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Barriers to research opportunities among osteopathic medical students

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Abstract

Context: Despite the increase of importance placed on research, both by residency program directors and the medical field at large, osteopathic medical students (OMS) have significantly fewer research experiences than United States (U.S.) allopathic medical students and non-U.S. international medical graduates. However, few studies have addressed this long-standing discrepancy, and none directly have focused on osteopathic medical students to assess their unique needs. The literature would benefit from identifying the barriers osteopathic medical students encounter when participating in research and understanding the currently available resources.

Objectives: To assess the barriers that OMS face when seeking research opportunities, identify resources currently available to osteopathic medical students at their respective schools, and investigate factors that contribute to an osteopathic medical student's desire to pursue research opportunities. Additionally, to investigate osteopathic medical students' confidence in research methodology.

Methods: A survey was created by the investigators and administered to participants over a three-month period via a GoogleForm. Research participants were surveyed for demographic information, as well as their involvement in research projects in the past, mentor availability, institutional

resources, motivation to participate in research, individual barriers to participation, and confidence in their ability to do independent research. Responses were de-identified and analyzed using Microsoft Excel functions to count data and calculate percentages, as well as Pearson's chi square analysis.

Results: After relevant exclusion, 668 responses were included. Of the students surveyed, 85.9% (574) indicated they currently and/or in the past were involved in research. More than half of the respondents that are not currently involved in research are interested in pursuing it (86.9%; 344). The primary barriers students reported facing include lack of time (57.8%; 386), feeling overwhelmed and unsure how to start (53.4%; 357), and lack of access to research (53%; 354). 34.7% (232) of students stated they either did not have resources from their school or were unsure whether these resources were available. The two most cited motivations to pursue research included boosting their residency application and/or interest in the area of study. Male gender and current research were associated with reported confidence in research ($\chi^2 [4, n=662]=10.6, p<0.05$).

Conclusions: Findings from this study provide a synopsis of the barriers to research opportunities among osteopathic medical students. Notably, 1/3 of OMSs reported an absence or unawareness of available research resources at their osteopathic medical schools.

Keywords: medical curriculum; medical education; medical student research; osteopathic medical schools.

Medical students believe that research experiences increase their competitiveness for residency positions [1]. A survey posed to students of five research-focused institutions indicated that students chose to engage in research activity for a “resume boost” rather than true interest in the subject [1]. The importance of research increased in National Resident Matching Program (NRMP) Program Director Surveys from 2008 to 2010 and the number of research experiences listed on residency applications also increased from 2016 to 2020 [2–8].

Despite the significance placed on conducting research while in medical school, interested medical students often face barriers to conducting independent research. Specific

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factors shown to increase participation in research include access to a mentor, knowledge on how to conduct research, and attitude towards research [9]. However, an international questionnaire study performed by Funston et al. revealed that medical students lacked these elements: adequate research training, difficulty finding research mentors, and lack of time to perform quality research projects due to the strenuous curriculum load of medical school [10, 11].

There has consistently been a well-documented discrepancy between osteopathic and allopathic medical students' involvement in research. NRMP data indicate both matched and unmatched allopathic applicants had a significantly higher number of research activities than osteopathic applicants [12]. This trend has continued into 2020, as matched United States (U.S.) allopathic seniors listed an average of 3.5 research experiences and 6.9 abstracts, presentations, and publications [8]. Matched U.S. osteopathic seniors listed 1.9 research experiences and 2.9 abstracts, presentations, and publications on their Electronic Residency Application Service (ERAS) applications [8]. There are no recent studies that identify the reason(s) for the discrepancy in research experiences between allopathic and osteopathic seniors.

The purpose of this study is to address the following questions: (1) What barriers, if any, do osteopathic medical students face when searching for research opportunities? (2) What resources are currently available to osteopathic medical students at their respective osteopathic medical schools? (3) What factors contribute to an osteopathic medical student's desire to pursue research opportunities? (4) Do osteopathic medical students feel they have basic understanding and/or confidence in research techniques?

Methods

This cross-sectional study with descriptive methods was reviewed and approved by the Touro College Health Subjects Institutional Review Board (HSIRB), who deemed this study exempt (HSIRB# 2142E). Funding for ten \$25 Amazon® gift cards were provided by the National SOMA and Arkansas College of Osteopathic Medicine (COM) SOMA chapter.

The anonymous survey was written by the authors and administered on GoogleForms. Informed consent from participants was obtained on the first page of the survey, where risks and benefits, as well as how to withdraw, were listed. All participants were osteopathic medical students enrolled at a US osteopathic medical school. This information was verified with students required to use an osteopathic medical school edu email address. Any individual who did not meet the inclusion criteria or did not sign the informed consent were excluded from the study. Compensation was provided in the form of ten \$25 Amazon gift cards. The raffle was conducted with a random number generator, and the winners were contacted via their voluntarily included email. All participants were SOMA members, recruited using social media, SOMA email newsletters, and direct contact with schools requesting to send out the study to their students.

Research participants were surveyed for demographic information, as well as their involvement in research projects in the past, mentor availability, institutional resources, motivation to participate in research, individual barriers to participation, and confidence in their ability to do research. The full survey is included in the appendix materials. In addition, the questionnaire inquired students about their level of research involvement, current osteopathic medical school attendance, motivation for seeking research opportunities, current research type involvement, available resources including but not limited to research advisor, institutional review board, and research committee at their institution. The survey took approximately 6 min to complete and was entirely check-boxes and multiple choice, with optional spaces provided if students wanted to elaborate. Survey responses were collected over a three month period, January 2022 to March 2022. An independent analyst removed the emails from the responses, creating a deidentified data set. The independent analyst was an author not involved in analyzing data.

Statistical analysis

Per the AOA's 2020–2021 Osteopathic Medical Professional Report, there are currently 33,800 osteopathic medical students, according to the Commission on Osteopathic College Accreditation [13]. Per internal SOMA data, there are roughly 15,000 SOMA members, with approximately 3,000 average openers of weekly emails. We recruited participants through SOMA's social media, email list, and direct contact with schools and requests to send out the study to their students. Therefore, the goal survey sample size was calculated to be 380 participants using a 5% confidence interval and 95% confidence interval using the Qualtrics Sample Size Calculator [14]. Analysis of the data was done using basic Microsoft Excel® functions to count data and calculate percentages, as well as Pearson's chi square analysis.

Results

Demographics

Responses from 32 of 43 (74%) of non-accredited and accredited COMs were collected. Six hundred sixty-nine (669) survey responses were completed. One participant did not consent to research and thus their responses were not included. There were 196 male (29.3%), 466 female (69.8%), and 2 non-binary (0.3%) participants, and 4 (0.6%) who preferred not to respond. 84.6% of the respondents were between the ages of 20–30, with the remainder above the age of 30. Table 1 describes demographics for student respondents. 25.3% (169) of participants were from a single site.

Research involvement

Participants were first asked about their current involvement in research. 40.7% (272) indicated that they were currently conducting research, and 25.6% (171) found the project through their school. 51.5% (344) indicated that

Table 1: Demographic characteristics of medical students.

Class year	Study participants, n	Percentage, %
OMS I	248	37.1
OMS II	251	37.6
OMS III	95	14.2
OMS IV	72	10.8
OMS V	1	0.1
OMS VI	1	0.1
Total	668	
Race		
American Indian or Alaska Native	9	1.3
Asian	160	24.0
Black	30	4.5
Hispanic	11	1.6
Middle Eastern	9	1.3
Multiracial	9	1.3
White	433	64.8
Prefer not to say	1	0.1
Total	662	

though they are not currently involved in research, they are interested. 81% (541) of participants had been involved in research before medical school. Of all the research that the students had participated in, 53.0% (354) had a successful publication or presentation from their work. Overall, 14.1% (94) of the participants had never participated in research, both prior or during medical school. For students currently involved in research, the distribution of the specific type of research involvement is noted in Table 2.

Of all participants, 55.8% (140) second-year students, 47.3% (45) third-year students, and 48.6% (35) fourth-year students reported current involvement in research. Most first year medical students (198; 79.8%) were not involved in research as referenced in Supplementary Table S1.

Barriers to research involvement

When the participants were asked if they had ever encountered any barriers in conducting research or obtaining research opportunities, 76.8% (513) indicated “yes.” Of those participants, the most often selected barriers were lack of time (227; 74.4%), feeling overwhelmed and unsure how to start (220; 72.1%), and lack of access (204; 66.9%). Notably, of the 23.2% (155) who had indicated that they had not experienced any barriers to finding research opportunities, only 17.8% (119) selected the consistent option that stated “None, I have never encountered any barriers to doing research.” Despite selecting that they had not encountered any barriers,

Table 2: Type of research involvement among osteopathic medical students currently participating in research projects.

Type of research involvement	Study participants, n	Percentage, %
Case report	200	29.9
Educational	159	23.8
Systematic review	155	23.2
Benchmark	148	22.1
Prospective	130	19.5
Transitional	61	9.1
Retrospective	9	1.3
Other	34	5.1
Total	668	

22.0% (20) of this group still cited lack of time and 12.1% (11) cited feeling overwhelmed.

Thus, greater than half of the participants selected either lack of time (386; 57.8%), feeling overwhelmed and unsure how to start (357; 53.6%), or lack of access (354; 53.0%) contributed to their lack of research involvement. The barriers cited by all respondents are listed in Table 3.

School resources and mentorship

Some osteopathic medical students have resources available to them at their medical schools, such as a research director (324; 48.5%), research club (294; 44.0%), or research committee (230; 34.4%). The types of research opportunities available at the institutions are noted in Supplementary Table S2.

65.1% (435) participants indicated that they did not have a research mentor, though when presented with options for where they found their research mentors, only 62.4% (417)

Table 3: Barriers encountered when seeking or conducting research projects among osteopathic medical students.

Barriers osteopathic medical students face when conducting research or obtaining research opportunities	Study participants, n	Percentage, %
Lack of time	386	57.8
Feeling overwhelmed and unsure how to start	357	53.4
Lack of access to research	354	53.0
Lack of quality mentorship	248	37.1
Lack of curricular flexibility	227	34.0
Little support from university authorities	202	30.2
Scarce financial resources	148	22.2
Difficulty in accessing the study population	92	13.8
Other	18	2.7
Total	668	

Table 4: Osteopathic medical students' motivation for research involvement.

Specified motivation for research participation during medical school among osteopathic medical students	Study participants, n	Percentage, %
Area of study	283	42.4
Desire to establish contacts	229	34.3
Desire to acquire research methodology skills	228	34.1
Prestige	114	17.1
Other	64	9.6
Not currently involved in research	269	40.3
Total	668	

selected “I don't have a research mentor.” Of the 37.9% (253) who selected an option for where they found their research mentor, 13.5% (90) indicated that the mentor was affiliated with their medical school, but had connected with him/her independently, 12.3% (82) found non-affiliated research mentors independently, 6.6% (44) from their undergraduate colleges, 2.8% (19) were from gap year or graduate school, and 2.7% (18) were assigned mentors.

Motivation for involvement

Students' motivation for involvement in research is listed in Table 4. 42.4% (283) students participated in research due to the area of study in which the research was being conducted. 34.3% (229) students wanted to establish connections through research participation, 34.1% (228) students desired to learn research methodological skills, and 17.1% (64) participated in research projects due to prestige. Other motivations for research participation during medical school are the following: improve residency application/resume (7.0%; 47), required research involvement (0.6%; 4), scientific advancement (0.4%; 3), build on prior research experience (0.9%; 6), general enjoyment/interest in research project (0.6%; 4).

Confidence in research skills

The final category in the questionnaire included the participants' self assessment in their understanding and confidence in their personal research skills. 77.1% (515) indicated that they had a basic understanding of research, but only 46.5% (11) indicated feeling confident in research, citing the most common areas in which they are lacking was knowledge about IRB protocols (238; 35.6%), data analysis (237; 35.5%),

Table 5: Level of confidence among osteopathic medical students to conduct research independently.

Confidence in current ability to conduct independent research	Study participants, n	Percentage, %
Strongly agree	55	8.2
Agree	192	28.7
Neutral	185	27.7
Disagree	159	23.8
Strongly disagree	77	11.5
Total	668	

literature review (147; 22.0%), and general research methodology (114; 17.1%). Only 8.2% (55) strongly agreed that they could conduct research independently, 28.7% (192) felt they could independently conduct research, while 35.8% (236) did not feel confident in their ability to conduct independent research projects. The distribution of the entire survey population across the Likert scale describing their self-confidence in independently conducting research is listed in Table 5. Whether students are currently involved in research was shown to significantly impact the confidence reported, $\chi^2(4, n=668)=41.3, p<0.001$, Supplementary Table S3.

Gender was shown to impact confidence reported in Supplementary Table S4. The percentage of those who self-identified as male and female were equally involved in research, with 40.8% (males=80, females=190) involved and 59.2% (males=116, females=276) not involved in research. Gender was shown to have an impact on confidence reported, $\chi^2(4, n=662)=10.6, p<0.05$. Female gender was associated with increased likelihood to select “Disagree” or “Strongly Disagree” with the statement, “I am confident in my current ability to independently conduct research” (OR=1.67, 95% CI [1.16, 2.4]) (Supplementary Table S5).

Discussion

Research involvement

Although research is an important aspect of medicine, it is has not historically been a critical component emphasized in osteopathic medicine, despite being emphasized in Dr. Andrew Taylor Still's early writings [15]. Research is not prioritized by DO schools, evidenced by the lack of federal funding at osteopathic medical schools and criticism from DO seniors [16]. Our study found that 40.7% of osteopathic medical students reported involvement in research projects; however, NRMP reports indicate 69.4% seniors of US DO medical schools had at least one research experience [17]. This discrepancy in

reports of research involvement is likely due to the broader population surveyed, with more than half of the study participants being in their first and second year of medical training, with only 10.8% of respondents being DO candidate seniors. Our study showed 20.2% (50) of OMS-I and 55.8% (140) of OMS-II are involved in research. Additionally, the small sample size of schools may not accurately reflect the priorities of all institutions nationally, and it is possible certain schools not well represented have more robust research programs. Furthermore, our study population of OMS-IV + may not be representative of the national residency applicants. When isolating the OMS-IV + involvement in research, the percentage of either currently involved or historically involved is 98.6% (73). The higher percentage of those involved compared to NRMP data may be due to different survey populations.

Barriers to research involvement

In this study, we explored the hurdles that students face when seeking research opportunities. We found that greater than 50% of osteopathic medical students report lack of time, feeling overwhelmed, unsure how to start, or lack of access as major barriers to research participation. This is consistent with other studies that have reported limited time, lack of access, lack of mentors, and lack of supporting infrastructure as blockades to research involvement among allopathic and international medical students [18–20]. Similarly, students enrolled in Baccalaureate/M.D. (B.A./M.D.) programs also reported a lack of time and prior research experience as their most common barriers to pursuing research opportunities [21]. Limited time as the main barrier to research involvement is not surprising as students are overburdened with ongoing examinations. Other studies have also reported non-institutional barriers such as lack of self-efficacy and poor scientific writing skills [22]. Furthermore, participation in research is not required for acceptance into medical programs, decreasing students' desire to prioritize research projects [23].

School resources and mentorship

The availability and accessibility of research mentors and resources at osteopathic medical schools is a challenge students encounter when seeking research opportunities. All osteopathic medical students are assigned a faculty advisor upon matriculation; however, not all students are paired with a research mentor. Only 13.5% osteopathic medical students had a research mentor affiliated with their medical school. A quarter of the participants had connected with their research mentor independently, implying students

must be proactive when seeking guidance for research involvement and conduct their own outreach. 51.0% of participants reported independent research opportunities available on their campus while 57.5% reported benchwork research was available on campus. Not all osteopathic medical schools have resources available for students such as a research director, student-run research club, or research committee. There was a significant amount of students that were not aware of whether these resources were available at their institution. Regardless of campus infrastructure, years, or prior research experience, there is an overall high interest in research education and opportunities; thus, the availability of research resources at osteopathic medical schools remains critical in fostering student interest in research [24].

Motivation for involvement

We found 42.4% of osteopathic medical students reported their motivation to get involved in a particular research project is the area of study while other studies have shown career progression and residency programs as the main motives behind allopathic medical student involvement in research [25]. Only 7% of the study participants reported improvement of residency applications/resume being motivations for participation in research. This discrepancy may be due to an observer bias, or due to overrepresentation of OMS-I and OMS-II students in our data, who may not yet be focusing on residency applications. In addition, 'improvement in residency applications/resume' was not an explicit option for participants to select in this survey; therefore, this could have led to the discrepancy we see between this study and Amgad et al.'s. The prioritizing of "area of study" may be related indirectly to residency application, as students often choose the research topic based on their chosen future specialty. Further longitudinal work can be done to determine if motivation for research involvement changes throughout a student's medical school career.

With the post-graduate single accreditation system, osteopathic medical students are directly competing with their allopathic counterparts for spots in residency programs. Though DO candidates have historically been allowed to match to allopathic residencies, they have routinely been disadvantaged [26–28]. The average number of research experiences among US DO seniors were higher for those that matched into competitive specialties such as dermatology, orthopedic surgery, otolaryngology, and general surgery [17]. It is evident that research experience is a fundamental aspect of residency applications, particularly for competitive specialties. We expect research experiences documented in

the NRMP Match to increase in the future as more DO applicants continue to apply to competitive specialties. Thus, it will be increasingly important for DO schools to support osteopathic medical students in their desire to access research opportunities.

Confidence in research skills

46.5% students reported feeling confident in their ability to conduct research independently. Reported areas of weakness included IRB protocols, data analysis, and literature review. Inadequate knowledge in research methodology was previously identified as one of the barriers that students face in student research [18]. A research role model relationship can positively impact personal development, research productivity, and career guidance [29]. Another way to foster better research skills is for faculty-run research workshops on various foundational topics, e.g., how to conduct data analysis or write an IRB proposal.

When discussing medical students' self-reported confidence in research, there was a significant difference in confidence among female osteopathic medical students compared to male osteopathic medical students ($p < 0.05$). In prior studies comparing differing confidence between genders, female medical students were viewed as significantly less confident during patient interactions [30]. Despite performing equally to their male counterparts, female medical students have been consistently reported to have lower self-confidence [30, 31]. Similarly, male and female groups differed in their confidence to conduct research independently ($p < 0.05$) with the male group appearing more confident (Supplementary Table S4). Not only have gender differences in self-confidence in research been reported, but female physicians were also less confident in their clinical competency compared to male physicians [32].

Limitations

There are several limitations to this study. Though statistically likely to be representative of the national osteopathic medical student population, merely 668 of approximately 33,800 students from 32 of 37 colleges at 58 sites are directly represented [13], and 25.3% are from one school alone. We do not know the true response rate and case reports were considered research in this study which likely makes the results of this study optimistic. There are several factors that may contribute to bias in distribution of responses: (a) survey respondents are overrepresented in schools that have student authors involved in this research project;

(b) students may be more likely to respond to research surveys if they are interested in research or have previously participated in a project; (c) the beginning of the survey states we are seeking to understand barriers to research opportunities among DO students, which may skew survey responses towards students who do not have prior research experience. Additionally, due to limitations within the survey medium, participants were enabled to occasionally respond with semi-contradictory answers, as referenced above.

Future work

This survey is the first step in elucidating why osteopathic medical students choose to be involved in research and the barriers they face. Further work should include longitudinal studies to understand how these motivations and difficulties change over the course of a medical student's educational career. Also, future studies should limit the opportunity for biases in survey distribution by requiring a quota of respondents for each institution surveyed which would achieve a more balanced and comprehensive respondent population. Additionally, as the 2022 NRMP Match cycle was only the second with the single-accreditation system, there will be new data released each year to further investigate the importance of research opportunities for osteopathic medical students, and how it affects their success in securing a residency spot. Identification of trends in the documented research experiences for DO students that successfully match to competitive residencies, in terms of both institutional support and student activity, will be useful for osteopathic medical schools to better support their students in upcoming years.

Conclusions

Osteopathic medical students have consistently reported being involved in less research than allopathic medical students [17, 32]. The importance of osteopathic medical students' access to research is increasing over time as DO students are now directly competing with their MD counterparts for residency spots in the post-graduate single accreditation system [26–28]. Many students do not have comprehensive research resources available to them, but want to be involved for a variety of reasons, e.g., bolstering residency applications for competitiveness in the NRMP residency match or furthering their investment in a particular field. The barriers students face include lack of time, feeling overwhelmed and unsure how to start, and lack of access. These can be addressed both on the medical student level and the national level, with

schools setting aside time for students to be involved in research earlier, improved mentoring opportunities, and registries of research opportunities.

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Competing interests: None reported.

Informed consent: All survey respondents provided electronic informed consent prior to accessing the survey.

Ethical approval: This quantitative cross-sectional study was reviewed and approved by the Touro College HSIRB, who deemed this study exempt (HSIRB# 2142E).

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