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Aliza Brown *

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Research Article

Residency Attrition and Associated Characteristics, a 10-Year Cross Specialty Comparative Study

Xixi Wang[1], Wei Zhang[1], Sen Sheng M.D, Ph.D[2], Rohan Sharma M.D[2], Mudassar Kamran M.D[3], Abhinandan R Pakanati M.D[4], Abhilash Thatikala M.D[2], Sisira Yadala M.D[2], Sanjeeva Onteddu M.D[2], Krishna Nalleballe M.D[2], Aliza Brown, Ph.D[2*]

[1]Department of Mathematics and Statistics, University of Arkansas in Little Rock, Little Rock, AR 72205

[2]Department of Neurology, University of Arkansas for Medical Sciences, Little Rock, AR 72205

[3]Department of Interventional Radiology, University of Arkansas for Medical Sciences, Little Rock, AR

[4]The Kidney Clinic, Snellville, GA 30078

***Corresponding Author:** Aliza Brown, PhD, FAHA, Associate Professor, Department of Neurology, University of Arkansas for Medical Sciences, Little Rock, AR, 72205.

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Abstract

Background/Aim: With the annual cost of training a single resident estimated at $141,240, the implication of residentattrition imposed on the public could far exceed that dollar amount. However, not all specialties face the same challenge. A study of the trend and dispersion of attrition rates across different specialties would detect physician shortages and misallocations from the outset.

Materials and Methods: Data of 20 major specialties from academic year 2010-2011 to 2019-2020 was collected from the ACGME data resource book. Annual attrition rate was calculated and its spread was visualized viabox-plot. Median and inter-quartile range (IQR) of annual attrition rate were calculated to draw comparison among specialties. Attrition rates' association with time was analyzed to identify temporal trends. The Kruskal-Wallis test was performed to identify any significant difference among attrition rates of 20 major specialties. Pairwise comparison was followed to differentiate high- and low-attrition specialties.

Results: Dermatology consistently had the lowest attrition rate (Medium, 0.46%; IQR, 0.32% - 0.70%) while Psychiatry had the highest (Medium, 7.53%; IQR, 6.74% - 8.60%). Urology had the fastestdecline in attrition rate (r= -0.93691; p<0.0001), followed by Internal medicine (r=-0.92173; p=0.0001). Primary care specialties including family medicine, obstetrics and gynecology and pediatrics have had more difficulty retaining their residents. A lower percentage of US medical school graduates (p<0.0001) and a higher percentage of female residents (p<0.0001) were foundin high-attrition specialties.

Conclusion: Attrition rate remained vastly different among specialties over the past decade, necessitating inter-specialty dialogue to effectively tackle this issue. Left simply to workforce supply and demand, physician shortage and maldistribution could further expose the more vulnerable of our society todisastrous consequences.

Keywords: residency attrition; graduate medical education (gme); medicare funding

Introduction

The novel coronavirus pandemic of 2020 forced us to confront many hardships, many of which embedded in the inequality of our society, disproportionately affecting the ethical minority, the elderly and the poor [1-3]. Among many other things, this pandemic also highlighted the significance of physician shortages in the United States, with current projections anticipating a national shortage of up to 122,000 physicians by 2032 [4,5]. However, not every specialty in medicine is facingthe same shortage and not every shortage has the same dire consequences. Studies have shown thatFamily medicine physicians play a vital role in caring for vulnerable populations [6] and yet the number of primary care physicians has grown at a fraction of the rate of specialized physicians [7]. Also emerging during the pandemic is the mental health crisis brought on by lockdown and isolation [8]. Demand for psychiatrists will increase in already strained emergency and mental healthsystems [9].

However, while the United States may face a future shortage of physicians, it does not presently have a shortage of doctors [10]. Studies found the graduate medical education had become the primary bottleneck in the physician pipe line with limited residency training positioned constrained by funding availability[4]. Yet, some specialties report as high

as 17-26% attrition rate [11-13]. Premature departure of a resident from training program is disruptive, and with annual cost of training a single resident estimated at $141,240 it has financial implications for the training institution [7,11] and poseseven greater opportunity cost in aggregate [10].

Multiple studies have examined resident attrition [11,14], with a vast majority of them investigating it for individual specialties [15-19]. A detailed analysis of resident attrition across various specialties is lacking. Given different data sources and varied methodologies, consistent evaluation of attrition rate even within a particular specialty may be challenging [18]. Moreover, there has been insufficient analysis of change in attrition rates over time. A thorough understanding of the attrition rate for various specialties driven from a comprehensive database, its comparison across other specialties,and its evolution over a period may help institutions better address this issue with educational andfinancial implications.

With that in mind, we began by examining the attrition rates for 20 major specialties and their evolution over a period of 10-years, employing a uniform Accreditation Council for Graduate Medical Education (ACGME) database.

Materials and Methods

Data collection

All data utilized in this study was collected from the ACGME data resource book (available at acgme.org). Data on attrition, and programmatic characteristics by specialty were gathered from academic year (AY) 2010-2011 to 2019-2020. Twenty major specialties, defined as those with thegreatest number of active residents by the end of AY 2019-2020, were analyzed. Cost and benefitanalysis of GME programs were extracted from prior studies.

Annual attrition rate

Annual attrition rate was calculated as dividing 'the number of residents leaving prior to completion of their training during an academic year' by 'the number of active residents at the endof the same academic year'. It has been calculated for each of the 20 specialties yearly for the past10 years.

A box-plot was devised to visually reflect the location and spread of these attrition ratesby specialty. Since it's easily observed there is significant variation in variances among attrition rates of different specialties, the Kruskal-Wallis test was carried out to compare their differences followed by post-hoc pairwise comparison using Dwass, Steel, and Critchlow-Fligner Method. Median and inter-quartile range (IQR) of attrition rates were calculated for each specialty.

A correlation analysis was then performed across specialties to identify any changes in attrition rates over time.

Characteristics of high-attrition and low-attrition specialties

Setting the specialty with the lowest sum of Wilcoxon scores as control and based on the result of pairwise comparison by Dwass, Steel, Critchlow-Fligner Method, specialties were separated into high- and low-attrition groups. The Wilcoxon Two-Sample Test was performed to exam the difference in characteristics including mean number of residents per program, percentage of female residents and percentage of US medical school graduates between specialties in high- and low-attrition groups.

The data analysis for this paper was generated using SAS software.

Results

Annual attrition rate variation by specialty

The level as well as the dispersion of annual attrition rate vary significantly by specialty over the past 10 years (Figure). Psychiatry has consistently had the highest attrition rate (Medium, 7.53%), and the widest variation (IQR, 6.74% - 8.60%). Last year, 417 out of its total of 6,618 (6.30%) residents left their program prior to graduation. Following it, Surgery (Medium, 3.37%; IQR, 3.10% - 3.70%), Pathology-anatomic and clinical (Medium, 2.91%; IQR, 2.55% - 3.29%), Neurological surgery (Medium, 2.43%; IQR, 2.06% - 2.97%), Family medicine (Medium, 2.21%; IQR, 1.94% - 2.69%) and Obstetrics and gynecology (Medium, 1.94%; IQR, 1.39% - 2.49%) also had relativelyhigh attrition rate. On the other end of the spectrum, Dermatology for most of the time had the lowest attrition rate (Medium, 0.46%) and one of the smallest variations (IQR, 0.32% - 0.70%). In AY 2019-2020, only six out of 1,594 (0.38%) Dermatology residents left prematurely. Ophthalmology (Medium, 0.82%, IQR, 0.56% - 1.14%), Emergency medicine (Medium, 0.83%; IQR, 0.72% - 1.00%), Otolaryngology (Medium, 0.84%; IQR, 0.76% - 1.06%) and Urology (Medium, 0.93%; IQR, 0.75% - 1.24%) were also among low-attrition rate specialties.

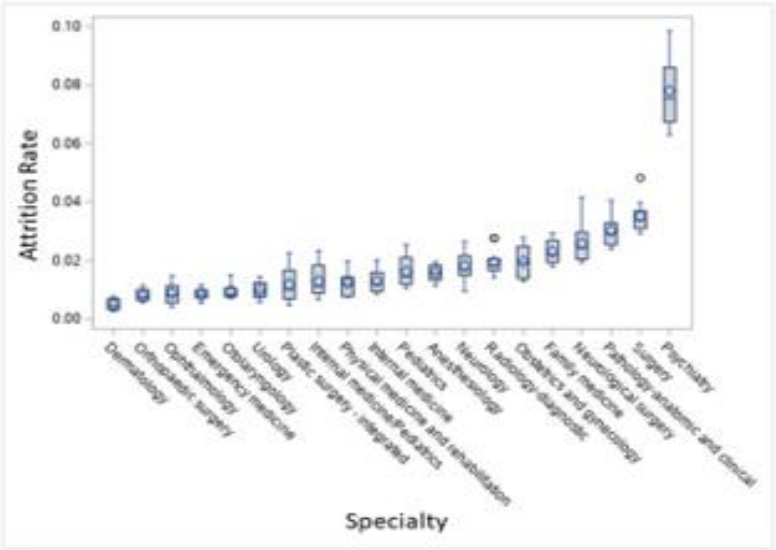

Figure: *The annual attrition rate of residents varies significantly by specialty. Over the past 10 years psychiatry has consistently had the highest attrition rate.*

Recent trend in attrition rate by specialty

Attrition rate is declining with time as there is a significantly negative correlation between attritionrate and year (r=-0.16809; p=0.0173). As for individual specialty, Urology (r= -0.93691; p<0.0001), Internal medicine (r=-0.92173; p=0.0001) and Psychiatry (r=-0.90114; p=0.0004) hadthe fastest declining attrition rate over time, followed by Anesthesiology (r=-0.89831; p=0.0004) and Pediatrics (r=-0.89330; p=0.0005) (Table).

Specialty	**AY 2010-2011 - AY 2019-2020 Attrition Rate**				**AY 2019-2020**		
	Median	**Lower Quartile**	**Upper Quartile**	**Correlation with Time****	**No. of Residents not Graduating**	**Number of Programs**	**Number of Active Residents**
Anesthesiology	1.55%	1.34%	1.84%	-0.89831 0.0004	76	160	6698
Dermatology*	0.46%	0.32%	0.70%	0.14942 0.6803	6	144	1594
Emergency medicine*	0.83%	0.72%	1.00%	-0.69837 0.0247	45	265	8293
Family medicine	2.21%	1.94%	2.69%	-0.82447 0.0033	246	701	13725
Internal medicine	1.20%	0.95%	1.59%	-0.92173 0.0001	251	569	29243
Internal medicine/Pediatrics*	1.11%	0.89%	1.84%	-0.81233 0.0043	11	79	1511
Neurological surgery	2.43%	2.06%	2.97%	-0.59617 0.0689	37	118	1515
Neurology	1.68%	1.49%	2.16%	-0.69858 0.0246	29	160	3062
Obstetrics and gynecology	1.94%	1.39%	2.49%	-0.87110 0.0010	73	285	5677
Ophthalmology*	0.82%	0.56%	1.14%	-0.37851 0.2808	8	124	1512
Orthopaedic surgery*	0.78%	0.64%	1.00%	-0.60780 0.0623	26	197	4342
Otolaryngology	0.84%	0.76%	1.06%	-0.46913 0.1714	12	124	1689
Pathology-anatomic and clinical	2.91%	2.55%	3.29%	-0.84538 0.0021	60	142	2324
Pediatrics	1.45%	1.19%	2.10%	-0.89330 0.0005	98	211	9323
Physical medicine and rehabilitation	1.19%	0.78%	1.43%	-0.55579 0.0953	15	94	1453
Plastic surgery - integrated*	1.00%	0.70%	1.66%	-0.04909 0.8929	5	82	961

Psychiatry	7.53%	6.74%	8.60%	-0.90114 0.0004	417	269	6618
Radiology-diagnostic	1.83%	1.66%	2.05%	0.78353 0.0073	126	197	4551
Surgery	3.37%	3.10%	3.70%	-0.65429 0.0401	273	330	8809
Urology*	0.93%	0.75%	1.24%	-0.93691 <.0001	10	145	1734

* Represent specialties in low-attrition group.

**In the 5th column of correlation with time, correlation coefficient is presented on top, corresponding p-value at bottom.

Specialties are listed in alphabetic order.

Table: *Comparison of Attrition Rate by Specialty.*

Division between high- and low-attrition specialties

In a more concrete statistics analysis, the Kruskal-Wallis test shows that there is significant difference among the annual attrition rate of various specialties ($p<0.0001$). Since Dermatology had the lowest sum of Wilcoxon scores, we set it as control and compared its attrition rate with allthe other specialties. Specialties including Internal Medicine/Pediatrics ($p=0.0783$), Urology($p=0.0980$), Emergency medicine ($p=0.2605$), Plastic surgery – integrated ($p=0.3069$), Orthopedic surgery ($p=0.4120$) and Ophthalmology ($p=0.7571$) did not have significantly different attrition rate from Dermatology and were thus placed in the low-attrition group. All the other specialties had significantly different attrition rate from Dermatology and were therefore placed in the high- attrition group (Table).

Characteristics comparisons between high- and low-attrition specialties

When comparing characteristics between high- and low-attrition groups, primary care specialties including Family medicine (Medium 2.21%; IQR 1.94% - 2.69%), Obstetrics and gynecology (Medium 1.94%; IQR 1.39% - 2.49%) and Pediatrics (Medium 1.45%; IQR 1.19% - 2.10%) fall within the high-attrition rate group. No significance difference in mean number of residents per program has been identified. A higher percentage of female residents ($p<0.0001$) and a lower percentage of US medical school graduates ($p<0.0001$) were found in the high-attrition group.

Discussion

This study identified a significant variation in annual attrition rates over the past 10 years, ranging from 0.26% to 10.05%, among 20 major specialties. The huge variation in attrition rate amplifies the specialty maldistributions in the U.S. directly at the level of graduate medical education [4]. Reform has been called upon to address the discrepancies between the type of health care availableand those in demand by patients and health care facilities [19]. However, the current incentive structure with which Medicare supports residency training makes inpatient care more lucrative than focusing on community health and outpatient care [12]. One study that investigates the costs and benefits of operating graduate medical education (GME) programs found internal medicine and family medicine faculty practice plans are estimated to operate at a loss, whereas the other specialties are estimated to operate at a profit, with the highest profit per resident estimated for Urology and the lowest profit estimated for cardiology and general surgery [7].

As our study indicated, primary care specialties like Family medicine (Medium, 2.21%; IQR, 1.94%

- 2.69%), Internal medicine (Medium, 1.20%; IQR, 0.95% - 1.59%), Obstetrics and gynecology (Medium, 1.94%; IQR, 1.39% - 2.49%) and Pediatrics (Medium, 1.45%; IQR, 1.19% - 2.10%) have all fallen under high-attrition group. Also alarming is that Psychiatry (Medium, 7.53%; IQR, 6.74% - 8.60%), facing a national shortage in the millennial generation [19], constantly experienced several times the attrition rate of any other specialty. This leads to speculation that specialties witha lower or negative profit margin per resident under the current Medicare funding structure mightbe less incentivized or effective at retaining their residents. Conversely, specialties like Urology (Medium, 0.93%; IQR, 0.75% - 1.24%), Orthopedic surgery (Medium, 0.78%; IQR, 0.64% - 1.00%) and Plastic surgery – integrated (Medium, 1.00%; IQR, 0.70% - 1.66%), known to be procedure-heavy and lucrative, fall straight into the low-attrition group. This attrition rate disparity between outpatient-focused specialties and procedure-heavy specialties should raise concerns for public health officials when addressing the publics access to health care, especially in the pandemic era when inequality has been exacerbated [22,23].

Another important result in our study points to the fact that the percentage of International medicalschool graduates (IMGs) is higher in the high-attrition group of specialties than that in the low- attrition group. This may be explained by their high concentration in primary care specialties while facing more obstacles to complete training. For example, a prior study found that family practice is becoming increasingly reliant on IMGs as they accounted for an increasing percentage of familypractice residency positions filled despite a drop in total positions filled [24]. A study has also shownIMG serves an important role in fostering diversity, equity and inclusion in its local communities through their language and culture connection to minority populations [25]. However, IMGs also self-reported considerable bias and prejudice, ranging from difficulty with getting externships and interviews to the critical view of their USMG counterparts.

Also, it is notable from our study that female residents present a higher percentage in high-attritionspecialties, coinciding with prior studies that identified women being more susceptible to generational priorities and family issues [26, 27]. A recent study also shows that female PCPs generated10.9% less revenue from office visits than their male counterparts and yet spent more time in directpatient care per visit, per day, and per year [28]. It's been argued that formal maternity policies, a shift in culture and ongoing discussion, are needed to retain female residents [29], which is especially urgent as the increasing need for primary care physicians accelerates during the pandemic.

Limitation

This study is limited by insufficient transparent data on the cost and

benefit of residency training by specialty, partially due to the complicated incentive formula for funding from Medicare and the difficulty with monetizing the full benefit of having a resident. Having more quantitative data on the financial engagement of residency training would enable us to derive more concrete results and analysis.

Conclusion

By differentiating factors influential to the resident attrition rate of various specialties, policymakers would be better informed in drawing up policies that are accountable to medical educators and receivers of medical care. The higher percentage of IMGs and female doctors in the high-attrition group of specialties, which includes most of the primary care specialties, signals anopportunity for health care officials to tackle maldistribution in physicians by implementing targeted measures that address specific challenges faced by these two groups of residents. If left unattended to, resident attrition could exacerbate difficulty with accessing healthcare for the vulnerable populations and worsening inequalities highlighted by the coronavirus pandemic.

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References

1. Liao TF, De Maio F. (2021). Association of Social and Economic Inequality with CoronavirusDisease 2019 Incidence and Mortality Across US Counties. JAMA Netw Open. 4(1):2034578.
2. Wiley Z, Kubes JN, Cobb J, et al. (2021). Age, Comorbid Conditions, and Racial Disparities in COVID-19 Outcomes. J Racial Ethn Health Disparities.
3. Clay LA, Rogus S. (2021). Primary and Secondary Health Impacts of COVID-19 amongMinority Individuals in New York State. Int J Environ Res Public Health. 18(2).
4. Ahmed H, Carmody JB. (2020). On the Looming Physician Shortage and Strategic Expansion ofGraduate Medical Education. Cureus. 12(7):9216.
5. Turalde C.W.R, Espiritu A.I, Macinas I.D.N. et al. (2022). Burnout among neurology residents during the COVID-19 pandemic: a national cross-sectional study. Neurol Sci. 43:1503-1511.
6. Partin M, Sanchez A, Poulson J, Berg A, Parascando J, Ramirez SI. (2021). Social InequitiesBetween Prenatal Patients in Family Medicine and Obstetrics and Gynecology with Similar Outcomes. J Am Board Fam Med. 34(1):181-188.
7. Wynn BO, Smalley R, Cordasco KM. (2013). Does It Cost More to Train Residents or to ReplaceThem? A Look at the Costs and Benefits of Operating Graduate Medical Education Programs. Rand Health Q. Fall. 3(3):7.
8. Li X, Fu P, Fan C, Zhu M, Li M. (2021). COVID-19 Stress and Mental Health of Students in Locked-Down Colleges. Int J Environ Res Public Health. 18(2).
9. Richmond JS, Dragatsi D, Stiebel V, Rozel JS, Rasimas JJ. (2021). American Association for Emergency Psychiatry Recommendations to Address Psychiatric Staff Shortages in Emergency Settings. Psychiatr Serv. 201900501.
10. Dewan MJ, Norcini JJ. (2020). We Must Graduate Physicians, Not Doctors. Acad Med. 95(3):336-339.
11. Khoushhal Z, Hussain MA, Greco E, et al. (2017). Prevalence and Causes of Attrition Among Surgical Residents: A Systematic Review and Meta-analysis. JAMA Surg. 152(3):265-272.
12. Kwakwa F, Jonasson O. (1999). Attrition in graduate surgical education: an analysis of the 1993 entering cohort of surgical residents. J Am Coll Surg. 189(6):602-610.
13. Dodson TF, Webb AL. (2005). Why do residents leave general surgery? The hidden problem in today's programs. Curr Surg. 62(1):128-131.
14. Brockberg M, Mittelman A, Dugas J, et al. (2019). Rate of Programs Affected by Resident Attrition and Program Factors Associated with Attrition in Emergency Medicine. J Grad Med Educ. 11(6):663-667.
15. Yang MK, Meyerson JM, Pearson GD. (2018). Resident Attrition in Plastic Surgery: A NationalSurvey of Plastic Surgery Program Directors. Ann Plast Surg. 81(3):360-363.
16. Lynch G, Nieto K, Puthenveettil S, et al. (2015). Attrition rates in neurosurgery residency: analysis of 1361 consecutive residents matched from 1990 to 1999. J Neurosurg. 122(2):240-249.
17. Prager JD, Myer CMt, Myer CM, 3rd. (2011). Attrition in otolaryngology residency. Otolaryngol Head Neck Surg. 145(5):753-754.
18. Mehwash Nadeem, M. Shahrukh Effendi, M. (2014). Hammad Ather. Attrition in surgical residency programmes: Causes and effects. Arab Journal of Urology. 12(1):25-29.
19. Schwed AC, Lee SL, Salcedo ES, et al. (2017). Association of General Surgery Resident Remediation and Program Director Attitudes with Resident Attrition. JAMA Surg. 152(12):1134-1140.
20. Chung BM. (2015). The State of Graduate Medical Education Funding and Meeting Our Nation's Health Care Needs. J Am Osteopath Assoc. 115(8):478-481.
21. Russo RA, Dallaghan GB, Balon R, et al. (2020). Millennials in Psychiatry: Exploring Career Choice Factors in Generation Y Psychiatry Interns. Acad Psychiatry. 44(6):727-733.
22. The Lancet Public H. (2021). COVID-19-break the cycle of inequality. Lancet Public Health. 6(2):82.
23. Chen DT, Wang YJ. (2021). Inequality-Related Health and Social Factors and Their Impact on Well-Being during the COVID-19 Pandemic: Findings from a National Survey in the UK. Int J Environ Res Public Health. 18(3).
24. Koehn NN, Fryer GE Jr, Phillips RL, Miller JB, Green LA. (2002). The increase in internationalmedical graduates in family practice residency programs. Fam Med. 34(6):429-435.
25. Gupta D, Schnur D. (2021). How an "IMG-Friendly" Program Serving an Immigrant CommunityFosters Diversity, Equity, and Inclusion Among Its Residents. Acad Psychiatry. 45(1):67-72.
26. Moschos E, Beyer MJ. (2004). Resident attrition: is gender a factor? Am J Obstet Gynecol. 191(2):387-391.
27. Agarwal N, White M. D, Pannullo S. C & Chambless L. B. (2019). Analysis of national trends in neurosurgical resident attrition, Journal of Neurosurgery JNS. 131(5):1668-1673.
28. Ganguli I, Sheridan B, Gray J, Chernew M, Rosenthal MB, Neprash H. (2020). Physician WorkHours and the Gender Pay Gap - Evidence from Primary Care. N Engl J Med. 383(14):1349-1357.
29. Todd AR, Cawthorn TR, Temple-Oberle C. (2020). Pregnancy and Parenthood RemainChallenging During Surgical Residency: A Systematic Review. Acad Med. 95(10):1607-1615.