

REVIEW

Closing the Gap in Musculoskeletal Education for Medical Students Entering Primary Care Careers

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ABSTRACT

The high prevalence of musculoskeletal disorders mandates that physicians in training receive thorough education on the subject. However, clinical observation supported with research data indicates that physicians in training are not being well prepared to treat musculoskeletal disorders. Medical school graduates often exhibit a lack of cognitive mastery in musculoskeletal medicine when evaluated using a validated examination. Furthermore, surveys and subjective evaluations have reported that residents but also practicing physicians lack confidence in patient care related to musculoskeletal medicine. In this review, we outline the current status of musculoskeletal education of medical students and residents, and present the recently developed initiatives to enhance it.

Level of Evidence: V; Descriptive review/Expert opinions.

Keywords: Medical education; Musculoskeletal knowledge; Medical student didactics.

INTRODUCTION

Musculoskeletal disorders affect an estimated 126.6 million American adults and account for \$874 billion in annual treatment cost and lost wages [1]. Additionally, 51.8 million adults reportedly have arthritis, 75.7 million adults suffer from neck or low back pain. One in 2 women and 1 in 4 men over the age of 50 will have an osteoporosis-related fracture [1]. Disorders of the musculoskeletal system remain among

the primary reasons that individuals visit healthcare providers in the United States and account for approximately 20% of visits to emergency departments and primary care clinics [2-4]. A survey of 300 primary care physicians reported that 30-40% of their case load involved musculoskeletal complaints [5].

In order to best care for their patients, physicians must understand the basic principles of diagnosing and treating musculoskeletal disorders [6]. Currently, physicians in training are not being well prepared to treat musculoskeletal disorders. Freedman & Bernstein, along with others, have reported that medical school graduates lack cognitive mastery in musculoskeletal medicine when evaluated using a validated

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examination [4,7-9]. Additionally, numerous surveys and subjective evaluations have reported that residents and practicing physicians lack confidence in patient care related to musculoskeletal medicine [8-14]. An underlying cause for a lack of confidence and competence in newly graduated physicians and medical students might be the lack of instruction. DiCaprio et al. found that only 53% (65 of 122) of US medical schools had a required musculoskeletal course [15]. Since that time, the United States Bone and Joint Initiative (USBJI), with the help of the Association of American Medical Colleges (AAMC), has advocated, with some success, for the incorporation of dedicated musculoskeletal coursework into the core curriculum. In 2011, a follow-up study by Bernstein et al. to assess the rate of required instruction in musculoskeletal medicine found that as of 2010, the number of US medical schools with required musculoskeletal instruction had increased to 83%, and that 78.7% (100/127) of these musculoskeletal courses are taught in the first 2 years [16]. While this study demonstrated an improvement in prevalence of dedicated musculoskeletal curriculum, there is still an unanswered question regarding the quality and content of required clinical courses, as only 15% (20/136) of medical school's curriculum has required musculoskeletal clinical instruction [3].

Since 2003, national efforts to promote musculoskeletal medicine education have been a priority for the USBJI, as there have been demonstrated inadequacies in the knowledge and comfort of both physicians and medical students. However, even with focused curriculum revisions, such as increased time in gross anatomy lab, musculoskeletal pathophysiology, and the physical examination, a lack of proficiency for medical students in musculoskeletal educa-

tion has been reported [11]. An institutional survey of medical students, years 1 to 4, who were given a validated orthopaedic examination in musculoskeletal competency, yielded only a 19.3% pass rate and average score of 51.1% (70% is passing) [4,17]. Students who had completed an elective in musculoskeletal had a significantly higher pass rate (67.5%; $p < 0.001$). A structured musculoskeletal lecture series during the clinical years showed a pass rate 81.6% on the musculoskeletal competency examination [4,18]. Another institutional survey found that only 18% of 85 first year residents passed the musculoskeletal competency examination [4]. Although this improvement exists, it would be ideal for 100% of medical schools to include musculoskeletal education in their overall curriculum, and those that do not include this may not be addressing this established knowledge gap.

Project 100

Undoubtedly, there is significant variability in the content and the teaching methods used during musculoskeletal education. This variability may in part be reflective of the fact that the accrediting body for medical schools, the Liaison Committee on Medical Education, does not have specific requirements for the structure and content of musculoskeletal education. This variability may be another factor contributing to the low competency and confidence levels in musculoskeletal education. Project 100 was the USBJI initiative, led by Joe Bernstein, MD, to raise the level of training that graduating medical students receive in musculoskeletal health. Project 100 aimed to bring about fundamental changes in the quality of care of patients with musculoskeletal conditions, a cornerstone goal of the Initiative. The purpose of Project 100 was to

have musculoskeletal medicine recognized as an Essential Discipline by all medical schools, and to have the schools promote the inclusion of musculoskeletal medical curriculum with an emphasis equal to that given to other important organ systems. In other words, to have 100% of American medical schools require that their students meet the learning objectives set forth by the AAMC Medical Schools Objectives Project for musculoskeletal medicine.

Through the work of Project 100, a number of significant achievements were accomplished. The AAMC released guidelines to medical schools on the attitudes, skills, and knowledge all graduating medical students should possess in musculoskeletal medicine. A standing the National Board of Medical Examiners (NBME) Task Force now reviews and develops new questions for the Step 2 examinations to test effective understanding of musculoskeletal conditions. The NBME has developed a musculoskeletal subject examination. Coupled with the AAMC guidelines, this is expected to drive musculoskeletal courses at all medical schools. One hundred and twenty-five medical schools declared their support of the Initiative.

Finally, to assess the goal of 100% compliance, a survey compared instruction in medical schools in 2002 to 2012 and found that in 2002, less than half of medical schools provided instruction or a clerkship in musculoskeletal medicine, while by 2012, this had increased to more than 80%. Studies have shown that much of musculoskeletal education occurs as lecture and is almost exclusively during the preclinical years, with 85% of schools having no required clinical clerkships [3]. This may be problematic in that clinical experiences have been shown to be an effectual learning experience, and earlier real-patient learning has been shown

to stimulate more effective learning seen through higher scores at the end of block exams and higher reported learner satisfaction [11,19,20].

Interactive student-centered learning using problem-based learning (PBL) and team-based learning (TBL) format have also been shown to improve student comprehension, retention, and critical thinking [21]. Evidence exists that these types of teaching benefit students through promotion of active learning, and ultimately may improve student competency in musculoskeletal education. Students at Johns Hopkins University and Harvard Medical School were found to have low confidence with performing a musculoskeletal examination [11,17]. Future efforts may need to focus on expanded clinical education that incorporates hands-on musculoskeletal physical exam skills with multidisciplinary clinical scenarios that may improve performance and competency. A recent review of experiential-based learning argued that clerkship experience is beneficial for student acquisition of appropriate knowledge, skills, and attitudes [22].

During clinical rotations, most schools utilize the NBME subject exams which draws on musculoskeletal questions for 5-10% of their surgery, family medicine, and medicine clinical science exams. Increasing the percentage of musculoskeletal questions would encourage schools to adjust the curriculum to fit the need for more musculoskeletal competence. This could also be supplemented with assessment methods designed from OSCE or USMLE Step 2 type integrative knowledge, which have demonstrated improved long-term retention and clinical performance [19]. Additionally, the implementation of a longitudinal musculoskeletal curriculum that spans all 4 years of medical school may prove to be beneficial [2].

The MS4 Musculoskeletal Education for Future Primary Care Physicians Project

The USBJI has had the consistent goal of increasing the amount of time and effort in medical schools that is devoted to education on musculoskeletal health. Under the outstanding leadership of Joseph Bernstein, MD, Project 100 has worked for a decade to increase formalized instruction in musculoskeletal medicine in medical schools. Although much progress has been made, there is still a gap that needs to be closed.

The AAMC is currently interested in redesigning the fourth year of medical school to enable a more effective transition of students into postgraduate training. Seeing this as an opportunity. The AAMC pursued the idea of developing an innovative, standardized 4-8-week musculoskeletal education elective for fourth year medical students that will enter primary care residencies. A project team under, the leadership of USBJI Board member, Bruce D. Browner, an orthopaedic trauma surgeon, has been working to develop the course during the past year.

In addition to musculoskeletal specialists from the member organizations, we are collaborating in the design and implementation of the program with primary care clerkship coordinators and program directors and educators from general internal medicine and family medicine. We seek to develop a curriculum, novel education material, and evaluation methods. It will include teaching techniques designed to appeal to the millennial learners.

This endeavor parallels concern expressed by the AAMC that the fourth year of medical school needs to be redesigned to create a more effective transition to postgraduate training. AAMC has encouraged USBJI to develop the course, and once it is implemented, said it may be able to assist with its adoption.

Musculoskeletal diseases are among the most common conditions patients present to healthcare providers and especially primary care providers; 30% is a frequently quoted estimate. They are major sources of pain, disability, and loss of productivity. Despite this reality, primary care physicians are underprepared to respond because education in the diagnosis and management of musculoskeletal disorders and injuries is underrepresented in undergraduate medical schools and postgraduate residency programs. This gap could be addressed by creation of a focused fourth year medical school education program designed to teach students headed for careers in primary care about the management of these problems.

The process of building the MS4 course will involve developing teaching tools and forging relationships that will enable us to subsequently build similar education programs for residents, nurse practitioners, physician's assistants, and practicing physicians. We look forward to working with members of these specialties toward these aims.

A large project team was created by incorporating some USBJI Board members, individuals recommended by USBJI member organizations, direct recruitment, and response to a posting made on the e-bulletin board of the Society of General Internal Medicine. Design of the course has evolved from active online email discussions by project team members from musculoskeletal specialties and primary care disciplines.

The principle goal has been to construct a standardized ready-to-use course with materials that can be employed by the faculty at all medical schools to deliver the course. The initial 4-week course is focused on the general approach to musculoskeletal problems. It will emphasize patient

evaluation with motivated interviewing and physical examination. Common musculoskeletal problems presenting in primary care office practice will be covered in modules organized by regional skeletal anatomy. Additional modules will address major problems including osteoporosis and fragility fractures, inflammatory arthritis, osteoarthritis, pain management, mechanical and postural problems, total joint replacement, and PCP-specialist coordination.

The course will employ the latest concepts in medical education, including the "flipped classroom," with extensive use of online mini-lectures, video of physical examinations and procedures for independent viewing; and in class, small discussion groups, case studies, physical examination labs for each body region, and relevant clinical experiences.

In addition to the 4-week general course, 2-week electives will be developed for musculoskeletal Pediatrics, musculoskeletal Emergency Medicine, Sports Medicine and Ultrasound, Geriatrics, Occupational Medicine, and Employee Health.

Recruitment is completed for musculoskeletal specialists and primary care physicians who will serve as Team Leaders for each anatomic and disease module. They will be responsible for working with project team members and others to define, the content of each module, create the online mini-lectures and case studies, design the hands-on physical examination labs for each anatomic area, and structure the clinical experiences. They will produce "owner's manuals" and assist subsequently in "training the trainers" when the course is rolled out.

A special subgroup of anatomists lead by Kelly M. Harrell, PhD, MPT, will produce a set of musculoskeletal anatomy online mini-lectures that will be shown at the

beginning of each set of anatomic mini-lectures. Another group lead by Kim Templeton, MD will cover sex, gender and cultural disparities in a video presentation on Day 1 of the course and ensure that they are considered in the case studies presented in class each day.

Evaluation methods for the course, students, and faculty will be developed. Strong consideration will be given to using the musculoskeletal NBME shelf exam that was created several years ago by the NBME in collaboration with a Project 100 task force. This would allow uniform national evaluation of knowledge acquisition. Self-assessment questions will be imbedded in the online mini-lectures. Clinical skills will be evaluated using objective structured clinical examinations (OSCEs). Course evaluation by students and faculty will be used to fine-tune the course. Surveys of primary care residency directors will seek impressions about readiness for musculoskeletal clinical activity of those who have taken the MS4 musculoskeletal course, compared with those who have not.

To keep costs down and allow distributed production of the mini-lectures by a variety of individuals at different geographic locations, we will allow the people creating these presentation to use the lecture creation programs supported by their institution. Standards will be established working with the team leaders to create a branded consistent appearance for the mini-lectures, case studies, and associated Powerpoint slide sets, lab instructions, clinical experience designs, and owner's manuals. Given the existence and use of different internal electronic bulletin boards at each medical school, the MS4 musculoskeletal Course materials will probably be compiled and distributed via dedicated website.

It is hoped that the material can be created over the next 6-9 months, so the course can be field-tested in a number of medical schools and refined before general distribution.

In addition to providing future primary care physicians with knowledge and tools to undertake independent care of patients with musculoskeletal problems, a goal of the course will be to enable more appropriate and timely referral of patients for treatment or consultation with a variety of musculoskeletal specialists. We hope, therefore, to work with our colleagues in primary care to improve the overall health system by more effectively coordinating care and enabling each group to assume a portion of the large burden of musculoskeletal disease in the US. The course will be designed and distributed for international use and benefit as well.

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