Undergraduate Knowledge of Osteopathic Medicine: What Premedical Students Know About Osteopathic Medicine and Its Effect on Burnout

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Context: Undergraduate student interest in becoming a physician continues to rise, but so too does the difficulty of earning acceptance to medical school. In this competitive environment, little is known about premedical students’ knowledge of their medical school options. Moreover, as undergraduate students’ emotional health continues to decline, little is known about whether premedical students experience or are at increased risk for the burnout symptoms reported by medical students and other physicians in training.

Objective: To examine premedical undergraduate students’ knowledge of osteopathic medicine, assess how they learned of osteopathic medicine, and collect information about any reported feelings of burnout.

Methods: In this institutional review board-approved study, we electronically distributed an anonymous survey to 342 premedical undergraduate students at a midsize, public research institution. The survey included 56 questions. Students were surveyed on their preference of medical schools, knowledge of osteopathic medicine, and experience with burnout via the Maslach Burnout Inventory which measures exhaustion, cynicism, and professional efficacy. Of those who completed the survey, only those who confirmed that they currently considered themselves to be premedical students were included in our analysis. A 2×2 factorial analysis of variance (ANOVA) test was applied to assess main and interaction effects amongst respondents who preferred osteopathic or allopathic programs, whether they learned of osteopathic medicine programs by their own research, and their scores on the 3 measures of the Maslach Burnout Inventory: exhaustion, cynicism, and professional efficacy. Bivariate and factorial analyses were completed using SPSS v26 software (IBM). All tests were 2-tailed and used a .05 standard P value.

Results: Of 342 students to whom the survey was sent, 160 (46.8%) responded, and only 92 (26.9%) considered themselves premedical students. Of the 160 students analyzed in our study, 80 (50%) reported first learning of osteopathic medicine through their own research. A 2×2 factorial ANOVA revealed a significant interaction effect for cynicism in respondents who reported learning of osteopathic medicine programs on their own. Conversely, when respondents reported learning of osteopathic medicine programs from another source, they also reported significantly lower cynicism (F[1,1]5.23, P=.03) and exhaustion (F[1,13] 5.79, P=.02) scores. Of the 92 respondents, only 2 students (2.2%) answered all questions regarding general osteopathic medical knowledge correctly.

Conclusion: The results of this study suggest that among premedical students, knowledge of osteopathic medicine may be incomplete and may be impeding medical school applications. Furthermore, respondents who reported interest in osteopathic medical schools and learned of this option through their own research seemed to experience greater burnout. Based on these findings, increased outreach and education have the potential to not only better inform students of the osteopathic profession, but also to reduce burnout.


Keywords: burnout, colleges of osteopathic medicine, COM, education, medical school, premedical students
There is a well-documented and growing need for physicians in the United States. Current estimates suggest that the demand will soon exceed the supply and that by 2033, the nation could face a shortage of 54,100 to 139,000 physicians. This is due to a number of factors, including a growing and aging population, a large portion of physicians nearing traditional retirement age, and fewer barriers to healthcare for underserved populations. Fortunately, undergraduate student interest in becoming a medical doctor continues to rise, with incoming students reporting a nearly threefold increase in interest over a 42-year period from 1976 to 2018. Medical schools are responding to rising student interest as well as the predicted shortage with the creation of new medical schools and the expansion of existing schools. While medical school growth has been beneficial to addressing the physician shortage, it has had consequences for those applying to medical school. According to the Association of American Medical Colleges (AAMC), the number of applicants to allopathic schools has increased at a rate greater than that of accepted students in recent years, thereby increasing the difficulty of acceptance to medical school.

In the United States, students have the choice between 2 types of medical schools: osteopathic programs, awarding the Doctor of Osteopathic Medicine degree (DO), and allopathic programs, awarding the Doctor of Medicine degree (MD). There are some differences in the curricula of each type of school, most notably the holistic training osteopathic physicians receive with a dedicated focus on caring for the whole person. While both allopathic and osteopathic schools are expanding, osteopathic schools are doing so at a much faster rate. Ultimately, graduation from either type of school is a pathway to postgraduate training (ie, residency, fellowship) and licensure to practice medicine.

A 2008 study documented potential lack of knowledge in the general public about osteopathic medicine, but little data has been published regarding premedical undergraduate students’ knowledge of osteopathic medicine and its differences or similarities with allopathic medical school. Each year, the American Association of Colleges of Osteopathic Medicine (AACOM) collects data on applicants, including their familiarity with osteopathic medicine, but the data is limited to students applying specifically to osteopathic medical schools and does not include those exclusively applying to allopathic schools.

Some osteopathic medical schools have developed outreach programs for local high school and college students to educate and raise interest in osteopathic medicine, but the applicants’ understanding of the profession and the influence of this knowledge on potential applications remains largely unknown. Moreover, the way in which undergraduate premedical students first learn about osteopathic medicine has not been well studied. While AACOM includes a related question in its annual assessment of applicants and matriculants, the data does not distinguish whether applicants learned of osteopathic medicine through their own research or another source.

Preparing a competitive application and selecting the medical schools to which that application will be sent are not the only challenges for premedical undergraduate students on their road to becoming a physician. The cost of college continues to climb, with those planning for medical school almost certain to experience debt. In the National Center for Education’s 2018 report, the average graduating physician had $246,000 in principal loan balances upon completion of medical school. Financial stress, reportedly affecting 70% of college students, is a key variable in the continued decline of undergraduate students’ reported emotional health. Financial factors, combined with the increasingly competitive application process, is undoubtedly associated with premedical student stress.

Premedical students’ reports of stress and anxiety are not a new phenomenon, with studies indicating that premedical students are more likely than nonpremedical students to experience burnout and depression. Burnout, defined as a work-related syndrome involving emotional exhaustion, depersonalization, and a sense of
reduced personal accomplishment, has garnered recent attention because of increasing rates among medical students, physicians, and physicians-in-training.\textsuperscript{16-19} Stress and burnout have a number of implications for future physicians, ranging from negative effects on academics and unprofessional behavior to lower reported empathy, increased risk of alcohol and substance abuse, and suicidal ideation.\textsuperscript{19-23} As burnout prevalence increases among medical students, it may be helpful to know whether some premedical students are at an increased risk for experiencing burnout symptoms.\textsuperscript{19} In this study, we examined the potential relationship between how premedical students researched medical schools, where and how they learned about osteopathic medicine as an option, and their experiences with burnout.

Methods

This study was approved by the Institutional Review Boards at Rowan University School of Medicine and Rutgers University. No written consent was required as the survey responses were anonymous and no intervention was applied.

We distributed a 56-question, anonymous, web-based survey via QualtricsXM to 342 undergraduate students identified by either their initial university application or subsequent registration as engaged in premedical studies at Rutgers University - Camden Campus, which is a mid-sized, public research undergraduate institution. Students were invited, via a series of 3 emails over a 1-month period, to participate in our survey (eAppendix) assessing their knowledge of medical school types and other individual metrics related to perceived academic competence, knowledge, and burnout. Of those who completed the survey, only students who confirmed they still considered themselves to be “premed” were included in the final analyses. Participants received financial compensation for their participation in the form of $5.00 Amazon gift cards.

To assess academic burnout, the Maslach Burnout Inventory—General Survey for Students (MBI-GS(S))\textsuperscript{16} was included as part of the survey. This 16-item measure includes 3 subscales of burnout indices: exhaustion (5 items), cynicism (5 items), and professional efficacy (6 items). The MBI-GS(S) was adapted from the MBI—General Survey.\textsuperscript{24} The MBI is a validated instrument that has long been considered the criterion standard for measuring burnout in research.\textsuperscript{25,26} Additionally, students were asked 8 questions regarding general osteopathic medical knowledge and knowledge about admission to osteopathic medical schools. These questions included both true/false and nominal (multiple-choice) questions developed by all of the authors. Finally, students were also asked about their preference for type of medical school (osteopathic vs. allopathic) and how they first learned about osteopathic medicine.

A 2×2 factorial analysis of variance (ANOVA) test was applied to assess main and interaction effects amongst respondents who preferred DO or MD programs, whether they learned of DO programs by their own research, and their scores on the 3 measures of the MBI-GS: exhaustion, cynicism, and professional efficacy.

Bivariate and factorial analyses were completed using SPSS v26 software (IBM Corp.). All tests were 2-tailed and used a .05 standard \( P \) value.

Results

Of 342 students to whom the survey was sent, 160 completed it (46.8%). Of those, 92 respondents (57.5%) confirmed they were still following a premedical path and included in the analyses. The majority (76; 82.6%) of respondents reported entered their current year of college enrollment as “first year” student; 90.2% (83) were in their third year of enrollment or less. The majority (87; 94.6%) of respondents lived on campus, and only 3 (3.3%) had applied to medical schools at the time of survey completion. The mean self-reported high school GPA of respondents was a 3.69 and the mean SAT score was 1201. Demographically, 53.3% of respondents (49) identified
as Black/African American, 27.2% (25) identified as Asian, 7.6% (7) identified as white/nonhispanic, 6.5% (6) identified as Hispanic, and the remainder (5; 5.5%) identified as more than 1 race or “other.” This distribution varies from the general population of the university where, at the time this survey was administered, 52% of the college population identified as white/nonhispanic, 18.3% Black/African American, 10.6% Asian, 16.5% Hispanic, and the remainder identified as more than 1 race or “other.” Sixty-two percent (57) of the respondents were women and 38% (35) were men. Thirty-nine respondents (42.4%) were first-generation college students, with the criteria that neither parent had completed a 4-year college degree.

Given that academic burnout may be tied to number of years in an academic program (as burnout may increase with each subsequent year of schooling), class year was examined as a source of variation among burnout measures to remove potential third variable mediation. Multivariate analyses showed no significant differences between the class year of the respondent and their corresponding medical school preference or any of the burnout ratings. Therefore, class year was not used as a variable of interest in subsequent analyses.

Of the 92 premedical student respondents, 48 (52.2%) reported having first heard about osteopathic medicine through their own medical school research (Table 2). In open-ended “other” responses to the question about how they’d first learned about osteopathic medicine, students reported the following: American Medical Student Association, proximity to an osteopathic school, graduate school fairs, the internet, friends in an osteopathic school, and programs while in high school. Of the 19 “other” responses, high school was mentioned most frequently (4; 21%).

Fifty-two respondents (56.5%) reported a preference for medical school type. Of the students with a school preference, 22 students (42.3%) preferred osteopathic schools and 30 students (57.7%) preferred allopathic schools. Among the 22 students with a preference for osteopathic schools, 14 (63.6%) indicated they had learned about osteopathic schools through their own research. Of the 30 students with a preference for allopathic schools, 17 (56.7%) had learned about osteopathic schools through their own research. Significant main effects were found neither for program preference nor whether respondents learned of DO programs on their own for any of the 3 Maslach burnout measures. A significant interaction effect was reported for cynicism, such that when respondents reported learning of osteopathic medical programs from a source other than their own research, those who preferred osteopathic medical programs reported significantly lower cynicism ($F[1,11]=5.23, P=.03$; Figure 1) and exhaustion ($F[1,13]=5.79, P=.02$; Figure 2) scores. Conversely, when respondents reported learning of osteopathic medical programs on their own, there was no difference between the reported cynicism or exhaustion level of students who preferred osteopathic medical schools vs those who preferred allopathic. No significant interaction was found for professional efficacy ($F[1,1]=0.12, P=.74$). Statistical power was limited because of small subsample sizes.

Respondents were asked to answer 8 questions regarding general osteopathic medicine knowledge. Only 2 respondents of 92 (2.2%) answered all questions correctly. A full summary of responses regarding the 8 questions about students’ understanding of the practice of osteopathic manipulative medicine and how the requirements of osteopathic schools compare to those of allopathic schools is available in Table 3 and Table 4. A 2×2 factorial ANOVA showed no main effects or an interaction effect between program preference (osteopathic vs allopathic) and whether respondents learned of osteopathic programs from their own research on how many correct answers respondents gave ($F[1,5]=0.56, P=.57$). While most of the sample reported familiarity with osteopathic medicine (80; 87.0%), 31 (33.4%) a third reported being unsure about admission requirements, standards, licensing, and training differences between DO and MD degree programs. When asked about their knowledge of osteopathic manipulative medicine (OMM), the majority of respondents consistently reported being unsure. For
example, more than half of respondents (57; 41.1%) were unsure whether OMM is used to treat musculoskeletal issues, nor whether all osteopathic physicians incorporate OMM into their practices (51; 55.4%). Interestingly, there was no difference in our results based on preference for school, be it osteopathic or allopathic. While only 8% of our sample indicated a preference for DO programs, nearly 60% of the sample indicated no preference.

### Discussion

Our results indicated that 50% of surveyed students first learned of osteopathic medicine through their own research. However, this did not significantly impact their burnout levels compared to those who learned about DO programs through other means. The mean scores for exhaustion, cynicism, and professional efficacy were higher for students who learned about DO programs through their own research compared to those who learned through other means. Furthermore, there was no significant difference in burnout levels based on school preference, with nearly half of the sample indicating no preference.
Table 2. Respondents’ First Sources of Knowledge About Osteopathic Medical School

<table>
<thead>
<tr>
<th>“How did you first learn about osteopathic medicine?”</th>
<th>Responses, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>By researching medical schools on my own</td>
<td>48 (52.2)</td>
</tr>
<tr>
<td>It was suggested by an advisor</td>
<td>5 (5.4)</td>
</tr>
<tr>
<td>My parent(s) or family member is an osteopathic physician</td>
<td>7 (7.6)</td>
</tr>
<tr>
<td>My physician is an osteopathic physician</td>
<td>1 (1.1)</td>
</tr>
<tr>
<td>Other</td>
<td>19 (20.7)</td>
</tr>
</tbody>
</table>

Figure 1. Factorial results for cynicism. *Abbreviations: DO, doctor of osteopathic medicine; MD, doctor of medicine.*
medicine, both in philosophy and career. Most respondents answered “not sure” in response to 8 basic questions about osteopathic medical training and practice (eAppendix).

A majority of respondents reported having no preference between osteopathic and allopathic medical school, which made it all the more striking that so few demonstrated understanding of the osteopathic profession. While this finding is interesting, it is difficult to interpret its significance. It is possible that the respondents interested in allopathic schools had done their due diligence in researching osteopathic medicine as a career and, as such, had approximately the same understanding of osteopathic medicine as those respondents preferring an osteopathic school. On the other hand, it could indicate that the respondents interested in

![Figure 2.](image)

Factorial results for exhaustion. Abbreviations: DO, doctor of osteopathic medicine; MD, doctor of medicine.

<table>
<thead>
<tr>
<th>Survey question</th>
<th>Respondents answering “true”</th>
<th>Respondents answering “false”</th>
<th>Respondents answering “not sure”</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Osteopathic Manipulative Medicine (OMM) is only used to treat musculoskeletal issues.”</td>
<td>10 (10.9)</td>
<td>30 (32.6)</td>
<td>47 (51.1)</td>
</tr>
<tr>
<td>“Every osteopathic physician uses OMM as a form of treatment.”</td>
<td>14 (15.2)</td>
<td>22 (23.9)</td>
<td>51 (55.4)</td>
</tr>
<tr>
<td>“If you graduate from an osteopathic medical school, you are required to perform OMM as an attending.”</td>
<td>14 (15.2)</td>
<td>19 (20.7)</td>
<td>53 (57.6)</td>
</tr>
<tr>
<td>“Osteopathic physicians can only practice primary care.”</td>
<td>4 (4.3)</td>
<td>47 (51.1)</td>
<td>36 (39.1)</td>
</tr>
</tbody>
</table>

* The correct answer to all questions listed in this section is “False.”
* Data are given as no. (%).
Osteopathic medicine had not researched the profession enough. Regardless, this finding suggests that while osteopathic programming and outreach might have increased, there is still a great need to educate potential applicants about osteopathic principles and philosophy.

Perhaps the most important finding from our study was that among respondents who had researched schools on their own, students who indicated a preference for osteopathic schools were more likely to experience burnout. The reason for this is unknown. We suspect that the additional pressure of researching schools (including different types of schools) could add to the stress that medical school applicants experience. A student suddenly discovering a whole new potential career path, and the many questions that may go with it, could begin to feel overwhelmed. Resources available to students, namely advisors, provide an opportunity for support in this process. While the roles of “premed advisors” look different across institutions—including academic advisors, faculty mentors, career counselors, and others—their mission is consistent in that they all provide resources and support to help students reach their goals. In fact, both AAMC and AACOM provide comprehensive information on their websites encouraging premedical students to consult with health professions resources as early as possible. Knowing who and when to ask for help can be a challenge, but it has been suggested that students with “learned resourcefulness” are better equipped to cope with stress. Among the characteristics of highly resourceful students is the ability to seek social support, and those who have social support have been found to be more resistant to stress. While those studies did not examine premedical

<table>
<thead>
<tr>
<th>Survey question</th>
<th>Respondents answering “similar”</th>
<th>Respondents answering that allopathic medical schools have more/higher standards</th>
<th>Respondents answering that osteopathic medical schools have more/higher standards</th>
<th>Respondents answering “not sure”</th>
</tr>
</thead>
<tbody>
<tr>
<td>“As you understand, do both allopathic and osteopathic medical schools have similar admissions requirements? (i.e. specific classes during undergraduate years, taking the MCAT)”</td>
<td>38 (41.3)</td>
<td>16 (17.4)</td>
<td>4 (4.4)</td>
<td>31 (33.4)</td>
</tr>
<tr>
<td>“As you understand, do both allopathic and osteopathic medical schools have similar admissions standards? (ie, GPA, MCAT score, overall CV)”</td>
<td>36 (39.1)</td>
<td>29 (31.5)</td>
<td>0 (0)</td>
<td>24 (26.1)</td>
</tr>
<tr>
<td>“As you understand, are both allopathic and osteopathic physicians trained to treat the same medical conditions?”</td>
<td>42 (45.7)</td>
<td>8 (8.7)</td>
<td>14 (15.2)</td>
<td>24 (26.1)</td>
</tr>
<tr>
<td>“As you understand, are both allopathic and osteopathic physicians licensed to practice in similar ways?”</td>
<td>41 (44.6)</td>
<td>12 (13.0)</td>
<td>14 (15.2)</td>
<td>22 (23.9)</td>
</tr>
</tbody>
</table>

* Data are given as no. (%).
* The correct answer to all questions listed in this section is “similar.”
students specifically, their results suggest the value added for premedical students who seek guidance from advisors. Additional research should examine whether meeting with advisors reduces reports of burnout among premedical students.

As burnout continues its prevalence in the medical profession, it is important to recognize that this phenomenon is not just affecting practicing physicians. Countless studies have reported burnout findings in physicians-in-training, both in medical school and residency,17,19,22,23 but we may need to more closely examine medical school applicants as well. These findings could direct future studies to examine whether early interventions for burnout would be beneficial to undergraduate premedical students. Though pipeline, pathway, and outreach programs are available both to high school and undergraduate students, the findings of this study suggest that additional and more comprehensive outreach from osteopathic schools may benefit premedical undergraduate students by improving awareness of the osteopathic profession and, potentially, reducing burnout in this population.

Our study was limited by a small sample size leading to limited statistical power to detect true effects, and it was conducted at a single university. Conducting a similar study across multiple institutions with a larger sample size could be helpful, as could recruiting a more diverse group of respondents representative of national medical school applicants. Further clarification of how students research medical schools would be interesting as well. It should also be noted that while respondents were compensated for completing the survey, it was given regardless of how the respondents answered.

**Conclusion**

The results of this study suggest that premedical students’ knowledge of osteopathic medicine may be incomplete, which may be a hindrance in the medical school application process. Moreover, based on our findings, students who are interested in osteopathic medical schools and have learned of this option through their own research seem to experience greater burnout. Increased outreach and education has the potential to not only better inform students of the osteopathic profession but also to reduce burnout and, possibly, improve the quality of their educational experiences and overall wellness.

**References**


