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# Musculoskeletal Education in Medical Schools: A Survey of Allopathic and Osteopathic Medical Students

Vani J. Sabesan, MD  
 Andrew Schrottenboer, DO  
 Jason Habeck, MD  
 Daniel Lombardo, MD  
 Sasha Stine, BS  
 Toufic R. Jildeh, BS  
 Arjun Meiyappan, MD

From Michigan State University College of Osteopathic Medicine (Dr. Andrew Schrottenboer); the Western Michigan University, Kalamazoo, MI (Dr. Habeck and Mr. Jildeh); the Wayne State University School of Medicine, Detroit, MI (Ms. Stine); The Levitz Department of Orthopaedic Surgery, Cleveland Clinic Florida, Weston Florida; and Cleveland Clinic Florida, Weston, FL (Dr. Meiyappan and Dr. Sabesan).

Correspondence to Dr. Sabesan: [sabes001@gmail.com](mailto:sabes001@gmail.com)

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## Abstract

**Background:** Musculoskeletal (MSK) disorders are one of the most common causes of disability and emergency department and physician visits in the United States. However, there is very little consistency in how physicians in training are prepared to treat MSK disorders. On the basis of published reports, medical school graduates have a relative lack of cognitive mastery in MSK medicine, even with the recent increase in instruction. This study sought to compare MSK education at an allopathic medical school with that at an osteopathic medical school.

**Methods:** An anonymous survey of students in medical school graduate years 2, 3, and 4 at Michigan State University College of Human Medicine (allopathic) and College of Osteopathic Medicine (osteopathic) was conducted. Questions were structured into three main categories: demographic information, content of the current MSK curriculum, and opinions regarding importance, instruction, and assessment of MSK education.

**Results:** As of 2010, 83% of medical schools require MSK courses because of the United States Bone and Joint Initiative to incorporate such coursework into core curriculum. Yet only 54% of surveyed students thought that their MSK education was adequate. A greater portion of osteopathic students (57.1%) compared with allopathic students (26.8%) thought that their MSK curriculum is adequate, and as a consequence, 36.6% of allopathic students thought that they were inadequately prepared for the MSK content of US medical licensing examinations compared with 8.1% of osteopathic students. Further curriculum development and improvement is needed to advance physicians' abilities to address and treat MSK disorders. Medical students surveyed feel that this goal can be accomplished by emphasizing MSK education in third and fourth years of medical school.

**Conclusion:** These findings highlight differences in MSK education between an allopathic and osteopathic medical school. Further standardization of the curriculum in medical schools may help improve the quality of teaching student comfort levels of new physicians.

**Level of Evidence:** Level III

Musculoskeletal (MSK) disorders accounted for 109.4 million total healthcare encounters including outpatient, hospital, and emergency department visits in 2010.<sup>1</sup> Disorders of the MSK system remain among the primary reasons that individuals visit healthcare providers in the United States both in a primary care setting and emergency department visits. To best care for their patients, physicians must understand the basic principles of diagnosing and treating MSK disorders.<sup>2,3</sup>

Currently, physicians in training are not consistently prepared to treat MSK conditions. There is a lack of standardization and limited time spent on MSK education during the pre-clinical years for a majority of U.S. medical students; furthermore, many students have no clinical training in MSK education during their third and fourth years, given the lack of explicit requirements in this regard. This lack of training can result in a lack of confidence and competence in treating MSK complaints for primary care providers; this is concerning because 43.7% of all office visits are MSK related.<sup>1</sup> Primary care physicians end up with limited training in the treatment of MSK conditions because of several factors, which can result in poorer patient outcomes and contribute to ever increasing healthcare costs.

Several studies have noted that although there has been a major initiative to install dedicated MSK curricula into all US medical schools, the curricula across institutions are widely variable.<sup>2</sup> The curricula further vary with regard to allopathic versus osteopathic medical schools and their respective governing bodies. Wood and Hahn<sup>4</sup> noted that

the Liaison Committee on Medical Education (LCME) standards for the academic environment, including preclinical and clinical curricula, are more expansive for allopathic schools compared with those set forth by the Commission on Osteopathic College Accreditation (COCA) for osteopathic schools.<sup>5</sup> Neither governing body sets forth specific curricular requirements; rather, they define competencies that graduates from accredited institutions are expected to develop.<sup>2,5</sup> This leaves individual medical schools the task of deciding what constitutes an adequate MSK education to meet LCME or COCA requirements. Thus, a wide variation may exist in the quality and quantity of MSK education at different medical schools. This is indeed concerning because a strong foundation in MSK knowledge is crucial to the practice of medicine.

In addition to differing curricular requirements from independent governing bodies, allopathic and osteopathic medical educations vary fundamentally and philosophically. There are four key tenets to osteopathic educational philosophy: (1) the body is a unit and the person is a unit of body, mind, and spirit; (2) the body is capable of self-regulation, self-healing, and health maintenance; (3) structure and function are reciprocally interrelated; and (4) rational treatment is based on the understanding of the basic principles of body unity, self-regulation, and the interrelationship of structure and function.<sup>4</sup> Osteopathic institutions further include education regarding “osteopathic manipulative medicine (OMM),” which requires knowledge of the basic MSK structure and function to safely perform manual manipulations as part of the treatment

of MSK ailments.<sup>5</sup> Allopathic medical education, however, is often thought of as the “traditional” medical education, focusing on the diagnosis and treatment of human disease. The different educational philosophies and focuses of allopathic and osteopathic medical schools may influence the quality and quantity of MSK education that the students at each type of institution receive.

Basic knowledge of the MSK system is essential to practicing medicine effectively. With MSK complaints remaining one of the top reasons for emergency department and outpatient visits, it is important to continually evaluate the state of the MSK curricula in US medical schools.<sup>5</sup> Several studies have examined junior residents’ performance regarding MSK care and found that many young physicians, those graduating from both allopathic and osteopathic schools, struggle in this arena.<sup>6</sup> An underlying cause for a lack of confidence and competence in newly graduated physicians and medical students may stem from a lack of adequate instruction during medical school. Because both LCME and COCA accredited institutions are graduating new resident physicians each year, it is important to evaluate and compare the state of MSK education in these two different academic settings.

The purpose of this study was to assess the perception of the adequacy of MSK instruction in allopathic versus osteopathic medical schools. We obtained feedback from medical students from 1 allopathic and 1 osteopathic medical school in Michigan. Accordingly, the aim of this study was to assess the quality, content, and perception of MSK

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education in osteopathic versus allopathic medical school in Michigan.

## Methods

### Survey Development and Study Population

This was an institutional review board–exempted study. The anonymous survey was distributed through email to medical students at both Michigan State University College of Human Medicine (CHM), which is an allopathic medical school, and Michigan State University College of Osteopathic Medicine (COM). The survey was disseminated to approximately 1500 students (600 CHM and 900 COM) via university email, of which 249 completed (16.6%) the survey. All participants were the second-, third-, and fourth-year medical students at the start of the 2014 to 2015 academic year. The survey was administered through Survey-Monkey and disseminated directly by medical school administration at each institution.

### Demographic Variables

The survey consisted of 22 questions. Questions were structured into three main categories: demographic information, content of the current MSK curriculum, and opinions regarding MSK education (see Appendix 1, Supplemental Digital Content 1, <http://links.lww.com/JG9/A10>). Demographic information including sex, race, type of medical school (CHM/COM), year in medical school, and specialty after graduation were collected (Table 1). Students were initially asked about the current MSK education at their particular medical school with regard to the timing and duration of the MSK curriculum, the methods for instruction (ie, problem-based learning, small group, and lecture), methods of

**Table 1**

#### Demographic Information of Surveyed Students

Factor	%	n
Sex		
Male	45.6	111
Female	54.3	132
Race		
American Indian or Alaskan Native	0.00	0
Asian/Pacific Islander	13.20	32
Black or African American	2.50	6
Hispanic American	0.80	2
White/Caucasian	81.00	196
Multiple ethnicity/other	2.88	7
Medical school		
MSU COM	66.30	161
MSU CHM	33.70	82
Current year		
Year 2	24.20	59
Year 3	39.30	96
Year 4	36.10	88

MSU CHM = Michigan State University Colleges of Human Medicine, MSU COM = Michigan State University Colleges of Osteopathic Medicine

evaluation, and availability of MSK electives. Students were then asked to give their opinion on the current state of MSK education because it pertained to timing and duration, assessment methods, and perceived importance of the MSK curriculum compared with other body systems (eg, cardiology, neurology, and pulmonary).

### Statistical Analysis

Summary statistics were performed on the compiled data from all schools for each of the above-specified variables using SPSS software (IBM).

## Results

### Musculoskeletal Course Timing, Length, and Teaching Modalities

Overall, 84.7% students reported that their institution explicitly offered

a required MSK-based course. The reported MSK course was reported as being taught in the first and second years of medical school. MSK courses were reported to be required only in the second year at CHM compared with both first and second years at COM (Table 2). Most students agreed that the first (59.1%) and second years (79.1%) are the appropriate time for teaching MSK education; however, 50.7% also responded that an additional course should also be taught during the third year and 21.9% during the fourth year of medical school. The MSK material is primarily described as being taught in a lecture format (94%), followed by cadaver laboratory (42.1%), and problem-based learning (39.1%). Allopathic students most frequently reported receiving their MSK material in problem-, lecture- and case-based format (Table 2). Osteopathic students used the same resources to learn the MSK material, but had an opportunity to use a cadaver laboratory and

**Table 2****Percent of Respondents Describing Years in Which the MSK Curriculum Is Taught, Teaching Methods, and Time Dedicated to Teaching at Allopathic (CHM) and Osteopathic Schools (COM)**

Curriculum Timing, Allocation and Modality	CHM (%)	COM (%)
When is the required MSK course taught?		
First year	7.3	93.9
Second year	71.4	93.9
Third year	14.6	5.8
Fourth year	0.0	4.5
What three methods of instruction are most commonly used to teach required MSK courses?		
Lecture	87.8	90.7
PBL	93.9	8.7
Small group	23.2	25.5
Cases	30.5	30.4
Cadaver laboratory	12.2	54.7
Online material	12.2	27.95
OMM	0.0	72.1
How much curriculum time is dedicated to REQUIRED MSK education?		
1 wk	2.4	1.2
2 wk	52.4	4.3
3 wk	20.7	3.7
4+ wk	14.6	65.2

CHM = Colleges of Human Medicine, COM = Colleges of Osteopathic Medicine, MSK = musculoskeletal, OMM = osteopathic manipulative medicine, PBL = problem-based learning

online resources more frequently, such as the OMM program (Table 2). Overall, students reported the most effective teaching strategies to be lecture (55.7%), cadaver laboratory (50.4%), and case studies (43.9%). In addition, 44.8% of osteopathic students thought that their OMM course was an effective learning modality as well.

A majority of allopathic students (52.4%) report spending 2 weeks on required MSK education, whereas most osteopathic students report spending  $\geq 4$  weeks on the MSK material (65.2%) (Table 2). Of note, 85.5% of all students thought that 3 weeks was the adequate time for dedicated MSK instruction. More osteopathic students (76.4%) were aware of an available MSK elective compared with allopathic students (67.1%).

### Methods for Testing Competency

For all medical students, examinations (94.2%), quizzes (46.0%), and anatomy practicals (54.4%) were the most frequently reported methods used to assess MSK knowledge (Table 2). A higher percentage of students thought that clinical skill assessments (42.0%) and objective structured clinical skill examinations (16.8%) were the best methods of assessing MSK knowledge, whereas examinations (22.1%) and practicals (12.8%) were less frequently reported as optimal assessment methods.

### Student Perceptions

Students with an interest in orthopaedics were found to be more likely to rank MSK education as a higher

importance in their medical education (Table 3) compared with other students. Students with career interest in family medicine and internal medicine ranked MSK education as the fifth most important unit in their curriculum. Overall, osteopathic students considered MSK education are more important than their allopathic counterparts. However, allopathic students on average found MSK education less important and ranked renal education higher in importance (Table 4).

Only 54% of students thought that their current MSK education was adequate, and 29.6% thought that their education was inadequate. A greater portion of osteopathic students (57.1%) compared with allopathic students (26.8%) thought that their MSK curriculum was adequate, and 36.6% of allopathic students thought that they were inadequately prepared for the MSK content of US medical licensing examinations (USMLE) compared with 8.1% of osteopathic students.

### Discussion

National efforts to promote and improve MSK medicine education have been a priority for the US Bone and Joint Initiative since 2003. Even with focused curriculum revisions, such as increased time in gross anatomy laboratory, MSK pathophysiology, and physical examination, Day et al<sup>7</sup> reported a lack of proficiency in MSK education for medical students. Our goal was to focus on MSK education in allopathic versus osteopathic schools in Michigan to see whether there were variations in content, perception, and proficiency.

The allopathic medical school (CHM) versus osteopathic medical school (COM) evaluated in our survey had several notable curriculum differences. At the osteopathic medical school, teaching of MSK reportedly

occurred during both the first and second years, whereas at CHMMSK, it was taught almost exclusively during the second year. There was considerably more time dedicated to MSK education at the osteopathic school compared with the allopathic school. In addition, MSK medicine was taught primarily via lecture, OMM, and cadaver laboratory at the osteopathic school, whereas lecture was the primary reported teaching modality at the allopathic school. Based on student perception, 47.6% of allopathic students thought that their current MSK curriculum was inadequate, whereas only 15% of osteopathic students thought that their MSK curriculum was inadequate; however, a majority of all students felt that an additional MSK education should be added to the third or fourth year of medical school.

Osteopathic students thought that OMM and cadaver laboratory were the most important methodologies of teaching compared with allopathic students who valued the traditional lecture format. Although these differences in opinion do not necessarily reflect differences in quality of education, they may provide some insights into the most effective teaching modalities. The traditional method of teaching MSK via lecture, predominantly practiced at CHM, may not be adequate. This was evidenced by the fact that CHM students generally expressed feeling insecure about their MSK knowledge base. Proportionally, fewer COM students felt that their MSK knowledge was inadequate compared to their CHM counterparts, suggesting that the hands-on teaching modalities experienced in the OMM or cadaver laboratories may more effectively build students' confidence in their understanding of MSK medicine. Perhaps allopathic medical schools may want to consider these data when designing and reformatting their curriculum and include more hands-on experiences when teaching the MSK material.

**Table 3****Perceived Importance of Each Body System Stratified by Student Interest**

Body System	Students Interested in Orthopaedic Surgery	Students Interested in Internal Medicine	Students Interested in Family Medicine
Cardiology	2.27	2.36	1.88
Endocrine	5.09	3.3	3.3
GI	5.45	3.91	4.12
Hematology/oncology	8.09	5.97	7.15
ID	6.64	4.91	4.97
MSK	2.18	5.21	4.48
Neurology	4	5.79	5.64
Psychiatry	9.27	8.09	7.76
Pulmonary	5	5.45	4.79
Renal	5.91	5.82	6.73

1 = most important, 10 = least important, GI = gastrointestinal, ID = infectious disease, MSK = musculoskeletal

**Table 4****Perceived Importance of Each Body System by Allopathic and Osteopathic Students**

Body System	Average Rank	CHM Average Rank	COM Average Rank
Cardiology	2.11	1.75	2.24
Endocrine	4.57	4.22	3.76
Gastrointestinal	4.81	4.04	4.40
Hematology/oncology	6.74	5.86	6.60
Infectious disease	5.82	4.48	5.53
MSK	5.58	5.77	4.39
Neurology	5.41	5.67	4.71
Psychiatry	8.21	8.04	8.07
Pulmonary	5.11	5.32	4.56
Renal	6.61	5.72	6.14

1 = most important, 10 = least important, CHM = Colleges of Human Medicine, COM = Colleges of Osteopathic Medicine, MSK = musculoskeletal

The lack of MSK medicine knowledge and skill base has been demonstrated in many studies.<sup>6,8-12</sup> The original Freedman and Bernstein<sup>13</sup> study assessed incoming residents from 37 different medical schools using a basic MSK cognitive examination and found that 82% failed the examination. In the past decade, the same assessments have been done at multiple institutions without

much improvement in the failure rate among medical students and residents.<sup>7-9,11,12</sup> Osteopathic medicine was established on the philosophical concept of unity between body mind and spirit, and this concept is now of the four main tenets stated by the American Osteopathic Association to be distinctive features of osteopathic medicine.<sup>14,15</sup> Osteopathic manipulative treatment (OMT) is a

distinctive MSK palpatory diagnostic and therapeutic approach to health and disease, which is practiced by osteopathic physicians. According to a study performed at four osteopathic schools, most of the first- and second-year medical students who participated (95% to 76%; depending on the question asked) expressed agreement with osteopathic philosophy, and 76% of the students agreed that OMT is a major distinguishing factor between a Doctor of Osteopathic Medicine (DO) and a Doctor of Medicine.<sup>16</sup> Osteopathic physicians surveyed about their use of OMT reported that >50% of conditions for which they treated patients with OMT related to the MSK system.<sup>17</sup> This implied an extensive knowledge of the MSK system and the associated disorders among physicians trained in osteopathic medicine. But according to the studies quoted above, graduating physicians perform very poorly in demonstrating MSK knowledge. One such study compared allopathic and osteopathic students and their performance on the Freedman Bernstein examination and found 70.4% and 82% failure rates for osteopathic and allopathic students, respectively.<sup>10</sup> Doctor of Osteopathic Medicine program graduates perform only marginally better on the MSK cognitive examination. Osteopathic graduates fail based on the guidelines established by both orthopaedic and internal medicine residency programs,<sup>11</sup> despite their perceived importance of the topic, thus, bringing up the fact that both Doctor of Medicine and DO medical schools are struggling to prepare their graduates for evaluating and treating MSK disorders.

When students were asked which subject they value higher based on the level of importance, COM ranked MSK in the top three subjects, whereas CHM ranked it among the top eight. This implies that enhanced exposure of MSK topics may lead to increased

appreciation of the value of this subject material. This may also be due to the increased emphasis on MSK training in osteopathic medicine as seen on its focus in training physicians skilled in knowledge and mobilization of MSK anatomy thorough OMT. The increased exposure to MSK issues and OMT during medical school training has been shown to increase students' comfort in addressing these issues,<sup>18,19</sup> which suggests that this strategy should be applied in both allopathic and osteopathic training curricula.

Standardization of the curriculum to align with USMLE and clinical related MSK topics may help improve mastery of MSK skills. Modifications to the format of MSK curriculum, such as standardization to align with USMLE and clinically-related topics, as well as to the methodology used to assess students' knowledge may help to improve long-term retention of MSK material, mastery of skills and clinical performance.<sup>20</sup> The fact that 36.6% of CHM students felt that the MSK curriculum does not prepare students for the USMLE, whereas only 17% of COM students felt that MSK curriculum does not adequately prepare them compounded with the fact that CHM students spend 2 weeks on the MSK material and COM students spend 4 weeks on the MSK material, further supports the view that the more exposure students receive to MSK the more prepared they feel when encountering the material.

We also think that the current teaching method of MSK medicine may be inadequate based on when it is presented. These two programs taught MSK during only the first 2 years of school, with COM teaching MSK during both year 1 and year 2 and CHM teaching MSK during year 2. A large proportion of our surveyed medical students thought that it would be important to receive education during the third and fourth years of school. In contrast to that

belief, only 24% (31/127) of medical schools surveyed in a 2011 study required a clinical clerkship in MSK medicine,<sup>21</sup> which is not great improvement from the initial assessment of 20% (25/122) schools in 2003.<sup>22</sup> Implementation of the MSK curriculum to the third and fourth years of medical school could also prove to be beneficial for the student because learning via clinical and hands-on experiences has proved to be an effective teaching tool. Teng et al<sup>19</sup> found that students with additional OMT clinical exposure during the third and fourth years of training caused an increase in participants' comfort level with OMT and the underlying topic of MSK disorders. We posit that future efforts may need to focus on expanded clinical education that incorporates hands-on MSK physical examination skills with multidisciplinary clinical scenarios starting from a students' first year and extending to the students' fourth year, which may ultimately improve performance and competency.

This study was limited because survey data were collected at allopathic and osteopathic schools in the Midwest under the same institution (Michigan State University). Further investigation would benefit from an extended view of a larger number of both allopathic and osteopathic institutions across different geographic regions of the United States. Thus, there are a few institutions across the United States that have both allopathic and osteopathic medical schools so there is a built-in control in our data collection.

Given that disorders of the MSK system remain among the primary reasons why individuals visit health-care providers in the United States, it is interesting to see the differences in approach to time and structure of teaching MSK education in allopathic versus osteopathic. Medical schools do not seem to be dedicating sufficient time and curriculum efforts

to MSK medicine competency. This suggests that medical students may be graduating underprepared to provide MSK treatment—especially those who will become the first line of treatment for MSK injuries as primary care physicians. Of note, there was an extremely varied response to medical students' perception of the adequacy of their MSK education. Although there has been a recent push toward instituting a curriculum nationwide for MSK education, the delivery of this education is not resulting in the perception of confidence to deal with these issues on a practical level. Further efforts need to be made to define adequate MSK education and to prepare the next generation of physicians for evaluating and treating these very common conditions.

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