Musculoskeletal Education for Medical Students

Arthritis and other musculoskeletal (MSK) conditions are only second to hypertension among self-reported chronic conditions in the United States Medicare recipients.\textsuperscript{1,2} In a study of eight countries (Denmark, France, Germany, Italy, Japan, The Netherlands, Norway, and the United States), arthritis had the greatest negative impact on health-related quality of life.\textsuperscript{3} In the United States, MSK disorders comprise the second most common reason for an outpatient visit.\textsuperscript{4} More than one-fourth of Americans seek medical attention for an MSK condition annually, and the direct and indirect costs of MSK disability are estimated as $849 billion annually in the United States.\textsuperscript{5}

Despite this tremendous healthcare burden, MSK medicine receives scant attention in medical school curricula. It is estimated that 3\% of curricular time in medical school is devoted to MSK medicine.\textsuperscript{6} In 2003, a review of Association of American Medical Colleges data revealed that only 41.8\% of schools had an MSK block in the preclinical years, and only 20.5\% had a required clinical rotation. Furthermore, the total curricular time averaged only 2.3 wks.\textsuperscript{7} At Harvard Medical School, students rated MSK education to be of major importance (3.8 on a 5-point Likert scale) but rated the amount of curricular time as poor (2.1/5). They had a low level of confidence in their MSK examination skills (2.7/5), and only 26\% of senior students was able to pass a cognitive test on MSK knowledge.\textsuperscript{8} Similarly, poor results were found when this cognitive examination was administered to nonorthopedic attending and resident physicians at several institutions.\textsuperscript{9,10} Even physiatric residents reported their training in MSK medicine to be suboptimal in a national survey.\textsuperscript{11} In the

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2008 Association of American Medical Colleges Graduation Survey, 37.5\% rated their training in rehabilitation as inadequate, 41.2\% rated it inadequate in occupational health, and 21.3\% rated their pain management training inadequate.\textsuperscript{12}

Physiatrists are uniquely qualified to fill in these gaps in medical education. We have skills in MSK anatomy, kinesiology, electrodiagnosis, physical examination, injection techniques, pain management, and disability management. Physiatrists contribute greatly to interdisciplinary care of MSK disorders in a wide variety of settings.\textsuperscript{13-17} Our strong philosophy of interdisciplinary teamwork and patient-centered care fosters communication skills.
RECOMMENDATIONS

Physical Medicine and Rehabilitation (PM&R) Should Partner in an Interdisciplinary Model for MSK Education

The American Association of Physiatrists (AAP) MSK Education for Medical Students Task Force (MSK TF) believes that this interdisciplinary model of patient care will translate well into teaching in medical schools. The MSK TF recommends partnering with colleagues in orthopedics, rheumatology, and primary care, as well as psychology, physical, and occupational therapy, which will provide educational opportunities for students who emphasize a comprehensive approach to patients with MSK disorders. Furthermore, the involvement of multiple specialties in this endeavor reinforces to curriculum committees and deans that MSK education is needed for students pursuing careers virtually in all medical specialties.

Each Medical School Should Have a Physiatrist MSK Education “Champion”

In this light, the AAP has become a major partner in the United States Bone and Joint Decade Project 100. This project, which has been endorsed by the Association of American Medical Colleges, aims to assure that 100% of medical schools include MSK education in their curricula. The United States Bone and Joint Decade Project 100 is co-chaired by Joseph Bernstein, MD (American Academy Orthopedic Surgeons), Geordie Lawry, MD (American College of Rheumatology), and R. Samuel Mayer, MD (AAP). Project 100 is compiling a list of MSK education champions to foster a curriculum at each medical school. This list will be shared with deans of curriculum at each medical school. Members of the AAP MSK TF, as well as approximately 15 other physiatrists, have volunteered to serve as United States Bone and Joint Decade champions for their medical schools. Currently, the United States Bone and Joint Decade has identified champions from orthopedic surgery, rheumatology, and PM&R in approximately 60 medical schools and is looking to find interested faculty in the remaining 50 schools.

Medical School Curricula Should Include Elements of MSK Medicine throughout All 4 Years

The MSK TF recommends that medical schools incorporate a 4-yr “strand” of MSK education into their curriculum, repeating and expanding on themes learned preclinically into the clinical rotations. This assures early exposure to MSK issues and promotes positive attitudes toward those patients who often suffer chronic pain and disability. The Association of American Medical Colleges has published a guideline, complete with objectives and curricular examples.

The AAP Should Maintain a Web-based Compilation of Model Curricula in MSK Medicine from a Physiatric Perspective

The MSK TF believes that the AAP needs a perpetual “living” document that encourages and disseminates innovative MSK curricula throughout American (and perhaps international) medical school. This repository would serve several functions. It would promote the ongoing exchange of ideas among interested faculty throughout the organization. It would provide an easily accessible resource for educators so that they would not have to “reinvent the wheel” with educational ideas for a given course or rotation. It would provide a visible platform for PM&R to promote itself as a leading provider of MSK education. Finally, it would provide a platform for PM&R faculty to “publish” curricula, enabling them to document dissemination of their programs for academic promotion committees.
MODEL CURRICULA IN MSK EDUCATION

The MSK TF has compiled some examples of curricula that can be implemented in each of the 4 yrs of medical school. This is by no means a comprehensive or complete list. We believe that champions from a multitude of medical schools should add their ideas, examples, and curricula to this compilation.

Year 1: Anatomy

Anatomy is taught in the first year at virtually every medical school and offers physiatrists a great opportunity to expose students early in their careers to the field of PM&R. Increasingly, medical schools are emphasizing clinical correlations in their anatomy courses. Most have a paucity of clinical faculty teaching in these courses and would welcome enthusiastic faculty willing to volunteer time to teaching clinical correlation modules. Some clinical correlation cases physiatrists have used include the following.

- Prevention and exercises for rotator cuff tendonitis.
- Ulnar nerve entrapments.\(^{20}\)
- Differential diagnosis of foot drop.
- Functional abilities of a C7 tetraplegic patient.

Year 2: Physical Examination of the MSK System

Physical examination courses are offered in the first or second year at most medical schools. This provides a great opportunity for physiatrists to highlight their MSK examination skills. The Department of PM&R at the Mayo Clinic has a long-standing, well developed module for second-year students during their clinical skills training. This 12-hr block has been described in detail.\(^{21}\)

Year 3: MSK Modules for Core Clinical Rotations

To address these inadequacies, we have compiled a list of pertinent MSK and rehabilitation topics that can be addressed during third-year core clerkships. Our goal was to highlight rehabilitation topics required across the third-year clerkship spectrum and to provide case examples for teaching. The third year of medical school is usually the first time medical students are consistently held responsible for patient care. Also, it is the time when most clerkships are required. Subsequent medical training often focuses on electives. These inadequacies exist even at the resident level.\(^{5,9}\) Potential barriers cited by residents included staff, money, and time. If barriers were removed, residents requested an increase in workshopping and activities such as visiting lecturers, workshops, and lecture series.\(^{9}\)

For example, the University of Colorado Denver School of Medicine added a MSK module to their internal medicine clerkship focusing on pain management and rehabilitation. This module included didactic lectures, small group discussions, and hands-on workshops. Table 1 provides a list of suggested MSK topic areas for required clerkships.

<table>
<thead>
<tr>
<th>Required Clerkship</th>
<th>PM&amp;R MSK Relevant Content</th>
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<tbody>
<tr>
<td>Internal medicine (inpatient)</td>
<td>Complications of immobility, cardiopulmonary dysfunction, exercise</td>
</tr>
<tr>
<td>Primary care (outpatient)</td>
<td>Sprains/strains, low back pain, neck pain, knee and shoulder injuries, sports injuries, myofascial pain</td>
</tr>
<tr>
<td>Pediatrics</td>
<td>Spasticity, gait disorders, congenital limb deficiency</td>
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<tr>
<td>Obstetrics/gynecology</td>
<td>Female athlete triad, low back pain in pregnancy, pelvic floor dysfunction</td>
</tr>
<tr>
<td>Surgery</td>
<td>Rehab after joint replacement, interventional pain procedures, conservative management of herniated discs, MSK ultrasound, prosthetics</td>
</tr>
<tr>
<td>Neurology</td>
<td>Electrodiagnosis, low back pain, stroke rehab, peripheral nerve anatomy, and dysfunction</td>
</tr>
<tr>
<td>Psychiatry</td>
<td>Chronic pain syndromes, conversion disorder</td>
</tr>
</tbody>
</table>
Medicine has a required clerkship during the third year of a medical school (MSIII). This 2-wk course is multidisciplinary with involvement of PM&R, orthopedics, and rheumatology providers. The course is designed to be primarily outpatient and has competency requirement in core clinical issues of arthritis, fracture, back pain, and MSK pain (including sprain/strain). In addition, there are basic science competencies in bone metabolism, anatomy, and rheumatologic laboratory assessment.

Alternatively, each of the core clerkships can integrate MSK didactic material or workshops relevant to that specialty (Table 1).

**Year 4: Advanced Elective Clerkships**

As part of the initiative to improve the MSK education of medical students, the goal of this portion of the section was to provide information on how physiatrist educators can formulate, arrange, and provide an advanced MSK clerkship geared toward the senior medical student (MSIV) in their medical school. By providing a concentrated clerkship in MSK evaluation, diagnosis, and clinical treatment, the physiatry department can effectively teach the unique holistic form of MSK care that physiatrists provide. Understanding that physiatrists are not the only providers of MSK care, certainly an advanced elective could be multidisciplinary in nature, integrating orthopedic and rheumatology colleagues to create an even more indepth experience in advanced clerkships.

This section will provide some assistance in delivering some numbers and examples of what is currently the state of advanced MSK clerkships in United States allopathic medical schools. Then, the section will provide some possible objectives, aligning with the six Accreditation Council of Graduate Medical Education (ACGME) competencies on medical education, which could be accomplished with such a rotation. We have also given examples of teaching methodologies or clinical settings for these. Finally, the section will present some evaluation methods that might assist in providing feedback to medical students taking such a course.

**State of Delivery of Clerkships in Advanced MSK Care in Medical Schools**

At this time, most medical school departments of rehabilitation medicine or PM&R integrate their MSK training of medical students into elective clerkships that may occur during the MSIII or MSIV years. A list of such clerkships is available at the AAP website, [http://www.physiatry.org/Education_Clerkship_List.cfm](http://www.physiatry.org/Education_Clerkship_List.cfm).

**Sample Objectives for a 2–4-Wk Advanced Clerkship in MSK Care**

**Patient Care**

Each medical student will be under the supervision of multiple physiatry faculty members throughout this clinical rotation. The faculty members will supervise the medical student during examinations in the settings of hospital-based clinics and outpatient offices to assure clinical learning and attainment of objectives including but not limited to those described below. The medical student will be constantly evaluated by the supervising physicians to ensure that the medical student obtains patient care experiences and acquires knowledge as expected for a senior-level medical student, such that they can graduate with the skills necessary to provide care for MSK complaints with an appropriate competency level as they graduate and enter residencies of any specialty. In broad and specific terms, the medical student will be expected to:

- Demonstrate caring and respectful behaviors (verbal and nonverbal) with patients.
- Elicit information using effective questioning and listening skills.
- Perform a full comprehensive history on patients with MSK-related injuries.
- Perform a full comprehensive examination on patients with MSK-related injuries (source: AAPMR/[PASSOR] MSK competencies [listed on separate attachment]).
- Create a differential diagnosis appropriate to the gathered history and physical findings.
- Learn to order and begin to learn to interpret laboratory tests, radiographic tests, and electrophysiologic tests appropriate to the MSK disorder suspected.
- Recommend medical treatment interventions pertinent to the findings on history, physical examination, and radiographic findings and based on the differential diagnosis applied to the clinical symptom severity.
- Learn when and why to order consultations with other physician medical specialists, including surgeons and rheumatologists.
- Learn when and why to order consultations with other medical care providers including physical therapists, occupational therapists, vocational therapists, and psychology providers.
- Integrate the findings to recommend rehabilitation treatment based on the MSK injury and medical treatment recommendations.
- Observe axial spine injections on selected patients. Become familiar with indications, safety, benefits, risks, and complications.
- Diagnose physical, cognitive, and psychosocial impairments in patients with MSK injuries.
- Learn to include an expanded functional examination and assessment.
- Observe peripheral joint injections on selected patients. Become familiar with patient, safety, indications, and complications.
- Learn the components of an Independent Medical Examination and of the disability rating systems.
- Write proper orders for physical therapy.

**Medical Knowledge**

Medical students will be expected to gradually increase their knowledge in MSK medicine. They will get opportunities to learn from senior residents and attending physicians via bedside teaching, but will also be expected to investigate medical topics via journal articles and specialized textbooks. Each of these will be made available by the supervising instructors in the rotation. Evaluation will occur by direct one-on-one feedback throughout the rotation. A formal written evaluation will be also performed at the end of the rotation. Specifically, the medical students will be expected to:

- Apply learned anatomy relevant to MSK injuries. ● Apply learned anatomy to each patient’s specific problem.
- Be able to identify specific MSK injuries including but not limited to:
  1. Shoulder injuries—i.e., rotator cuff tears, impingement syndrome.
  2. Knee injuries—menisci injuries, patellofemoral syndrome, etc.
  3. Elbow injuries—lateral epicondylitis, bursitis, etc.
  4. Wrist/hand injuries—carpal tunnel syndrome, tendonitis, etc.
  5. Lumbar spine injuries—herniated disc, zygoapophaseal joint injuries, myofascial pain, etc.
  6. Cervical spine injuries—herniated disc, zygoapophaseal joint injuries, myofascial pain, etc.
  7. Ankle injuries—sprains, plantar fascistic, etc.
  8. Hip injuries—runners’ injuries, osteoarthritis, etc.
9. Interventional spine.
   - Learn rehabilitation protocols for medical/rehabilitative treatment of MSK injuries.
   - Apply the physiology and basic science behind sports medicine injuries.
   - Learn the proper pharmacologic interventions for the treatment of MSK injuries and pain.
   - Learn all of the treatments available for MSK conditions, when and how they are applied, the benefits, risks, and complications.
   - Be exposed to the physical performance of MSK treatment procedures.
   - Learn about special considerations, which need to be applied to the injured worker.
   - Learn about special considerations, which need to be applied to the motor vehicle accident victim.

**Practice-based Learning and Improvement**

Medical students will be evaluated throughout the rotation by the supervising physicians to assure that the medical student obtains exposure to practice based learning as expected for their level of training. In addition, medical students will receive training in practice-based learning through didactic sessions. Specifically, medical students will:

- Evaluate their own knowledge and incorporate feedback from others.
- Investigate and apply evidence from scientific studies to enhance patient care throughout the rotation.
- Use information technology (computers, journals, etc.) to access and manage patient information and support their own education and treatment decisions.
- Contribute their findings to discussions on the care of the rehabilitation patient with other healthcare professionals in addition to their immediate instructors—such as physical therapists, occupational therapists, nurses, and vocational therapists.
- Attend and participate in any conferences and rounds to facilitate such discussions.

**Interpersonal and Communication Skills**

Each medical student will be under the supervision of faculty members throughout their clinical rotation. They will learn appropriate interpersonal skills as they relate to many different PM&R physicians, patients, and medical persons from other specialties. In the rotation setting, the medical student will be expected to:

- Establish trust and maintain rapport with patients and family.
- Complete all chart notes and dictations in a timely manner.
- Present material clearly and accurately to patients and family.
- Effectively communicate, verbally and in writing, patient’s needs to all staff involved with the rehabilitation patient.
- Use effective listening skills.
- Participate in all relevant discussions.
- Present cases effectively to the teaching faculty.

**Professionalism**

Each medical student will work under the supervision of a faculty member throughout his or her clinical rotation (who is approved to work in the medical school educational system). Faculty will offer a good example to medical students. The medical student will be evaluated in a one-on-one basis during
the rotation by supervising physicians to assure that the medical student demonstrates appropriate professionalism. Medical students will be required to:

- Exemplify respect and compassion toward patients.
- Show reliability, punctuality, integrity, and honesty.
- Accept responsibility for their actions and decisions.
- Apply sound ethical principles in patient practice, including areas of patient confidentiality, informed consent, and provision and withholding of care.
- Consider the effects of personal, social, or cultural factors in the disease process and patient management.
- Demonstrate sensitivity to patients of different ages, social status, race, and gender.
- Use other members of an interdisciplinary team of healthcare providers appropriately and professionally.
- Accept feedback appropriately.
- Refrain from introducing distractions such as a cell phone into the patient examination room.

**System-based Practice**

Each medical student will be under the supervision of a faculty member throughout their clinical rotation who will be expected to engage the medical student in discussions pertinent to the medical system in general and how the system impacts their care of the individual patient.

Specifically, the resident will be expected to:

- Collaborate and work effectively with other healthcare professionals and maintain appropriate behavior.
- Assess how their decisions affect others—patients, family, and other healthcare professionals.
- Integrate care of patients across hospital and community settings.
- Distinguish different settings for treatment of MSK injuries.
- Evaluate the cost of the treatments and diagnostic tests that are ordered.
- Advocate for patients who need tests and treatments if they are inappropriately denied.
- Recognize requirements for documentation.
- Identify some of the patient care requirements for a state-injured workers system.
- Begin to understand legal ramifications of MSK injuries.

**Sample Format of Clinical Clerkship**

There are many formats that an advanced clinical clerkship in MSK care can take. The basic components of rotations typically include and center on a clinical experience. Typically, MSK care is provided by physiatrists in the outpatient setting. These settings can include academic university outpatient clinic spaces, university or nonuniversity hospital-based outpatient centers, or private offices with voluntary faculty. The basic tenets of clinical care should be emphasized—with the senior resident student being given the opportunity to perform patient histories and MSK physical examinations, both independently and under the direct observation of the teaching faculty member.

On completing the H&P, medical students should be able to engage with teaching faculty in listing a problem-based differential diagnosis. Such differential diagnoses should be ranked in order of probability to then facilitate discussion on potential further diagnostic tests that should be ordered and
the likelihood that each would confirm a suspected diagnosis. Every attempt should be made to give the
student an opportunity to follow-up on such diagnostic tests that could include electrodiagnostic
testing, x-rays, magnetic resonance imaging scans, computed tomographic scans, bone scan, and
laboratory testing.

On review of the test results, medical students need to be given the opportunity to engage in the
discussion on treatment—choosing from a menu of options that they have learned about during the
rotation. When feasible, the medical student should be able to observe or even participate in the
treatments delivered, for example, injection procedures and physical therapy. When possible, the
medical student should participate in follow-up care after such treatments to learn the effectiveness of
the treatments.

A didactic program should be coupled with an assigned reading program. Usually, advanced
clerkships have small numbers of medical students. Therefore, the lectures can be small sessions done
with enough frequency to touch on the full breadth of MSK care.

Sample Evaluation Methods

There are several described methods of evaluation of clinical competence in medical students.
Perhaps, the best known method is the Objective Structured Clinical Exam (OSCE) examination. A
“model” patient is provided for the medical student to perform a history and physical examination. The
expectations should be well known. Feedback is then given by the examinee and supervising faculty
instructor. Self-evaluation could also be used to gain further insight into the medical students’ self-
awareness and confidence level.

Another method to evaluate clinical competence is observation by the teaching faculty of a full
history and physical examination performed by the medical student. In the PM&R residency, the
Resident Observation and Competency Assessment (ROCA) form is used for this purpose in the
outpatient setting. Then, immediate constructive feedback can be given to the student.

Appropriate for a 4-wk rotation, the 360° evaluation could be used and would include clinic staff—
secretaries and nurses, resident physicians, and therapists if they share the clinic, and even patients.
This allows the student to understand their level of professionalism and interpersonal communication
skills.

Finally, written examinations can be given on any topic relevant to MSK care. Specific competencies
should be designed for such an examination, so that the examination will be objective in nature. The
National Board of Medical Examiners has developed a “shelf exam” for MSK medicine.

CONCLUSIONS

The AAP MSK TF recommends that all medical schools provide all medical students with a strong
background in MSK medicine because of the immense burden of MSK disorders on individuals and
society. We believe that physiatrists are in a unique position to provide a pivotal role in MSK education.
Key physiatric faculty members at each medical school should become champions for MSK education
and form a network to exchange ideas. We also believe that PM&R will be most successful at integrating
into medical school curricula by becoming interdisciplinary partners in this endeavor with orthopedic
surgeons, rheumatologists, primary care physicians, therapists, and other interested specialists.

We recognize that each medical school has a different culture and different resources to provide
MSK education. We have provided some sample curricula, but many more models need to be added to
this list during time. The AAP will provide a web-based repository for model MSK curricula, which can be continuously updated and improved.

There are many realistic limitations to our proposals. Faculty members are stretched heavily with clinical, administrative, and research burdens that limit the amount of time available for teaching. Teaching needs to be more valued in medical school missions. In some schools, curricular time is tightly controlled by the “old guard,” and often PM&R is the “new kid on the block.” In some instances, poor interdisciplinary relations may limit the role of PM&R. However, we believe that in the vast majority of cases, curriculum committees and deans will be supportive of enthusiastic teaching efforts by PM&R faculty in this crucial content area of MSK medicine.

Approved by the Board of Directors: 2009

REFERENCES


