02-K-012-2024-10-2315**) on **11 November 2024**. Participation in the study was voluntary, and informed consent was obtained from all participants prior to data collection. Data were collected anonymously, and confidentiality was strictly maintained throughout the study. Any modifications to the approved research protocol were to be reported to the appropriate institutional authority for further ethical review, as required.

3. Results

Characteristics of students interested in neurology

Table 1 summarizes the demographic characteristics of 373 Saudi Arabian medical students who expressed interest in pursuing neurology as a specialty. The majority were female (71.3%, $n=266$), and the predominant age group was 20–23 years (52.8%, $n=197$). In terms of university affiliation, the largest proportion came from “other universities” (30.8%, $n=115$), whereas Imam Abdulrahman bin Faisal University had the lowest representation (0.8%, $n=3$). The most common academic year among respondents was the second year (23.3%, $n=87$), while medical interns and residents were least represented (7.8%, $n=29$). Academic distribution was nearly equal between pre-clinical (41.0%, $n=153$) and clinical (41.3%, $n=154$) levels. With respect to academic performance, the largest group reported a GPA >4.75 (20.6%, $n=77$), whereas the smallest group reported a GPA between 3.75 and 4.0 (9.7%, $n=36$).

Figure 1 illustrates the main factors influencing students’ selection of neurology. The most frequently cited motivation was general interest in the specialty (65.1%, $n=243$). Financial considerations such as higher income (31.9%, $n=119$) and greater employment opportunities (30.0%, $n=112$) were also important. Prestige played a role, with 28.7% ($n=107$) acknowledging the high social status of neurologists. Less common reasons included the possibility of practicing away from urban centers (15.5%, $n=58$) and external influence from relatives or friends (16.1%, $n=60$). Other reported factors included the intellectual challenge of neurological reasoning (21.4%, $n=80$), fewer emergencies and a quieter lifestyle (24.1%, $n=90$), inspiration from interactions with neurologists (24.9%, $n=93$), the distinctiveness of the neurological physical exam (24.4%, $n=91$), research opportunities

(26.0%, $n=97$), and family-friendly lifestyle considerations (21.4%, $n=80$).

Characteristics of students uninterested in neurology

Table 2 presents the demographic characteristics of 308 Saudi Arabian medical students who reported no interest in pursuing neurology as a future specialty. Similar to the interested group, most were female (71.8%, $n=221$), with the largest age group being 20–23 years (68.2%, $n=210$). In terms of university affiliation, the highest proportion came from “other universities” (36.4%, $n=112$), while Alfaisal University had the lowest representation (0.6%, $n=2$). The third year was the most represented academic level (22.1%, $n=68$), whereas second-year students were the least represented (7.8%, $n=24$). More than half of respondents were in their clinical years (53.6%, $n=165$). Regarding GPA, the largest group achieved >4.75 (22.1%, $n=68$), while the smallest groups reported GPAs of 3.75–4.0 and 4.0–4.25 (9.1%, $n=28$ each).

Figure 2 summarizes the reasons cited for avoiding neurology as a career. The most common was the perceived difficulty of neuroanatomy and neuroscience (50.3%, $n=155$). Other major factors included neurology’s complex topics (38.6%, $n=119$) and the poor prognosis of many neurological conditions (38.0%, $n=117$). Additional concerns involved neurology being less appealing than specialties such as cardiology (30.8%, $n=95$), the time-intensive nature of history taking and examinations (23.7%, $n=73$), limited procedural opportunities (19.8%, $n=61$), diagnostic overemphasis (19.5%, $n=60$), reliance on imaging tools (17.9%, $n=55$), limited exposure during medical school (18.2%, $n=56$), and unsatisfactory income expectations (15.9%, $n=49$).

Characteristics and career perceptions of undecided students toward neurology

Table 3 presents the characteristics of 256 Saudi Arabian medical students who reported being undecided about pursuing neurology as a future career. The majority were female (75.0%, $n=192$), and the most common age group was 20–23 years (62.9%, $n=161$). In terms of university affiliation, the largest proportion came from “other universities” (35.9%, $n=92$), while Alfaisal University had the least representation (0.8%, $n=2$). The fourth year was the most common academic year (23.0%, $n=59$), whereas

Table 1. Personal characteristics of the study medical students who are interested in Neurology as a future career, Saudi Arabia (n=373)

Personal data	No	%
Age in years		
>20	98	26.3%
>26	30	8.0%
20-23	197	52.8%
24-26	48	12.9%
Gender		
Male	107	28.7%
Female	266	71.3%
University		
Alfaisal University	4	1.1%
Imam Abdulrahman bin Faisal University	3	.8%
King Abdulaziz University	28	7.5%
King Khalid University	15	4.0%
King Saud bin Abdulaziz University for Health Sciences	22	5.9%
Other university	115	30.8%
Qassim University	11	2.9%
Taibah University	18	4.8%
Taif University	67	18.0%
Umm al-Qura University	90	24.1%
Academic year		
2 nd year	87	23.3%
3 rd year	66	17.7%
4 th year	65	17.4%
5 th year	47	12.6%
6 th year	42	11.3%
Medical intern / resident	29	7.8%
Others	37	9.9%
Academic level		
Pre-clinical	153	41.0%
Clinical years	154	41.3%
Intern/ resident	29	7.8%
Others	37	9.9%
GPA		
<3.5	45	12.1%
3.5-3.75	62	16.6%
3.75-4	36	9.7%
4-4.25	45	12.1%
4.25-4.5	40	10.7%
4.5-4.75	68	18.2%
>4.75	77	20.6%

“others” were least represented (5.9%, n=15). Clinical-level students comprised half of the group (50.0%, n=128). With respect to GPA, the largest category reported >4.75 (18.8%, n=48), while the smallest were 4.0–4.25 and 4.25–4.5 (10.9%, n=28 each).

Figure 3 outlines potential reasons for considering neurology. The most frequently cited factor was the prospect of higher income (37.1%, n=95), followed by general interest in the specialty (35.5%, n=91). Other influential reasons included greater employment

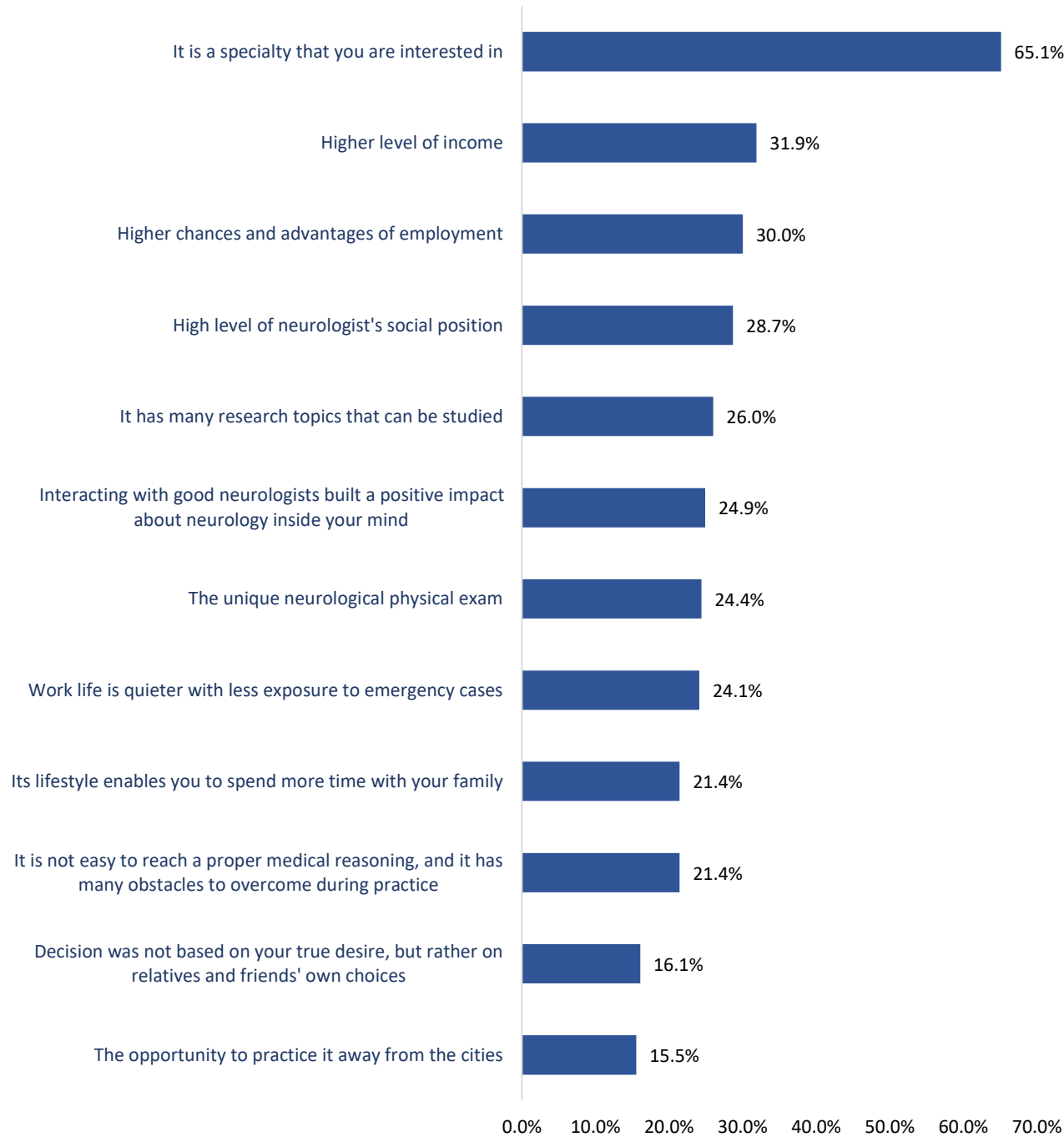


Figure 1. Reported reasons for selecting neurology as a career choice among medical students who are interested in pursuing Neurology as a career, Saudi Arabia (n=373)

opportunities (28.5%, n=73), the high social status of neurologists (27.3%, n=70), and research opportunities (27.0%, n=69). A quieter lifestyle with fewer emergencies (25.8%, n=66), the uniqueness of the neurological physical exam (23.4%, n=60), and positive exposure to neurologists (21.5%, n=55) were also highlighted. Lifestyle benefits such as more family time (20.3%, n=52) and intellectual challenge (19.1%,

n=49) were mentioned less frequently. The least cited motivators were influence from relatives and friends (15.2%, n=39) and the opportunity to practice outside cities (12.5%, n=32).

Figure 4 shows the reasons against neurology. The leading concern was the difficulty of neuroanatomy and neuroscience (48.4%, n=124), followed by the poor

Table 2. Personal characteristics of the study medical students who are not interested in Neurology as a future career, Saudi Arabia (n=308)

Personal data	No	%
Age in years		
>20	26	8.4%
>26	17	5.5%
20-23	210	68.2%
24-26	55	17.9%
Gender		
Male	87	28.2%
Female	221	71.8%
University		
Alfaisal University	2	.6%
Imam Abdulrahman bin Faisal University	3	1.0%
King Abdulaziz University	35	11.4%
King Khalid University	11	3.6%
King Saud bin Abdulaziz University for Health Sciences	13	4.2%
Other university	112	36.4%
Qassim University	7	2.3%
Taibah University	23	7.5%
Taif University	43	14.0%
Umm al-Qura University	59	19.2%
Academic year		
2 nd year	24	7.8%
3 rd year	68	22.1%
4 th year	45	14.6%
5 th year	55	17.9%
6 th year	65	21.1%
Medical intern / resident	29	9.4%
Others	22	7.1%
Academic level		
Pre-clinical	92	29.9%
Clinical years	165	53.6%
Intern/ resident	29	9.4%
Others	22	7.1%
GPA		
<3.5	40	13.0%
3.5-3.75	53	17.2%
3.75-4	28	9.1%
4-4.25	28	9.1%
4.25-4.5	38	12.3%
4.5-4.75	53	17.2%
>4.75	68	22.1%

prognosis of many neurological conditions (42.2%, n=108). Additional deterrents included complexity of neurology topics (34.8%, n=89), perceived lack of appeal compared to cardiology (26.2%, n=67), and limited procedural opportunities (20.7%, n=53). Other barriers involved the time-intensive nature of

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assessments (19.1%, n=49), diagnostic focus (18.4%, n=47), unsatisfactory income (14.5%, n=37), insufficient exposure in medical school (14.1%, n=36), and reliance on imaging for diagnosis (12.5%, n=32).

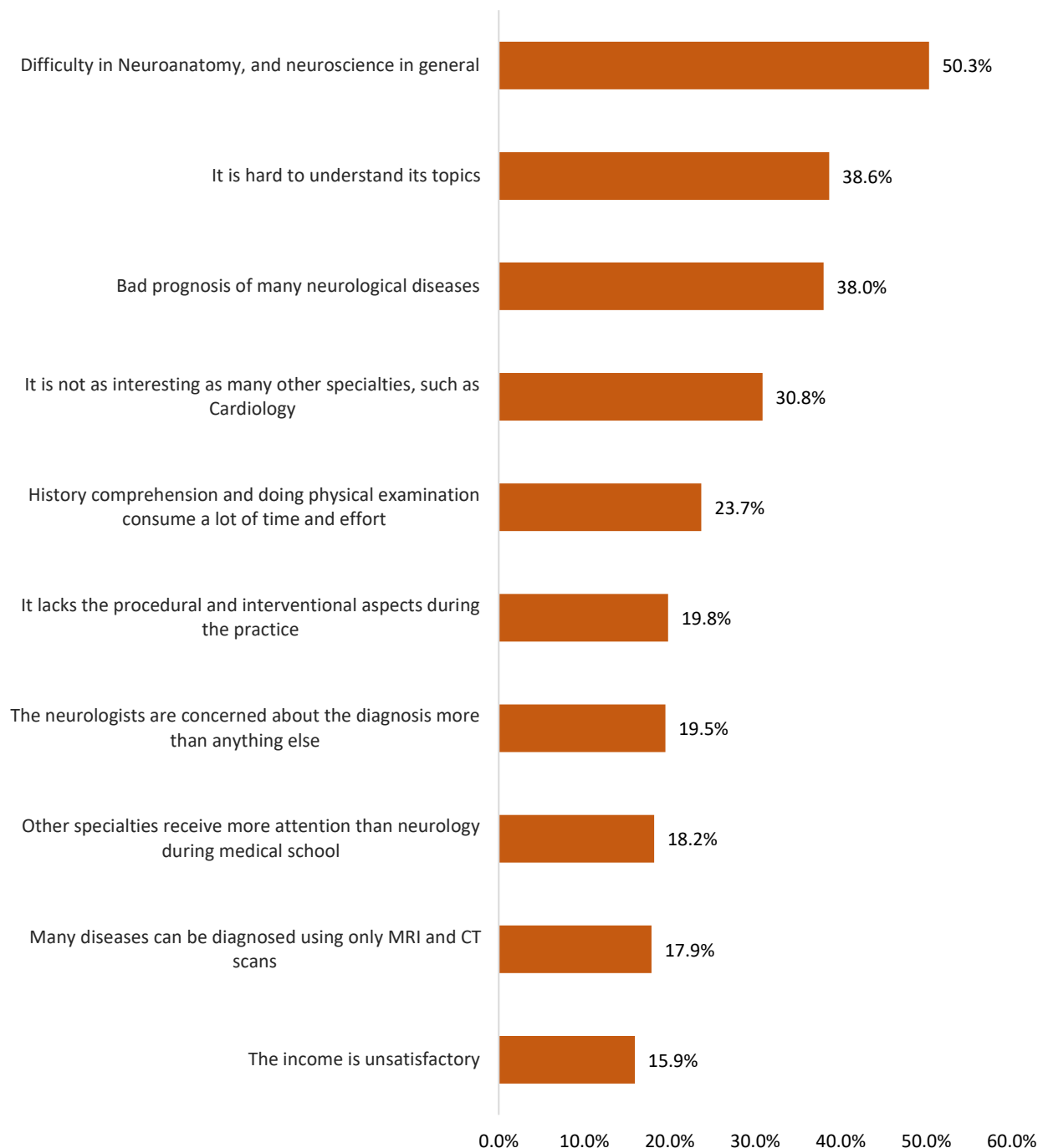


Figure 2. Reported reasons for not selecting neurology as a future career among medical students who are not interested, Saudi Arabia (n=308)

4. Discussion

This study examined interest in neurology among Saudi medical students and the factors shaping their specialty preferences. In the context of the growing

global burden of neurological disorders, population aging, and persistent shortages of neurologists, particularly in the Middle East. Neurological diseases account for a substantial proportion of global disability and healthcare utilization [11].

Table 3. Personal characteristics of the study medical students who are undecided about Neurology as a future career, Saudi Arabia (n=256)

Personal data	No	%
Age in years		
>20	42	16.4%
>26	11	4.3%
20-23	161	62.9%
24-26	42	16.4%
Gender		
Male	64	25.0%
Female	192	75.0%
University		
Alfaisal University	2	.8%
Imam Abdulrahman bin Faisal University	3	1.2%
King Abdulaziz University	20	7.8%
King Khalid University	14	5.5%
King Saud bin Abdulaziz University for Health Sciences	12	4.7%
Other university	92	35.9%
Qassim University	3	1.2%
Taibah University	14	5.5%
Taif University	47	18.4%
Umm al-Qura University	49	19.1%
Academic year		
2 nd year	41	16.0%
3 rd year	51	19.9%
4 th year	59	23.0%
5 th year	42	16.4%
6 th year	27	10.5%
Medical intern / resident	21	8.2%
Others	15	5.9%
Academic level		
Pre-clinical	92	35.9%
Clinical years	128	50.0%
Intern/ resident	21	8.2%
Others	15	5.9%
GPA		
<3.5	34	13.3%
3.5-3.75	44	17.2%
3.75-4	34	13.3%
4-4.25	28	10.9%
4.25-4.5	28	10.9%
4.5-4.75	40	15.6%
>4.75	48	18.8%

These findings provide important insights for medical education planning and workforce development [11,12]. Understanding how neurology is perceived at the undergraduate and early postgraduate levels is essential to addressing future gaps in neurological care. In Saudi Arabia and the wider Arab region, shortages

of neurologists have been identified as a structural challenge, affecting access to timely diagnosis and specialized care [12,13]. While expanding training positions is one strategy to address this gap, recruitment into neurology ultimately depends on students' perceptions, motivations, and educational

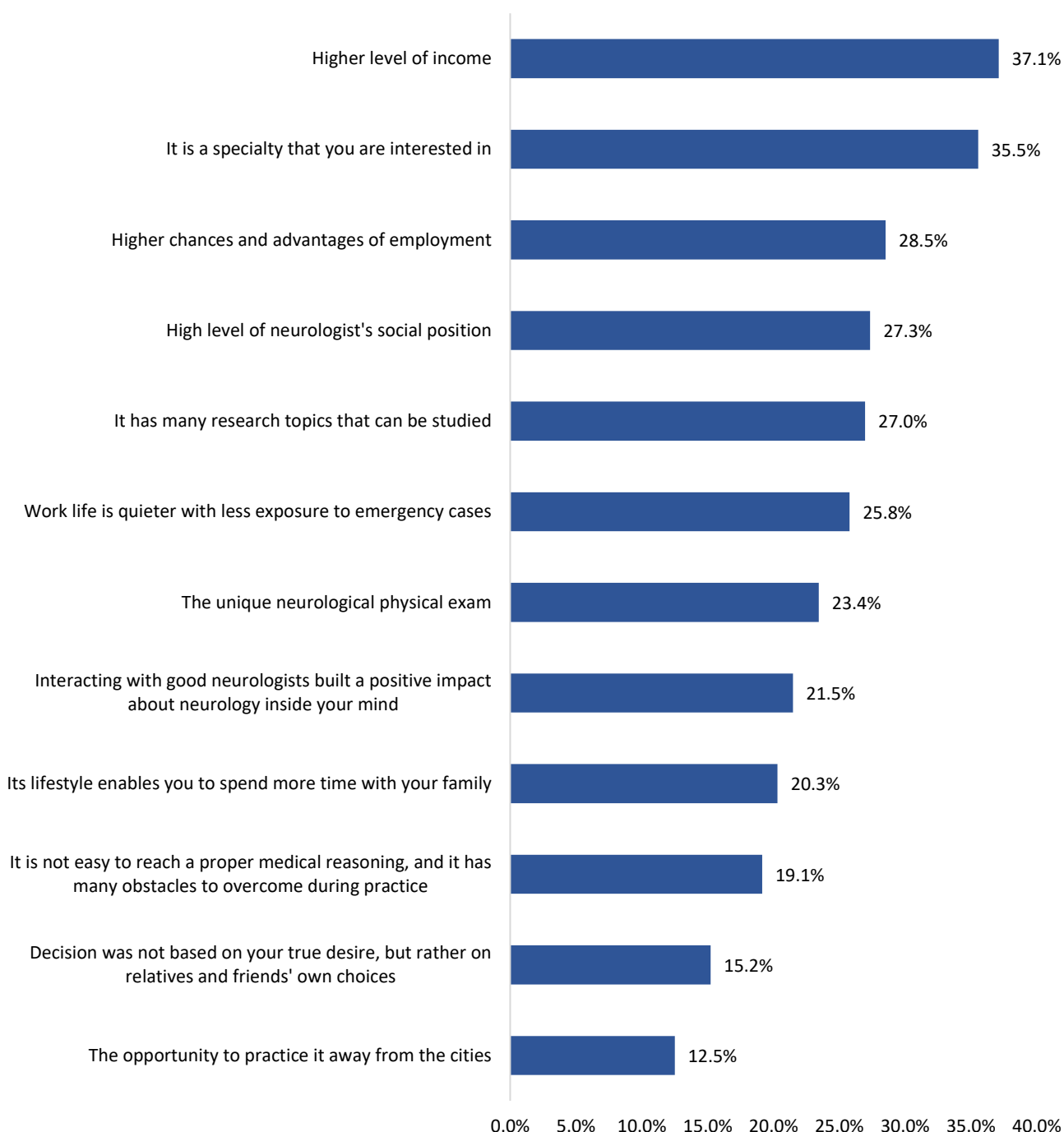


Figure 3. The proposed reasons for selecting neurology as a future career among medical students who were undecided about it, Saudi Arabia (n=256)

experiences, highlighting the importance of studying specialty choice determinants [14]. In the present study, 38% of respondents expressed interest in neurology, a proportion comparable to findings from Iraq (35.3%) but higher than reports from India, where interest has been notably lower [10,15,16]. These regional differences likely reflect variations in undergraduate curricula, quality of neurology

exposure, and availability of mentors. International studies suggest that institutions offering earlier and more structured clinical exposure to neurology tend to report higher student interest, supporting the role of curriculum design in shaping specialty choice [15,17].

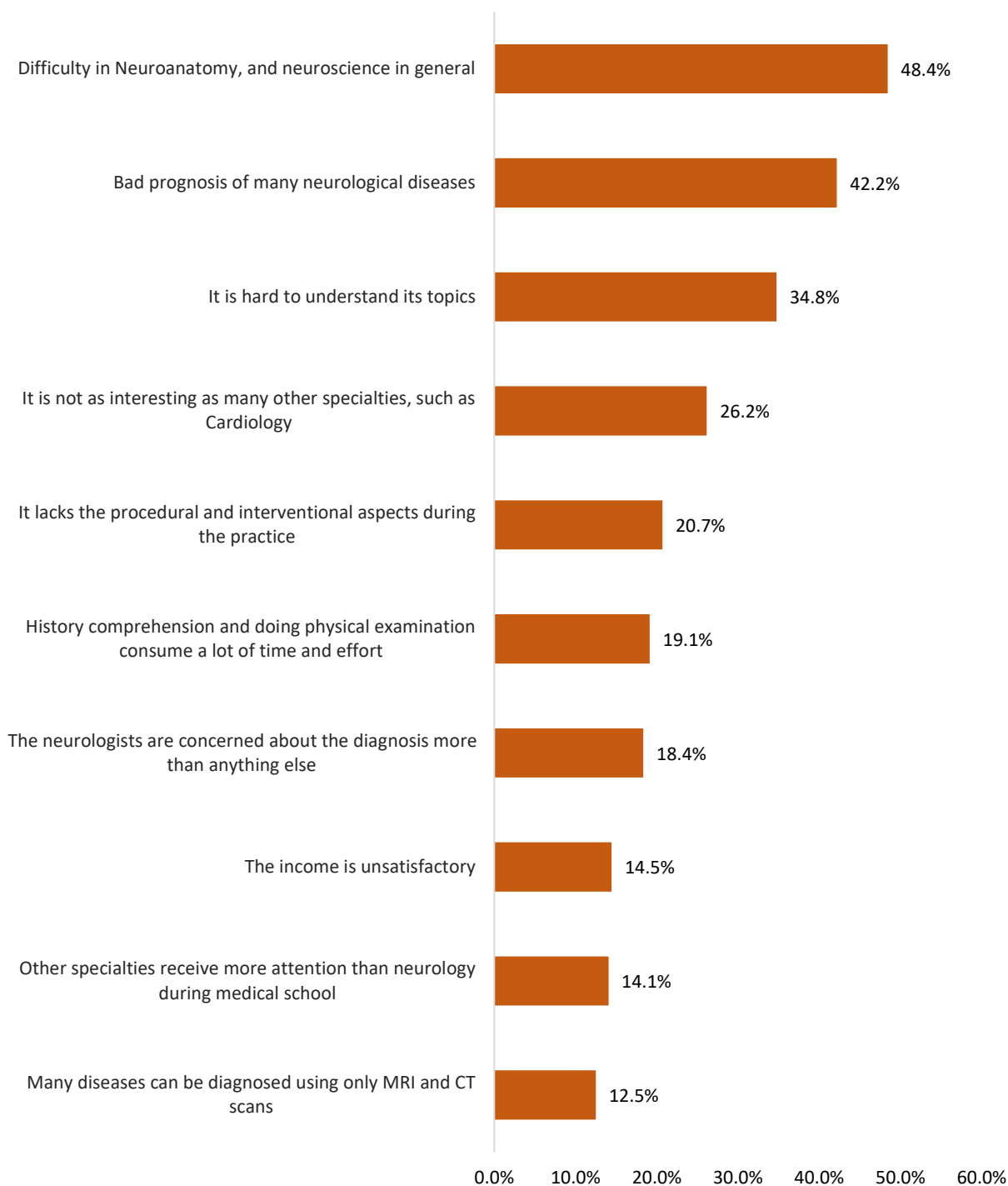


Figure 4. The proposed reasons for not selecting neurology as a future career among medical students who were undecided about it, Saudi Arabia (n=256)

Interest in neurology was primarily driven by intrinsic factors, particularly general interest in the specialty, followed by extrinsic considerations such as income potential, job security, and professional prestige. These motivations are consistent with studies from the United States and Europe, where neurology is often viewed as

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intellectually challenging and research-oriented, attracting students with strong academic interests [7,18]. Notably, interaction with neurologists and exposure to positive role models emerged as an important influence, reinforcing international evidence that mentorship significantly impacts specialty

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selection [19]. From an educational perspective, this finding supports the integration of structured mentorship and increased faculty–student interaction within neurology training programs [20].

Conversely, deterrents were dominated by the perceived difficulty of neuroanatomy and neuroscience, a finding that aligns with the widely reported phenomenon of “neurophobia” [17]. Nearly half of uninterested and undecided students cited this concern, echoing reports from Saudi Arabia, the United Kingdom, and India that identify neurology as one of the most intimidating specialties for medical students [16,17]. Additional deterrents such as perceived poor prognosis of neurological diseases, limited procedural opportunities, and reliance on imaging mirror international findings in which students favor specialties offering visible therapeutic interventions and rapid clinical outcomes [16]. These perceptions, while not always reflective of modern neurological practice, may discourage capable students from considering the specialty.

Participants also perceived neurology as underrepresented in the medical curriculum, a concern consistent with international literature linking limited clinical exposure to reduced confidence and interest in neurology [15,17]. Educational strategies such as integrated neuroscience teaching, case-based learning, and earlier bedside neurology exposure have been shown to reduce neurophobia and improve student engagement. Implementing such strategies within Saudi medical schools could help address misconceptions and strengthen interest in neurology.

Demographic patterns further inform workforce planning. Greater interest among students in clinical years and those with higher academic performance suggests that increased exposure and confidence may positively influence neurology career decisions. Interestingly, openness to neurology among early-year students indicates a potential window of opportunity during preclinical training, which may be lost without sustained positive experiences. Students who remained undecided represented a particularly important group, balancing recognized advantages of neurology against persistent concerns. Targeted interventions for this group—such as mentorship programs, skills-based workshops, and exposure to successful patient

outcomes—could meaningfully influence career trajectories.

Overall, these findings demonstrate that neurology career choice is shaped by both modifiable educational factors and broader perceptions of the specialty. Addressing neurophobia, enhancing curriculum design, and strengthening mentorship pathways are actionable strategies that medical educators and policymakers can adopt to support neurology workforce development. Aligning these efforts with national healthcare priorities may contribute to improving access to neurological care and addressing specialist shortages in Saudi Arabia.

Strengths, limitations, and future directions

This study addresses an important yet underexplored topic in the Saudi context by examining factors influencing interest in neurology among both medical students and practicing physicians. A key strength lies in the inclusion of participants across multiple training stages and institutions, which enhances the relevance and generalizability of the findings. The structured study design and clear presentation of results, including tabulated data on motivating and discouraging factors, further strengthen the interpretability of the findings and their applicability to medical education and workforce planning.

Several limitations should be acknowledged. The cross-sectional design limits causal inference between identified factors and specialty choice. Data were collected through a voluntary, self-administered online survey, which may introduce self-selection and voluntary response bias, as individuals with a pre-existing interest in neurology may have been more likely to participate. Additionally, reliance on self-reported data may be subject to recall bias. While the sample was diverse, it may not fully capture perspectives from all medical institutions in Saudi Arabia, particularly those underrepresented in online academic networks.

Future research should employ longitudinal designs to track changes in interest in neurology over time and assess the impact of curricular and experiential interventions. Incorporating structured exposure to neurology, mentorship programs, early clinical

rotations, and standardized neurology teaching across institutions may help reduce neurophobia and improve recruitment into the specialty. Such initiatives could play a critical role in strengthening neurology training pathways and addressing workforce needs in alignment with national healthcare transformation goals.

5. Conclusion

This study demonstrates a substantial level of interest in neurology among Saudi medical students, particularly among those in clinical training stages and with higher academic performance. While interest is driven by intellectual appeal and career prospects, neurophobia and perceived complexity remain key deterrents. These findings highlight the need for targeted educational interventions, including earlier and integrated neuroscience teaching, increased clinical exposure to neurology, and structured mentorship programs. At a policy level, standardizing neurology training pathways and expanding opportunities for undergraduate and postgraduate neurology exposure may help strengthen recruitment into the specialty and support future neurology workforce needs in Saudi Arabia.

Author Contributions: Conceptualization: Muhannad A. Alahmadi; Data collection: Moath M. Alomairi, Nawaf H. Aljafari; Writing—original draft: Aseel O. Banasir; Writing—manuscript preparation: Sara S. Al-Zahrani, Abdulaziz M. Almeahmadi; Revision: Abdulrahman E. Alraddadi; Supervision and critical review: Omar Babateen. All authors read and approved the final manuscript.

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Data sharing statement: The data supporting the findings of this study are available from the corresponding author upon reasonable request. All datasets have been anonymized to protect participant confidentiality. Due to ethical considerations and privacy restrictions, individual responses cannot be made publicly accessible.

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preparation of this manuscript, the authors used ChatGPT 4.0 and Google Gemini to assist with language refinement and manuscript structuring. After using these tools, the authors critically reviewed, edited, and validated all content and take full responsibility for the accuracy and integrity of the published work.

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