

**COMPARISONS OF EMERGENCY MEDICINE RESIDENCY PROGRAMS IN THEIR INCLUSION OF
ALLOPATHIC AND OSTEOPATHIC GRADUATES**

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Lauren J. Auerbach

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Mentor: J. Stephan Stapczynski, MD

Abstract

Introduction: In the United States, two systems of medical education produce practicing doctors: allopathic and osteopathic; with 141 allopathic schools granting an MD degree and 34 institutions of osteopathic medicine granting a DO degree as of 2017. Historically, a majority of DO students enter specialties related to primary care such as family medicine, pediatrics, and internal medicine, while their MD counterparts are more likely to match in non-primary care fields. A lower acceptance rate of DO graduates into non-primary care residency programs may be due to biases held by the predominately allopathic faculty towards osteopathy at these programs. This study investigated the numbers of osteopathic physicians at emergency medicine residency programs.

Methods: During June-July 2018, the publicly accessible webpages of 240 separate emergency medicine residency programs noted on “Emergency Medicine Resident’s Association’s (EMRA)” website were reviewed. The residents in each program were tabulated according to their medical education; allopathic, osteopathic, and international medical school. The number of faculty with MD or DO degrees was counted. The program director was also categorized as either an MD or DO.

Results: From the websites, it was possible to categorize residents in 219 programs, faculty in 224 programs, and program directors in 234 programs. Per program, the mean number of MD residents 24.4 ± 18.6 , the mean number of DO residents was 8.0 ± 10.5 , and the mean number of international graduate residents was 1.2 ± 3.6 . The mean number of MD faculty were 24.8 ± 23.9 and the mean number of DO faculty were 3.6 ± 4.4 . The residency directors were 178 MD’s and 56 DO’s. Logistic regression found that the number of DO faculty was associated with a 34% likelihood of a program having four or more DO residents (OR 1.34, 95% CI 1.15 -1.56, $p = <0.001$) In programs where the director was a DO, there was a 6-fold increase in having more than four DO residents

Conclusions: Increasing DO faculty and a DO program director were associated with an increased likelihood of osteopathic graduates matching to an EM residency program.

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Introduction

In the United States, two systems of medical education exist to produce practicing doctors: allopathic and osteopathic.

In modern use, allopathic medicine refers to the use of drugs or physical interventions to treat the pathophysiologic processes of disease. Education in allopathic medicine developed when university-training physicians from England came to the United States and established programs to train doctors. In 1765, the University of Pennsylvania opened the first medical school in the country with the goal of supplementing medical lectures with bedside learning¹. Following their model, 52 medical schools open their doors to students hoping to obtain their MD.

Osteopathic medicine is founded on the theory developed by Andrew Taylor Still that disease and physiologic dysfunction are due to a disordered musculoskeletal system, and by diagnosing and treating the musculoskeletal system, physicians could treat a variety of diseases. Dr Still founded the American School of Osteopathy (now known as A.T. Still University) in Kirksville, Missouri in 1892, based on this approach, combining knowledge of anatomy and physiology, along with principles of physical manipulation and ideas of preventive medicine. Initially, the training received by osteopathic students was very different than allopathic students, but during the 20th century, the approaches to medical education have become very similar. One major difference is the continued addition of manipulative medicine to osteopathic curriculum.

As of 2017, there are 141 schools granting an MD degree and 34 institutions of osteopathic medicine granting a DO degree².

Currently, students from MD and DO schools have separate residency programs, accredited by the Accreditation Council for Graduate Medical Education (ACGME) or American Osteopathic Association (AOA), respectively. There are different application processes for students to match into either ACGME or AOA accredited programs; the National Resident Matching Program (NRMP) for ACGME-accredited programs and the AOA Intern/Resident Registration Program for AOA-accredited programs. It has been possible for DO students to match into

allopathic programs by taking the United States Medical Licensing Examination (USMLE) in addition to their required (COMLEX) counterparts. In 2016, 49% of osteopathic graduates matched into AOA-accredited residency programs and 46% matched into ACGME-accredited programs.

Since medical education has become nearly equivalent in allopathic and osteopathic schools, there has been a growing desire to merge these two separate accreditations and matches into one. Starting in June 30, 2020, all osteopathic residency programs will be required to have ACGME accreditation, the AOA will cease accreditation activities, and there will be a common residency matching program for both MD and DO students³.

Currently, there are differences between MD and DO graduates when they apply to ACGME-accredited programs through the NRMP. Historically, a majority of DO students end up entering specialties related to primary care such as family medicine, pediatrics, and internal medicine, while their MD counterparts match in more specialized fields, although the differences are less in recent years. Though not well studied, fewer DO applicants are chosen for non-primary care specialty positions than MD applicants. A lower acceptance rate of DO graduates into ACGME-accredited residency programs may be due to the small, but tangible, underlying differences in medical training, but may also be due to biases held by the predominately allopathic faculty towards osteopathy at these programs. In the 2018 NRMP, 94.3% of US allopathic graduates matched into a first-year position whereas only 81.7% of US osteopathic graduates were able to match into a first-year position. Specifically for Emergency Medicine, in 2018 there were 1679 allopathic-graduates who applied via the NRMP, with 1538 matching into an EM program (91.6% match rate) compared to 517 osteopathic-graduates with 434 matching (83.9% match rate)⁴.

The decision-making process whereby an osteopathic graduate chooses which specialty and which programs to apply via NRMP is undoubtedly complex, but one factor may be the perception of how their application will be considered; does that program have a bias against osteopaths.

This project sought to analyze the numbers of MD graduates, DO graduates, and international medical school graduates at ACGME-accredited emergency medicine programs within the United States. By comparing these numbers and how they relate to location, breakdown of faculty, and degree of the program direction, we seek to have a better understanding of the diversity of emergency medicine residencies as it relates to their teams.

Methods

Data was gathered over a month's period during June-July 2018 using the "Emergency Medicine Resident's Association's (EMRA)" website. At the time of data collection, 240 separate emergency medicine residency programs were noted; 226 accredited by the ACGME and 14 accredited by the AOA. Data was gathered by visiting each residency program's website and counting the number residents coming from an allopathic, osteopathic, and international medical school. Each program was recounted a separate time to check for errors. The faculty page was then visited and faculty were separated into MD or DO categories. Last, the program director information was collected on their MD or DO designation. All of this information was entered into an Excel® spreadsheet.

Data was then analyzed by a biostatistician who used univariate and multivariable logistic regression, Wilcoxon rank sum to compare continuous variables, and Fisher's exact to compare categorical variables.

Results

Using EMRA and the program's respective website, 234 programs were able to be used for data analysis from an original 240 programs listed; 226 were ACGME-accredited and 14 were AOA-accredited. Six programs were excluded which is explained in the limitations section.

The total number of residents were 7368 and the total number of faculty were 6352. The mean number of MD residents per program was 24.39 ± 18.6 , the mean number of DO residents per program was 8.04 ± 10.5 , the mean number of international residents was 1.22 ± 3.58 , the mean number of MD faculty were 24.77 ± 23.9 , and the mean number of DO faculty were 3.59 ± 4.44 . In the current PGY1 positions, there were 1,606 allopathic graduates, 484 osteopathic graduates, and 109 international graduates. Per program, the mean number of allopathic and osteopathic graduates was 24.4 ± 18.6 and 8.04 ± 10.5 , respectively. The median number of osteopathic graduates per program was 4. Of the 234 programs used for data analysis, 167 (70.8%) were of a 3-year duration and 69 (29.2%) were 4-year in duration. There was no statistical significance of the number of DO residents between the two program types (Figure 1).

Descriptive Stats

Variables	Overall	OR (95% CI)	P-value ¹
Region (n, %) (n=234)			
New England	14 (5.98)	REF	
Mid/South Atlantic	93 (39.7)	2.34 (0.69, 8.01)	0.17
East, West North Central	64 (27.4)	4.17 (1.17, 14.8)	0.03
East, West South Central	30 (12.8)	2.50 (0.64, 9.76)	0.19
Mountain, Pacific, Territory	33 (14.1)	1.42 (0.37, 5.56)	0.61
Program Length (n, %) (n=236)			
3	167 (70.8)	REF	
4	69 (29.2)	1.13 (0.65, 1.98)	0.67
Number of MD's (mean, SD) (n=219)	24.4 (18.6)	0.92 (0.91, 0.94)	<0.001
Number of DO's (mean, SD) (n=219)	8.04 (10.5)	N/A	
AOA Initial Accreditation (yes, %)	54 (22.8)	110.3 (14.8, 820.1)	<0.001
Number of International Residents (mean, SD) (n=219)	1.23 (3.58)	0.96 (0.89, 1.04)	0.43
Percent DO's (mean, SD) (n=219)	31.1 (38.1)	N/A	
Number of MD Faculty (mean, SD) (n=224)	24.8 (23.9)	0.94 (0.92, 0.96)	<0.001
Number of DO Faculty (mean, SD) (n=224)	3.59 (4.44)	1.37 (1.23, 1.54)	<0.001
Percent DO Faculty (mean, SD) (n=224)	21.8 (28.4)	1.08 (1.05, 1.12)	<0.001
DO Resident Directors (n, %) (n=234)	56 (23.9)	32.2 (9.68, 107.4)	<0.001

¹Univariate Logistic regression with no adjustments.

Figure 1. Descriptive Statistics

Programs were then categorized by location into five regions: New England (MA, VT, NH, MA, CT, RI, NY, PA, NJ, MD), Mid/South Atlantic (VA, WV, NC, SC, GA, FL), North Central (MI, WI, OH, IN, KY, MN, IA, NE, MS, KS), South Central (TN, AL, MS, AR, LA, TX, OK), and Mountain/Pacific/Territory (CO, NM, UT, AZ, CA, OR, WA, PR). There were 14 (5.98%), 93 (39.7%), 64 (27.4%), 30 (12.8%) and 33 (14.1%) programs respectively in each region.

In comparing regions, New England was used as the reference range as it had the lowest percentage of DO residents. Comparing regions, only the North Central showed statistical significance of having more than the median number of four DO residents in comparison to New England ($p = 0.03$).

When looking at the number of MD residents, for every one MD, the program was 8% less likely to have four DOs ($p < 0.001$). Similarly, for every one MD in a faculty position, the program was 4% less likely to take 4 DOs ($p < 0.001$). However, when a DO faculty member was present, the program was 37% more likely to have four or more DO residents ($p < 0.001$) and for each percent increase of DO faculty members to MD faculty members, there was an 8% increase in the likelihood of having four or more DO residents. Last, if the program director was a DO, there was a 32-fold increase in having four or more DO residents in that program.

When the variables were stratified by program length, there was a statistically higher percent of DO residents in 3-year programs ($p = 0.05$), as well as a higher percentage of DO faculty ($p = 0.03$) and percent DO program directors ($p < 0.001$) (Figure 2).

Variables stratified by program length

	3-Year Programs N=167	4-Year Programs N=67	P-value ¹
Region (n, %) (n=234)			
New England	8 (4.85)	6 (8.82)	0.04
Mid/South Atlantic	70 (42.4)	23 (33.8)	
East, West North Central	45 (27.3)	18 (26.5)	
East, West South Central	25 (15.2)	5 (7.35)	
Mountain, Pacific, Territory	17 (10.3)	16 (23.5)	
Number of MD's (mean, SD) (n=219)	24.3 (15.1)	24.9 (25.1)	0.79
Number of DO's (mean, SD) (n=219)	6.34 (3.98)	12.0 (14.8)	0.07
AOA Initial Accreditation (yes, %)	20 (11.9)	33 (47.8)	<0.001
Number of International Residents (mean, SD) (n=219)	1.38 (3.98)	0.91 (2.42)	0.42
Percent DO's (mean, SD) (n=219)	23.6 (30.3)	0.47 (47.9)	0.05
Number of MD Faculty (mean, SD) (n=224)	23.3 (18.3)	28.7 (33.9)	0.44
Number of DO Faculty (mean, SD) (n=224)	3.11 (7.76)	4.69 (5.65)	0.12
Percent DO Faculty (mean, SD) (n=224)	17.3 (25.0)	31.5 (32.8)	0.03
DO Resident Directors (n, %) (n=234)	25 (15.2)	30 (44.1)	<0.001

¹Wilcoxon Rank Sum to compare continuous variables while Fisher's Exact to compare categorical variables.

Figure 2. Variables stratified by program length

Using logistic regression, there were variables that predicted which programs would be more or less likely to have four or more DO residents. For every one MD faculty, a program was 5% less likely to have four or more DO residents ($p = <0.001$). For every one DO faculty, a program was 37% more likely to have four or more DO residents ($p = <0.001$) overall, but a 28% increase in 3 year programs ($p = 0.002$). And specifically, for every percent increase in DO faculty, there was a 12% increase in having four or more DO residents, but only in four-year programs ($p = <0.001$). In programs where the director was a DO, there was a 6-fold increase in having more than four DO residents ($p = 0.01$) (Figure 3).

Logistic Regression Ascertainning the likelihood of > 4 DO residents within their respective EM residency programs

Variables	Overall		3-Year Programs		4-Year Programs	
	OR (95% CI)	P-value ¹	OR (95% CI)	P-value ¹	OR (95% CI)	P-value ¹
Number of DO Faculty	1.34 (1.15, 1.56)	<0.001	1.31 (1.12, 1.53)	0.001		
Number of MD Faculty	0.96 (0.94, 0.98)	0.001	0.96 (0.93, 0.98)	0.004		
AOA Initial Accreditation	21.3 (2.60, 173.9)	0.004	N/A		449.5 (38.7, 5226.1)	<0.001
Area Under the Curve	0.86		0.79		0.95	

Multivariable Logistic Regression ascertainning the likelihood of having >4 DO residents following a backwards variable selection.

Figure 3. Logistic regression.

Discussion

Allopathic and osteopathic graduates receive similar training during medical school, yet, until recently, have had a separation in their training after graduation. Traditionally, osteopathic graduates have entered primary care specialties while their allopathic counterparts moved toward specialty programs. While ACGME and AOA programs have recently merged into a common system, there continues to be a gap in representation of DO residents in more MD-laden specialties.

Based on the data collected, there is still a lower than expected number of DO graduates than pure numbers of graduates would indicate. While these numbers are slowly equalizing, the discrepancy still exists. Based on 2016 and 2017 allopathic and osteopathic graduate numbers, one would expect to have a ratio of 1 osteopathic resident for every 3.27 to 3.50 allopathic residents. In most regions, the percentage of DOs fell well below 30%. While selection bias may be present, these unexplained low numbers may have to do with low EM mentorship present within osteopathic medical schools⁵.

Unsurprisingly, an increase of DO representation of faculty and staff had a positive impact on the number of DO residents in each respective program. The more DO representation present in faculty, the higher likelihood of DO residents. Even more impactful was the presence of a DO program director. In fact, that had the highest positive predictive value of any variable tested. Similarly, the fewer DO representatives present, the lower chance of having DO residents.

While these trends make logical sense, it highlights the importance of having solid representation of DO faculty and staff to the diversity of DO-graduate inclusion into residency programs. This is important for many reasons. First, diversity is clearly needed to support diversity in resident profiles. These instructors play an important role in destigmatizing the abilities of DO-trained physicians and offer valuable new insights into patient care. Second, more DO representation results in more DO mentorship to students. This could have a positive impact in the future of increasing DO numbers in emergency medicine.

Future Directions

These variables have ability to be reassessed in an annual fashion to determine the trends of DO representation. Since the AOA and ACGME will have merged, following these trends will show if the merge had any major impact. Similarly, these methods could be used for any sets of variables such as age, gender, and applicant descriptors.

Limitations

The limitations to this study are mostly related to the method and timing of data collection. First, programs were initially found using EMRA's Residency Match website. This is a useful tool that lists the programs, their ACGME or AOA accreditation and contact information. Other lists of EM residency programs contain different numbers. The Society for Academic Emergency Medicine Residency Directory notes 231 ACGME-accredited program on their website. The American College of Osteopathic Emergency Physicians notes 54 residency programs in their website. The American Osteopathic Association notes 25 emergency medicine programs that had former AOA accreditation and have transitioned to ACGME accreditation. This variation may be related to programs unlisted or being phased out. Second, the researcher had to rely on the program website to contain reliable, accurate, and up to date listings for residents, faculty, program director, and their respective credentials. If a website failed to have credentials listed, their data was excluded. On a similar note, certain programs listed all emergency medicine faculty while others only listed those faculty directly involved in the program. The researcher counted all faculty that was listed on the website. The researcher was unable to find information on residents in all military-affiliated residency programs, so those were excluded.

A critical limitation involved the timing of data collection, as it was done between the months of June and July, an important time when new residents are starting a program. Some websites did not have those new residents listed while others had an updated website. Likewise, there was a discrepancy between programs still listing their recently graduated seniors and those still including them on their site. The researcher relied in accurate information on the website, and there were times when credentials did not match the resident's title (ie resident listed as MD but attended an osteopathic medical school). Last, and most critically, was the potential for counting error. The researcher manually counted each individual resident and faculty member along with their credentials. This count was done twice in the hopes of catching any error, but there is the possibility that some counts may be incorrect. This could have been countered by an additional, randomized counting from a second researcher to check for accuracy.

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