



Regular Article

Leadership perspectives on osteopathic medical school applicants to pathology residency training



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ABSTRACT

The number of graduating allopathic (MD) medical students matching into pathology has declined in recent years, while the number of osteopathic (DO) medical students has increased modestly, given the rapid expansion of osteopathic medical schools. Nonscholarly publications and materials on the internet often perpetuate negative perceptions of osteopathic physicians. Anecdotally, perspectives exist that some pathology residency programs are not DO-friendly; however, the reasons and how widespread an effect this might be are unclear. Our survey queried pathology chairs and residency program directors about their perceptions of osteopathic applicants and their knowledge of osteopathic medical school/training in general. This study utilized two similar, parallel surveys of pathology chairs and residency program directors with general questions structured around the perceptions and knowledge of both allopathic and osteopathic physicians, their medical training, and the consideration of osteopathic applicants to pathology residency. Pathology residency leaders acknowledge some negative perceptions of osteopathic physicians in the medical profession, the news, and social media. They also have some knowledge and perception gaps regarding osteopathic training and applicants, although experience with training osteopathic physicians as residents has been equivalent to that with allopathic physicians, and consideration appears to be fairly equal for osteopathic applicants. Even though negative perceptions of osteopathic physicians persist in news and social media, our surveys demonstrate that the leadership of pathology residency programs does not hold the same degree of bias and that DOs perform well in allopathic pathology residency programs without evidence of inferior outcomes.

Keywords: Pathology residency, Osteopathic students

Introduction

A number of recent publications and national forums have focused attention on the decline in US allopathic medical students matching into pathology and the potential implications for the pathology pipeline and patient care.¹⁻⁹ Previous studies have demonstrated the percentage of US allopathic students matching into pathology between 2011 and 2021 to

range from 1.7 % to a low of 1.1 %. Over the same interval, the overall number of pathology positions offered in the National Residency Matching Program (NRMP) has increased by 23 % (from 518 to 603; 476 and 587 positions filled, respectively).^{3-5,7,9} The number of pathology positions filled by osteopathic graduates has nearly doubled during this period, from 34 of 476 to a high of 67 of 587 in 2020.^{3-5,7,9} Numerous factors are likely contributory, including the addition of new osteopathic

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medical schools and expansion via branch campuses by existing schools. Factors influencing osteopathic student interest in pathology are on the whole similar to those of allopathic students; however, some notable curricular differences have been previously identified, and gaps may pose opportunities for increased engagement with these students.¹ Given the rapid growth of osteopathic medical schools and a modest but steady number of osteopathic students entering the field of pathology, osteopathic physicians appear to be a growth opportunity for the pathology residency pipeline.

A brief internet search using standard search engines easily turns up negative perceptions about osteopathic medicine and physicians, often including words like “stigma,” “dubious,” “quack,” “real doctors,” etc. Even articles trying to dispel such notions may still convey the suggestion that DOs are inferior to MDs. Such perceptions can also be found in non-scholarly publications and on websites commonly accessed by college students seeking information on both allopathic and osteopathic medical schools.^{10–16} Factual information about osteopathic medicine can be found through the American Osteopathic Association.¹⁷ However, not all consumers of electronic information will attempt to balance generalized information on the internet with data from a reputable source.

An article published in 2009 surveyed the perceptions of osteopathic medicine among allopathic physicians in the deep central and southern United States, an area where osteopathic physicians are underrepresented compared to allopathic physicians. This survey found that the only demographic factor with a statistically significant impact on negative perceptions of osteopathic medicine among respondents was a lack of contact with osteopathic physicians. Most respondents in this study recognized the distinctiveness of osteopathic medicine but could not clearly articulate those differences in responses to other survey items specifically querying training/qualifications, practice activities, overall opinion, and philosophy.¹⁸ Additional articles have detailed delayed acceptance of osteopathic medicine within the international medical community, including a lack of full practice rights or practice limited to osteopathic manipulation therapy only in certain countries.^{19,20}

There is a limited amount of research into perceptions of how osteopathic applicants are viewed or how an osteopathic degree may impact one's career course. A recent study surveying allopathic and osteopathic radiology residents found statistically significant differences in the perceived value of a DO versus a MD degree. Almost four times as many osteopathic graduates felt that being a DO altered their career options, with many indicating that they were advised against pursuing a career in radiology because their osteopathic degree was not perceived to be as competitive. More DO graduates indicated that their abilities and competencies were questioned more than those of their allopathic counterparts. Additionally, almost 90 % of allopathic and osteopathic radiology residents felt that the residency selection process favored MDs over DOs.²¹ An article exploring osteopathic applicants to Emergency Medicine programs noted that the allopathic programs that interview and accept osteopathic applicants varied from year to year and gave the advice for applicants to reach out to other students, residents, and faculty members who have been involved in the specific residency of interest, as well as to screen the program website for current and past DO residents and faculty members.²² Another recent article looked at the attitudes toward allopathic and osteopathic candidates to dermatology residency after the merged accreditation system for MD and DO graduate medical education programs in June of 2020. As background, the merged accreditation system was intended to create a more uniform process in the pathway to residency for all medical students. It was also intended to lower costs by eliminating the need for dual accreditation and by promoting consistency in how residents and fellows are evaluated. The dermatology article found that since the merger, there has been a declining match rate of osteopathic students into the traditionally competitive specialties such as dermatology, despite increases in the total overall number of osteopathic medical students in the U.S. and therefore, applicants. This survey found that 16 % of allopathic residents and 74 % of osteopathic residents perceived bias based on their degree, and a lack

of research experience was a barrier for osteopathic graduates. The survey also highlighted that osteopathic applicants were less likely to receive mentorship by both allopathic and osteopathic dermatology faculty. While this article had some limitations, it did highlight a trend that DOs may encounter greater challenges due to bias in pursuing dermatology as a specialty.²³

A literature search did not reveal any articles on attitudes toward DOs in pathology or on the objective performance of osteopathic physicians in allopathic pathology residency programs. However, there are anecdotal perspectives that some pathology residency programs are not DO-friendly, meaning that they either do not consider osteopathic applicants at all or consider them less favorably. Additionally, some programs require osteopathic medical students to have taken the United States Medical Licensing Examination (USMLE) in addition to the Comprehensive Osteopathic Medical Licensing Examination of the United States (COMLEX-USA) required by their osteopathic medical school.²⁴ This poses an additional financial burden and stressor on osteopathic candidates.

This study used two similar, parallel surveys to query pathology chairs and residency program directors on their perceptions of osteopathic applicants and their knowledge of osteopathic medical school/training in general. The surveys aimed to particularly address 1) whether pathology residency training programs give equal consideration to osteopathic and allopathic residency candidates, 2) whether pathology residency program directors and department chairs hold the same negative perceptions of osteopathic physicians that are commonly present on the internet and in other non-scholarly publications, 3) whether or not there was misalignment between perceptions of department chairs and residency program directors and the actual credentials of osteopathic applicants, and 4) how pathology residency leaders perceive osteopathic medical school graduates compared to allopathic medical school graduates with regard to preparation for residency and performance during residency training. The surveys also assessed demographic data, exposure to osteopathic physicians in training, in practice, and personally, as well as the general knowledge of program leaders about osteopathic medicine and its training.

Identifying knowledge gaps about osteopathic medicine in PDs and chairs could lead to opportunities for pathology residency program leadership to learn more about osteopathic medicine to better assess osteopathic applicants, as well as evaluate the objective performance of osteopathic physicians in pathology residency based upon supplemental data from the American Board of Pathology. This could thereby lead to outreach opportunities, further support the pipeline of osteopathic candidates into pathology residency, and allow program directors to identify the potential strengths and weaknesses of osteopathic pathology trainees to help support their education. It may also provide meaningful information to those mentoring osteopathic students regarding their career choices.

Materials and methods

A 28-question survey was developed to query program directors on their exposure to, attitudes toward, and understanding of osteopathic physicians, including perceptions of osteopathic physicians in the media and nonscholarly publications. Additionally, questions focused on osteopathic medical school training and the Comprehensive Osteopathic Medical Licensing Examination-USA (COMLEX-USA). A 25-question survey was addressed to pathology chairs. This survey was essentially parallel to the PD survey, with the exception of excluding a few questions that better pertained to those most closely involved in the residency interview and applicant selection process. Basic demographic information was also collected from both sets of survey respondents.

This survey project underwent expedited review from the Pennsylvania State University College of Medicine institutional review board and was deemed exempt.

Contact information for program directors was identified from the Accreditation Council for Graduate Medical Education (ACGME) list of

programs by specialty²⁵ and chairs from the Association of Pathology Chairs directory²⁶ with supplemental internet searches. The survey was developed and administered via REDCap. Pathology residency program directors and department chairs received an invitation to participate in the research via an e-mail cover letter containing a link to the survey. Data were collected via two anonymous online surveys administered through REDCap from July 25–August 21, 2022. Nonrespondents received three e-mail reminders. A screening question on each survey ensured respondents currently held the role of program director or chair. Branching logic was employed in the survey to screen out questions that would be inappropriate given a previous answer. All attempts were made to construct questions in such a way as to promote honest responses and to avoid socially favorable bias (answering in such a way as to purposely avoid disclosing bias or discriminatory beliefs). When asking questions aiming to assess public perceptions of osteopathic medicine, parallel questions about allopathic medicine were also presented. Both surveys are available as [Supplemental Material 1](#).

Because the data were anonymous, program director and chair responses could not be linked, and the institutions they represent were not identifiable. The survey was constructed such that respondents could skip any question, and free text commentary was not mandatory. Thus, the number of respondents to a given question was the denominator used to determine percentages. All percentages presented in tables and figures were rounded to the nearest whole number.

Results

Of 152 PDs, 60 responses were received, reflecting a 39 % response rate. Of 113 chairs, 38 responded, reflecting a 34 % response rate. Baseline data were collected regarding PD and chair exposure to osteopathic physicians.

Respondent demographics

Background information was collected about the respondents' medical credentials. Of PDs, 78 % (N = 47 of 60) were MDs, 12 % (N = 7 of 60) were MD/PhDs, 2 % (N = 1 of 60) were MD equivalents (e.g. MBBS), and 8 % (N = 5 of 60) were DOs. Of chairs, 55 % (N = 21 of 38) were MDs, and 45 % (N = 17 of 38) were MD/PhDs. Of note, no chairs were DOs.

PDs and chairs were fairly evenly distributed across geographic locations. In the development of the surveys, it had been theorized that individuals working in a region with a greater number of osteopathic medical schools may have had more exposure to osteopathic physicians, and that might influence perceptions. Given the small numbers for each location, it was not possible to further analyze the data to see if there were any differences in responses based on location.

The largest contingent of PD and chair respondents came from programs that had 16 to 23 residents (41 %, N = 23 of 56, and 51 %, N = 19 of 37), respectively. Given the overall small numbers dispersed over smaller or larger programs, it was not possible to further analyze data based on this demographic.

In the development of the surveys, it was theorized that years in practice might influence a respondent's exposure to osteopathic physicians given the tremendous growth of osteopathic medical schools and campuses in the past ten years. The largest contingent of PD respondents were in practice 10+ to 20 years (39 %, N = 22 of 56), and the majority of chairs (84 %, N = 31 of 37) were in practice >20 years, with the remainder of chairs in practice 10–20 years. Twenty-nine percent (N = 16 of 56) of PDs were in practice 5–10 years, 21 % (N = 12 of 56) were in practice >20 years, and 11 % (N = 6 of 56) were in practice <5 years.

Chairs and PDs were queried on the number of years they had served in their roles, with breakdowns of 3 years or less, 3+ to 5 years, 5+ to 10 years, 10+ to 20 years, and >20 years given as options. A majority of PDs were in their role for <5 years (57 %, N = 32 of 56), whereas chairs were more evenly distributed among time intervals of service. Given the

relatively small numbers within each category within years of practice and years of role, these demographics were not studied against responses.

Exposure to osteopathic physicians

Sixty PDs responded in regard to exposure to osteopathic physicians during their graduate medical education as residents or fellows. Forty-three percent (N = 26 of 60) had exposure to osteopathic faculty members, 42 % (N = 25 of 60) did not, and 15 % (N = 9 of 60) did not remember. A higher percentage (62 %, N = 37 of 60) had exposure to osteopathic peers, 30 % (N = 18 of 60) did not, and 8 % (N = 5 of 60) did not remember. Chairs were not asked these questions; knowing that most had trained over 20 years ago, this question seemed less relevant for this group.

The majority of respondents indicated that there is an osteopathic medical school campus in their state: 78 % of PDs (N = 45 of 58), and 87 % of chairs (N = 33 of 38). Twelve percent (N = 7 of 58) of PDs and 11 % (N = 4 of 38) of chairs indicated that there was not an osteopathic school campus in their state, and 10 % (N = 6 of 58) of PDs and 3 % (N = 1 of 38) of chairs did not know. Given the anonymity of the survey, responses were not fact-checked for accuracy.

The majority of PDs (83 %, N = 48 of 58) and chairs (76 %, N = 29 of 38) confirmed that osteopathic medical students had rotated in their department within the past 10 years, compared to 5 % of PDs (N = 3 of 58) and 13 % of chairs (N = 5 of 38) who did not have osteopathic students rotate in their department, and 12 % of PDs (N = 7 of 58) and 11 % of chairs (N = 4 of 38) who did not know.

The majority of PDs (66 %, N = 38 of 58) and chairs (71 %, N = 27 of 38) indicated there were osteopathic physicians as faculty members in their departments in the past 10 years. Twenty-six percent of PDs (N = 15 of 58) and 24 % of chairs (N = 9 of 38) said they did not have osteopathic physicians as faculty members, and the remainder did not know. Of note, chairs indicated whether they had been responsible for hiring the DO faculty. Twenty-four percent of the chairs (N = 9 of 38) had hired the osteopathic physicians into their departments.

Specific questions pertaining to the overall perceptions of allopathic and osteopathic physicians were asked. The results are detailed below.

Pathology residency leaders' perceptions of osteopathic physicians and allopathic physicians in the medical community, news, and social media

Participants were queried about how allopathic and osteopathic physicians are regarded in the medical community (overall, not limited to the pathology medical community), the news, and social media. For all three areas, the questions were structured in parallel without asking respondents to compare allopathic and osteopathic physicians directly to avoid bias. Response choices were listed on a 5-point scale, including very negatively (1) negatively, neither positively nor negatively, positively, and very positively (5). Respondents also had the option to select "I don't know." These responses were not assigned a point value and were excluded from the statistical analysis.

Fifty-seven PDs reported their perception of the level of regard in the medical community for allopathic physicians, and 56 PDs responded for osteopathic physicians. As shown in [Fig. 1](#), Panel A, 95 % (N = 54 of 57) of PDs perceived that allopathic physicians are either positively or very positively regarded in the medical community, compared to 78 % (N = 44 of 56) of PDs saying the same of osteopathic physicians. No PDs indicated that allopathic physicians are regarded negatively, compared to 13 % of PDs (N = 7 of 56) indicating a negative perception of osteopathic physicians. The corresponding mean for osteopathic physicians (M = 4.05, SD = 1.00) was significantly lower than the mean rating of medical community regard for allopathic physicians (M = 4.74, SD = 0.55), $t(55) = -5.144$, $P < .001$. Chairs held similar perceptions, with 97 % (N = 37 of 38) indicating positive or very positive medical community regard for allopathic physicians, compared to 78 %

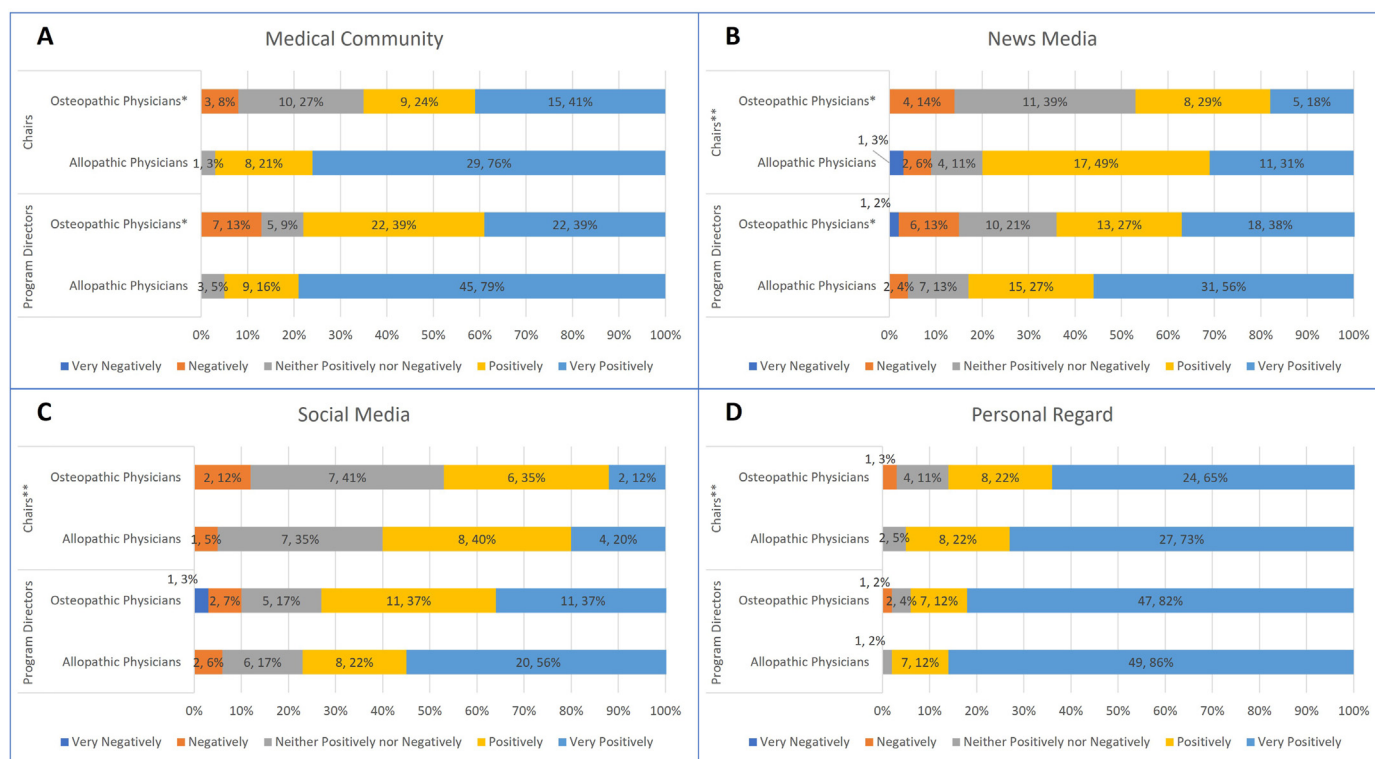


Fig. 1. PD and chair ratings of regard for osteopathic and allopathic physicians
 Panel A - Perception of regard within the general medical community
 Panel B - Perception of regard within the news media
 Panel C - Perception of regard within social media
 Panel D - Personal regard
 *Osteopathic physicians rated significantly lower than allopathic physicians.
 **Chairs rated both physician groups significantly lower than did Program Directors.

indicating the same for osteopathic physicians, and a slightly higher proportion indicating that osteopathic physicians were regarded neither positively or negatively (27 %, N = 10 of 37) and 8 % (N = 3 of 38) perceiving negative regard. Consistent with the PD result, the mean chair rating of medical community regard for osteopathic physicians (M = 3.97, SD = 1.01) was significantly lower than that for allopathic physicians (M = 4.74, SD = 0.50), $t(55) = -4.604, P < .001$. In summary, most PDs and chairs believe allopathic and osteopathic physicians are well regarded in the medical community; however, regard for allopathic physicians was significantly more positive.

Eighty-three percent of PDs (N = 46 of 55) perceive that allopathic physicians are regarded positively or very positively in the news, compared to 65 % (N = 31 of 48) for osteopathic physicians (see Fig. 1, Panel B). A higher percentage of neutral and negative or very negative responses were seen for osteopathic physicians: 21 % (N = 10 of 48) and 15 % (N = 7 of 48), respectively, compared to 13 % (N = 7 of 55) neutral responses and 4 % negative responses for allopathic physicians. Corresponding means were significantly lower for osteopathic physicians (M = 3.85, SD = 1.13) compared to allopathic physicians (M = 4.36, SD = 0.85), $t(47) = -3.102, P = .003$.

Similarly, 83 % of chairs (N = 28 of 35) perceive that allopathic physicians are regarded positively or very positively in the news, compared to 47 % (N = 13 of 28) for osteopathic physicians. Higher percentages of neutral and negative or very negative responses were seen for osteopathic physicians: 39 % (N = 11 of 28) and 14 % (N = 4 of 28), respectively, compared to 11 % (N = 4 of 35) neutral responses and 9 % (N = 3 of 35) negative or very negative responses for allopathic physicians. Corresponding means were significantly lower for osteopathic physicians (M = 3.50, SD = 0.96) compared to allopathic physicians (M = 4.00, SD = 0.97), $t(27) = -2.750, P = .01$. It should also be noted

that the mean chair rating was significantly lower than the mean PD rating for both allopathic [M = 4.00 and 4.36; $t(35) = 3.353, P = .002$] and osteopathic physicians [M = 3.50 and 3.85; $t(29) = 2.551, P = .02$]. In summary, PDs and chairs expressed that regard in the news media was lower for both, but again, PDs and chairs felt that the regard for osteopathic physicians is significantly lower than for allopathic.

PD responses for regard in social media were statistically comparable between osteopathic (M = 3.97, SD = 1.07) and allopathic physicians (M = 4.28, SD = 0.94), $t(29) = -1.610, P = .12$. Chairs also provided statistically comparable ratings of osteopathic (M = 3.47, SD = 0.87) and allopathic (M = 3.75, SD = 0.85) physician regard in social media, $t(16) = -1.317, P = .21$. Of note, however, the mean chair rating was significantly lower than the mean PD rating for both allopathic [M = 3.75 and 4.28; $t(35) = 3.353, P = .002$] and osteopathic physicians [M = 3.47 and 3.97; $t(29) = 2.551, P = .02$]. PD and chair response distributions are shown in Fig. 1, panel C.

Pathology residency leaders' personal regard for osteopathic physicians

PDs and chairs were queried about their personal regard for both allopathic and osteopathic physicians based upon personal/professional interactions such as personal/family medical treatment, day-to-day interactions with colleagues, and service on professional committees. Despite perceptions of lesser regard in the medical community, news, and social media, pathology residency leaders did not report that they personally regard osteopathic physicians less favorably. Ninety-four percent of PDs (N = 54 of 57) reported positive or very positive personal regard for osteopathic physicians, compared with only 2 % (N = 1 of 57) holding a negative view (see Fig. 1, Panel D). The mean PD rating for

personal regard for osteopathic physicians (M = 4.75, SD = 0.61) was statistically comparable to the mean rating for allopathic physicians (M = 4.84, SD = 0.41), $t(56) = -1.067, P = .29$. Chairs also provided statistically comparable ratings of personal regard for osteopathic (M = 4.49, SD = 0.80) versus allopathic (M = 4.68, SD = 0.58) physicians, $t(36) = -1.465, P = .15$. It is interesting to note, however, that chairs provided a slightly higher neutral response of 11 % (N = 4 of 37) for osteopathic physicians versus 5 % (N = 2 of 57) for allopathic. Furthermore, the mean chair rating for personal regard was significantly lower than the mean PD rating for both allopathic [M = 4.68 and 4.84; $t(56) = 2.959, P = .005$] and osteopathic physicians [M = 4.49 and 4.75; $t(56) = 3.294, P = .002$]. While chairs rated their personal regard for osteopathic physicians significantly lower than DO PDs, their ratings, on average, were still very positive.

PD ratings of personal regard for osteopathic physicians were further examined to identify any differences in regard based on having been exposed to osteopathic physicians as faculty or peers during training. No significant differences were observed. Chairs were not asked about exposure to osteopathic physicians during training, being that most would have trained >20 years ago, making responses for this demographic potentially less meaningful.

Pathology residency leaders' perceptions of osteopathic medical training

Respondents were queried on their understanding of allopathic versus osteopathic medical training. PDs and chairs rated their agreement with four statements on a 5-point scale, including strongly disagree (1), disagree, no opinion, agree, and strongly agree (5). The first agreement statement was "allopathic medical training and osteopathic medical training are essentially interchangeable in terms of educational content"

(see Fig. 2, Panel A). On average, PDs (M = 3.82, SD = 0.98) were significantly more likely than chairs (M = 3.29, SD = 1.01) to agree with this statement, $t(56) = 4.101, P < .001$. Seventy-seven percent (N = 44 of 57) of PDs strongly agreed or agreed, compared with 50 % of chairs indicating the same. Over one-quarter of the chairs (28 % or 10 of 38) disagreed or strongly disagreed, and a notably higher percentage had no opinion (24 % or 9 of 38) compared to PDs (5 % or 3 of 57).

The second agreement statement was "osteopathic medical training has a stronger focus on primary care compared to allopathic medical training" (see Fig. 2, Panel B). PD and chair responses were more closely aligned on this question, with 61 % (N = 35 of 57) of PDs and 66 % (N = 25 of 38) of chairs strongly agreeing or agreeing. Similar responses were seen at the opposite end of the scale as well, with 30 % (N = 17 of 57) and 9 % (N = 5 of 57) of PDs having no opinion or disagreeing, respectively, and 24 % (N = 9 of 38) and 11 % (N = 4 of 38) of chairs having no opinion or disagreeing, respectively. The corresponding means for PDs (M = 3.74, SD = 0.90) and chairs (M = 3.63, SD = 0.79) were comparable, $t(56) = 0.899, P = .37$.

The third agreement statement was "allopathic medical schools have higher admissions standards than osteopathic medical schools" (see Fig. 2, Panel C). On average, the PD (M = 3.82, SD = 0.78) and chair (M = 3.86, SD = 1.08) ratings of this item were also comparable, $t(56) = -0.342, P = .73$. Sixty-six percent (N = 38 of 57) of PDs, compared with 70 % (N = 26 of 38) of chairs, strongly agreed or agreed. A higher percentage of PDs had no opinion (30 %, N = 17 of 57) compared to chairs (16 %, N = 6 of 37). Interestingly, a higher percentage of chairs disagreed or strongly disagreed at 14 % (N = 5 of 37) compared with 4 % (N = 2 of 57) of PDs.

The fourth agreement statement was "osteopathic medical training is less academically rigorous than allopathic medical training" (see Fig. 2, Panel D). On average, chairs (M = 2.97, SD = 1.04) were significantly more

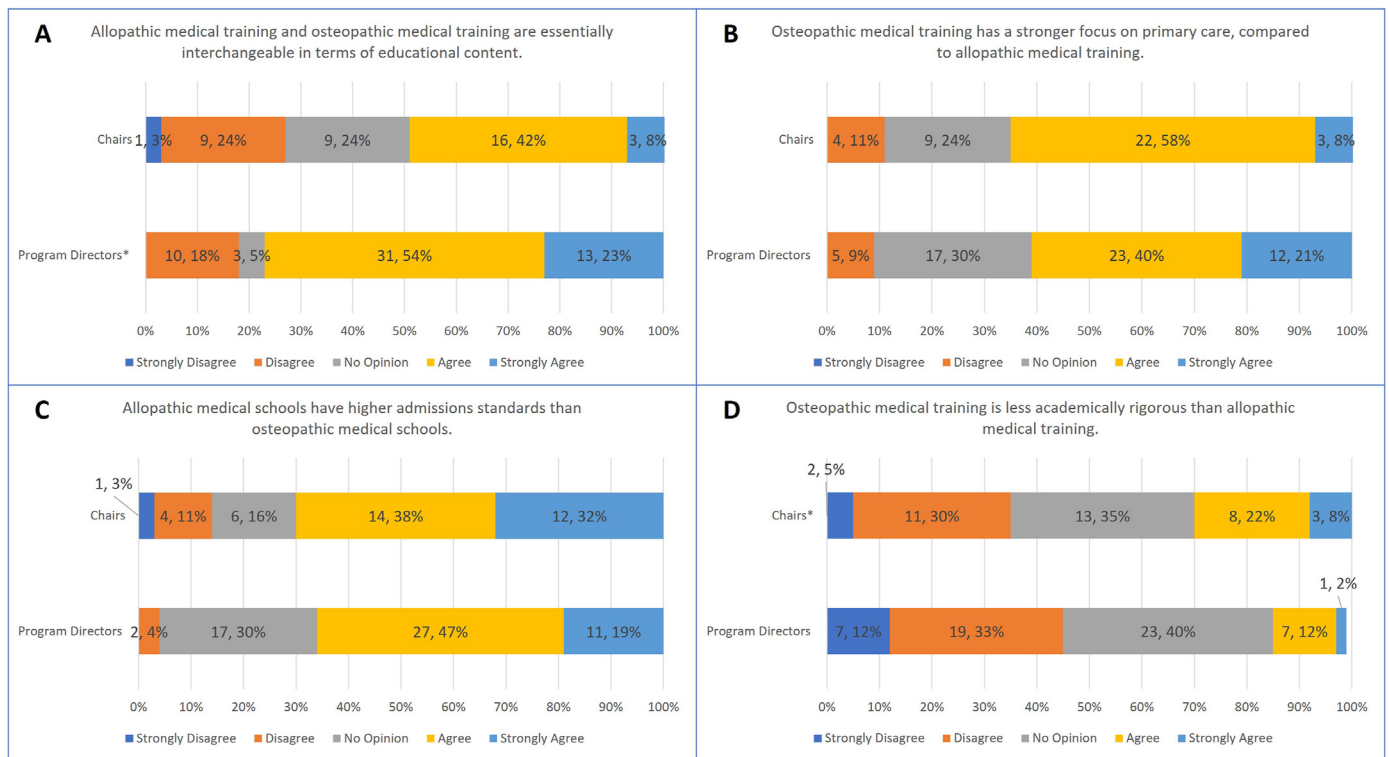


Fig. 2. PD and chair perceptions of osteopathic versus allopathic medical training
 Panel A - Perception of the interchangeability of educational content between allopathic and osteopathic medical school training
 Panel B - Perception of osteopathic medical school training having a stronger focus on primary care
 Panel C - Perception of admission standards between allopathic and osteopathic medical schools
 Panel D - Perception of the academic rigor of allopathic versus osteopathic medical training
 *Mean agreement rating is significantly higher.

likely than PDs ($M = 2.58, SD = 0.92$) to agree with this statement, $t(56) = -3.192, P = .002$. Thirty percent of chairs ($N = 11$ of 37) strongly agreed or agreed, compared with only 14 % ($N = 8$ of 57) of PDs. Similar percentages held no opinion: 40 % ($N = 23$ of 57) of PDs compared with 35 % ($N = 13$ of 37) of chairs. A higher percentage of PDs disagreed or strongly disagreed at 45 % ($N = 26$ of 57), compared with 35 % ($N = 13$ of 37) of chairs.

In summary, most PDs and chairs agreed that allopathic medical schools have higher admissions standards. While few in either group indicated that osteopathic training is less academically rigorous, many PDs and chairs could not offer an opinion, indicating a potential gap in knowledge of osteopathic training. Of the two groups, chairs were significantly less likely to agree that osteopathic and allopathic training are interchangeable in terms of educational content and more likely to agree that osteopathic training is less academically rigorous. PD responses were further analyzed against exposure to DOs during their training. There were no statistically significant differences in responses to the four agreement statements based upon exposure to osteopathic physicians during training.

Pathology residency leaders' consideration of osteopathic and allopathic residency candidates

Most PDs and chairs reported that osteopathic and allopathic applicants to their program are, on average, ranked the same (see Table 1). However, a small percentage did indicate ranking osteopathic applicants lower or rarely ranking them at all.

PDs and chairs generally agree on how osteopathic candidates should be considered/ranked at the time of evaluating program applicants. However, leadership support for equal consideration of osteopathic candidates in some programs may be mixed, with 5 % ($n = 3$ of 56) of PDs indicating a difference in opinion between their ranking of osteopathic candidates compared to their chair's preferences. Specific responses from PDs indicated that their chair prefers to rank MDs over DOs and that there is some residual dismissal of DO applicants among older faculty members. One chair respondent commented that the prior chair did not interview DOs; however, the responding individual welcomed the interviews and ranking. Another chair indicated that prior to their tenure, DOs would always be ranked below MDs, but this individual has now equalized this, and both degrees are considered and ranked accordingly. Another chair commented that they felt the educational experience of osteopathic applicants can be inferior to that of allopathic candidates and therefore only occasionally ranks osteopathic medical students. Several other PD and Chair respondents noted no noticeable difference in the quality of MD versus DO candidates. One PD respondent commented that osteopathic applicants must work harder to find and participate in pathology opportunities, which usually makes their dedication to the field more apparent. This refers to the fact that since most osteopathic medical schools do not

Table 1
PD and chair assessment of how osteopathic applicants are ranked.

	Program directors (N = 56)		Chairs (N = 38)	
	N	%	N	%
N/A/Our program has not had any osteopathic applicants in the past 10 years	0	0 %	0	0 %
Ranked higher than allopathic applicants	0	0 %	0	0 %
Ranked the same as allopathic applicants	51	91 %	33	87 %
Ranked lower than allopathic applicants	3	5 %	3	8 %
Our program considers but rarely ranks osteopathic applicants	2	4 %	2	5 %
Not ranked/our program does not consider osteopathic applicants	0	0 %	0	0 %

have their own hospital and since pathology is not a primary care specialty, students have to put time and effort into finding a pathology practice that will allow them to participate in an elective rotation. This often requires the student to make their own connections rather than having preexisting connections through their schools. This was especially difficult during the COVID-19 pandemic, when many sites restricted or entirely curtailed outside rotators from participating in on-site rotations. Lack of easy access to pathology practices may also make it more difficult to do informal shadowing or partake of additional pathology-related educational opportunities such as observing autopsies or signing out at a multiheaded microscope when not formally on a pathology rotation. Another respondent indicated that an allopathic student with red flags is ranked lower than an osteopathic applicant who has had experiences stepping outside of their comfort zone and/or demonstrated a strong work ethic, and that outstanding DO candidates are ranked highly, but those with weaker applications are ranked lower than comparable MD candidates. One hundred percent ($N = 37$) of chairs felt that they had agreement with their PD on how osteopathic candidates should be ranked.

Chair involvement in residency education

Chair respondents were asked whether they are currently or have previously been a PD or Associate PD. Sixty-one percent ($N = 22$ of 36) of chairs have served as PDs.

Seventy-six percent ($N = 29$ of 38) of chairs are involved in pathology resident recruitment activities, with more involvement in later stages of the recruitment process (interviews and rank list), as shown in Table 2.

PDs and chairs rated the extent to which the chair influences how their program ranks osteopathic candidates on a 5-point scale, including not at all (1), only slightly, somewhat, for the most part, and very much so (5). On average, chair ratings ($M = 2.63, SD = 1.57$) were significantly higher (i.e. indicated greater influence) than PD ratings ($M = 1.79, SD = 1.19$), $t(55) = -5.325, P < .001$. As shown in Fig. 3, 29 % of chairs ($N = 11$ of 38) felt that they very much or for the most part influence how their program ranks osteopathic candidates, compared with only 10 % ($N = 6$ of 56) of PDs. Sixty-one percent ($N = 34$ of 56) of PDs, compared with 37 % ($N = 14$ of 38) of chairs, indicate no chair influence on the process.

PDs and chairs also rated the extent to which educational leadership (i.e. GME office, dean) at their institution influences the ranking of osteopathic applicants. Higher levels of education leadership appear to have very little influence on the ranking of osteopathic applicants, with only 4 % ($N = 2$ of 56) of PDs and no chairs indicating that higher leadership either very much or for the most part has influence (see Fig. 4). The majority of PDs and chairs indicated no influence. Mean ratings on this item for PDs ($M = 1.27, SD = 0.77$) and chairs ($M = 1.18, SD = 0.51$) were comparable, $t(55) = 0.849, P = .40$. Only one specific comment indicated that the dean has stated a sequential preference for graduates of U.S. MDs, U.S. DOs, Caribbean graduates, and lastly, IMGs.

Factors informing understanding/perceptions of osteopathic candidates

COMLEX-USA

PDs and chairs rated their preparation to interpret COMLEX-USA results on a 5-point scale, including not at all (1), only slightly,

Table 2
Chair involvement in residency recruitment.

Recruitment activities	Chairs (N = 29)	
	N	%
Review applications and provide recommendations for which applicants to interview	9	31 %
Approve which applicants are invited to interview	5	17 %
Interview applicants	27	93 %
Provide recommendations for the Match rank list	25	86 %
Approve the Match rank list	20	69 %

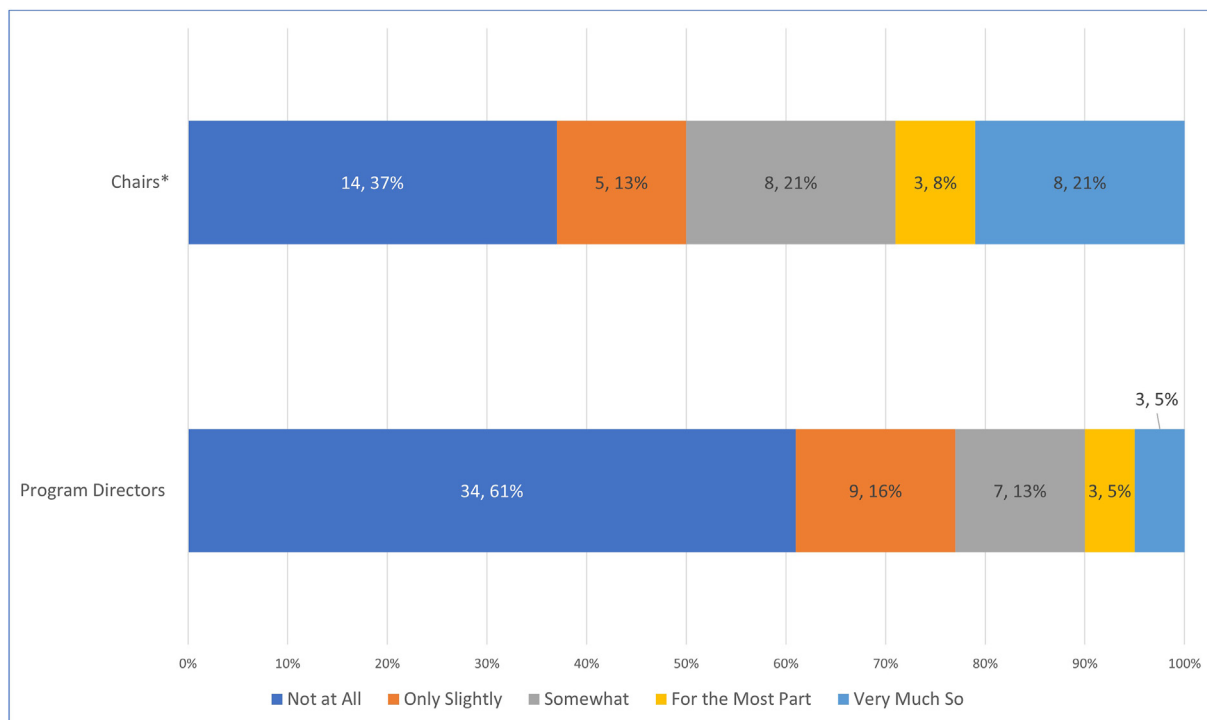


Fig. 3. PD and chair perceptions of chair influence on ranking of osteopathic applicants
*Mean rating is significantly higher.

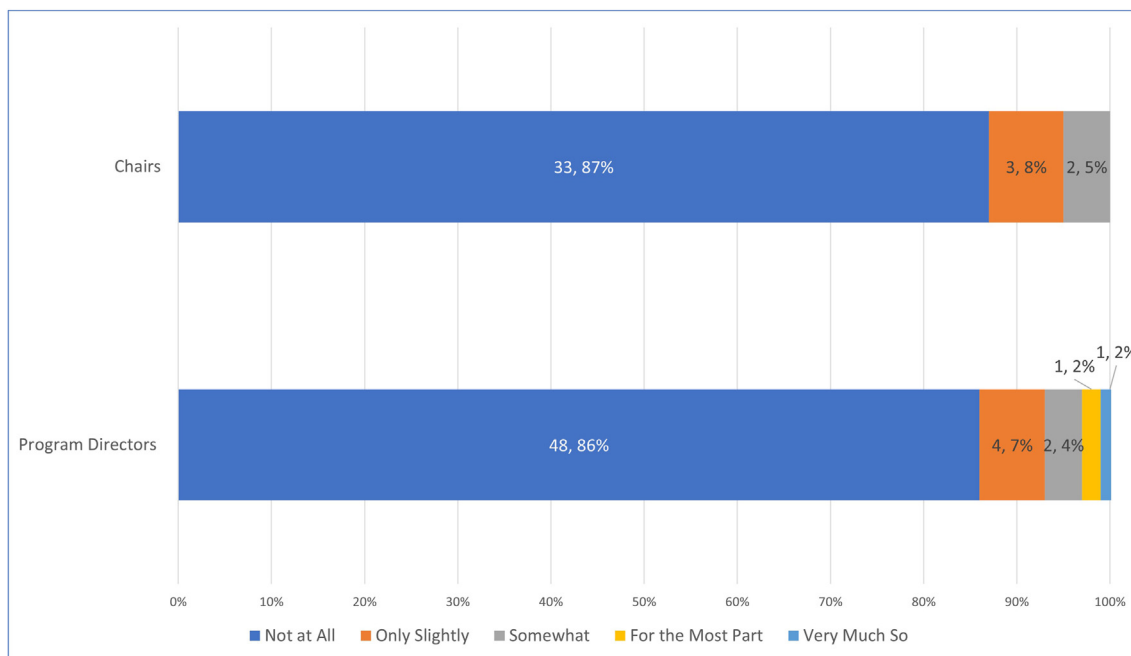


Fig. 4. PD and chair perceptions of education leadership influence the ranking of osteopathic applicants.

somewhat, for the most part, and very well (5) prepared. Respondents also had the option to indicate they had never heard of COMLEX-USA, and these responses were excluded from the statistical analysis. On average, PDs (M = 3.57, SD = 1.29) were significantly more prepared to interpret COMLEX-USA results than chairs (M = 2.69, SD = 1.35), $t(55) = 5.108, P < .001$. As shown in Fig. 5, 55% (N = 31 of 57) of PDs felt very well prepared or well prepared to interpret COMLEX-USA results, compared to only 30% (N = 11 of 36) of chairs. Conversely, 31% (N = 11 of 36) of chairs, compared to only 7% (N = 4 of 56) of PDs, are

not at all prepared to interpret COMLEX-USA. It should also be noted that 2 chairs (5% of 38 respondents) indicated that they had never heard of COMLEX-USA.

Chair preparation to interpret COMLEX-USA was further examined on the basis of prior or concurrent experience as a PD. Chairs who have previously served or concurrently served as a PD (N = 21, M = 3.29, SD = 1.23) were better prepared to interpret COMLEX-USA than those who have not (N = 13, M = 1.62, SD = 0.870), $t(32) = 4.268, P < .001$. Only 14% of chairs (N = 3 of 21) who have previously served or

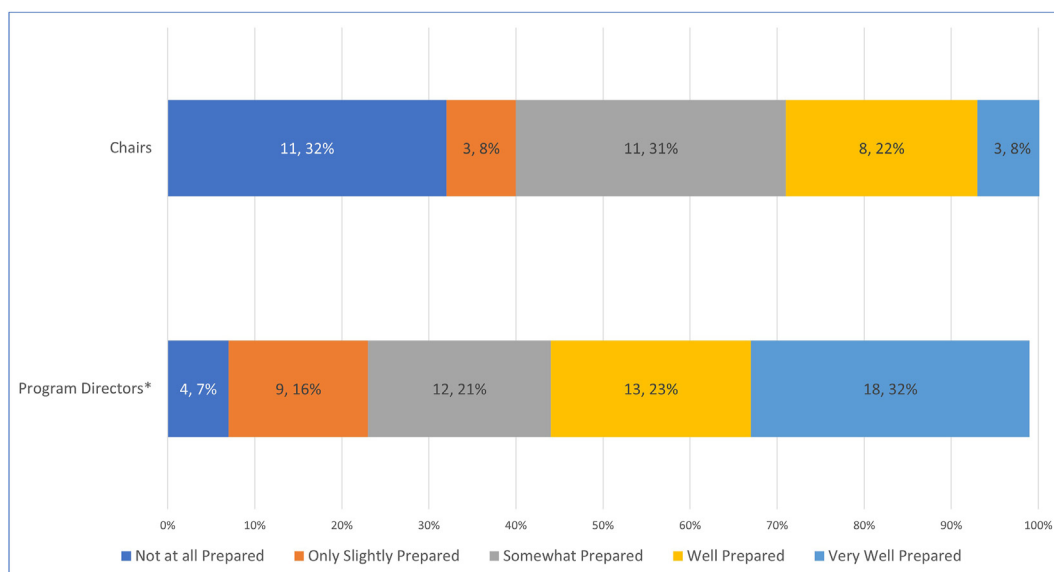


Fig. 5. PD and chair preparation to interpret COMLEX-USA

*Mean rating is significantly higher.

concurrently served as PD indicated being not at all prepared, compared to 62 % of chairs without this experience ($N = 8$ of 13). Conversely, 48 % of chairs with this experience ($N = 10$ of 21) felt very well prepared or well prepared, while none of the chairs without this experience indicated the same.

While PDs may have felt better prepared to interpret COMLEX-USA results, most do not know how the difficulty level compares to USMLE. Survey respondents were queried how the difficulty of COMLEX-USA compares to USMLE and were given options of much harder, somewhat harder, about the same, somewhat easier, much easier, and I do not know. Fifty-seven percent ($N = 32$ of 56) responded that they do not know. Of the 24 PDs who felt that they could offer an opinion, 83 % ($N = 20$ of 24) indicated that the difficulty was about the same. Among those with an opinion, there was a small minority (16 %, $N = 4$ of 24) who believe COMLEX-USA is easier.

Most programs do not require USMLE in addition to COMLEX-USA, with 98 % ($N = 55$ of 56) of PDs indicating this to be true. However, 11 % ($N = 4$ of 35) chairs indicated that USMLE is required in addition to COMLEX-USA, and 40 % ($N = 14$ of 35) responded, "I don't know." Some free text comments indicated they prefer to see USMLE, but it is not actually required. One PD commented that the existence of a separate osteopathic medical board is partially to blame for the perceived difference between MDs and DOs. This respondent also indicated that most faculty do not know how to interpret COMLEX and expressed a desire for an authoritative guide on comparing USMLE and COMLEX or abolishing COMLEX all together.

Pathology residency leaders' perceptions based upon direct experience with training osteopathic physicians

Ninety-three percent ($N = 52$ of 56) of PDs and 92 % ($N = 34$ of 37) of chairs indicated that their program has trained osteopathic physicians in the past 10 years. Respondents were queried on the performance of osteopathic and allopathic physicians in terms of preparation for residency training and overall performance in the ACGME core competencies. Questions were asked in parallel to avoid direct comparisons between allopathic and osteopathic physicians and to avoid socially desirable bias in responses.

Preparation for residency was rated on a 5-point scale, including completely unprepared (1), mostly unprepared, somewhat unprepared, mostly prepared, and completely prepared (5). On average, PDs rated

osteopathic ($M = 4.76$, $SD = 0.79$) and allopathic ($M = 4.72$, $SD = 0.76$) physicians' preparation for residency very similarly, $t(50) = 0.404$, $P = .69$. Chairs also provided comparable ratings for osteopathic ($M = 4.47$, $SD = 1.05$) and allopathic ($M = 4.50$, $SD = 1.02$) physicians, $t(33) = -0.163$, $P = .87$. Interestingly, chair ratings of preparation for residency were significantly lower than PD ratings for both allopathic ($M = 4.50$ and 4.72, respectively; $t(49) = 2.055$, $P = .04$) and osteopathic ($M = 4.47$ and 4.76, respectively; $t(50) = 2.665$, $P = .01$) physicians. PD and chair response distributions are shown in Fig. 6.

Overall performance in the ACGME core competencies was rated on a 5-point scale, including poor (1), marginal, fair, good, and excellent (5). Nearly all PDs and chairs rated both osteopathic and allopathic physician performance as good or excellent (see Fig. 7). On average, PD ratings of osteopathic physician performance ($M = 4.40$, $SD = 0.57$) were the same as those provided for allopathic physicians ($M = 4.40$, $SD = 0.50$). One specific comment from a PD regarding osteopathic trainees included that there may be on average less of a "hard science" background for DOs, which may initially affect their performance in clinical chemistry, in particular. This likely refers to the basic sciences taught in the traditional first 2 years of medical school curriculum, although based on the comment, it is not possible to discern further what was meant. Both allopathic and osteopathic medical school education is accredited by agencies recognized by the U.S. Department of Education, the Liaison Committee on Medical Education (LCME), and the Commission on Osteopathic College Accreditation (COCA), respectively. Core curriculum recommendations from both accreditation bodies are not reviewed here. Another PD respondent commented that DOs may have less experience with research, which may initially lead to a higher learning curve for starting projects in residency. Most who wrote comments felt that any differences were entirely dependent on the individual, with mention of both outstanding and mediocre residents from both backgrounds. Another comment from a PD noted that DO residents, on average, are slightly better communicators and less likely to struggle with professionalism issues. Similarly, no significant differences were observed in chair ratings of osteopathic ($M = 4.09$, $SD = 0.52$) and allopathic ($M = 4.24$, $SD = 0.50$) physician performance, $t(32) = -1.640$, $P = .11$. However, chair ratings of performance were significantly lower than PD ratings for both allopathic ($M = 4.24$ and 4.40, respectively; $t(51) = 2.385$, $P = .02$) and osteopathic ($M = 4.09$ and 4.40, respectively; $t(51) = 3.977$, $P < .001$) physicians. The chairs made no specific comments.

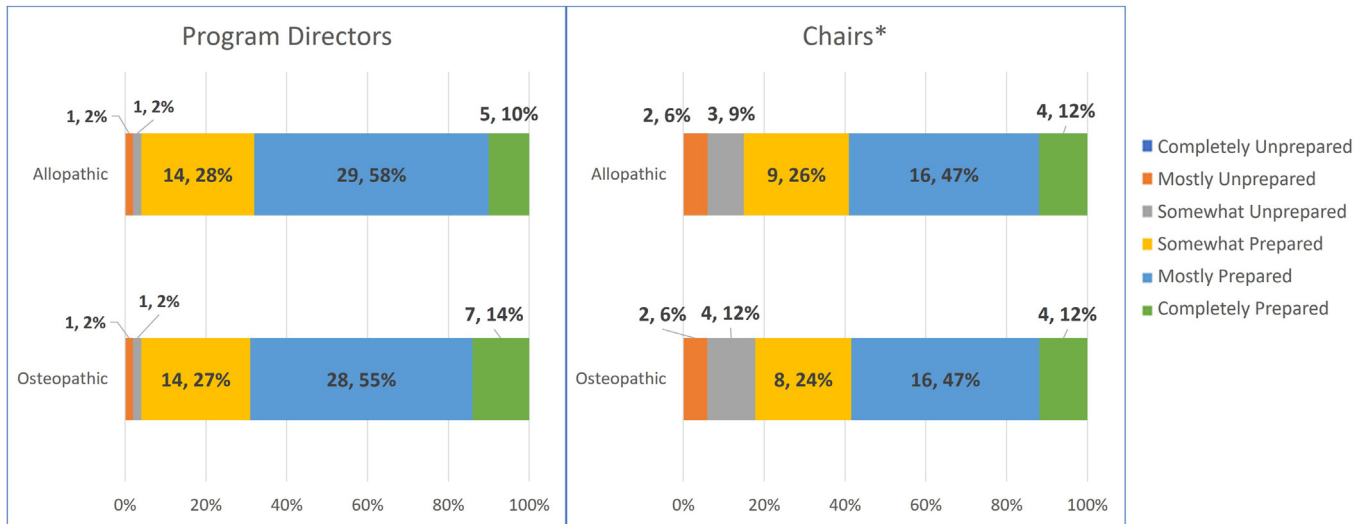


Fig. 6. PD and chair ratings of preparation for residency
 *Chairs rated both physician groups significantly lower than did Program Directors.

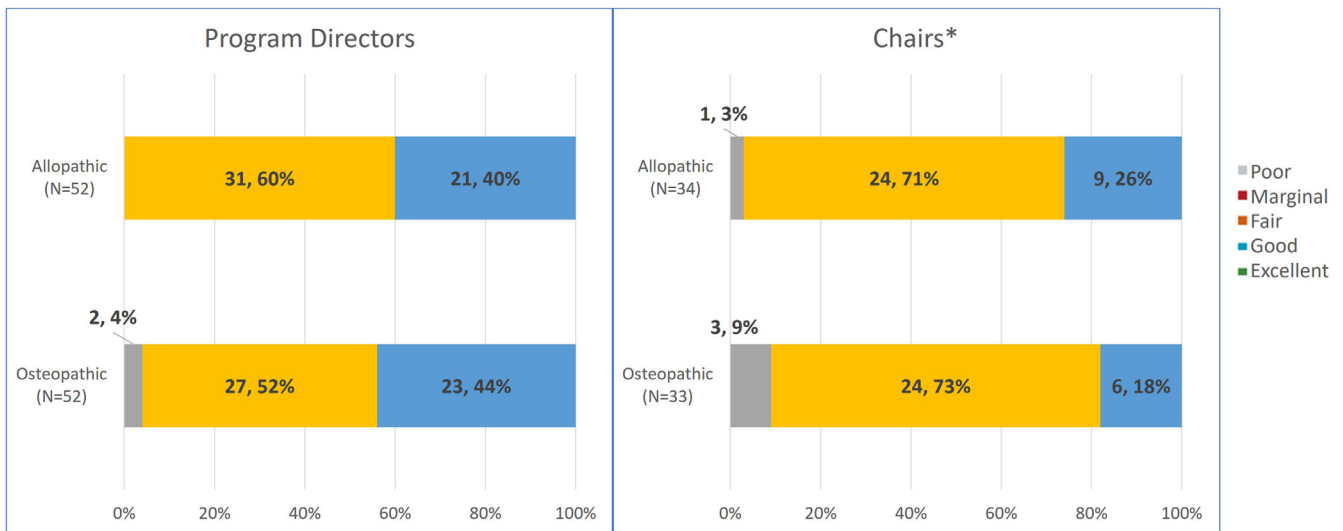


Fig. 7. PD and chair ratings of performance in the core ACGME competencies
 *Chairs rated both physician groups significantly lower than did Program Directors.

PDs were queried further on the ASCP Resident In-Service Examination (RISE) and American Board of Pathology (ABPath) board results, whereas chairs were not asked these questions, as they may not be as intimately involved in that aspect of resident performance. Ninety-four percent (N = 49 of 52) of PDs have not noticed a difference in RISE scores between osteopathic and allopathic resident physicians. Only 2% (N = 1 of 52) reported osteopathic physicians had lower scores, whereas 4% (N = 2 of 52) reported they had higher scores. Eighty-seven percent (N = 45 of 52) have not noticed a difference in board pass rates, whereas 4% (N = 2 of 52) reported osteopathic physicians to have lower pass rates, and 10% (N = 5 of 52) reported osteopathic physicians to have higher pass rates.

To investigate the predominant PD perception that there is no difference in board pass rates between osteopathic and allopathic physicians, pass rates for the ABPath AP and CP Primary Certification examinations administered from 2006 to 2022 were examined. Across this period, the passing rate for allopathic physicians on the AP exam was 87% (range: 80% to 94%) compared to 83% (range: 66% to 96%) for

osteopathic physicians. To determine the significance of this result, the odds ratio (OR) was computed, which yields the ratio of the odds of passing the examination for allopathic physicians compared to the odds for osteopathic physicians. An odds ratio equal to 1 indicates allopathic and osteopathic physicians are equally likely to pass the examination. Results indicated there was a statistically significant difference in the odds of passing the AP certification exam between allopathic and osteopathic physicians (OR = 1.365, 95% CI [1.09, 1.71]). Specifically, allopathic physicians odds of passing were greater than those of osteopathic physicians. However, the effect size was negligible, with a Cohen's d of 0.17. This indicates the strength of the relationship between medical degree type and passing rate for the AP examination is weak. With regards to the CP examination, the passing rate for allopathic physicians was 86% (range: 68% to 96%) which was equal to the aggregate passing rate for osteopathic physicians (86%, range: 56% to 98%). There was no significant difference in the odds of passing the CP certification exam based on medical degree type (OR = 1.009, 95% CI [0.79, 1.29]).

Pathology leaders' perceptions on career paths for osteopathic and allopathic residents

No PDs indicated a difference in the types of fellowships to which MDs and DO trainees apply. This question was aimed at addressing whether the perceived primary care focus of osteopathic training leads to more DOs pursuing subspecialties with some direct patient contact, such as blood banking/transfusion medicine, or cytology. One PD did note that osteopathic physicians tend to apply to a greater number of fellowship programs. One chair noted some specific examples of having a DO chief resident who was terrific and lined up a prestigious fellowship. However, the same individual indicated a fear that onboarding more DO residents would cause MD applicants to shy away from their residency. No explanation as to why was offered. Another noted that some of the lingering osteopathic internship requirements for specific state licenses are very limiting for osteopathic residents when they graduate, and included an example of an osteopathic physician having to retrain in primary care to return to their home state.

Pathology residency leaders' future consideration of osteopathic applicants

Similar results were seen for PDs and chairs regarding their likelihood of considering osteopathic applicants in the future based on past experiences, with 90 % of PDs (N = 47 of 52) and 94 % of chairs (N = 32 of 34) being equally likely, and 10 % of PDs (N = 5 of 52) and 6 % of chairs (N = 2 of 34) being more likely to consider osteopathic applicants. Some specific comments made by chairs reiterated success in recruiting and training DO applicants, with the hope that this continues. Another comment indicated that for the vast majority of trainees, they were not aware of whether they were osteopathic or allopathic graduates. The work ethic and success of the trainee are more reliant on individual characteristics than the type of medical school they attended.

Discussion

This study aimed to evaluate the perceptions of osteopathic applicants to pathology residency by comparing them in parallel to allopathic applicants across the metrics evaluated. There is always a risk of selection bias, and those who feel strongly may feel more compelled to respond to a survey. Despite best efforts to avoid socially desirable responses, respondents may have purposely tried to avoid impressions of bias against osteopathic physicians, and responses may have been skewed to reflect more positive views. As with any survey that is opinion- or perception-based, there are a number of factors without hard facts to compare against.

The overall response rate was fair, with 39 % of PDs and 34 % of chairs responding; however, a greater response rate would have yielded more robust data. Due to anonymity, PDs and chairs from the same institution could not be linked. It might have been more informative to link the responses of PDs and chairs to get a better idea of program-specific perspectives. Given that 61 % of chair respondents currently serve or have previously served as PDs, this might have skewed the type of chairs who responded. Those who were more interested in and experienced in graduate medical education might have self-selected to take the survey. It does also beg the question of whether chairs who had never served as PD or APD would have responded differently, and perhaps more negatively, based upon less exposure to osteopathic applicants to pathology residency. Per the ACGME listing of pathology residency program directors, 6 of the 144 program directors were DOs (4 %).²⁵ In our study, 8 % (N = 5 of 60) of respondents were DOs, which may indicate some DO APDs responded or an especially high response rate given the small number of DO PDs. Zero chair respondents held a DO, which is not surprising since of the 135 chairs affiliated with a medical school and of those with a residency program, there were no DO pathology chairs, a metric substantiated by the Association of Pathology Chairs directory and a recent publication.^{26,27}

There are no prior publications about how osteopathic applicants to pathology residency were perceived in the past compared to now. So, the anecdotal experiences from more than 10 years ago cannot be backed up with data. Most available papers review the impressions of specific populations of patients regarding osteopathic physicians and the experience of osteopathic applicants in specialties that are generally considered more competitive than pathology (radiology and dermatology). There are no comparable papers in the literature on program leadership perceptions of osteopathic applicants to other medical specialties. To our knowledge, there are also no other publications citing objective data on osteopathic physician performance in pathology residency.

In general, the results of these surveys demonstrate that while osteopathic physicians may be held in lower regard in the medical community, news, and social media, personal regard from residency leadership overall is positive. However, there is a small but consistent negative bias in most categories of questions asked. This was especially true of responses from the chair group and slightly less with the PD group. There do appear to be some gaps in understanding of osteopathic training, and in particular in interpretation of COMLEX-USA. When queried about the interchangeability of educational content between allopathic and osteopathic training, >75 % of PDs and only 50 % of chairs agreed, and >25 % of chairs strongly disagreed. The question aimed to address foundational education content in the basic sciences and core medical competencies and was not particularly aimed at highlighting differences, such as the additional curricular component of osteopathic manipulation therapy. However, given the wording of this question, different interpretations were possible, and responses might have indicated some understanding of curricular differences rather than an impression of osteopathic education being lesser. Almost a third of pathology chairs believe that osteopathic medical training is less academically rigorous than allopathic medical training. This is a metric that is much more difficult to compare, especially with separate licensing examinations between training systems. An additional complication is that USMLE and COMLEX-USA recently went to pass/fail rather than numerical scores. The overall impression of osteopathic medical training having a stronger focus on primary care is accurate, with the mission statements of most osteopathic medical schools directly indicating a focus on producing primary care physicians.^{17,28} However, what cannot be ascertained from this question or its responses is whether that is seen as a disadvantage or whether there is a belief that such students would be less prepared for entry into and performance in nonprimary care specialties such as pathology.

Most PDs and chairs believe that allopathic medical schools have higher admissions standards than osteopathic schools. A literature search did not yield articles specifically addressing this; however, there are websites and academic consulting firms that publish average and minimal Grade Point Average (GPA) and Medical College Admission Test (MCAT) scores for virtually all U.S. medical schools. On average, the review of these admissions criteria does appear to be slightly lower for osteopathic medical schools than for allopathic.²⁹ However, with a push toward a more holistic review of applications, scores alone may not be the only predictors of success. Published data from 2012 show that the average age of new osteopathic medical students was between 24 and 25 years, which was slightly higher than that of first-year allopathic medical students. Osteopathic schools might be more accepting of older applicants with prior life experiences in or outside of health care disciplines.³⁰ Prior experience as well as intangibles such as grit and resilience are not easily assessed but are important personal qualities for success.

Preparedness to interpret COMLEX-USA is low among chairs, with almost two-thirds being only somewhat prepared or not prepared at all to interpret. While low preparedness to interpret COMLEX-USA is not as surprising for chairs who may not be as closely involved in screening applications, it is more concerning that among PDs, over 40 % were somewhat prepared or not prepared at all to interpret these results. Not being prepared to interpret COMLEX-USA is disadvantageous to both programs and applicants in seeking the best matches and developing the

best future pathologists. Due to anecdotes of programs not accepting COMLEX-USA or leadership not being prepared to interpret results, in 2020, nearly 60 % of osteopathic students took both COMLEX-USA (obligatory) and USMLE (voluntary), at double the cost, time, and stress.³¹ The American Medical Association (AMA) House of Delegates made an address in 2018 that COMLEX-USA should be viewed as equal to the USMLE and encouraged PDs to become versed in interpreting scores in advance of the 2020 merger of MD/DO graduate medical education accreditation.³² Information regarding the specifics of the COMLEX-USA examinations is readily available through the National Board of Osteopathic Medical Examiners (NBOME), including a percentile score converter.³³ This may be less of an issue with COMLEX-USA Level 1 having gone to pass/fail just like USMLE Step 1. Additionally, resources may be found in the Program Directors' Toolbox, hosted on the Association of Pathology Chairs' website³⁴ and jointly sponsored by the College of American Pathologists. There are some publications comparing COMLEX-USA to USMLE performance that could perhaps help program leadership with the interpretation of scored examinations.^{35–37}

Pathology chairs appear to be more involved in the later stages of residency recruitment, such as interviewing and preparing the final rank list. Interestingly, chairs felt they had greater influence on the final ranking than PDs indicated, and higher levels of educational leadership such as the dean seem to have little to no influence on how osteopathic applicants are ranked. Therefore, PDs appear to be empowered to make ranking decisions without undue external pressure.

The overall sense of preparedness for residency and subsequent performance in ACGME competencies is perceived as the same for allopathic and osteopathic pathology residents. These are likely more reliable indicators of the quality of training. Additionally, PDs have not noticed any appreciable differences in performance on the RISE or Board examinations. Data from the American Board of Pathology comparing the performance of MD and DO test takers demonstrated a statistically significant difference in the 83 % (osteopathic) versus 87 % (allopathic) pass rate for the AP exam; however, effects size analysis helps put into perspective that this difference over a 12-year period is trivial from a practical standpoint.

Pathology PDs and chairs endorse that osteopathic and allopathic residency candidates were given equal consideration, and the impressions of osteopathic residents in terms of preparation for residency, performance on ACGME competencies, RISE, and boards appear to be quite comparable. Based upon prior experiences with DOs, no PDs or chairs were less likely to consider osteopathic applicants, which speaks well of how osteopathic physicians have performed in pathology residency. Given the increase of applicants to pathology residency, actively recruiting from DO schools may be beneficial for the GME pathology pipeline.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Authors' notes

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Supplementary data

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