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LETTER TO THE EDITORS

Research Output Among US Anesthesiology Residency Applicants: A Positive Sign or a Worrisome Trend?

EKAMBIR SARAN, HBSC
CONNOR T. A. BRENNAN, MD

SHIVEN SHARMA, JD
JUNAID NIZAMUDDIN, MD

KARIM S. LADHA, MD, MSc, FRCPC

TO THE EDITORS:

Research experience has been recognized as an increasingly important factor in the National Resident Matching Program (NRMP), and match data illustrate steady growth in scholarly engagement indicated by the number of applicant-reported publications, abstracts, and presentations.¹ Specialties traditionally regarded as highly competitive, such as neurological surgery, plastic surgery, and dermatology, have seen a dramatic increase in research output among applicants, creating an “arms race” in scholarly output.¹ Over recent years, admission into US anesthesiology residency programs has also become progressively more competitive: anesthesiology was recognized as one of the most competitive specialties in the 2023 Match report.² To better understand how research productivity may factor into admission to anesthesia residency positions, we examined trends in research productivity among US anesthesia residency applicants from 2007 to 2024.

Data was extracted from the NRMP's *Charting Outcomes* reports from 2007 to 2024 to assess trends in research output among graduating US (allopathic and osteopathic) medical students applying to anesthesia residency in the United States. Independent and international applicants were excluded from the analysis as data were variably reported for these groups. The outcomes measured included the

number of research experiences as well as the number of abstracts, presentations, and publications reported by the applicants. Abstracts, presentations, and publications were collectively counted as “research outputs” for our analysis as the NRMP did not distinguish between these categories in its reporting. Linear regression analyses were performed to evaluate trends over time for both matched and unmatched applicants applying to anesthesiology, using the year of application as the independent variable. Independent *t* tests were employed to compare the mean number of research experiences and outputs between matched and unmatched applicants from 2007 to 2024. Statistical significance was set at $p < .05$. All data were analyzed and presented using Prism 10.3.1 (Graphpad Software, Boston, MA) and Stata 18.0 (STATA Corp, College Station, TX).

There were a total of 10 775 US MD and DO graduates who matched to anesthesia residency programs and 1158 applicants who did not match to anesthesia residency from 2007 to 2024. Linear regression analysis demonstrated a significant upward trend in both the number of research experiences and outputs from 2007 to 2024 (Figure 1) among both matched applicants (research experiences: slope = 0.106, $p < .001$; research outputs: slope = 0.333, $p < .001$) and unmatched applicants (research experiences: slope = 0.073, $p = .0016$; publications: slope = 0.170, $p = .0016$). Matched applicants reported an average of

2.68 research experiences and 4.17 outputs, whereas unmatched applicants reported 2.35 research experiences and 3.37 outputs. Independent *t* tests confirmed that these differences were statistically significant for both research experiences ($p < .001$) and outputs ($p < .001$). Visual inspection of the trendlines suggested a particularly steep rise in both research experiences and outputs between 2022 and 2024.

Our findings reveal an upward trend in reported research experiences and outputs among both matched and unmatched applicants to US anesthesiology residency programs over the past 2 decades with significantly more research experiences and outputs reported by matched candidates. This trend may reflect the rising competitiveness of anesthesiology training, mirroring trends seen in other fields in which research productivity has become a distinguishing factor for applicants.

Just as numerical metrics, such as test scores, may not fully capture the quality of a student's medical education, the number of research outputs may not reflect the depth, rigor, or impact of the applicant's scholarly work. Residency programs face the challenge of evaluating applicants across many different factors, including scholarly achievements. Increased productivity may suggest the success of integrated research training schemas or the enrollment of medical students who

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more often have obtained graduate degrees involving research; however, it could also reflect changes in the research community that permit heightened productivity or the accumulation of nonindexed publications, such as abstracts, book chapters, and presentations, which often have limited academic impact in comparison to high-quality, peer-reviewed publications.

Further research is warranted to explore the impact and quality of NRMP candidates' research (using metrics such as journal of publication, number of citations, field-weighted citations, and h-indices) and how these factors relate to resident match success. Future studies should also examine whether research publications at the time of application correlate with subsequent performance as a resident, likelihood of pursuing an academic career, and long-term research productivity as an attending physician. Such data could help inform fair and holistic approaches to candidate assessment and selection for residency.

This study has several limitations. First, the NRMP data relating to research experience are self-reported and may not always be verified on an independent basis and thereby may be subject to exaggeration

or inaccuracies. In fact, concerns about misrepresented or unverifiable research have been previously documented in anesthesiology and other specialties,³ raising questions regarding the reliability of self-reported data. Importantly, these concerns may be further amplified by the transition of the United States Medical Licensing Examination step 1 to a pass/fail scoring system, which may drive applicants to seek alternative ways to enhance their competitiveness, such as by increasing reported research activity. Furthermore, all types of scholarly output were grouped together in our analysis, limiting distinctions between low- and high-impact work. Our analysis also excluded international and independent applicants, reducing generalizability. Last, whereas trends were observed, causality cannot be established, and as noted above, numerous other factors may have influenced research output over time.

Overall, our analysis demonstrates a rise in reported research activity among US anesthesiology residency applicants from 2007 to 2024, paralleling broader trends among other competitive specialties. Whereas this growth may reflect increasing academic engagement, it also highlights the complexity of interpreting self-reported

metrics. As research output continues to evolve as a component of applicant profiles, especially in the context of recent changes to medical education assessments, it remains important to consider not only the quantity but also the context in which the scholarly work was conducted, such as whether it involved basic science or clinical research or whether it was completed independently or under mentorship. The nature of the work is also relevant, including distinctions between peer-reviewed publications and less formal outputs such as conference abstracts or posters. Such distinctions are important as they offer insight into the depth of an applicant's engagement, the skills the applicant may have acquired, and the potential relevance of the applicant's experiences to success in residency and future academic productivity.

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The following authors are at the University of Toronto in Toronto, ON, Canada: **Ekambir Saran** is an MD Candidate at the Temerty Faculty of Medicine; **Connor T. A. Brenna** is a Resident Physician and PhD candidate in the Departments of Anesthesiology and Pain Medicine and Physiology; **Karim S. Ladha** is an Associate Professor in the Department of Anesthesiology and Pain Medicine and a Staff Physician in the Department of Anesthesia and Pain Management at the University Health Network in Toronto, ON, Canada. **Shiven Sharma** is an MD candidate at the Icahn School of Medicine in New York, NY. **Junaid Nizamuddin** is an Associate Professor in the Department of Anesthesia and Critical Care at the University of Chicago, Chicago, IL.

Corresponding author: Ekambir Saran, HBS, Temerty Faculty of Medicine, University of Toronto, 27 King's College Circle, Toronto, ON, M5S 1A1, Canada. Telephone: (416) 509-2100

Email address: Ekambir Saran: ekam.saran@mail.utoronto.ca

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Figure

Figure 1. Trends in research experiences and outputs among matched and unmatched anesthesia residency applicants (2007–2024). Panel A shows the average number of research experiences for matched (turquoise circles) and unmatched (pink squares) US MD and DO graduates applying to anesthesia residency programs from 2007 to 2024. Panel B depicts the average number of research outputs for the same groups over the same time period.

