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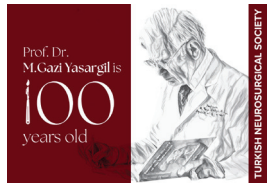

Evaluation of Neurosurgery Residency Training and Surgical Performance: A National Survey in Turkey

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ABSTRACT

AIM: To assess the number of independent surgical procedures performed, working hours, and satisfaction with training among residents in Turkey.

MATERIAL and METHODS: An electronic survey was sent to all neurosurgery residency in Turkey through e-mail and social media group. The survey, which includes 37 questions primaly encompassed independently performed surgical procedures, work hours (post-night shift rest), satisfaction of educational activities.

RESULTS: The responses were collected from n=276 participants, representing 35% of the entire residents. Responses came from 88% (73/83) of all training programs in Turkey. The independent application more than fifteen rate for low-risk interventions (External ventricular drain (EVD) /intracranial pressure (ICP)-monitoring, supratentorial craniotomy, lumbar drainage, laminectomy) was approximately 50% in PGY 3 and 80% in PGY 4&5. %50 of PGY 4&5 residents performed more than fifteen procedures for hematoma, shunting, lumbar disc disease, and thoracic-lumbar (TL) trauma surgery. Post-night shift rest is implemented in the majority of training programs, with data revealing that it is statistically more widely adopted in training and research hospitals compared to other educational programs. 84% of responders found post-night shift rest beneficial.

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CONCLUSION: Post-night shift rest is implemented in the majority of training programs, and most residents find it beneficial. Only half of senior residents adequately apply general neurosurgery practices. However, it is predicted that resting after shifts could further shorten the overall training period and negatively impact the already low case numbers for residents. Therefore, it is crucial to organize and standardize training programs in a way that mitigates this negative effect. The fact that only a quarter of residents plan to practice their profession in Turkey raises serious concerns about the future sustainability of neurosurgical services at the national level.

KEYWORDS: Working hour restriction, Neurosurgery Residency, Satisfaction rate, Independently performed case, Turkish Neurosurgical Society, Turkish Young Neurosurgeons Board

ABBREVIATIONS: EVD: External ventricular drain, **ICP:** Intracranial pressure, **PGY:** Postgraduate years, **TL:** Thoracic-Lumbar, **GUH:** Government university hospital, **TRH:** Training and research hospital, **PUH:** Private university hospital, **OT:** Operating theater

INTRODUCTION

Over the last century, while the landscape of modern neurosurgery residency training has evolved continuously, there is a need for constant adaptation to the dynamic demands of the era. This is imperative for not only disseminating profound theoretical knowledge but also for cultivating refined surgical skills within the constraints of a limited training period. However, maintaining a standardized practice and comprehensive curriculum extending across diverse global regions, including both developed and developing nations, is a formidable challenge (1,5,6,9). Furthermore, the need for multiple qualifications for skill acquisition and the stringent limitations imposed by restricted working hours pose a significant challenge to both learning and imparting these intricate skills.

The key issues encountered during any residency training include adverse working conditions, the absence of standardized educational activities, and a demand for more diversified practices. Post-specialization, a critical concern emerges regarding the need for greater expertise in the field. These factors collectively contribute to a considerable decline in students' motivation throughout their professional education journey. Navigating the innate complexities and challenges of neurosurgery warrants a delicate balance between comprehensive clinical and surgical education, all while ensuring that working conditions align with the fundamental characteristics of human nature. Yet, it remains to be determined at which stage fundamental skills are acquired and to what extent they are independently applied. At the local level, recent legal regulations have mandated compulsory rest periods for residents following night shifts; the impact of these regulations on resident training is yet to be fully discerned.

Therefore, the study aimed to provide a comprehensive qualitative and quantitative overview of neurosurgery residency training in Turkey by assessing the number of independent surgical procedures performed, working hours, and satisfaction with training among residents. This study marks an inaugural effort at a national level within the field of neurosurgery in the country. To the best of our knowledge, this is the first study conducted on a national level within the field of neurosurgery in Turkey.

MATERIAL and METHODS

This study was conducted with the permission of the Turkish Neurosurgical Society by the Young Neurosurgeons Committee of the TNS. Due to its multi-center participation, being a survey study, and the prior approval obtained from the Turkish Neurosurgical Society, no application was made to an Institutional Review Board.

This study, conducted between August and September 2023, was undertaken by the Young Neurosurgeons Committee of the Turkish Neurosurgical Society. An online survey comprising 37 questions across four sections—demographics, workplace circumstances, surgical practices, and educational satisfaction—was crafted utilizing the Google Forms application (see Table I for details). Subsequently, the survey was disseminated to residents through both personal email addresses (n= 357) and the department's WhatsApp group (n= 62). To assess the evolving practical application and working hours, data were systematically gathered from each post-graduate year (PGY) within the training program, without imposing restrictions on the number of participants from each program. The survey's overarching objective was to encompass at least 60% of the programs in Turkey authorized to provide neurosurgery residency training, ensuring the robustness of the sample group.

The survey encompassed diverse question categories, including demographic information (age, gender), type of training program, independently performed surgical procedures, satisfaction with night shift rest, evaluation of educational activities, and post-specialization career plans. Inquiries aimed at discerning the characteristics of training programs, such as the number of residents, attending physicians, implementation of night shift rest, and the count of residents who resigned in the last year, regulated responses from multiple participants in the same program as a unified response.

Practical procedures were bifurcated into two groups: minor and major interventions. Minor interventions encompassed bedside procedures in intensive care and emergency services, involving specific parts of the operation, diagnostic procedures, and spinal injections. In this study, ordinal variables were used to enable participants to express themselves more easily regarding of procedures performed and to enhance the

Table I: Questions Asked in the Survey and Possible Responses Allowed

Question	Allowed Responses
How old are you? (Years)	Numbers
What year of your residency are you in?	1, 2, 3, 4, 5
What is the type of your residency institution?	Goverment Univesty Hospital, Research and Training Hospital, Private University Hospital
Information About Institution	
How many residents are currently enrolled in your residency program?	Numbers
How many attending surgeons are currently employed by your residency program?	Numbers
How many residents resigned from your residency program in the past year?	Numbers
How many night shifts are currently required for your residency program?	Numbers
Does your residency program have a post-night shift rest policy?	Yes, No
Do you find your residency program's post-night shift rest policy helpful?	Yes, No
Minor Surgical Practice (*How many times have you performed the following procedures and surgical steps as the primary surgeon?)*	None, Less than 15, More than 15
Burr-Hole	
External ventricular drainage/ICP monitoring/reservoir	
Craniotomy	
Cranioplasty	
Stereotactic/Navigation biopsy	
Lumbar drainage	
Laminectomy	
Pain injection	
Diagnostic endovascular procedures	
Major Surgical Practice (*How many times have you performed the following procedures and surgical steps as the primary surgeon?)*	None, Less than 15, More than 15
Chronic subdural haematoma/ epidural haematoma evacuation	
Supratentorial tumour excision	
Posterior Fossa Lesions Surgery (Including Bone Decompression)	
Aneurysm Surgery	
Shunting Procedures	
Cervical Disc Disease/Spondylosis (Anterior Approachs)	
Cervical Disc Disease/Spondylosis (Posterior Approachs)	
Laminotomy/Laminectomy for Lumbar Disc Disease/Spondylosis	
Decompression/Fusion for Thoracolumbar Spinal Trauma	
Spinal Tumor Surgery	
Epilepsy Surgery	
Peripheral Nerve Surgery (Excluding Median Nerve Decompression)	
Meningocele or Meningomyelocele Repair	
Transsphenoidal or Transcranial Approaches for Pituitary Adenomas	
Skull Base Tumour Surgery	
Cerebellopontine Angle Tumour Surgery	
Assessment of Training	
How would you rate the following aspects of your training?	Excellent, Good, Average, Poor , Very poor
Theoretical Training	
Practical Training	
Do you have any thoughts of working abroad after your residency training?	Yes, No, Undecided

reliability of the statistical analyses. The number of procedures performed was assessed across three categories: 0, 0-15, and 15+. Notably, the case volume figures solely represented independently performed procedures, acknowledging that assuming comprehensive responsibility and managing the stress of a surgical procedure from inception to completion is integral to the learning process.

Statistical analyses of the obtained results were conducted based on the type of program. Participants were stratified into three subgroups according to postgraduate years: the first two years (PGY1&2), the third year (PGY 3), and the last two years (PGY 4&5). Participant satisfaction with theoretical and practical training was evaluated employing a 5-point Likert scale. Due to the limited number of participants from the private university hospital, they were excluded from statistical tests.

Statistical Analysis

Statistical analyses were performed using IBM SPSS (version 22.0, IBM Corp.). Chi-square, man Whitney u, t student tests were used to compare groups. Correlation analysis was performed using Spearman's correlation coefficient test. A threshold value of $p<0.05$ was defined for statistical significance.

RESULTS

The demographic and essential characteristics of the study participants are summarized in Table II. At the end of the survey period, data were collected from 35% (n=276) of residents. Residents from a total of 83 training programs were approached, of which responses were garnered from 73 training programs, yielding an impressive response rate of 88%. The mean age of participants was 29 ± 3 years, with the majority being male participants (n=218). The average age at the commencement of residency training was 27 ± 2 years. Based on the type of residency program, participants were stratified into government university hospital (GUH), training and research hospital (TRH), and private university hospital (PUH) categories, comprising 152 (55%), 118 (42.7%), and 6 (2.1%) participants, respectively. The sample was well-balanced across each training year.

The average number of residents per program was 10 ± 6 (range = 1–31). During the survey period, 61 residents resigned from specialization training, constituting 26% of those who had initiated the residency program in the past year. A statistically significant but weak correlation ($p<0.01$) was observed between the number of residents and resignation rates. The average number of attending surgeons in educational clinics was 5 ± 2, which showed a statistically significant and moderately positive correlation with the number of residents ($p<0.01$).

Table III presents the data for the minimum and maximum hours per month for night shifts based on the PGY. While university hospitals demonstrated a well-distributed pattern based on education years, TRHs tended to concentrate more in the early postgraduation period (Figure 1). Post-night shift rest was adequately implemented in 82.1%, 74.2%, and 66.7% of TRHs, GUHs, and PUHs, respectively, with a significant difference observed among program types ($p=0.02$). The majority of participants (84%) found post-night shift rest beneficial, with no significant differences in terms of sex, education years, or program type. However, 11% of participants who received a post-night shift leave and 34% of those who were not subjected to this leave believed this practice was not beneficial.

Table IV presents a summary of the distribution of the minor and major interventions performed by participants across PGY levels. In the minor procedures group, the independent application rate for low-risk interventions (external ventricular drain/intracranial pressure [EVD/ICP] monitoring, burr hole trepanation, supratentorial craniotomy, lumbar drainage, laminectomy) was approximately 50% in PGY 3 and 80% in PGY 4 and 5. Burr hole procedures were the most frequently performed minor procedure, independently performed by 83% and 90% of PGY 3 and PGY 4 and 5 students, respectively (Figure 2). Specific interventions, such as stereotactic biopsy, spinal injection procedures, and diagnostic endovascular interventions, were performed in only some training programs due to equipment inadequacy and a lack of attending subspecialists. However, residents involved in training programs performing these specific procedures exhibited high rates of independent performance in the early years. Half of the PGY 4

Table II: Baseline Characteristics of the Study Participant (n=276)

Characteristic	Value
Mean Age	29 ± 2.7 (Male)
	28 ± 2.4 (Female)
Gender, n (%)	
Male	218 (79.3)
Female	58 (20.7)
Programme Type, n (%)	
Government University Hospital	152 (55.4)
Training and Research Hospital	118 (42.7)
Private University Hospital	6 (2.1)
Post Graduate Year (PGY), n (%)	
PGY 1	59 (21.4)
PGY 2	58 (21.0)
PGY 3	53 (19.2)
PGY 4	45 (16.3)
PGY 5	61 (22.1)
Do you find your residency program's post-night shift rest policy helpful?	
Yes	223 (80.8)
No	53 (19.2)

and 5 residents independently performed >15 procedures for subdural/epidural hematoma, shunting, lumbar disc disease, and thoracic-lumbar trauma surgery (Figure 2); a quarter of the PGY 4 and 5 group independently performed interventions for supratentorial and posterior fossa lesions, as well as anterior/posterior cervical procedures. Approximately 40%–60% of the PGY 4 and 5 group did not perform other major interventions (aneurysm, pituitary adenoma, spinal tumor, and peripheral nerve surgery). In the PGY 1 and 2 group, approximately half of the residents independently performed various basic procedures at least once (EVD = 68%, burr hole = 49%, craniotomy = 44%, lumbar drainage = 55%). Other frequently performed procedures included shunt procedures (36%), laminectomy (27%), and spinal instrumentation (23%).

Resident training is primarily provided in GUHs and TRHs. On comparing practical applications between these educational institutions, we found that residents of TRHs demonstrated advantages in most practical applications, with significant differences observed ($p<0.05$) for interventions such as burr hole, craniotomy, laminectomy, subdural/epidural hematoma, thoracolumbar trauma, and aneurysm (comparisons primarily involved the PGY 4 and 5 group).

Overall, participants rated their theoretical education as moderate, while practical training was perceived as average to good. GUHs proved more advantageous for academic training, whereas TRHs demonstrated superiority in practical training. There were no statistically significant differences in participant satisfaction with theoretical and practical training, and these responses did not vary by age, sex, or PGY level.

Notably, 41% of participants expressed intentions to pursue their professional careers abroad after completing PGY training, while only 24% planned to practice in Turkey, with no significant differences in terms of age, sex, or institution type.

DISCUSSION

This study provides a comprehensive overview of the characteristics of neurosurgery residents practicing in Turkey, the extent of independence allowed in practical training, case volumes, working conditions, and satisfaction with training. The findings of this research are anticipated to contribute not only to the national context but also to the broader international implementation of neurosurgical residency programs.

Specialty training programs in neurosurgery vary widely across countries, each having its unique structure and duration. Some nations mandate general surgery training before commencing neurosurgical education, while others focus exclusively on neurosurgery from the outset (9,11,14). In Turkey, the curriculum and instructional authority for neurosurgery are regulated by the Board of Medical Specialization. Admission to a residency program is contingent on success in the local board exam, and interviews are not required as part of the acceptance process. Although the official duration of training is stipulated as five years, residents often extend their training by 6–12 months for multiple reasons, such as gaining more experience, enhancing academic performance, or pursuing fellowships. The early stages of residency are characterized by long working hours, frequent night shifts (working 36 hours, followed by 12 hours of rest, and night shifts decrease paral-

Table III: Monthly Night Shift Hours by Post Graduate Years (Hours)

	PGY-1	PGY-2	PGY-3	PGY-4	PGY-5
Goverment University Hospital	130.76	128.50	112.00	107.83	105.76
Training and Research Hospital	124.69	120.62	114.09	100.36	91.56
Overall	127.19	124.97	112.30	104.18	101.77

PGY: *Post graduate year.*

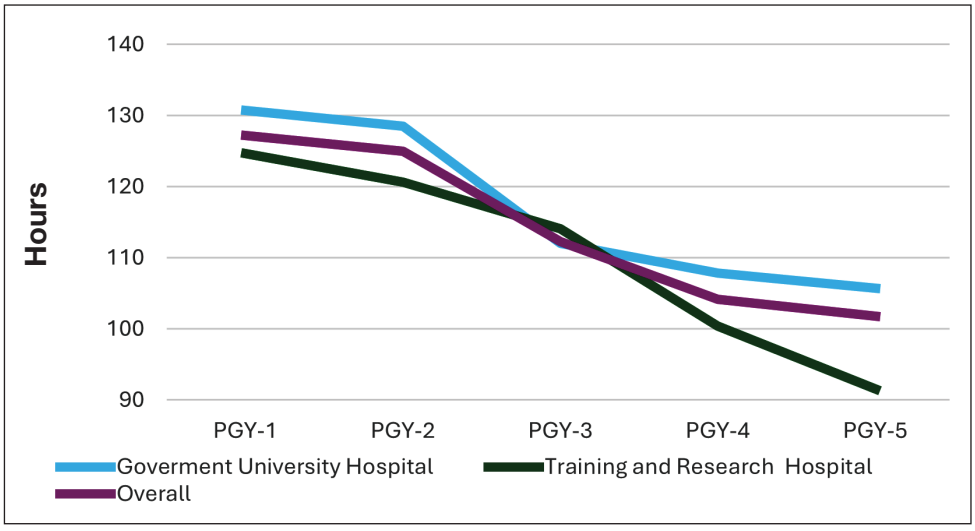

Figure 1: Distribution of monthly night shift hours by post graduate years (PGYs).

Table IV: The Distribution of the Total Number of Minor and Major Interventions Performed

	EVD/ICP-monitoring			Burr hole			Craniotomy (supratenoriyal)			Cranioplasty			Stereotactic/ Navigation Biopsi			Lumbar Drainage			Laminectomy			Spinal injection procedures			Diagnostic DSA		
	0	0-15	15+	0	0-15	15+	0	0-15	15+	0	0-15	15+	0	0-15	15+	0	0-15	15+	0	0-15	15+	0	0-15	15+	0	0-15	15+
PGY 1 &2	18%	68%	14%	20%	49%	32%	41%	44%	15%	70%	27%	3%	93%	6%	1%	27%	55%	18%	61%	27%	12%	72%	18%	10%	94%	4%	2%
PGY 3	0%	43%	57%	0%	17%	83%	4%	30%	66%	15%	74%	11%	72%	28%	0%	9%	38%	53%	8%	53%	40%	51%	17%	32%	81%	9%	9%
PGY 4 &5	0%	22%	78%	0%	10%	90%	1%	13%	86%	12%	42%	45%	61%	26%	12%	10%	18%	72%	7%	20%	74%	36%	20%	44%	91%	0%	9%

	Chronic subdural/ epidural haematoma			Supratentorial Tumours and Lesions			Posterior Fossa Lesions			Aneurysm			Shunting procedure			Cervical Disc Disease: Anterior			Cervical Disc Disease: Posterior			Lumbar Disc Disease Laminectomy		
	0	0-15	15+	0	0-15	15+	0	0-15	15+	0	0-15	15+	0	0-15	15+	0	0-15	15+	0	0-15	15+	0	0-15	15+
PGY 1 &2	50%	44%	7%	85%	12%	3%	90%	9%	2%	97%	3%	0%	60%	36%	4%	85%	14%	2%	89%	9%	2%	72%	22%	6%
PGY 3	6%	62%	32%	60%	38%	2%	66%	34%	0%	94%	6%	0%	25%	58%	17%	72%	25%	4%	75%	25%	0%	30%	49%	21%
PGY 4 &5	4%	35%	61%	22%	56%	23%	24%	54%	23%	75%	21%	4%	7%	39%	55%	29%	47%	24%	28%	47%	25%	10%	33%	57%

	Spinal Trauma: Instrumentation			Spinal Tumours			Surgery for Epilepsy			Peripheral Nerve (expect CTS)			Meningomyelocele			Pituitary adenomas			Skullbase Surgery			PCA Surgery		
	0	0-15	15+	0	0-15	15+	0	0-15	15+	0	0-15	15+	0	0-15	15+	0	0-15	15+	0	0-15	15+	0	0-15	15+
PGY 1 &2	74%	23%	3%	88%	10%	2%	100%	0%	0%	79%	17%	3%	88%	10%	2%	96%	3%	2%	93%	5%	2%	98%	2%	0%
PGY 3	38%	47%	15%	74%	26%	0%	92%	8%	0%	47%	32%	21%	74%	25%	2%	91%	9%	0%	89%	11%	0%	94%	6%	0%
PGY 4 &5	23%	29%	48%	40%	50%	10%	83%	17%	0%	41%	40%	20%	50%	43%	7%	68%	26%	6%	61%	30%	8%	74%	23%	4%

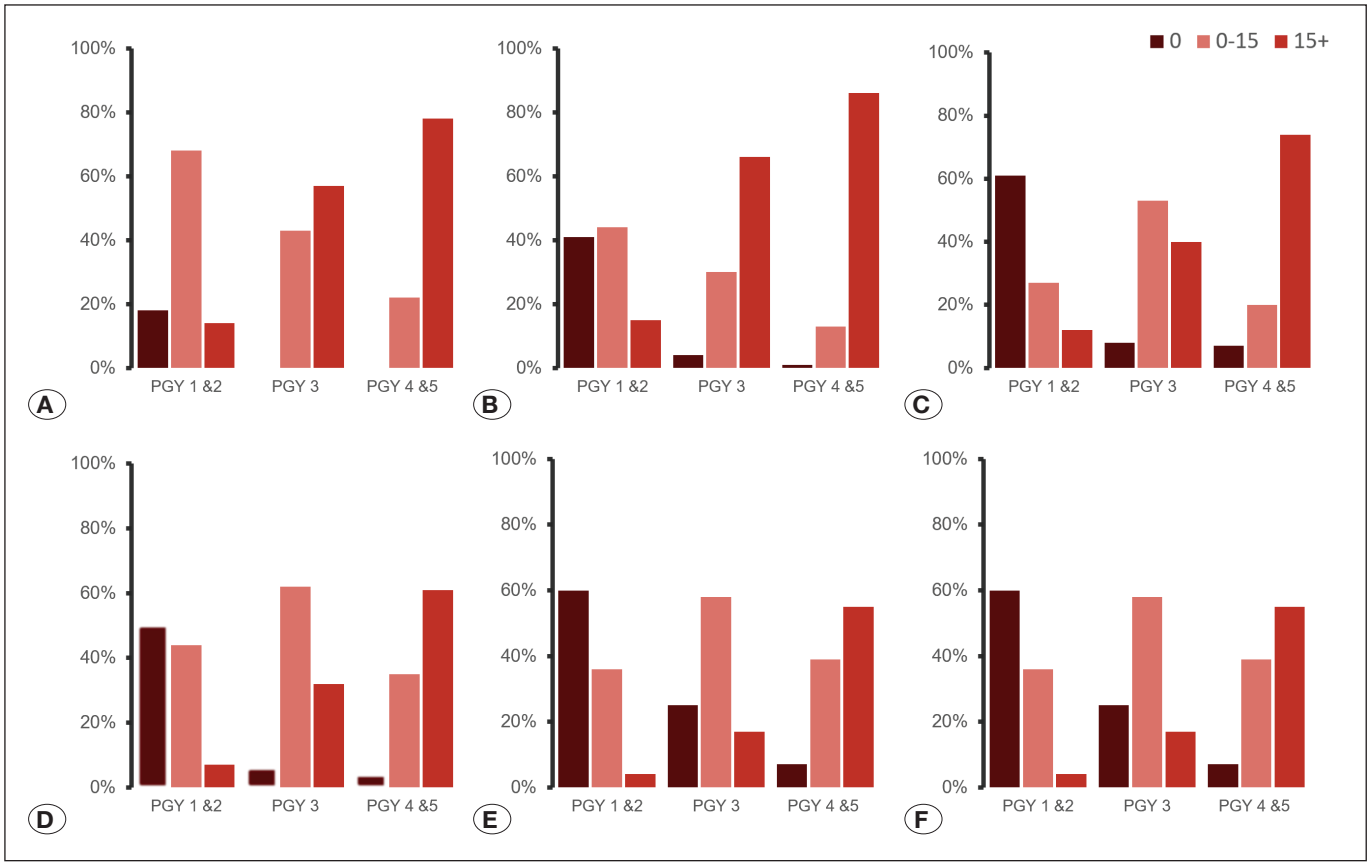

Figure 2: The distribution of the percentage of minor and major surgeries performed, stratified by PGY's groups. **A)** EVD/ICP-monitoring, **B)** supratentorial craniotomy, **C)** laminectomy, **D)** subdural/epidural hematoma, **E)** shunting, **F)** thoracic-lumbar trauma surgery.

lel to the training year), pre/postoperative patient care outside the operating theater (OT), and ward responsibilities. As residents progress through their PGYs, the emphasis gradually shifts toward OT. A legal regulation implemented in Turkey in September 2022 restricts residents to a maximum of 8 night shifts per month and prohibits their participation in health service delivery on the day following a night shift. Despite being a recent development, the implementation rates for this restriction are relatively high compared to other countries (12). This regulation is anticipated to reduce total working hours by approximately 25%–30% over the five-year training period. Similar regulations in developed countries have demonstrated a decrease in exposure to OT prompting the need for new curricula to enhance early exposure to OT (7,14). We observed that post-night shift rest was more widely implemented in TRHs compared to other educational programs; this trend may be attributed to the strong affiliation of TRHs with governmental institutional mechanisms.

Previous European studies on similar restrictions have indicated that this practice led to a significant decrease in residents' case volumes (almost 65 cases less per year). In our survey, 84% of participants perceived the restrictions as beneficial, which underscores the positive potential of making post-night shift rest a universal practice across all educational programs. However, with night shift rest, the duration of the training program was reduced by 66%. Interestingly, in our study, the acceptance of these restrictions was inversely proportional to PGYs, indicating that residents in the early training period require more rest due to heightened workload (PGY 1: 91.5%, PGY 2: 87%, PGY 3: 84%, PGY 4: 77%, PGY 5: 77%). Conversely, senior residents may exhibit reluctance to move away from the OT, aligning with findings from a European study conducted by the EANS (12).

Determining the optimal case volume for neurosurgical residency training is a complex task due to the dynamic nature of the field, individual variations in performance, and resource limitations. Reulen and Marz recommended an annual caseload of 250–300 cases per resident, while another study from the United States suggested an annual case index of approximately 500 cases per resident (3,10). However, individual performances exhibit significant variations despite these guidelines (1). The lack of OT experience has prompted residents to explore alternative training methods, such as cadaver courses and simulation training, which enhance anatomical and technical knowledge; however, practitioners have emphasized low satisfaction rates with these applications (4). Additionally, while these applications enhance anatomical and technical knowledge, practitioners have emphasized their low satisfaction rates (12). In this regard, the crucial role of performance-related stress and independent decision-making in practical training must be acknowledged, highlighting the importance of evaluating only separately performed procedures in our study. It was observed that most residents rarely performed major surgeries independently, except for minor operations and primary surgical cases, such as hematoma evacuation, lumbar discectomy, laminectomy, burr hole, and shunt. The rate of first independent surgery performed by PGY 1 was 71% for EVD/ICP catheter placement, 31% for hematoma evacuation, 25% for shunt, and 19% for lumbar surgery, which concur with the findings reported by Stienen et al. (12). The decline in independently performed procedures may not solely be attributed to the restricted working hours; factors such as the expanding influence of private healthcare industry, decreasing prevalence of neurosurgery patients in certain subspecialties, and an increase in the number of residents exceeding population growth, contribute to this decline (13,14).

Comparisons between TRH and GUH indicate that although TRHs have more surgical procedures, there was no statistically significant difference. The inclination of young attending surgeons to work in TRHs to compensate for their lack of experience creates a cyclic challenge for residency training. Furthermore, this behavioral pattern suggests that even after the official training period concludes, the trainee may extend their residency until they feel adequately prepared.

The evolution of interdisciplinary approaches and the incorporation of modern medical practices into neurosurgery has led to many uncertainties regarding the essential skill set that should be acquired during training. The increasing trend toward early specialization and sub-specialization in postgraduate neurosurgery education is concerning and may lead to over-specialization, potentially distancing practitioners from general brain surgery, and fostering reluctance or lack of motivation among trainees for cases they may not encounter in their future careers.

Participants in this study generally graded their theoretical training as moderate. While there was a more positive trend for satisfaction with theoretical education among young residents (PGY 1 and 2), it was not universally decisive. Satisfaction with theoretical education at GUHs was associated with its abundant educational infrastructure and extensive facilities. At GUHs, high academic performance may contribute to increased satisfaction with theoretical education during residency (15). Satisfaction with practical training was higher in TRHs, reflecting the consequences of higher case volumes and greater practical opportunities.

The study also revealed a resignation rate of 26% within the last year, which is comparatively high compared to previous national and international studies (2,8). The primary reasons cited for resignation were heavy workload and long work hours. The number of residency positions at the national level has increased in recent years, making residency positions more accessible. This ease of accessibility may lead candidates to choose the neurosurgery specialty without a full understanding of its challenging nature. From another perspective, the increase in the number of neurosurgical trainees can be a boon if managed carefully; however, if not properly regulated, it could become a bane, leading to diminished training quality. Balancing the need for more neurosurgeons with the realities of training capacity and job availability is crucial to ensuring that the field remains robust and that trainees are well-prepared for successful careers. Additionally, we observed a statistically significant but weak correlation between the number of residents and resignation rates, suggesting that while there is a relationship, it is not strong enough to imply

that the increase in the number of residents was the primary driver of resignations. This weak correlation could also indicate the role of other socio-economic factors and inadequate experience in influencing resignation decisions.

The demanding, challenging, patience-requiring, yet highly motivating nature of neurosurgery leaves little time to address other socio-economic issues; however, often, these problems force individuals to seek change. Notably, only one in four residents intended to continue practicing in their current location, highlighting the need for further exploration of factors influencing career choices and geographical preferences among neurosurgery residents in Turkey.

This study shares common limitations inherent to survey-based research. Achieving a nuanced and finely tuned analysis of responses, marked by precise accuracy, was regrettably unattainable. The amalgamation of responses into predefined ranges for the number of surgeries performed, and the exclusive focus on independently executed surgical practices, offered participants the scope to express their responses qualitatively, rather than relying solely on numerical values. However, this ordinal classification was not without its inherent drawbacks. The categorization of procedures into minor and major groups was designed based on the perception of daily neurosurgical practice, and this differentiation may not necessarily align with the medical significance of each procedure.

In survey studies, securing a representative sample group is critical. Opting for a proactive approach, we chose to actively engage with potential participants rather than relying on their voluntary participation, which allowed us to reach a cohort that could more accurately mirror the diversity of the general population, as opposed to a specific group with a proclivity for training activities. These results, when isolated from this subgroup, were also diligently examined and discussed in the subsequent sections.

CONCLUSION

It is not easy to define boundaries in neurosurgical training and resident education constitutes the most crucial step in this challenging process. In Turkey, post-night shift rest is implemented in the majority of training programs, and most residents find it beneficial. Approximately half of senior residents adequately apply general neurosurgery practices. However, it was perceived that resting after shifts could further shorten the overall training period and negatively impact the already low case numbers for residents; therefore, training programs must be organized and standardized accordingly to mitigate this. The fact that only 24% of residents plan to practice their profession in Turkey is concerning and may prove detrimental to the continuity of neurosurgery services at the national level.

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Appendix

* Contributors of the "Turkish Young Neurosurgeons Board and Resident Representatives Committe" (listed in alphabetical order):

Turkish Young Neurosurgeons Board

- Ahmet Can Özak
- Ali Ekrem Adıyaman
- Atakan Emengen
- Bilgehan Potoğlu
- Çağhan Tönge
- Eyüp Bayatlı
- Pınar Kuru Bektaşoğlu
- Samet Dinç
- Serdar Onur Aydın
- Yücel Doğruel

Resident Representatives Committe

- Arda Topçu
- Ahmet Özdemir
- Barış Altun
- Cemre Eren
- Cihat Karagöz
- Doruk Taş
- Ecem Engin
- Ege Tanyeli
- Eren Kocakaplan
- Eren Taşkın
- Fatih Koç
- Ferhat Arslan
- Gülseli Berivan Sezen
- Halil Emre Alcan
- Hüseyin Ömer Keskin
- Kaan Özalpay
- Mehmet Akif Erbaş
- Mehmet Berat Erturhan
- Mehmet Özer
- Mert Çerçi
- Muhammed Zahid Aslan
- Mustafa Türkmen
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- Oğuzhan Uzlu
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AUTHORSHIP CONTRIBUTION

Study conception and design: TT, PK

Data collection: CK, ED, HSU, IA, ST, SG, SCC

Analysis and interpretation of results: TT, AK

Draft manuscript preparation: TT, SKD, CU

Critical revision of the article: IDC, PK

Other (study supervision, fundings, materials, etc...): YEO, CU, TT, PK

All authors (TT, CU, SKD, AK, IDC, YEO, CK, ED, HSU, IA, ST, SG, SCC, PK) reviewed the results and approved the final version of the manuscript.

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