



Musculoskeletal Education in Medical Schools: a Survey in California and Review of Literature

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Abstract

Introduction Though musculoskeletal complaints account for roughly one-quarter of primary care and emergency department visits, only 2% of US medical school curriculum is devoted to musculoskeletal disease. Many graduating students demonstrate poor knowledge and report low confidence in treating musculoskeletal disorders. This study defines the current state of musculoskeletal curriculum of medical schools in detail to identify variations and potential shortcomings.

Methods All eleven medical schools in California were invited to participate in an in-depth survey detailing the design and content of their musculoskeletal curriculum.

Results A response rate of 100% was achieved. Overall, schools devoted an average of 58.7 h to musculoskeletal medicine, of which more than half was spent covering anatomy. The primary instructor for musculoskeletal medicine was a clinician in four schools (36.4%). Six schools offered a dedicated musculoskeletal physical exam course. No schools required students to complete a clinical rotation in musculoskeletal medicine. There was high variability among institutions when evaluating core subject coverage.

Discussion There is large variation in the content and structure of musculoskeletal instruction among California medical schools. Increased curricular time, integration of preclinical and clinical experiences, greater specialist participation, and standardized objectives may provide more consistent and comprehensive musculoskeletal education.

Keywords Medical school · Medical education · Musculoskeletal education

Introduction

A large discrepancy exists between the frequency of musculoskeletal disease seen in the clinical setting and the attention devoted to it in medical schools [1]. Musculoskeletal issues are the most common presenting complaint to a physician, accounting for 15–30% of primary care and 20% of emergency room visits in the

USA [1]. These conditions are a leading cause of long-term disability [2, 3] and are responsible for 850 billion healthcare dollars each year [4, 5]. However, many medical schools require no clinical clerkship in musculoskeletal medicine [6]. Among schools that do offer a dedicated musculoskeletal educational program, less than 5% of total academic time over the 4-year medical school curriculum is spent on the topic, a fraction disproportionate to the burden of disease [6–8].

Freedman and Bernstein revealed 78–82% of first-year medical residents failed a basic musculoskeletal competency test [9, 10], findings that have been reproduced in other studies [5, 11–13]. Medical students uniformly report dissatisfaction with their musculoskeletal education and low confidence in their clinical skills. The Association of American Medical Colleges (AAMC) has documented insufficient clinical knowledge and poor physical exam competency in musculoskeletal medicine. Lack of instruction has been identified as a principal contributor to this gap. Though medical schools have increased curriculum time, the ideal way to define and achieve

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musculoskeletal competency in the primary care setting has not yet been identified.

Given the current shortcomings in musculoskeletal education, the goal of this study is to define the current state of musculoskeletal education in medical schools as a first step to improving competency. This study expands on previous work describing general trends in musculoskeletal education [1, 8] to investigate these in greater detail, describing quantity and distribution of teaching hours, instructor background, and extent of core topic coverage among different institutions. We hypothesize there is large variation among medical schools in both quantity and structure of musculoskeletal education in both clinical and preclinical years.

Materials and Methods

A cross-sectional survey was distributed to all medical schools in California to detail the design and content of musculoskeletal instruction at each school. As California has long been heralded as a bellwether for the rest of the country [14, 15], medical schools in this state were selected as an appropriate pilot group. Allopathic and osteopathic medical schools in California were identified using the online directory provided by the Association of American Medical Colleges (AAMC) and Colleges of Osteopathic Medicine (AACOM), respectively [16, 17]. As the specifics of each individual school's musculoskeletal curricula were not publicly accessible, a survey was chosen as the most effective instrument to consistently collect data in the desired detail. The respondent from each school was identified online as either the musculoskeletal block director or Assistant Dean of Education. No incentives were offered for completion of the survey.

Field items within the survey were modeled after a previously published musculoskeletal education survey [1] and adapted in conjunction with the Assistant Dean for Student Advising at Stanford University School of Medicine (A.L.) and Clerkship Director for Orthopaedic Surgery at the University of Pennsylvania School of Medicine (J.B.). A list of critical musculoskeletal topics from the American Academy of Family Physicians Musculoskeletal Curriculum Guidelines [9, 10, 18] and previously validated musculoskeletal competency examination [9] were utilized to identify topics for depth-of-coverage assessment. The final survey is provided in Appendix 1.

Responses were collected through Google Forms (Google LLC, Mountain View, CA) and analyzed using Microsoft Excel (Microsoft Corporation, Redmond, WA). Aggregate data was evaluated using descriptive statistics, whereas continuous variables were reported with mean and standard deviation values.

Results

A response rate of 100% was obtained from all nine allopathic medical schools and two osteopathic medical schools in California (Table 1). Survey results were collected between August 2014 and April 2015. The primary respondent of the survey identified themselves as the musculoskeletal block director for nine schools and the Associate Dean of Education for the remaining two schools.

Musculoskeletal Anatomy

The mean time spent on musculoskeletal gross anatomy was 29.7 h (range 4–50 h, Fig. 1). Nine of 11 schools (81.8%) reported the involvement of clinicians, defined as physicians who regularly see patients, in the teaching of gross anatomy. In six of these schools, clinicians serve as primary lecturers or dissection leaders, whereas the other three utilize them in supporting roles (e.g., adjunct dissection instructors). Five schools (45.4%) reported clinical correlates are formally taught concurrently with musculoskeletal anatomy. Eight schools (72.7%) reported that X-rays, ultrasound, and CT and MRI scans are used in anatomy instruction, typically in conjunction with clinical case discussions.

Preclinical Education

Ten of the 11 (90.9%) schools reported having a dedicated musculoskeletal education block within their preclinical 1st and 2nd year medical education. Of these schools, six reported musculoskeletal education is taught as its own stand-alone block, whereas four schools incorporated it with the teaching of other specialty subjects. Schools with a stand-alone musculoskeletal block reported time dedicated to this block ranged from 2 to 4 weeks.

The mean time spent teaching preclinical musculoskeletal education, including anatomy, was 58.7 h (range 6–150 h,

Table 1 List of medical school included in survey

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|--|
| University of Southern California Keck School of Medicine |
| Loma Linda University School of Medicine |
| Stanford University School of Medicine |
| University of California, Davis School of Medicine |
| University of California, Irvine School of Medicine |
| University of California, Los Angeles David Geffen School of Medicine |
| University of California, San Diego School of Medicine |
| University of California, San Francisco School of Medicine |
| University of California, Riverside School of Medicine |
| Touro University College of Osteopathic Medicine |
| Western University of Health Sciences College of Osteopathic Medicine of the Pacific |

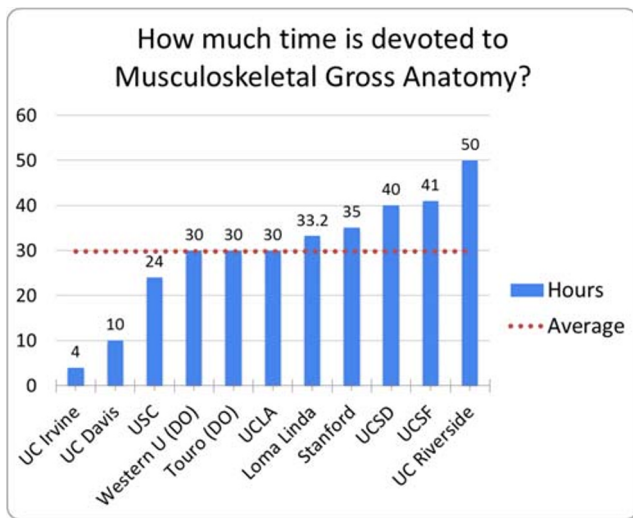


Fig. 1 Number of hours dedicated to musculoskeletal gross anatomy reported by each institution

Fig. 2). Four schools reported preclinical musculoskeletal curriculum occurred during the first year only, three schools reported it occurred during the second year only, and four schools reported it occurred during both the first and the second years. Six schools offered a dedicated musculoskeletal physical exam course.

A clinician served as the course director for preclinical musculoskeletal education in four out of the 11 schools surveyed (36.4%); it was otherwise led by basic scientists or anatomists. Preclinical musculoskeletal lectures are most frequently taught by rheumatologists, whereas musculoskeletal physical examination is most frequently taught by primary care physicians (Fig. 3a and b). Eight schools had active involvement from orthopedic surgeons, typically as supplemental lecturers.

All 11 institutions provide instruction in basic musculoskeletal anatomy and physiology. Nine schools (81.2%)

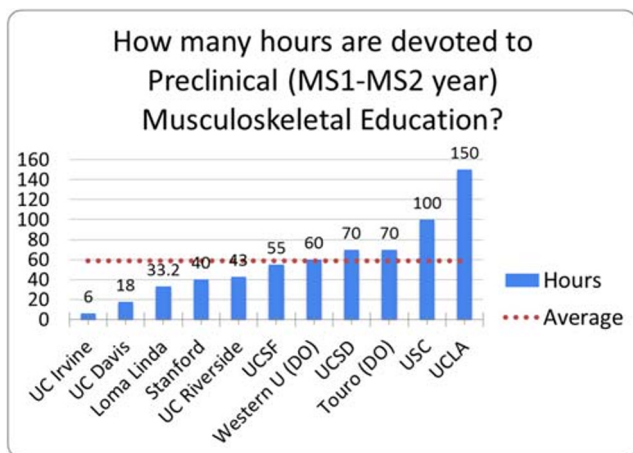


Fig. 2 Number of hours dedicated to musculoskeletal preclinical education reported by each institution

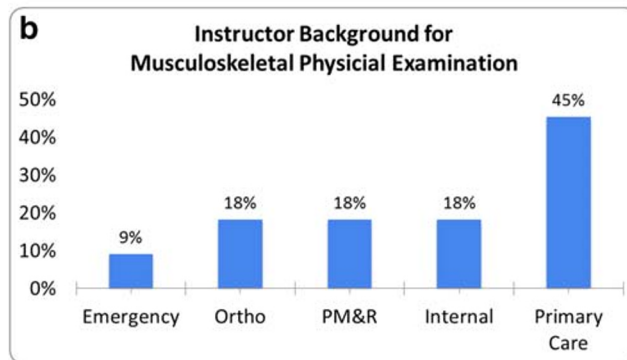
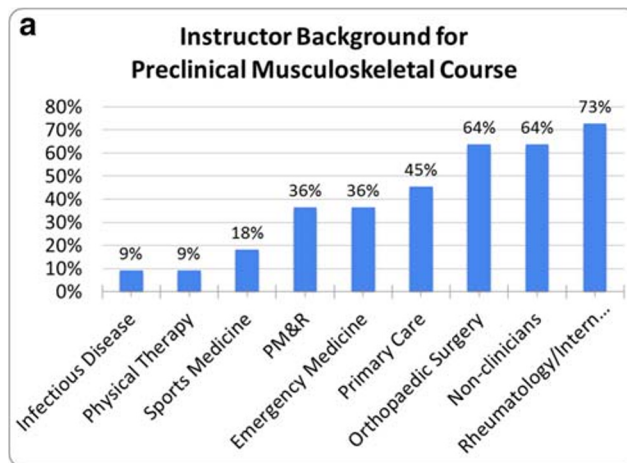


Fig. 3 Instructor background for preclinical musculoskeletal course (a) and musculoskeletal physical exam (b). Percentages listed are the percent of institutions (out of 11 schools) that reported use of an instructor with given subspecialty background

reported teaching topics of chronic musculoskeletal conditions (rheumatoid arthritis, gout, etc.) and nine schools (81.2%) reported teaching topics of acute musculoskeletal injuries (fractures, tendon injuries, trauma, etc.). All 11 institutions reported that lectures are utilized as the primary format for teaching preclinical musculoskeletal education; seven institutions (63.6%) incorporated small-group cases, small-group practicum, or self-study as well.

Figure 4 illustrates the depth of coverage for core musculoskeletal topics. Each topic was covered to some extent at the majority of schools. Only three topics (18.8%: carpal tunnel syndrome, ankle sprains, and lumbar disc herniation) out of our list of 16 were found to be reliably covered at all institutions.

Clinical Education

No California medical schools require clinical rotations in orthopedic surgery, rheumatology, or physical medicine and rehabilitation. One respondent remarked that there are “hardly any opportunities for clinical musculoskeletal education.”

Medical students are assessed by paper or computer-based examination in 9 of the 11 schools. Objective Structured

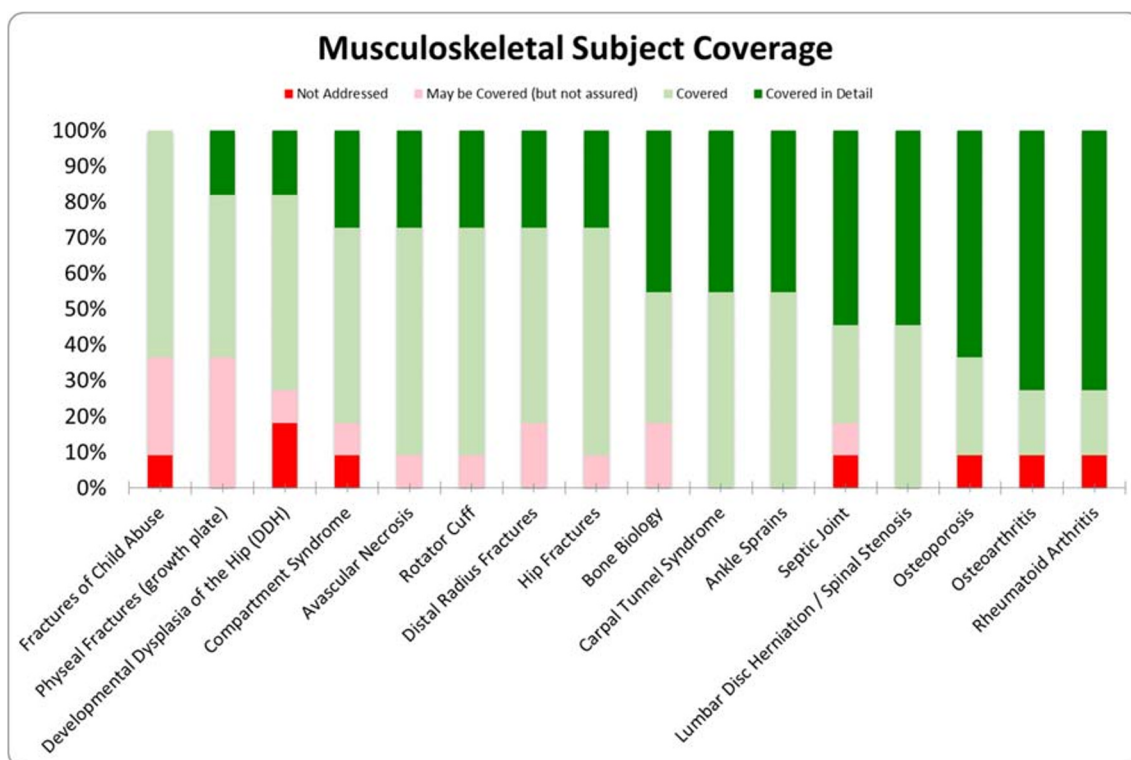


Fig. 4 Distribution of how each topic is covered among institutions. Percentage listed is the percent of schools (out of 11 schools) reporting level of coverage

Clinical Examinations (OSCE) are utilized to assess physical exam proficiency in 4 schools. All respondents reported instructors are satisfied with their mode of assessment for musculoskeletal education. When asked how prepared students are to approach/triage basic musculoskeletal conditions on a scale of 1–5 (1 poorly prepared and 5 extremely prepared), the mean value was 3.4 (range 2–4); no schools reported students to be extremely prepared.

Discussion

In this study, we identified a large variation in the structure and content of musculoskeletal education in California medical schools. Nearly all schools offered a preclinical musculoskeletal block. On average, 58.7 h was devoted to musculoskeletal medicine, of which more than half was devoted to anatomy. There was a 10-fold difference in the hours devoted to musculoskeletal education between the lowest- and highest-reporting schools. Similar to other authors, we found no differences in the quantity or qualitative breakdown of educational hours between allopathic and osteopathic medical schools [19]. Approximately half of medical schools surveyed offered a dedicated musculoskeletal physical exam course. No institutions required students to complete an orthopedic surgery, rheumatology, or rehabilitation clerkship. Though most subjects on a core list of musculoskeletal topics were

reportedly covered, seven topics (out of 16) were found not to be addressed at all at some institutions and only 3 topics were assuredly covered at all schools. There exist clear variation and deficiencies within medical school musculoskeletal curriculum: quantifying these may help create targeted solutions and improve the preparedness of undergraduate medical students.

Though musculoskeletal complaints account for roughly one-quarter of primary care and emergency department visits, only 2% of medical school hours is devoted to musculoskeletal disease [6–8]. Insufficient exposure likely plays a role in the poor musculoskeletal proficiency documented in medical school graduates [9, 10]. These findings also extend to physicians in practice as well, as a high proportion of primary care and emergency medicine physicians were unable to pass a basic musculoskeletal competency test [20, 21]. Given that primary care physicians report their principal source of musculoskeletal education occurred in medical school, the importance of a comprehensive curriculum cannot be understated [9, 22–24].

Traditional medical education may lead to fragmentation of learning, as it typically compartmentalizes the teaching of basic science by anatomists and physical examination by clinicians. Medical students frequently report lack of confidence in musculoskeletal anatomy [25]. Greater success in musculoskeletal competency has been achieved when preclinical teaching is concurrently incorporated with clinical

applicability [11, 25–27]. Involving subspecialists as instructors has been shown to yield greater retention of musculoskeletal subjects [28]. In this study, we found few schools had clinicians play an active role in preclinical curriculum. Additionally, most instructors for the musculoskeletal physical exam course were primary care physicians and few schools had active leadership from orthopedic surgeons. Greater subspecialist involvement may lead to better student engagement and ultimate proficiency in the clinical setting.

Additionally, students exposed to a clinical musculoskeletal rotation report greater confidence in their abilities [29]. Leaders within the academic orthopedic community have advocated for increased musculoskeletal curriculum time and at least one required clinical rotation in medical school [1, 30, 31]. As an alternative to a formal subspecialty rotation, some have proposed a 2–4-week clinical workshop focused on common musculoskeletal complaints seen in the primary care or emergency setting [19, 25]. In 2005, the AAMC recognized the need to restructure musculoskeletal medical education [12, 32] and recent collaborative efforts increased the proportion of medical schools requiring musculoskeletal education from 47 to 83% [7, 12, 23]. Despite this, disparity between the incidence of musculoskeletal disease and priority within medical school education still exists.

Bernstein et al. identified time, money, politics, and lack of enthusiasm as impediments to musculoskeletal curricular reform [8]. They proposed that the cooperation of national organizations, integration of orthopedic residents as teachers, and embracing technology as ways to create innovations in musculoskeletal education. Through this investigation and review of published studies, we have identified these recommendations for effective musculoskeletal curriculum:

- 1 Ensure dedicated teaching time in musculoskeletal medicine that covers anatomy alongside clinical correlates, including physical examination skills, case-based scenarios, and radiologic interpretation. Identifying a single director to steer the undergraduate musculoskeletal medical education may result in a more cohesive curriculum.
- 2 Involve subspecialists (such as orthopedic surgeons, rheumatologists, or physiatrists) as instructors to provide expertise in teaching [28].
- 3 Introduce a musculoskeletal clinical experience during medical school, which may place priority on common complaints in primary care or the emergency department. If introduced in the final year of medical school, a secondary goal of this rotation may be to synthesize information-gathering and develop medical decision-making skills in anticipation of the transition from student to practitioner [7].

Technology can also be leveraged to deliver learning objectives without challenging current constraints on classroom

time [32]. Stebbings et al. reported high student enthusiasm with an online rheumatology course integrating lectures, photos and videos, interactive questions, and clinical scenarios. This course was implemented concurrently with in-person physical examination skills, radiologic interpretation, quizzes, and lectures to offer a comprehensive curriculum without encroachment on other important subjects [33]. Saleh et al. introduced an online musculoskeletal course integrating anatomy, pathophysiology, and clinical evaluation [34]. The authors prioritized proficiency in the primary care setting and found improved student confidence and long-term retention.

Strengths of this study include the 100% survey response rate from California medical schools to provide a “birds-eye” view of current practices in musculoskeletal education. Additionally, this study attempts to obtain as much detail from current education efforts as possible, in order to identify targets for improvement. Limitations include the possibility of response bias in the survey results and lack of a gold standard in the ideal musculoskeletal curriculum. However, in performing a review of the literature, we have set out to define shortcomings of previous efforts and identify successful techniques that previous authors have reported.

This study quantifies the large variation in structure and content of musculoskeletal instruction among California medical schools, which is likely found nationwide. Though greater awareness has been made, current methods of education still yield relatively low proficiency on basic competency tests. Given the burden of musculoskeletal disease and shortfalls of existing efforts, we propose a need for interdisciplinary collaboration to create standardized objectives to achieve basic competency in the primary care setting. Increasing curriculum time alone is not sufficient, but success hinges on the integration of preclinical and clinical experiences to create long-lasting retention [23]. Integration of preclinical and clinical experiences, greater specialist participation, and standardized objectives may provide more consistent and comprehensive education and, ultimately, physicians with greater musculoskeletal competency.

Data Availability Available upon request.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Code Availability n/a

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