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BRAIN DRAIN IN HEALTHCARE: CAREER PROSPECTS AND MIGRATION INTENTION AMONG ANESTHESIA TECHNOLOGY GRADUATES IN PESHAWAR, PAKISTAN

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Abstract

Background and Objectives: Anesthesia technology graduates play a crucial role in perioperative and critical care services, yet little is known about their career prospects and migration intentions. This study aimed to assess perceived career prospects and migration intentions, and to identify push factors among anesthesia technology graduates in Peshawar, Pakistan. Methodology: A cross-sectional study design was employed, involving 244 anesthesia technology graduates. Convenience sampling design was chosen, and data were collected using a structured, self-administered questionnaire. The data were collected from anesthesia technology graduates who were working or training at various hospitals and educational institutions in Peshawar. The questionnaire consisted of four sections: demographics, perceived career prospects, migration intention, and push factors. Data analysis was carried out using IBM SPSS version 27. Results: We found that migration intention is very high (88.9%, Mean = 4.42 ± 0.58), indicating that most participants strongly intend to migrate. Push factors are also high at 68.9% (Mean = 3.90 ± 0.78), indicating that respondents have strong reasons to migrate. In contrast, perceived career prospects are low to moderate, at 30.3% and 45.9%, respectively (Mean = 2.88 ± 0.98), suggesting that participants are generally not satisfied with their career prospects. Overall, the findings indicate that low career prospects and high push factors are associated with a very strong intention to migrate. Conclusions: The participants were generally not satisfied with career prospects, job opportunities, professional recognition, career advancement, and long-term professional stability in the local healthcare structure. The intention to migrate among the study participants was very high, with 88.9% of respondents intending to emigrate abroad. The majority of participants indicated that they often consider going abroad for work, have

migration intentions for later in life, and would emigrate if opportunities arose. The study participants strongly felt that professional advancement opportunities, salaries, training, and living standards are better abroad than in Pakistan.

Introduction

Brain drain refers to the migration of highly skilled and educated individuals from their home countries to seek better employment opportunities, higher salaries, improved living conditions, quality education, and career advancement abroad [2,3]. The term was first introduced by the Royal Society of London in the 1950s to describe the migration of intellectuals to North America [4]. According to the International Organization for Migration (IOM), brain drain is the movement of educated and talented individuals that results in a reduction of skilled human resources in the country of origin [2]. Healthcare worker (HCW) migration from low- and middle-income countries (LMICs) to high-income countries (HICs) is a major global concern, driven by factors such as better salaries, working conditions, career opportunities, inadequate healthcare systems, political instability, and limited professional growth in source countries [5]. The United States, United Kingdom, Canada, and Australia remain major destinations for healthcare professionals, with 40–75% of practicing physicians in these countries originating from LMICs [4].

The migration of healthcare professionals has significant consequences for source countries, particularly those already experiencing workforce shortages [6]. A projected global shortage of nearly 18 million healthcare workers by 2030 is expected to affect LMICs most severely [5]. In Africa, which bears 25% of the global disease burden, only 1.3% of the global healthcare workforce is available [6]. Similar concerns exist worldwide, with increasing migration of physicians and nurses from developing countries to wealthier nations [7,8]. Although healthcare worker migration cannot be completely prevented, effective policies are required to minimize its negative impact on healthcare systems and economic development in source countries [10].

Pakistan's healthcare system follows a three-tier structure comprising primary, secondary, and tertiary care. However, chronic underfunding, inadequate infrastructure, shortages of medicines and equipment, and insufficient numbers of healthcare professionals continue to challenge service delivery [11,12]. Approximately 32,897 doctors graduate annually in Pakistan, yet around 40% seek opportunities abroad [13]. Between 1971 and 2022, more than 50,000 healthcare professionals, including doctors, nurses, and pharmacists, emigrated from Pakistan [14].

Anesthesia professionals play a critical role in perioperative care, intensive care, pain management, and patient safety [15]. Despite their importance, there is a substantial global shortage of anesthesia providers, particularly in LMICs [17]. The World Federation of Societies of Anesthesiologists reported a global anesthesia workforce density of 8.8 providers per 100,000 population in 2024, whereas Pakistan had only 1.48 physician anesthesia providers per 100,000 population [20]. This shortage is further aggravated by workforce migration, inadequate infrastructure, high workloads, limited professional recognition, and restricted career development opportunities [21,22].

In Pakistan, non-physician anesthesia providers (NPAPs), including anesthesia technologists and technicians, play an essential role in delivering anesthesia services, particularly in secondary, tertiary, and rural healthcare facilities [18,19,23]. Given the persistent shortage of physician anesthesia providers and the increasing reliance on NPAPs, retaining qualified anesthesia technology graduates is crucial for maintaining safe and effective anesthesia services. However, little is known about the migration intentions and perceived career prospects of anesthesia technology graduates in Pakistan. Understanding these factors is essential for developing strategies to improve workforce retention and strengthen the healthcare system. Therefore, this study aims to assess migration intentions, perceived career prospects, and factors influencing the brain drain of anesthesia technology graduates in Peshawar.

Methodology

This descriptive cross-sectional study was conducted over four months in public and private hospitals and educational institutions across Peshawar. Data were collected from anesthesia technology graduates working in healthcare facilities, tertiary care hospitals, educational institutions, as well as trainees, interns, and unemployed graduates.

The sample size was calculated using Cochran's formula for estimating a single population proportion, assuming a prevalence of 67.5%, a 95% confidence level, and a 6% margin of error, resulting in a required sample of 242 participants [4]. A non-probability convenience sampling technique was employed due to the absence of a central registry of anesthesia technology graduates.

Eligible participants included anesthesia technology graduates employed in government or private hospitals, working as faculty members, trainees, interns, or currently unemployed. Graduates unwilling to participate were excluded from the study.

Data were collected using a structured self-administered questionnaire developed through an extensive literature review and validated for relevance and content. The questionnaire consisted of four sections: demographic characteristics, perceived career prospects, migration intention, and push factors influencing migration.

After obtaining approval from the institutional research committee, participants were informed about the study objectives and provided informed consent. Confidentiality and ethical standards were strictly maintained throughout the study. Completed questionnaires were checked for completeness and coded before analysis.

Data were analyzed using IBM SPSS version 27. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize the data. Scores for perceived career prospects, migration intention, and push factors were categorized as low, moderate, and high.

Results

A total of 244 anesthesia technology graduates participated in the study. Data were analyzed using IBM SPSS version 27.

Sociodemographic Characteristics

The majority of participants were aged 31–40 years (52.0%), followed by 20–30 years (38.1%). Participants aged above 40 years constituted only 9.8% of the sample. Most respondents were male (92.6%) and single (68.0%).

Regarding professional status, 77.0% were working as anesthesia technologists/technicians, 14.8% were trainees/interns, 5.7% were lecturers, and 2.5% were unemployed. More than half of the participants were employed in private hospitals (50.8%), followed by government hospitals (35.7%) and educational institutions (13.5%).

Most respondents belonged to lower- and middle-income categories, with 44.3% earning PKR 50,000–100,000 per month and 40.2% earning less than PKR 50,000. Only 15.5% reported earning more than PKR 100,000 monthly. Furthermore, 32.8% had a family member living abroad, while only 12.3% reported previous work experience abroad.

Table 1: ***Sociodemographic Characteristics of Participants (N=244)***

Variable	**Category**	**n** (%)
Age	20–30 years	93 (38.1)
	31–40 years	127 (52.0)
	41–50 years	15 (6.1)
	>50 years	9 (3.7)
Gender	Male	226 (92.6)
	Female	18 (7.4)
Marital Status	Single	166 (68.0)
	Married	78 (32.0)
Workplace	Government Hospital	87 (35.7)

Variable	Category	n (%)
	Private Hospital	124 (50.8)
	University/Institute	33 (13.5)

Perceived Career Prospects

The overall mean score for perceived career prospects was 2.88 ± 0.98, indicating a low perception of career opportunities in Pakistan. All five items scored below the midpoint of the scale (3.0). Participants reported limited job opportunities (Mean=2.89), insufficient professional growth opportunities (Mean=2.82), inadequate professional recognition (Mean=2.92), and uncertainty regarding long-term career prospects (Mean=2.83).

When categorized, 30.3% of participants reported low career prospects, 45.9% moderate career prospects, and only 23.8% perceived high career prospects.

Migration Intention

Migration intention demonstrated the highest mean score among all constructs (Mean=4.42 ± 0.58), indicating a very strong desire to migrate abroad. The highest-rated statement was "I would migrate if possible" (Mean=4.50), with 60.2% strongly agreeing. Participants also strongly agreed that better employment opportunities (Mean=4.45) and better living conditions (Mean=4.45) were available abroad.

Overall, 88.9% of participants were classified as having high migration intention, while only 0.8% demonstrated low migration intention.

Push Factors

Push factors showed a high overall mean score (3.90 ± 0.78), suggesting that unfavorable local conditions substantially contributed to migration intentions. Low salary emerged as the strongest push factor (Mean=4.29), with 90.1% of respondents agreeing or strongly agreeing that it encouraged migration. Limited training opportunities (Mean=4.07), political and economic instability (Mean=3.84), and high workload and stress (Mean=3.77) were also important contributors.

Overall, 68.9% of respondents experienced high levels of push factors, while only 4.1% reported low levels.

Table 2: ***Summary of Study Constructs***

Construct	Mean ± SD	Low n (%)	Moderate n (%)	High n (%)
Perceived Career Prospects	2.88 ± 0.98	74 (30.3)	112 (45.9)	58 (23.8)
Migration Intention	4.42 ± 0.58	2 (0.8)	25 (10.2)	217 (88.9)
Push Factors	3.90 ± 0.78	10 (4.1)	66 (27.0)	168 (68.9)

Association Analysis

Chi-square analysis identified three statistically significant associations. Participants with prior work experience abroad showed significantly different migration intentions compared to those without such experience (χ^2=9.291, p=0.010). Workplace type was significantly associated with perceived career prospects (χ^2=10.652, p=0.031), with university employees reporting more favorable career prospects than hospital-based staff. Family member status abroad was significantly associated with push factors (χ^2=9.831, p=0.007).

No significant associations were observed between migration intention, career prospects, or push factors and age, gender, marital status, or monthly income (p>0.05).

Table 3: ***Significant Chi-Square Associations***

Variable	Outcome	χ^2	p-value
Prior Work Experience Abroad	Migration Intention	9.291	0.010
Workplace Type	Career Prospects	10.652	0.031
Family Member Abroad	Push Factors	9.831	0.007

Migration intention remained consistently high across all age groups, ranging from 82.8% among respondents aged 20–30 years to 100% among those older than 40 years, indicating that age had minimal influence on the desire to migrate abroad.

Discussion

The study aimed to find out the perceived career prospects and migration intention among anesthesia technology graduates in Peshawar, Pakistan. The result offers valuable insight into the profession of anesthesia technology graduates in the local healthcare system. The results indicate that migration intention is very high, with low to moderate career prospects. Push factors were also high among the participants.

The majority were between the ages of 31 and 40 years (52.0%), followed by those between the ages of 20 and 30 years (38.1%), while fewer were above 40 years. The majority were male (92.6%) and unmarried (68.0%). In their current role, most were technologists/technicians (77.0%). Private hospitals (50.8%) and government hospitals (35.7%) were the most common workplaces, with the remaining 13.5% of participants working in universities/institutes. Most earned between 50,000–100,000 PKR (44.3%), while 40.2% earned less than 50,000 PKR. In addition, 32.8% of them had family members abroad, but just 12.3% had prior work experience overseas. Overall, the participants are mainly young, male, and hospital-based healthcare workers, mainly in the private sector, with moderate income levels.

From our findings, 88.9% (Mean = 4.42 ± 0.58) of anesthesia technology graduates intended to emigrate, which is consistent with other similar studies on brain drain in healthcare [35] [4]. Our findings are also consistent with similar emigration studies in Ireland and Nigeria. [43, 44]. These studies, however, focus on the physician brain drain and report emigration intention between 60-90 %. Our study focuses on anesthesia technology graduates and is the first study of its kind. Our findings indicate a very high level of emigration intention among anesthesia technology graduates. The majority of respondents actively thought about emigration and would emigrate if they were offered the opportunity.

The study showed that the perceived career prospects among anesthesia technology graduates were low to moderate (mean = 2.88 ± 0.98). Low salary, limited training, lack of healthcare infrastructure, high workload, and stress seem to be associated with low to moderate career prospects. On the question if anesthesia technology graduates had good career prospects, 38.5 % participants disagreed, while on sufficient job opportunities, 41.8 % disagreed. 39.8 % participant indicated that they do not see a long-term future in anesthesia in Pakistan. These results are similar to other studies regarding low levels of job satisfaction and appreciation in Pakistan [38] [21]. Although our findings on recognition and appreciation are mixed.

Ninety-one percent of respondents agreed or strongly agreed that low salary was the main push factor. Limited training and career opportunities followed with 84.6 %, high workload and stressful working conditions with 68.8 % agreement. Sixty-seven percent of respondents agreed that political instability is also among the push factors. The last push factor, “lack of equipment and resources,” had 59% agreement. The mean score for push factor was 3.90 ±078. These findings indicate that anesthesia technology graduates foresee strong push factors in the local healthcare system to compel them to emigrate. These findings are consistent with national and international studies regarding the factors influencing brain drain and migration. Low salary, poor working conditions, and limited professional development opportunities, among others, have been reported [26] [31].

Higher salaries in HIC countries pull the HCW abroad, with ninety-one percent of our participants choosing low salary as one of the strongest push factors. Pakistan's public health expenditure in fiscal year 2024-25 was 0.9 % of the GDP [45]compared to Egypt’s 5.5 % and Libya’s 3.3 % in the last few years [4], which is very low compared to the WHO recommendation of 6 %of the GDP. Consequently, HIC offers high salaries, which is a strong pulling force for healthcare workers in LMIC. Financial security and self-actualization needs were also recognized by other studies to be among the push factors [31]. Our findings indicate

that these push factors are also relevant in anesthesia technology graduates.

The chi-square showed a significant relationship between previous work experience abroad and migration intention (p = 0.010). The migration intention between those who had worked abroad and those who had not. The result indicates that graduates who had no prior work experience abroad had a higher migration intention.

The other significant association was between the workplace and perceived career prospects (p = 0.031). Those respondents who served as faculty in universities and institutions felt that their career prospects were moderate to good, compared to those working in hospitals. Academic positions may offer greater professional recognition, career advancement, and employment security than clinical positions. This indicates the fact that the environment in the workplace is strongly associated with career prospects.

There was also a significant association of a family member abroad with push factors (P =0. 007). Respondents who did not have a family member overseas reported higher push factors than those who did. This can be a sign that people who have family overseas already have the migration opportunities and support system. Some earlier studies have indicated that family and social networks drive migration decisions [30].

The findings of this study show that low to moderate career prospects, stressful working conditions, low salaries, lack of recognition, high workload, political and economic instability, and lack of opportunities could be driving the desire in anesthesia technology graduates to move abroad.

Conclusion

We examined the perceived career prospects, migration intention, and influencing push factors among anesthesia technology graduates in Peshawar. We had 244 respondents, who were from public and private hospitals and educational institutions. The results provide significant information regarding anesthesia technology graduates' professional concerns and potential migration patterns.

It was found that the majority of respondents had low to moderate perceptions about their future in Peshawar, Pakistan, with 45% of participants having a moderate score and 30.3% having a low career prospects score. The mean career prospect score was (2.88 ± 0.98). The participants were generally not very satisfied with career opportunities, professional recognition, career advancement, and long-term professional stability in the local healthcare structure.

The migration intention among the study participants was very high, with 88.9% of respondents intending to emigrate abroad. The majority, almost all of the respondents, indicated that they often consider going for work abroad, have migration intention later in their life, and would emigrate if there were opportunities. The study participants strongly felt that professional advancement opportunities, salaries, training, and living standards are better abroad than in Pakistan.

The chi-square analysis indicated that the majority of demographic variables (gender, age, marital status, workplace, and monthly income) were not statistically significant with the intention of migration. In contrast, a strong relationship with migration intention was obtained with prior work experience abroad. Suggesting that respondents who have had exposure overseas are more inclined to think about migration. The workplace was strongly related to perceived career prospects, with those working in hospitals having a low career prospect score compared to those working at educational institutions. The family member abroad variable was significantly associated with push factors. Those who had a family member abroad felt low push factors compared to those who had not. Overall, anesthesia technology graduates had a high migration intention and low to moderate career prospects in Peshawar.

Recommendation

Healthcare authorities and hospital administrations should revise the salary structure for anesthesia technology graduates and provide appropriate compensation to prevent economic discontent among them. Structured career pathways, promotions, specialization opportunities, and career laddering should be introduced to encourage long-term career prospects for anesthesia professionals to see a pathway within the local healthcare system. Workshops, Certifications, and

advanced training courses in Anesthesia should be introduced by hospitals and educational institutions.

It is essential to reduce stress and burnout by ensuring safe working conditions, a manageable workload, and reasonable duty hours, all of which are supported by peers and the administration. Hospitals must provide modern anesthetic facilities, up-to-date monitors, and sufficient medical resources to support safe anesthesia practice, thereby improving job satisfaction and reducing frustration among anesthesia professionals. Professional recognition should be strengthened by formal recognition of the role of anesthesia technology graduates, involving them in the process of clinical decision-making, and incorporating them in healthcare policy development and planning.

To further motivate and retain anesthesia technology graduates, universities and healthcare institutions should offer research opportunities and academic development. A more holistic approach to retaining skilled anesthesia professionals through training and retention initiatives should be undertaken by healthcare and government policymakers to ensure that the healthcare environment in the country is as attractive and competitive as possible in the world. Conclusively, future research should be carried out on a large scale in different provinces of Pakistan to further explore the intention to migrate, job satisfaction, and retention among anesthesia professionals and other allied health workers to develop evidence-based policies at a national level.

Limitations

A cross-sectional design was used, which only captures perceptions and intentions at a single point in time, making it impossible to draw causal inferences about the relationships among career prospects, push factors, and the intention to migrate. This restricts the capacity for further measurement and for measuring changes in attitudes over time.

Non-probability sampling was used due to the lack of a central registry for anesthesia technology graduates, the results may not be representative of the entire population of anesthesia technology graduates in Pakistan.

The study was geographically limited to hospitals/institutions in Peshawar only, and the results might not be representative of other cities or provinces of Pakistan. The data were gathered using a self-administered questionnaire, which may have introduced response bias, as study participants might have over- or underreported their perceptions and intentions. In addition, respondents may have given socially desirable responses rather than their true opinions, especially to questions about their desire to move.

Lastly, the study's focus was limited to certain variables such as perceived career prospects, intention to migrate, and push factors due to time constraints. However, other potentially relevant considerations, such as pull and push factors, elaborated family influence, and psychological motivations, were not investigated in detail and may have provided a more comprehensive picture of the phenomenon of brain drain among anesthesia professionals in Pakistan.

References

1. Arfeen Z, Nash E, Rashid MA. Reliance on migrant healthcare workers in the United Kingdom: A critical discourse analysis. PLOS Glob Public Health. 2025;5[9]:e0005141.
2. Cakir S, Demirag S. Brain Drain in Healthcare: A Critical Global Issue. Mathews Journal of Psychiatry & Mental Health. 2025;10[1].
3. Bener A, Ventriglio A, Almas F, Bhugra D. Determinants of brain drain among physicians in Turkey: Findings from a national exploratory study. Int J Soc Psychiatry. 2025;71[1]:179-87.
4. Tariq Z, Aimen A, Ijaz U, Khalil KUR. Career Intentions and Their Influencing Factors Among Medical Students and Graduates in Peshawar, Pakistan: A Cross-Sectional Study on Brain Drain. Cureus. 2023;15[11]:e48445.
5. Toyin-Thomas P, Ikhurionan P, Omoyibo EE, Iwegim C, Ukueku AO, Okpere J, et al. Drivers of health workers' migration, intention to migrate and non-migration from low/middle-income countries, 1970-2022: a systematic review. BMJ Glob Health. 2023;8[5].

6. Eaton J, Baingana F, Abdulaziz M, Obindo T, Skuse D, Jenkins R. The negative impact of global health worker migration, and how it can be addressed. Public Health. 2023;225:254-7.
7. Ebeye T, Lee H. Down the brain drain: a rapid review exploring physician emigration from West Africa. Global Health Research and Policy. 2023;8[1].
8. Al-Btoush A, El-Bcheraoui C. Challenges affecting migrant healthcare workers while adjusting to new healthcare environments: a scoping review. Hum Resour Health. 2024;22[1]:56.
9. Dotsey S. Foreign Healthcare Workers and COVID-19 in Europe: The Paradox of Unemployed Skilled Labour. Social Sciences. 2023;12[4].
10. Apostu SA, Vasile V, Marin E, Bunduchi E. Factors Influencing Physicians Migration—A Case Study from Romania. Mathematics. 2022;10[3].
11. Muhammad Q, Eiman H, Fazal F, Ibrahim M, Gondal MF. Healthcare in Pakistan: Navigating Challenges and Building a Brighter Future. Cureus. 2023;15[6]:e40218.
12. Zohra Kurji ZSP, Yasmin Mithani. Analysis of the health care system of pakistan: Lessons learnt and way forward. J Ayub Med Coll Abbottabad. 2016;28[3]:601-4.
13. Khan SJ, Asif M, Aslam S, Khan WJ, Hamza SA. Pakistan's Healthcare System: A Review of Major Challenges and the First Comprehensive Universal Health Coverage Initiative. Cureus. 2023;15[9]:e44641.
14. Meo SA, Sultan T. Brain drain of healthcare professionals from Pakistan from 1971 to 2022: Evidence-based analysis. Pak J Med Sci. 2023;39[4]:921-5.
15. Zahran A, Besharieh F, Hamdan Y, Alsadder T, Jaber M, Shawahna R. Knowledge and perceptions of the roles of anesthesiologists as providers of healthcare services: toward better-educated patients. BMC Health Serv Res. 2024;24[1]:1568.
16. Woldemichael AB, Nemani ST. How the health professionals perceive anesthesia and anesthetists' role in the health delivery system at Dessie Comprehensive Specialized Hospital, a cross-sectional study. International Journal of Surgery Open. 2024;62[5]:589-95.
17. Kudsk-Iversen S, Shamambo N, Bould MD. Strengthening the Anesthesia Workforce in Low- and Middle-Income Countries. Anesth Analg. 2018;126[4]:1291-7.
18. Edgcombe H, Baxter LS, Kudsk-Iversen S, Thwaites V, Bulamba F. Training non-physician anaesthetists in sub-Saharan Africa: a qualitative investigation of providers' perspectives. BMJ Open. 2019;9[3]:e026218.
19. Karydi KI, Kabaghe S, Blamey H, Mohamed M, Shamambo N, Edgcombe H. Non-physician anaesthesia providers' perspectives on task sharing practices in Zambia and Somaliland: a qualitative study. BMJ Open. 2024;14[5]:e078939.
20. Law TJ, Lipnick MS, Morriss W, Gelb AW, Mellin-Olsen J, Filipescu D, et al. The Global Anesthesia Workforce Survey: Updates and Trends in the Anesthesia Workforce. Anesth Analg. 2024;139[1]:15-24.
21. Haider A K, Sana A, Zain,Bilal, Baz M A. Professional obstacles to anesthesia personale practice inpublic sectors hospital of peshawar. Pakistan Journal of Medical & Cardiological Review 2026.
22. Kumar A, Rehman MA, Khan B, Saddique F, Ali P, Zahid MA. "Resilience unveiled: empowering Pakistani anesthetists in challenging low-resource environment". Anaesthesia, Pain & Intensive Care. 2023;27[5]:592-8.
23. Umair A RS, Muhammad M,Shagufta N, Mehwish Q. Health System Barriers To Delivering Safe Anesthesia In Low-Resource Settings. Pakistan Journal of Medical & Cardiological Review 2025;4[2].
24. Mohamad N AS, Narresh S,Muhammad H j. Brain-Drain Phenomenon among Healthcare Workers. International Journal of Public Health and Clinical Sciences. 2019;6[3].
25. Dohlman L, DiMeglio M, Hajj J, Laudanski K. Global Brain Drain: How Can the Maslow Theory of Motivation Improve Our Understanding of Physician Migration? Int J Environ Res Public Health. 2019;16[7].

26. Ogaboh1 AAM, HTU, Eka IT. Why Brain Drain in the Nigerian Health Sector? Asian journal of applied sciences 2020;volume 8[02]:10.
27. Saliya CA. The Brain Drain Dilemma: A Critical Examination. social Sciences Research network. 2024:11.
28. Bou-Habib P. The brain drain as exploitation. Politics, Philosophy & Economics. 2021;21[3]:249-68.
29. Gowda A, Alhazza HN, Cahill ED, Ong JBSQ, Flaherty GT. Stemming the Brain Drain of Medical Graduates From Developing Countries: Controversies and Solutions. International Journal of Travel Medicine and Global Health. 2022;10[3]:104-7.
30. Adovor E, Czaika M, Docquier F, Moullan Y. Medical brain drain: How many, where and why? J Health Econ. 2021;76:102409.
31. Dia N I ETA, Yahaya A A. Brain drain of healthcare professionals and its impact on healthcare
delivery at the Federal Medical Centre, Jabi, and university of abuja teaching hospital (uath), gwagwalada abuja, nigeriaa. Polac economic review. 2025;5.
32. Saluja S, Rudolfson N, Massenburg BB, Meara JG, Shrime MG. The impact of physician migration on mortality in low and middle-income countries: an economic modelling study. BMJ Glob Health. 2020;5[1]:e001535.
33. Nadir F, Sardar H, Ahmad H. Perceptions of medical students regarding brain drain and its effects on Pakistan's socio-medical conditions: A cross-sectional study. Pak J Med Sci. 2023;39[2]:401-3.
34. Muhammad Hamza M, Muhammad U, Izatullah, Hassan Raza A, Faiza I, Muhammad T. Medical Brain Drain from Pakistan: A Qualitative Study of Push–Pull Factors and the Professional and Personal Experiences of Migrated Physicians. Journal of Health, Wellness and Community Research. 2026.
35. Nazish I ZA, Imran H, Naeem A,Muhhmad R B. Brain Drain: Post Graduation Migration Intentions and the influencing factors among Medical
Graduates from Lahore, Pakistan. BMC research note. 2021;4.
36. Shahbaz S, Zakar R, Howard N. Anaesthesia provision challenges in public hospitals of Pakistan's Punjab province: a qualitative study of expert perspectives. BMJ Open. 2023;13[12]:e075108.
37. Afshan G, Khan RI, Karmaliani R, Ahmed A, Khan FA. Barriers to safe anaesthesia care in South Asian countries: a virtual focus group discussion. J Pak Med Assoc. 2024;74[4]:724-9.
38. Tayyeb M, Hussain H, Jamil Z, Khan SU, Ud-Din I, Sheharyar M, et al. Level of job satisfaction among anesthetists in Khyber Pakhtunkhwa: an in-depth examination of influencing factors. Ann Med Surg (Lond). 2025;87[9]:5462-9.
39. Khan FA, Merry AF. Improving Anesthesia Safety in Low-Resource Settings. Anesth Analg. 2018;126[4]:1312-20.
40. Knoble A, Pathak J, Bhandari R, Ssempiira J, Shah K, Paudel P, et al. The effect of deploying non-physician anaesthesia providers on surgical access and capacity across Nepal's primary and secondary government hospitals: a quasi-experimental mixed methods study. BMJ Glob Health. 2026;11[3].
41. Kols A, Kibwana S, Molla Y, Ayalew F, Teshome M, van Roosmalen J, et al. Factors Predicting Ethiopian Anesthetists' Intention to Leave Their Job. World J Surg. 2018;42[5]:1262-9.
42. [Available from: https://beoe.gov.pk/foreign-jobs/610774.
43. Cronin F, Clarke N, Hendrick L, Conroy R, Brugha R. The impacts of training pathways and experiences during intern year on doctor emigration from Ireland. Hum Resour Health. 2019;17[1]:74.
44. Ossai EN, Una AF, Onyenakazi RC, Nwonwu EU. Emigration plans after graduation of clinical medical students of ebonyi state university Abakaliki, Nigeria: Implications for policy. Niger J Clin Pract. 2020;23[7]:995-1003.
45. anwar F. Pakistan Economic survey. printing corporation of pakistan press islamabad,

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