



Experiences and Challenges of International Neurosurgical Residents in Germany

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■ **OBJECTIVE:** The number of international neurosurgical residents in Germany has significantly increased in recent years. This study investigates residents' satisfaction with the training program, factors contributing to dissatisfaction—including surgical exposure and psychological well-being—experiences of disparities, and future subspecialty preferences.

■ **METHODS:** A cross-sectional survey was conducted among neurosurgical residents in Germany. Data were collected from international residents and a control group of native German residents between 2023 and March 2024. An anonymous questionnaire was distributed via the German Society of Neurosurgery network and institutional email channels. Descriptive statistical analysis was performed.

■ **RESULTS:** A total of 85 international and 65 control group residents participated. International residents were predominantly male (79%), while the control group had a female majority (62%). More international residents worked in community hospitals (47%) versus university hospitals for controls (63%). Neuro-oncology was the most preferred subspecialty in both groups. About one-third of international residents reported moderate satisfaction with training, a level similar to that of the control group. However, limited surgical exposure (36%) and research opportunities (19%) were more frequently cited by international residents. Burnout was reported by 51% of international residents versus 89% of the control group ($P < 0.0001$).

Race-based disparities were occasionally reported by 30% of international residents, yet 88% never filed a formal complaint, citing futility or fear of inaction. Despite high emotional strain in both groups, most residents did not consider psychological support necessary.

■ **CONCLUSIONS:** This study highlights training challenges in neurosurgery training. Key areas for improvement include increasing surgical exposure, expanding research opportunities, and improving reporting mechanisms for race-based disparities.

INTRODUCTION

For decades, Germany has been a destination for international neurosurgeons, such as the renowned “Majid Samii” (born June 19, 1937), to pursue training and careers in neurosurgery.¹ In recent years, this trend has increased significantly, driven by a variety of factors, including exposure to advanced neurosurgical techniques, well-equipped hospitals, and financial aspects, including costs of living, training reimbursement, and long-term career prospects compared to other countries.^{2,3} which make Germany an attractive option for aspiring neurosurgical residents from around the world.

In the recent decade, Germany faced a significant health-care challenge, with 5500 medical positions in hospitals remaining unfilled—a trend that has continued to escalate over the years.⁴ This physician shortage has led to an increasing reliance on foreign doctors to fill the gaps, particularly at the trainee level.⁵

Key words

- Germany
- International residents
- Neurosurgical training
- Race-based disparities
- Workplace environment

Abbreviations and Acronyms

DGNC: German Society of Neurosurgery

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Thus, over the past decade, the number of foreign doctors working in Germany has doubled, from 35,893 in 2013 to 63,763 at the end of 2023.⁶ Interestingly, the field of neurosurgery has diverged from the general trend of medical shortages. Over the past 2 decades, the number of neurosurgeons in Germany has steadily increased, driven by factors such as the introduction of new surgical treatment options, an increased workload per case, economic incentives associated with favorable reimbursement in neurosurgery, and compliance with the European Working Time Directive, effective since August 2004.^{7,8} While this might ensure wide availability of neurosurgical care, it also presents several challenges, including a potential decline in the quality of surgical training due to reduced caseloads and diminished career prospects for younger neurosurgeons.⁹ Moreover, the number of international neurosurgical residents in Germany has also risen.⁷ These foreign residents encounter unique challenges, ranging from language barriers and cultural differences to the complexities of mastering highly specialized medical procedures in a foreign environment and lack of surgical training due to a saturated training system. The specific challenges faced by foreign neurosurgical residents have never been earlier examined, leaving a significant gap in understanding that could impact both the integration of these professionals and the quality of neurosurgical training and patient care.

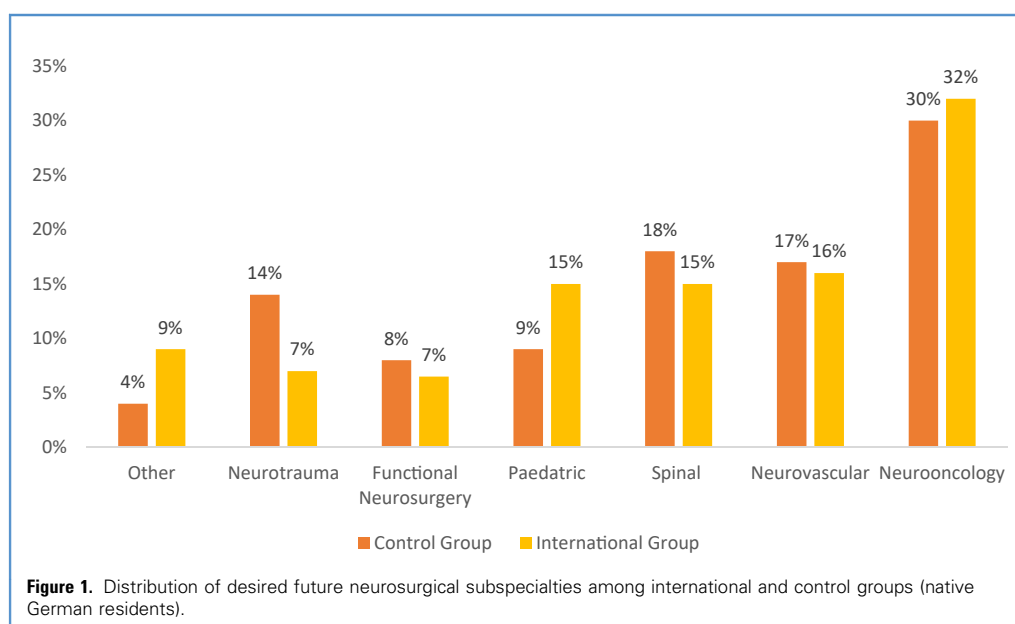
Our study seeks to address this gap by systematically analyzing the challenges faced by foreign neurosurgical residents in Germany. The results of the study may help enhance the integration and effectiveness of these medical professionals within the German health-care system, ultimately contributing to the continued high standards of neurosurgical care in Germany.

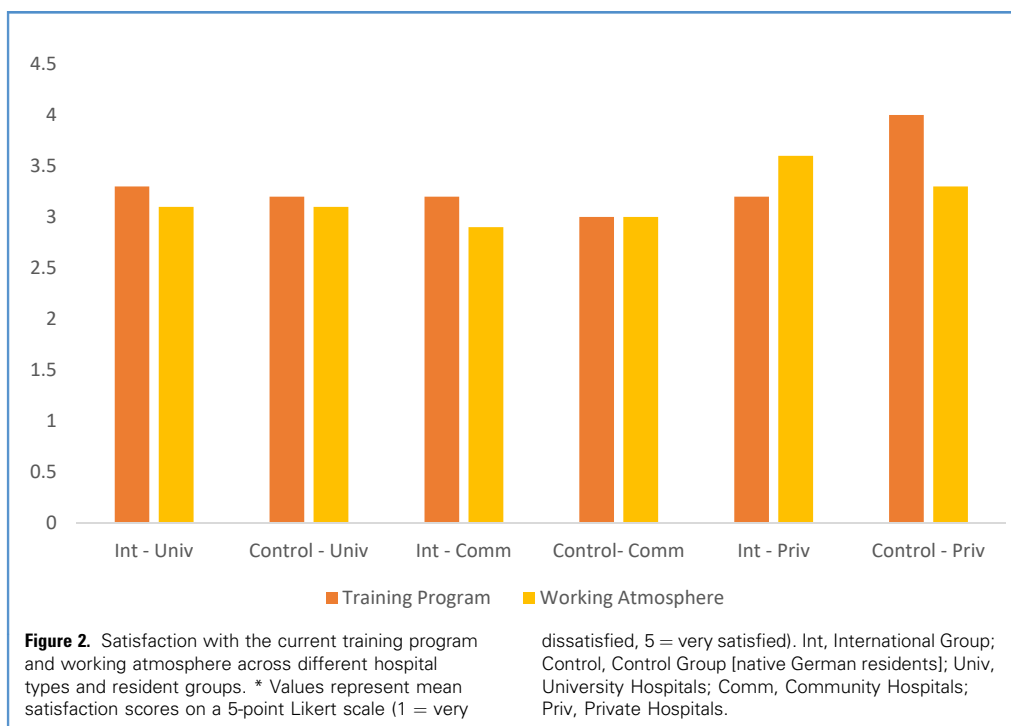
METHODS

Study Design and Participants

This cross-sectional survey study utilized an anonymous questionnaire to collect data from international neurosurgery residents across Germany. For the purposes of this study, international neurosurgery residents were defined as A) individuals whose first language is not German and who have lived in Germany for fewer than 10–15 years. This range was chosen based on studies suggesting that linguistic and cultural adaptation in a new country typically stabilizes within this period, particularly in professional contexts.¹⁰ This definition captures the broader social and cultural challenges associated with residency training rather than strictly legal definitions of nationality. Furthermore, B) non-German citizens whose mother tongue is German, such as Swiss or Austrians, were also included in the study as a control group.

The international residents were identified using a checklist, which was provided with definitions of an international neurosurgical resident at the beginning of the survey. A pilot study was conducted with 10 international residents (approximately 10% of the total expected sample size) to test the clarity and functionality of the questionnaire. Feedback from the pilot study was used to refine wording and adjust the survey length. While specific data on the number of international neurosurgical residents in Germany are unavailable, approximately 15% of all medical doctors in Germany are foreign.^{11,12} Using this figure as a proxy, we estimate that out of the 1000 neurosurgical residents in Germany, around 150–200 are likely to be international. In this study, we surveyed 85 international neurosurgical residents, representing approximately 57% of the estimated international resident population in the country. This sample size was calculated to achieve a 95% confidence level, with a margin of error of ± 5 .





The questionnaire was distributed through 2 primary channels: the German Society of Neurosurgery (DGNC) network and direct email outreach. Approximately 30% of the international respondents (25 participants) were recruited through the DGNC. While the exact number of international residents within the DGNC network is unknown, the distribution through this channel aimed to leverage its extensive reach among neurosurgeons in Germany. Additionally, 80 email invitations were sent via the coauthors' professional networks in Germany, yielding 59 responses, corresponding to a response rate of 74% from this group. This multi-pronged approach ensured a wide reach across various institutions.

The control group consisted of 65 neurosurgical residents who self-identified as native Germans and reported all White ethnicity. This group was primarily reached through the DGNC network and institutional distribution channels. It served as a reference to explore potential differences in training experiences compared to international residents.

The participants represented a variety of hospital settings, including university hospitals, private hospitals, and community hospitals. The survey included sections on demographic information, surgical exposure, research opportunities, work environment, experiences of race-based disparities, and overall job satisfaction ([Supplement Content 1](#)). In the questionnaire, terms such as “depression” and “burnout” were used to describe subjective emotional experiences rather than clinical diagnoses, reflecting the participants' self-reported perceptions during their training. Most of the data collection took place between January and March 2024. This study was conducted in accordance with the Checklist for Reporting of Survey Studies ([Supplement Content 2](#)).

For the statistical analysis, R-Studio (version 4.3.2) was used to process the collected data. The analysis compared different aspects of residency experiences, including exposure to surgical cases, research opportunities, and experiences of discrimination or abuse. Percentage comparisons provided a straightforward representation of the data.

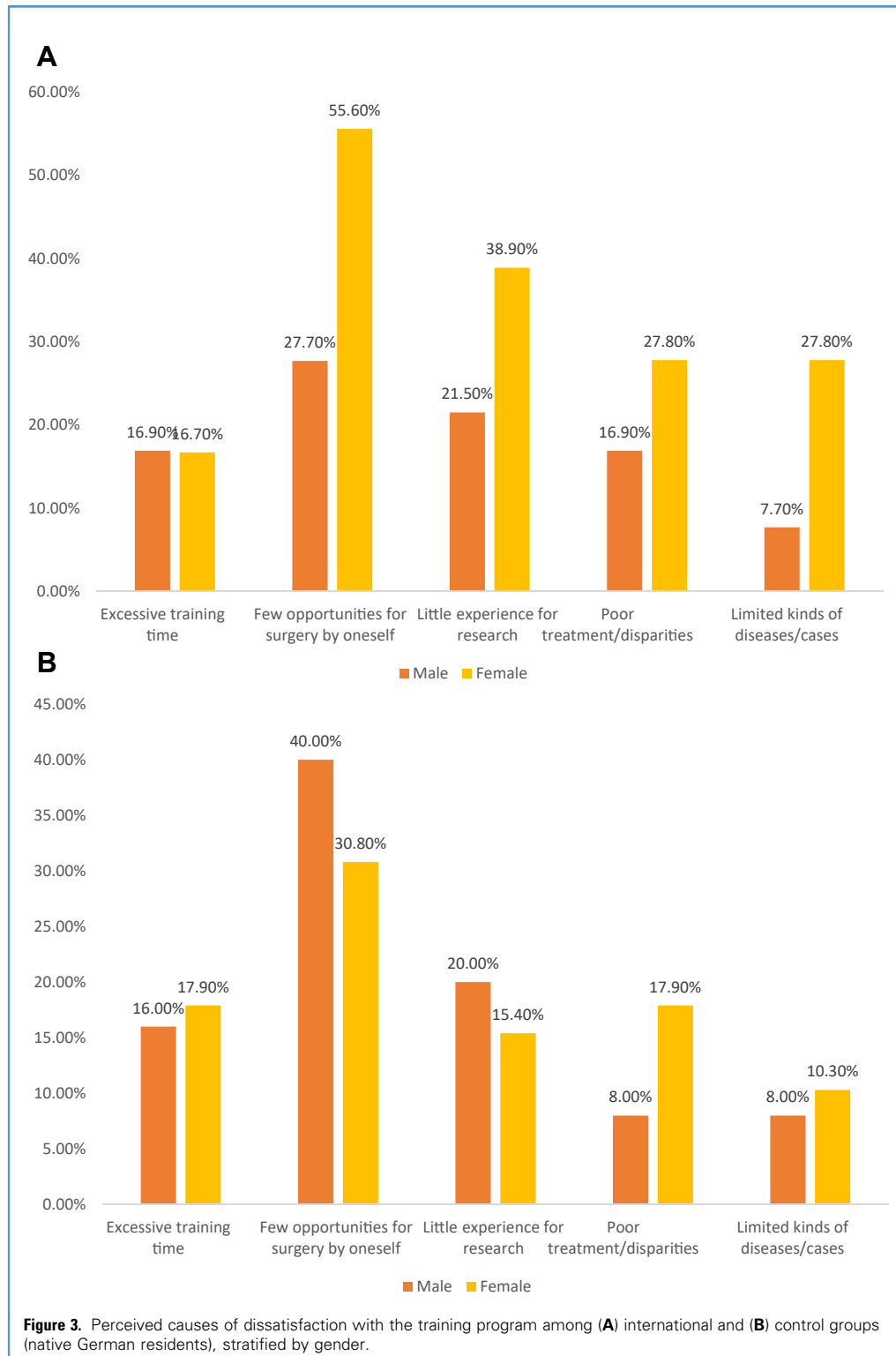
Ethical Considerations

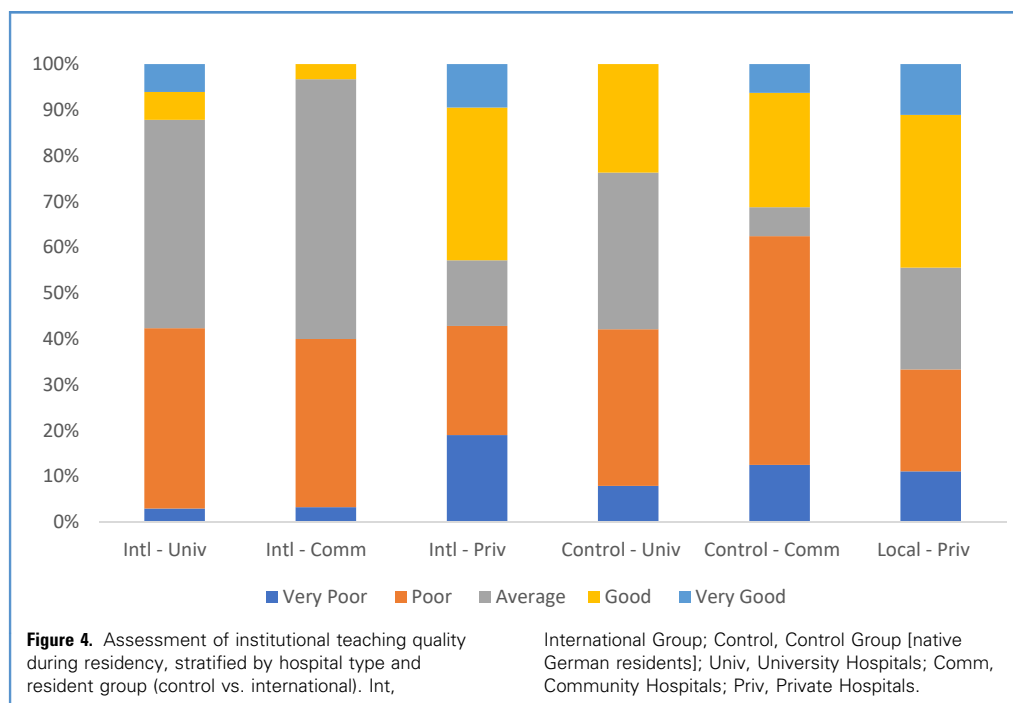
In compliance with the anonymous design of the study, where no personal or sensitive data were collected, this study was exempted from ethical review by the chamber of physicians as per [paragraph 15 of the Professional Code for Physicians in Thuringia, Germany]. This exemption is in line with ethical guidelines for research involving human subjects. The guidelines stipulate that due to the anonymity of the data collected in this study, obtaining consent from participants is not requisite. Documentation confirming the exemption is available and can be provided upon request. All methods were carried out in accordance with relevant guidelines and regulations.

RESULTS

Demographics and Future Subspecialty Training

Eighty-five international neurosurgical residents in Germany participated in the study; 79% (67) were male and 21% (18) were female. Most participants (36%) were in training years 3–4, and 74% were in a relationship or married. Sixty-two percent had no children. Regarding hospital type, 47% worked in community hospitals, 35% in university hospitals, and 18% in private





institutions. Geographically, 42% were based in western Germany, 28% in the north, 19% in the south, and 11% in the east. The control group of 65 residents was 38% male and 62% female, with a greater proportion working in university hospitals (63%) and based in southern Germany (48%) (Table 1).

Regarding future subspecialty preferences, neuro-oncology was the most preferred subspecialty among both international and control residents (32% vs. 30%, respectively), followed by spinal neurosurgery (18% vs. 15%) and neurovascular subspecialization (17% vs. 16%) (Figure 1).

Overall, 33% of participants reported moderate satisfaction with their training program, while 31% expressed similar satisfaction with the working atmosphere. The 2 groups reported comparable levels of satisfaction in university and community hospitals; however, international residents in private hospitals reported slightly higher satisfaction with both training and workplace environment than their local counterparts (Figure 2).

The most commonly reported causes of dissatisfaction with the training program were limited opportunities to perform surgery independently, insufficient research experience, and perceived disparities in treatment. Among international residents, females more frequently cited a lack of self-performed operations (56%) and poor treatment or discrimination (39%) compared to males (28% and 22%, respectively). In the control group, male residents most commonly reported limited operative experience (40%), while reports of discrimination remained low in both genders (Figure 3).

Most residents rated the quality of teaching during residency as average or poor, especially in university and community hospitals. International residents in private hospitals reported better

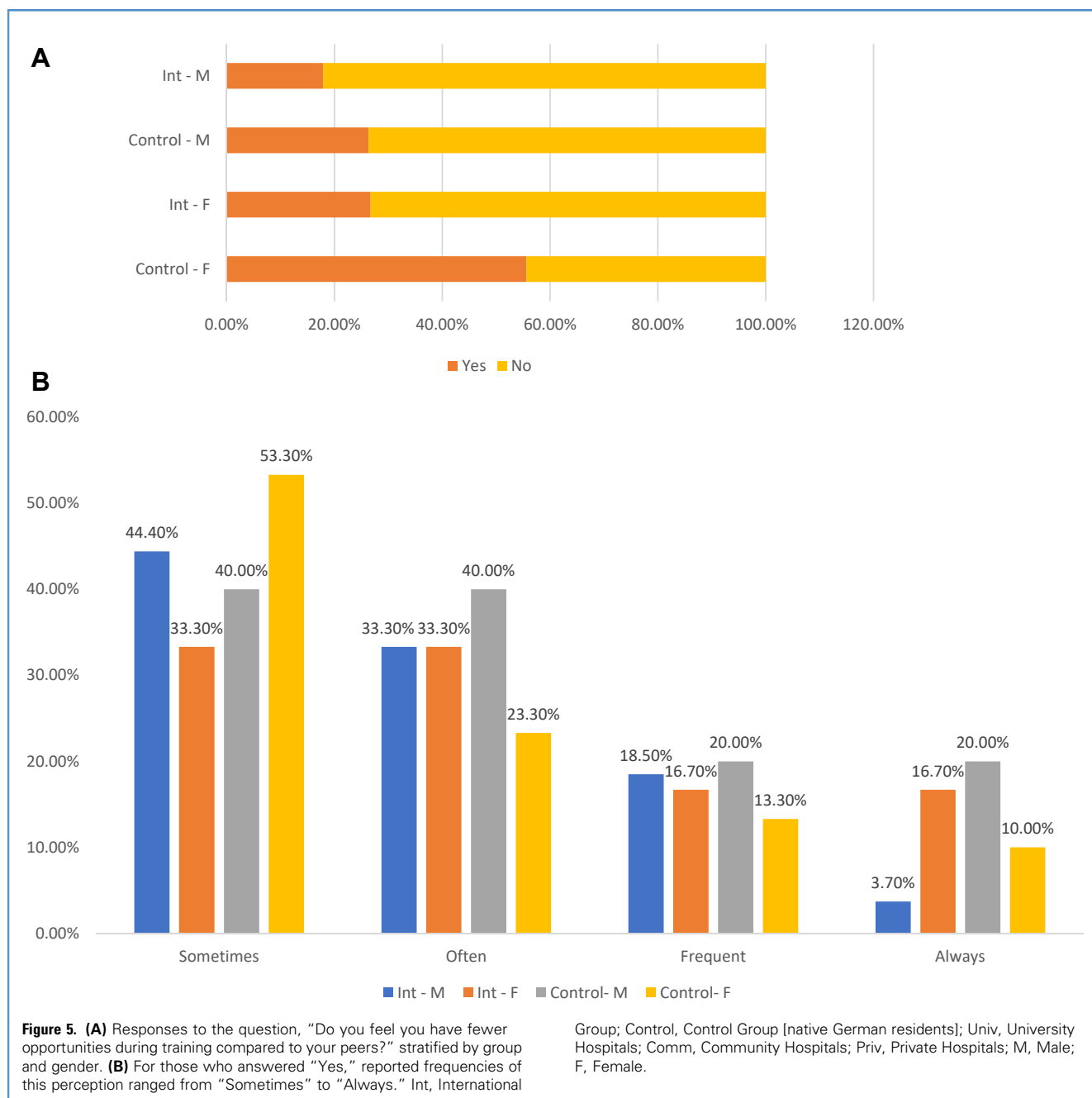
teaching experiences, with more positive ratings compared to other groups. Teaching was rated lowest in community hospitals by both groups (Figure 4).

Perceived Discrimination and Its Impact

A notable proportion of residents reported feeling that they had fewer opportunities during training compared to their peers (Figure 5A). This perception was most common among the female residents in the control group (53%), followed by international males (44%). Among those who answered “yes,” the perception occurred most frequently as “sometimes” or “often” across all groups, with local female residents again reporting the highest rates of recurrence (Figure 5B).

In terms of opportunity distribution, international residents rated their surgical exposure slightly lower overall than the control group, with fewer selecting “very good” and more choosing “very poor.” For research opportunities, international residents reported a markedly more negative experience, with a larger proportion indicating “very poor” and “poor” compared to their local counterparts, who showed a more favorable assessment overall (Figure 6).

Figure 7 explores the experience of race-based disparities. Of the interviewees, 30% reported “occasional” encounters of race-based disparities. Furthermore, 38% reported that they “sometimes” experience verbal and emotional abuse. Table 2 summarizes reported sources of harassment during training, stratified by gender. Verbal or emotional abuse was most frequently attributed to patients or their families (27%), followed by nurses or other staff (24%), and senior colleagues or supervisors (17%). Physical abuse was less commonly reported



(5%), and sexual harassment was rarely disclosed (0.5%). While both male and female respondents reported negative experiences, proportions varied slightly across source categories.

The impact of ethnic differences is illustrated in **Figure 8**, which shows a subjectively significant negative impact in terms of respect and value in the department internally, overall job satisfaction, hands-on chances, access to leadership positions, and selection of subspecialty. Half of the respondents indicated that there was no significant impact on the quality of patient care.

Reporting Discrimination, Emotional Burden, and the Need for Psychological Support

Eighty-eight percent of international neurosurgery residents responded that they had never reported race-based disparities. Nonetheless, **Figure 9** details the reasons given for not reporting events including the perception that it was not worthwhile to report it (21%), that doing so would not make a difference (17%), or that the issue would not receive fair treatment (13%).

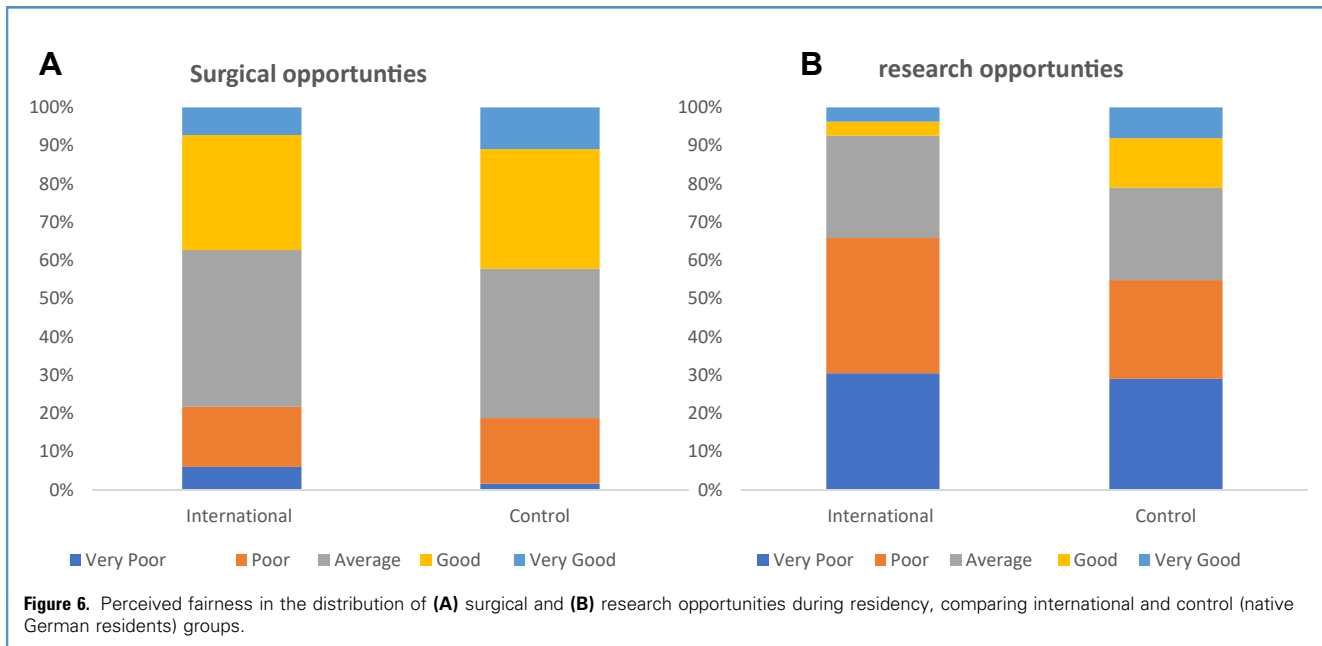


Table 3 presents residents' experiences of occasional emotional strain during training. Occasional frustration was the most commonly reported, affecting 93% of international and 91% of local residents. Depression was also prevalent, reported by 66% of international residents and 83% of the local group. Burnout showed the most notable difference, reported by 51% of international residents compared to 89% of the control group ($P < 0.0001$). Despite these findings, most residents did not consider psychological support necessary during their training.

DISCUSSION

Our study provides insights into the experiences of international residents in neurosurgery in Germany and highlights the main challenges they face. The primary difficulties identified by participants include limited surgical exposure, insufficient research opportunities, and occasional incidents of ethnic disparities, often accompanied by an absence of proper reporting mechanisms. These findings highlight the need for targeted interventions to better support international neurosurgical residents, ensuring they

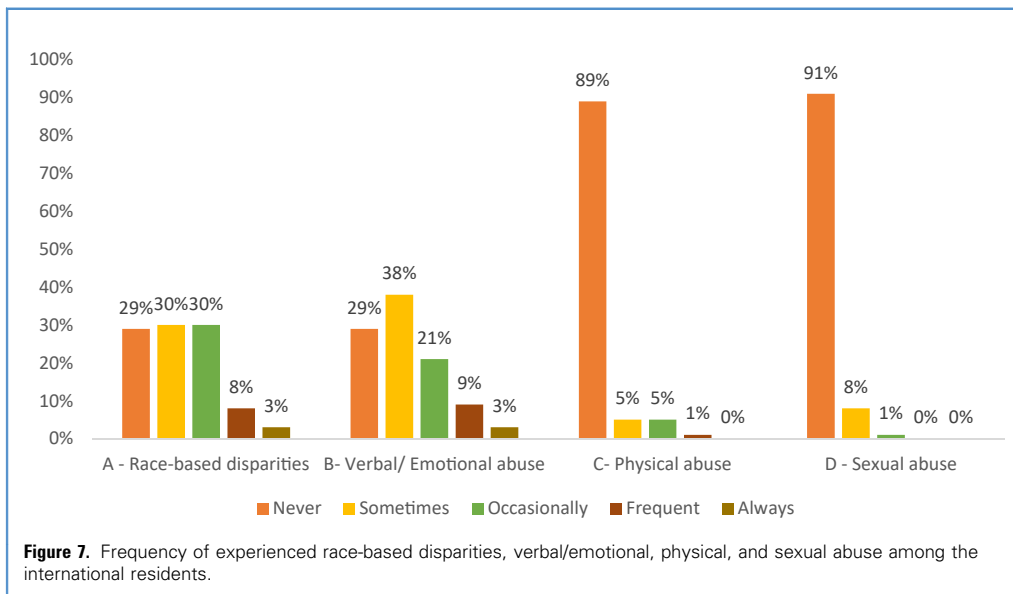


Table 1. Demographic and Professional Characteristics of International and Control (Native German Residents) Groups

Characteristic	International Group (n = 85)	Control Group (n = 65)
Male	67 (79%)	25 (38%)
Female	18 (21%)	40 (62%)
Total	85 (100%)	65 (100%)
Training year		
Training year 1–2	22 (26%)	17 (26%)
Training year 3–4	31 (36%)	15 (23%)
Training year 5–6	20 (23%)	18 (28%)
Training year >6	12 (15%)	15 (23%)
Relationship status		
Married/relationship	63 (74%)	46 (71%)
Not in relationship	22 (26%)	16 (25%)
Divorced/Widowed	-	3 (5%)
Children		
No children	53 (62%)	50 (77%)
One child	19 (22%)	9 (14%)
More than 1	13 (16%)	6 (9%)
Type of hospital		
University hospital	30 (35%)	41 (63%)
Community hospital	40 (47%)	16 (25%)
Private hospital	15 (18%)	8 (12%)
Demographic background	Middle Eastern, North African 36 (42%)/Black 9 (11%)/Asian 10 (12%)/Latin American 5 (6%)/White 16 (19%)/Others 9 (10%)	White 100%
Program location		
North	24 (28%)	13 (20%)
South	16 (19%)	31 (48%)
East	9 (11%)	11 (17%)
West	36 (42%)	10 (15%)
North, Schleswig-Holstein, Hamburg, Lower Saxony, Bremen; South, Thuringia, Baden-Württemberg, Bavaria; West, North Rhine-Westphalia, Hessen, Rhineland Palatinate; East, Mecklenburg Western Pomerania, Brandenburg, Saxony-Anhalt, Berlin, Saxony.		

have access to equitable training opportunities and an inclusive work environment.

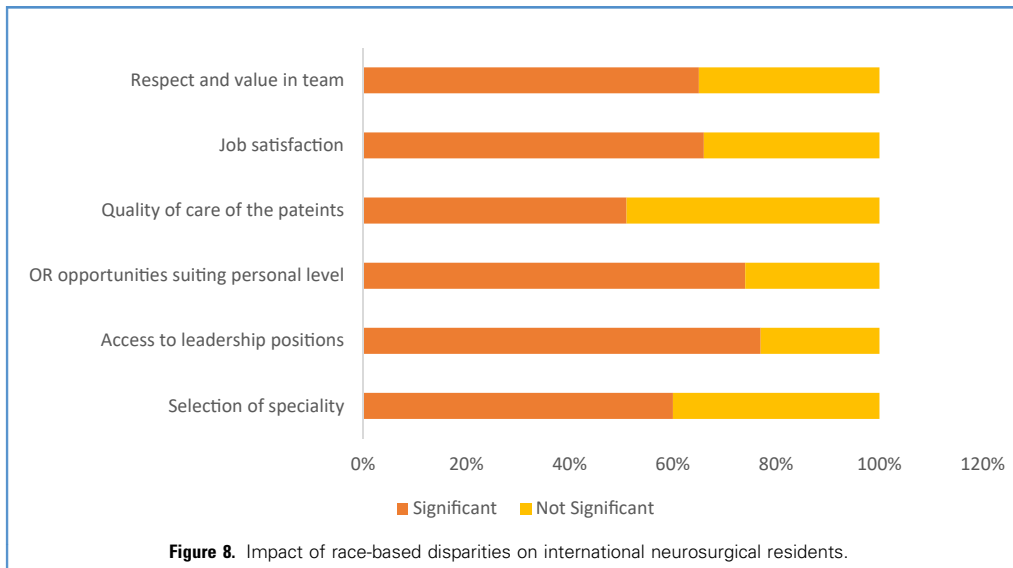
It is estimated that 10–20% of neurosurgical residents in Germany are international, with our survey showing that 42% of respondents were of Middle Eastern/North African origin. In

Table 2. Sources of Harassment During the Training Period Stratified by Gender

Source of Harassment	Gender	Verbal/Emotional Abuse (%)	Physical Abuse (%)	Sexual Harassment (%)
Patient or patient's family	Male	40 (59.7%)	5 (7.5%)	-
	Female	8 (44.4%)	2 (11.1%)	-
	Total	48 (27%)	2 (1%)	-
Senior colleague/supervisor	Male	25 (37.3%)	-	-
	Female	5 (27.8%)	1 (5.6%)	-
	Total	30 (17%)	1 (0.5%)	-
Co-resident	Male	26 (38.8%)	3 (4.5%)	-
	Female	3 (16.7%)	-	-
	Total	29 (16%)	3 (2%)	-
Nurses or other staff	Male	37 (55.2%)	5 (7.5%)	1 (1.5%)
	Female	7 (38.9%)	1 (5.6%)	-
	Total	44 (24%)	6 (5%)	1 (0.5%)
Unidentified source	Male	13 (19.4%)	1 (1.5%)	-
	Female	1 (6%)	-	-
	Total	14 (8%)	1 (0.5%)	-

comparison, only 6% of neurosurgical residents in the United States are international medical graduates, with the Middle East also being the most represented geographic region among them.¹³ Neurosurgery, while part of the broader trend of increasing dependency on international doctors in Germany, presents a unique situation. A significant contributor is the sharp rise in the number of neurosurgical residents, with a 115% increase in board-certified neurosurgeons from 2000 to 2019, compared to only a 1% growth in Germany's population during the same period.⁷ This disproportionate rise has intensified competition for hands-on experience, resulting in fewer surgical cases per surgeon, limiting opportunities for individualized mentorship and advanced procedural exposure for residents, including international trainees.¹⁴

According to our survey, 33% of participants said they were only moderately satisfied with their training. These results are in line with previous research and the difficulties that neurosurgery trainees in Germany typically encounter; according to recent studies, 37% of neurosurgical residents expressed only moderate satisfaction with their training programs.¹⁴ This trend is consistent with studies from other regions of the world,^{15–17} such as South Korea, where only moderate satisfaction with the neurosurgical training system was observed.¹⁸ The absence of a centralized body overseeing training further exacerbates the limited hands-on experience, as the allocation of operative cases is left to individual departments, leading to potential bias. Limited exposure to subspecialties like peripheral nerve, functional, and vascular neurosurgery affects the situation.¹⁹



The lack of research opportunities also contributes to resident dissatisfaction. Kilinc et al. found that neurosurgery residents in German university hospitals published an average of 2.9 articles during their training, far fewer than their counterparts in the United States, who averaged 9.2 publications. The average h-index for German residents was 1.1, compared to 2.4 in the United States.^{20,21} Studies suggest that early exposure to research and strong mentorship are key to fostering academic productivity among neurosurgical trainees.²²

Challenges in the quality of teaching during neurosurgical residency contribute to the dissatisfaction of international

residents. Data from the European Association of Neurological Surgeries Training Committee show that residents report moderate to below moderate satisfaction with clinical education, indicating systemic issues within neurosurgical training across Europe.¹⁷ One key difference between Germany and the United States is the absence of standardized written assessments,²³ making objective evaluation of theoretical knowledge difficult. Without such assessments, individual departments evaluate residents, leading to variability and subjectivity, which complicates the maintenance of consistent educational standards in Germany.

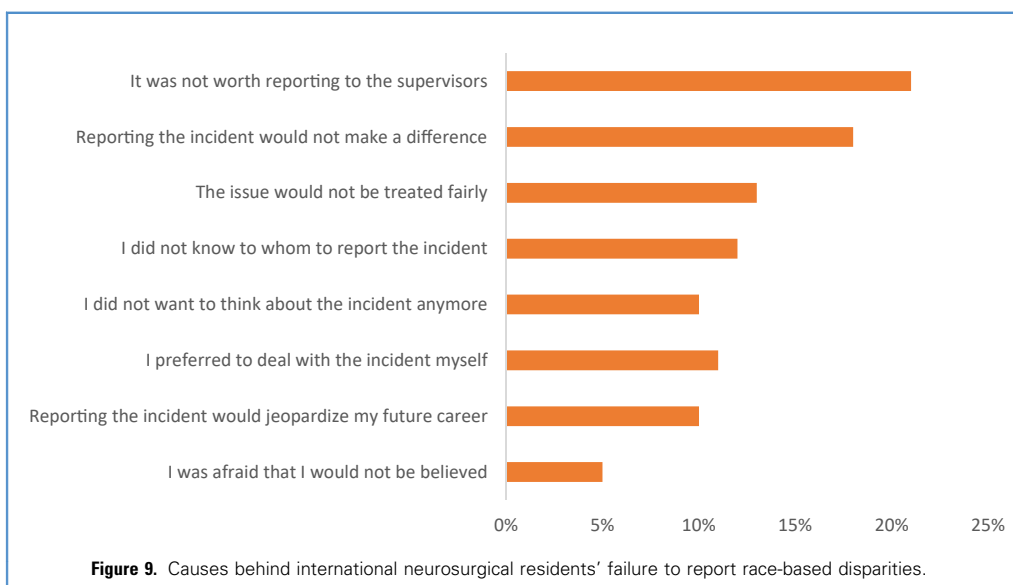


Table 3. Percentages of International and Local Neurosurgical Residents Reporting Occasional Experiences of Frustration, Depression, and Burnout During Their Training Period, Stratified by Gender

Outcome	International			Local			P Value*
	Male	Female	Overall	Male	Female	Overall	
Frustration	64 (95%)	15 (83%)	79 (93%)	23 (92.0%)	36 (90.0%)	59 (90.8%)	0.8554
Depression	46 (69%)	10 (56%)	56 (66%)	21 (84.0%)	33 (82.5%)	54 (83.1%)	0.0297
Burnout	43 (64%)	8 (44%)	43 (51%)	22 (88.0%)	36 (90.0%)	58 (89.2%)	<0.0001

Percentages reflect responses indicating frequent experiences of each outcome.
*P values represent comparisons between overall frequencies in the international and local groups.

Our survey found that 53% of international residents in neurosurgery felt they had fewer chances compared to their national counterparts, consistent with broad patterns of disadvantage and disparity for international and minority professionals.^{24,25} This subjective perception could be a sign of systemic disparities or expected issues such as cultural differences, language differences, or unfamiliarity with national practices, all of which can be barriers to career advancement and workplace integration. Prejudice against international residents and delays in medical licensure consistently place such professionals in subordinate roles and worsen their challenges.^{12,26,27} Furthermore, hierarchical health systems also discourage international residents from speaking out.²⁸ In addition, 30% of respondents reported “occasional” racial based-disparities, consistent with a systematic review by El Boghdady and Ewalds-Kvist, in which 18.6% of women and 15.1% of men in surgery residencies reported ethnic disparities.²⁹ These disparities often intersect with negative behaviors such as emotional or verbal abuse. In our survey, 20% of respondents reported occasional abuse, typically by senior colleagues or nursing staff, consistent with previous international literature attributing such problems to an international trainee or non-native English speaker.^{30,31}

Furthermore, 88% of the participants indicated that they never reported incidents of discrimination due to the fact that they believed reporting would yield no positive changes or believed the incident was not serious enough to report it. Others feared that the supervisors would treat them unjustly in such issues, and this made them reluctant to report such incidents. One likely cause of this could be the workplace culture, where some of the mistreatment becomes part of the work culture. Normalization of such behaviors results in a culture where the employees feel reporting such incidents would be meaningless. Also, lack of confidence in the reaction of the institution and the perception that the system exists to protect the institution and not the victim reinforce the perception that reporting will yield no positive changes. In addition to this, fear of retaliation and likely negative impacts on their career further discourage employees from reporting.³²⁻³⁴ Our findings suggest that ethnic disparities, according to the responders, lower job satisfaction, which, as indicated by the literature, could negatively impact some aspects of patient care.^{35,36} These stressors also contribute to burnout, which can further diminish the mental health and well-being of these residents.³⁷

When considering future career plans, most international neurosurgery residents have an interest in pursuing specialization in neurosurgical oncology as a first preference and in spinal and vascular neurosurgery as a second preference. This trend holds importance in planning for future fellowship positions in neurosurgery at the national level. Conversely, the limited exposure to subspecialties such as peripheral nerve, functional, and pediatric neurosurgery during training may discourage residents from pursuing these fields. Recent data from the United States, where established fellowship programs have long been in place, show that international medical graduates completing neurosurgical residencies most frequently chose oncology/skull base as their subspecialty, followed by vascular neurosurgery.³⁸

To address the needs of international residents in neurosurgery in Germany, a series of specific interventions are proposed. While our study results specifically did not address mentorship, previous studies have shown that mentorship programs can be useful in addressing some of the issues in the trainee phase.^{39,40,41} Fair access to operating room cases and participation in research for international residents also must be guaranteed by the institution through transparent and standard processes for the distribution of cases and participation in research. Reducing ethnic disparities by having open and easily accessible reporting systems in place is also needed. Institutions need to have a zero-tolerance policy on discrimination, and staff need to be trained in unconscious bias and inclusivity. These interventions can result in an inclusive and supportive culture for neurosurgery residents as well as patient care (Box 1).

Limitations

This study has several limitations that should be noted. The cross-sectional design limits our ability to assess changes in experiences over time, which is essential for understanding how residency challenges evolve. Furthermore, the sample size, while sufficient for a survey, may not fully represent the diverse experiences of all international neurosurgery residents in Germany, particularly given the decentralized nature of neurosurgical training across various hospitals. Additionally, satisfaction was assessed based on subjective perceptions without a standardized definition, which makes interpretation partially challenging. The reliance on self-reported data introduces potential bias, and the study did not examine other relevant metrics of residency success, such as skill

Box 1 Recommendations for Improving Neurosurgical Training for International Residents in Germany

Recommendation	Description
1-Improve surgical autonomy	Implement transparent criteria for case assignment to ensure equitable surgical exposure for all residents. Encourage progressive responsibility, especially in later period of training. ⁴²
2-Establish clear reporting mechanisms	Develop standardized, confidential, and accessible systems for reporting race-based disparities and harassment. Include clear follow-up protocols and institutional accountability. ^{31,43}
3-Cultural competency training	Introduce mandatory workshops for faculty and staff on unconscious bias, inclusivity, and diversity in the workplace to foster a more respectful environment. ^{44,45}
4-Expand research access and support	Create protected research time and mentorship structures, particularly in community and private hospitals where resources are limited. ⁴⁶
5-Subspecialty curriculum enhancement	Offer structured exposure to underrepresented fields (e.g., functional and peripheral nerve) through rotations, fellowships, or interdepartmental collaborations. ⁴⁶
6-Psychological support infrastructure	While most residents did not request support in the current study, institutions should proactively provide optional, stigma-free counseling services and peer support initiatives. ⁴³
7-Transparent evaluation and feedback	Introduce objective and standardized evaluations (e.g., national written exams, skill checklists) to reduce subjectivity in performance assessments. ⁴⁷
8-Monitor training equity	Regularly audit training distribution and feedback to identify disparities across demographic groups and adjust policies accordingly. ³¹

acquisition, academic output, or procedural volume. While this study provides valuable insights into training satisfaction and perceived disparities, it does not address other important aspects such as how international residents choose their training centers, how long they stay at each institution, or how their professional maturation is measured over time. Finally, the study did not collect qualitative data, such as in-depth interviews, which could have provided deeper insights into residents' personal experiences and motivations. Future research should aim to incorporate longitudinal designs, qualitative approaches, and objective measures of training success to capture the evolving and multifaceted experiences of international neurosurgery residents.

CONCLUSION

This article highlights the experiences and challenges of international residents in neurosurgery in Germany, including limited exposure to surgery, insufficient exposure to research, and underreporting of occasional instances of ethnic disparities. Addressing these issues is important to enhance resident training experience and well-being. Institutions should focus on creating

transparent policies to combat disparities, improve reporting mechanisms, and increase equitable access to surgical, research, and teaching opportunities. Further research, particularly longitudinal studies, is needed to better understand how these challenges evolve and to track the long-term progress of international resident satisfaction with the training program.

CRedit AUTHORSHIP CONTRIBUTION STATEMENT

Mazin Omer: Conceptualization, Writing – original draft, Writing – review & editing. **Marco Bisolo:** Conceptualization, Data curation. **Amir El Rahal:** Conceptualization, Data curation. **Ramy Amirah:** Conceptualization, Data curation. **Mamoun Ahmed:** Conceptualization, Data curation. **Oday Atallah:** Conceptualization, Data curation. **Kathrin Machetanz:** Data curation. **Anna C. Lawson McLean:** Conceptualization, Data curation. **Thuy Linh Nguyen:** Conceptualization, Data curation. **Akram A. Alhamdan:** Conceptualization, Data curation, Methodology. **Ahmed Alnaggar:** Data curation. **Jürgen Beck:** Writing – review & editing. **Jussi P. Posti:** Supervision, Writing – review & editing.

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