Recommended Curriculum Guidelines for Internal Medicine Residents
Musculoskeletal and Sports Medicine

This document was developed in cooperation with the American Medical Society for Sports Medicine (AMSSM) and the following authors:
- David G. Liddle, MD, FACP, Vanderbilt University Medical Center, Departments of Orthopaedics and Internal Medicine, Nashville, TN
- Carlin Senter, MD, University of California San Francisco, Departments of Medicine and Orthopaedics, San Francisco, CA
- Bradley Changstrom, MD, University of Colorado Hospital, Department of Medicine, Denver, CO
- Selina Shah, MD, FACP, Center for Sports Medicine, Walnut Creek, CA
- Claudia Dal Molin, DO, University of Maryland, Department of Orthopaedics, Baltimore, MD
- Byron Moran, MD, University of South Florida Morsani College of Medicine, Department of Internal Medicine, Tampa, FL
- Kevin Eerkes, MD, NYU School of Medicine, Department of Medicine, New York, NY
- Ariel Nassim, DO, Nassim Medical, P.C., Great Neck, New York
- Richard Greene, MD, NYU School of Medicine, Department of Medicine, New York, NY
- Amy P. Powell, MD, University of Utah Health Center, Department of Orthopaedics, Salt Lake City, UT
- Margot Putukian, MD, FACSM, Princeton University, University Health Services, Princeton, NJ
- Kenneth P. Barnes MD, MSc., FACSM, Greensboro Orthopaedics, Greensboro, NC
- Nicole Stern, MD, FACP, Sansum Clinic Urgent Care, Santa Barbara, CA
- Justin M. Young, MD, University of Hawaii, Department of Family Medicine and Community Health, Honolulu, HI

We will first seek the endorsement of the American Medical Society for Sports Medicine (AMSSM) followed by that of the American Board of Internal Medicine (ABIM), the American College of Physicians (ACP), the Society of General Internal Medicine (SGIM), and the Association of Program Directors in Internal Medicine (APDIM).

Introduction

Internal Medicine physicians who also practice Primary Care Sports Medicine and who are members of the American Medical Society for Sports Medicine developed this curriculum guideline. Our interest in doing so was to meet the need for
improved musculoskeletal education amongst internal medicine residents, and, by so doing, help them meet the needs of their patients.

The American Board of Internal Medicine recognizes Primary Care Sports Medicine as a sub-specialty board certification. Physicians with this training, as internists, treat not only acute and chronic general medical conditions, but specialize in the diagnosis and treatment of both acute and chronic orthopaedic and musculoskeletal conditions as well as medical issues unique to exercise and sport. These physicians practice in both internal medicine and multidisciplinary groups in both academic and private practice settings. They serve as team physicians where they perform sideline evaluations and make return to play decisions, perform procedures (including joint injections, aspirations, ultrasound guided injections and diagnostic exams, laceration repairs, joint dislocation and fracture reductions, fracture splinting and casting), and care for athletes of all ages at all levels of sport. Sports medicine physicians are promoters of overall health and wellbeing providing expertise in exercise physiology and exercise with chronic disease.

This Curriculum Guideline defines a recommended training strategy for internal medicine residents. Attitudes, knowledge and skills that are critical to internal medicine should be attained through longitudinal experience that promotes educational competencies defined by the Accreditation Council for Graduate Medical Education (ACGME) http://www.acgme.org.

Program requirements specific to internal medicine residencies may be found on the ACGME website.

The curriculum must include structured experience in several specified areas. Most of the resident’s knowledge in musculoskeletal medicine will be gained by caring for ambulatory patients. Structured didactic lectures, conferences, journal clubs and workshops must be included in the curriculum with an emphasis on outcomes-oriented, evidence-based studies that delineate common and chronic diseases affecting adult patients. Appropriate referral patterns to Primary Care Sports Medicine physicians and Orthopaedic surgeons as well as provisions for cost-effective, value-based care should be part of the curriculum.

Each residency program is responsible for its own curriculum. This guideline provides a useful strategy to help residency programs design their curricula for educating internal medicine physicians.

**Preamble**

The combined burden of medical conditions affecting the musculoskeletal system and preventable chronic diseases that are related to improper nutrition and inactivity in the United States is staggering. Musculoskeletal complaints comprise 20-30% of all outpatient office visits for general medicine and primary care providers.¹ Visits for musculoskeletal disorders and arthropathies rank second only
to visits for general medical examinations, routine prenatal care, and routine infant or child health checks.² Patients present with musculoskeletal complaints more often than they do for upper respiratory infections, hypertension, or diabetes.² In spite of the frequency of patients presenting with these conditions, instruction in musculoskeletal medicine for internal medicine residents represents, on average, less than 1% of their total didactic and clinical education time. Moreover, studies indicate musculoskeletal medicine education in U.S. medical schools and primary care residencies may be inadequate.³,⁴,⁵

We recognize the immense breadth of knowledge and skill required to train residents in the practice of medicine. There is much to learn and many settings in which to do so. The purpose of this curriculum is to provide guidance and recommendations to internal medicine residencies wishing to provide their graduates with a solid foundation in musculoskeletal medicine. Doing so will prepare them to meet the demands of their adult patient populations. This guideline was created to be comprehensive so that residents can learn to provide optimal care for musculoskeletal conditions in an organized, efficient, evidence-based, and value-based manner. We encourage residency programs to design their curricula to include the attitudes, knowledge and skills provided herein.

Residency education must be designed to provide experiences in a variety of settings that will give residents opportunities to gain expertise in the diagnosis, prevention, treatment, and rehabilitation of musculoskeletal diseases. These experiences should include adult patients with conditions of congenital, traumatic, and degenerative etiologies.

**Goals**

The goals of this curriculum are to guide internal medicine residency programs in designing educational programs that will enable residents:

1. To demonstrate understanding of the physical, psychological, financial and other quality-of-life consequences of living with both acute and chronic musculoskeletal conditions⁶
2. To acquire the attitudes, knowledge, and skills needed to:
   a. Evaluate and treat common musculoskeletal disorders that present to primary care doctors
   b. Evaluate and treat common neurologic and rheumatologic disorders that affect the musculoskeletal system
   c. Evaluate and treat medical issues related to exercise & sport
   d. Use exercise as medicine to prevent and manage chronic disease by utilizing exercise prescriptions
3. To understand how chronic disease may affect exercise response, exercise prescription, and participation in exercise and/or sport
4. To recognize the role and importance of the primary care physician in treating common orthopaedic, neurologic, and rheumatologic disorders.
5. To understand the role of both Primary Care Sports Medicine physicians and Orthopaedic surgeons.
6. To identify proper indications for referral from Internal Medicine to Primary Care Sports Medicine and/or Orthopaedic Surgery.

**Learning Objectives Overview**

After instruction on the topics below, residents should be able to demonstrate ability to:

1. Obtain pertinent history, perform an appropriate and efficient physical exam, develop a differential diagnosis, and recommend treatment, including appropriate referral as needed, for each of the conditions listed in the sections below:
   a. Musculoskeletal and nerve related conditions (see Knowledge> Common Musculoskeletal, Neurologic, and Rheumatologic Conditions)
   b. Sports/exercise related medical conditions (see Knowledge>Sports Specific Considerations>#4)
2. Provide value-based care by minimizing unnecessary testing and ordering appropriate views of radiographs or other advanced imaging studies for varying orthopaedic conditions.

**Competencies**

At the completion of residency training, an internal medicine resident should:

1. Perform an appropriate musculoskeletal history and physical examination, and formulate an appropriate diagnosis and recommend treatment, including requisite subspecialty referrals to Physical/Occupational Therapy, Primary Care Sports Medicine, or Orthopaedic Surgery (Patient Care, Medical Knowledge, Systems-Based Practice)
2. Perform an evidence-based, age-appropriate and activity-specific preparticipation physical evaluation, including evaluation for fitness for duty for work or participation in sports/exercise, and provide guidance for an appropriate exercise prescription (Patient Care, Medical Knowledge, Interpersonal and Communication Skills, Professionalism)
3. Communicate effectively with a wide range of individuals regarding musculoskeletal health care, including patients, their families, coaches, school administrators and employers (Interpersonal and Communication Skills)

**Attitudes**

The resident should demonstrate attitudes that encompass an awareness of:
1. The physical, psychological, financial and other quality-of-life consequences of living with both acute and chronic musculoskeletal conditions
2. The importance of diagnosing and treating musculoskeletal injuries in internal medicine
3. Exercise as an important and beneficial part of patients’ lives
4. Appropriate preparticipation physical evaluation including exercise testing as indicated
5. Awareness of the special needs of patients who have acute injuries
6. Proper rehabilitation of acute musculoskeletal injuries to help speed recovery, maximize function and minimize the risks of re-injury, chronic pain and chronic disability
7. Prevention strategies as an important part of the care of the musculoskeletal system

**Knowledge and Skills**

Residents should demonstrate their knowledge of the topics and conditions listed below. Moreover, they should also demonstrate the ability to independently perform procedures or manage the same conditions, or refer when needed.

**Normal Physiology and Clinical Applications**

1. Normal anatomy and physiology
2. Normal growth and development
3. Normal aging and its impact on musculoskeletal health
4. Impact of physical activity and exercise on disease prevention, chronic disease management, and morbidity and mortality
5. Musculoskeletal history taking
6. Principles of musculoskeletal physical examination
7. Indications, contraindications and interpretation of laboratory data (e.g., joint fluid analysis, CPK)
8. Indications, limitations, contraindications and informed consent for office-based musculoskeletal procedures such as:
   a. Common joint aspirations and injections
   b. Common injections for bursitis
   c. Common injections for tendonopathy

**Pathogenesis/pathophysiology and recognition of:**

1. Joint pain, swelling and erythema
2. Muscular pain, swelling and injury
3. Musculoskeletal trauma
4. Fractures and stress fractures
5. Dislocations
6. Ligament sprains
7. Tendonopathy (tendinitis to tendonosis)
8. Tendon ruptures (partial and complete)
9. Nerve injuries
10. Bone and joint deformities
11. Bone and joint infections
12. Metabolic bone diseases
13. Congenital musculoskeletal anomalies in adult patients
14. Compartment syndrome
15. Avascular necrosis
16. Overuse syndromes
17. Back pain syndromes

Common Musculoskeletal, Neurologic, and Rheumatologic Conditions
1. Head
   a. Nasal Fracture & Nasal Septal Hematoma
   b. Orbital Blow Out Fracture
   c. Mandible Fracture
2. Cervical Spine
   a. Musculoskeletal Neck Pain
   b. Neck Sprain/Whiplash (include application of Ottawa C-Spine Rules)
   c. Facet Arthropathy
   d. Cervical Spinal Stenosis
   e. Cervical Radiculopathy
3. Shoulder
   a. Adhesive Capsulitis
   b. Subacromial Impingement
   c. Subacromial Bursitis
   d. Rotator Cuff Tear (Acute vs. Chronic)
   e. Glenohumeral Degenerative Joint Disease (DJD)
   f. Glenohumeral Instability (Dislocation/Subluxation)
   g. Acromioclavicular DJD
   h. Acromioclavicular Joint Sprain
   i. Proximal Biceps Tendonopathy
   j. Proximal Biceps Tendon Tear
   k. Clavicle Fracture
   l. Proximal Humerus (1 part) Fracture
   m. Greater Tuberosity Compaction Fracture
4. Elbow
   a. Lateral and Medial Epicondylopathy
   b. Olecranon Bursitis
   c. Radial Head Fracture
   d. Cubital Tunnel Syndrome
5. Wrist
   a. Distal Radius and Ulnar Fractures
   b. Scaphoid Fracture
   c. Wrist Sprain
   d. De Quervain’s Tenosynovitis
   e. Flexor and Extensor Tendonopathy
   f. Ganglion Cysts of the Wrist
6. Hand
   a. Trigger Finger and Thumb
   b. Phalangeal and Metacarpal Fractures
   c. MCP and Interphalangeal Joint Dislocations
   d. 1st CMC Joint DJD
   e. 1st MCP/Thumb Ulnar Collateral Ligament Sprain

7. Chest
   a. Rib Fracture
   b. Chest Wall Contusion
   c. Costochondritis

8. Lumbar Spine
   a. Vertebral Compression Fractures
   b. Musculoskeletal Lumbar Spine Pain/Lumbar Strain
   c. Facet Arthropathy
   d. Lumbar Spinal Stenosis and Sciatica

9. Hip and Thigh
   a. Femoroacetabular DJD
   b. Trochanteric Bursitis
   c. Hip Abductor Tendonopathy
   d. Hamstring, Adductor, Quadriceps Strains
   e. Meralgia Paresthetica
   f. Femoral Neck Stress Fracture

10. Knee
    a. Patellofemoral Pain Syndrome
    b. Knee DJD
    c. Knee Effusions
    d. Meniscus Tears
    e. Iliotibial Band Syndrome
    f. Anterior Cruciate Ligament Tears
    g. Medial Collateral Ligament Sprain
    h. Pes Anserine Bursitis
    i. Patellar Tendonopathy
    j. Patellar Instability (Dislocation/Subluxation)
    k. Popliteal (Baker’s) Cysts

11. Ankle and Leg
    a. Ankle Sprains (include application of Ottawa Ankle Rules)
    b. Medial and Lateral Malleolar Avulsion Fracture
    c. Distal Fibular Fracture
    d. Achilles Tendonopathy
    e. Peroneal Tendonopathy
    f. Posterior Tibialis Tendonopathy
    g. Anterior Tibial Stress Fracture
    h. Gastrocnemius Strain
12. Foot
   a. Plantar Fasciitis
   b. 5th Metatarsal Base Avulsion Fracture
   c. 5th Metatarsal Stress Fracture
   d. Navicular Fracture & Stress Fracture
   e. Hallux Rigidis
   f. Hallux Valgus
   g. 1st MTP Sprain
   h. Flexor Hallucis Strain/Turf Toe
   i. Morton’s Neuroma

13. Rheumatologic Disorders
   a. Gout and CPPD (Pseudogout)
   b. Rheumatoid Arthritis
   c. Reactive Arthritis
   d. Bowel-Related Arthropathy (Celiac or IBD)
   e. Psoriatic Arthritis
   f. Systemic Lupus Erythematosus (SLE)
   g. Polymyalgia Rheumatica
   h. Ankylosing Spondylitis
   i. Fibromyalgia
   j. Scleroderma

Orthopaedic emergency recognition and stabilization
1. Acute compartment syndrome
2. Hip dislocation
3. Knee dislocation
4. Unstable pelvis fracture
5. Cervical spine fracture
6. Spinal cord injury
7. Cauda equina syndrome

Sports Medicine Specific Considerations
1. Conditioning and training techniques, including principles of aerobic and resistance training
2. Appropriate exercise prescription for
   a. Healthy persons of all ages taking into account physiologic differences related to age and gender
   b. Patients who have chronic illnesses (See conditions listed in #3)
   c. Pregnant women
   d. Physically or mentally challenged persons
   e. Patients who have various cardiovascular conditions, especially those known to increase the risk of sudden death
3. Medical care considerations for patients with chronic diseases as well as the role and use of exercise testing and exercise prescriptions in treating 7:
   a. Diabetes Mellitus
   b. Cardiovascular Disease
c. Dyslipidemia
d. Metabolic Syndrome
e. Hypertension
f. Asthma
g. COPD, Interstitial Lung Disease, and Cystic Fibrosis
h. Inflammatory Bowel Disease and Celiac Disease
i. Chronic Kidney Disease
j. Organ Transplantation
k. HIV/AIDS and Immunocompromising Conditions
l. Cancer
m. Movement and Neurodegenerative Disorders and Spinal Cord Injuries
n. Depression, Anxiety, and other Mental Illness
o. Chronic Pain and Fatigue Syndromes
p. Arthritis
q. Obesity
r. Osteoporosis and Low Bone Density

4. Assessment and care of the medical issues related to sports and exercise, including but not limited to:
   a. Concussion (mild traumatic brain injury or mTBI)
      i. Definitions and symptoms of concussion
      ii. Initial treatment and expected clinical course
      iii. Indications for referral and/or imaging
      iv. General practice guidelines for return to learning, play, & work
   b. Corneal abrasion & Hyphema
   c. Otitis Externa
d. Exercise-induced asthma and shortness of breath in athletes
e. Cardiovascular Conditions including screening, treatment, and referral for:
   i. Structural Heart Disease
      1. Hypertrophic Cardiomyopathy
      2. Arrhythmogenic Right Ventricular Cardiomyopathy
      3. Congenital Coronary Artery Anomalies
      4. Marfan’s Syndrome
      5. Aortic Stenosis
      6. Mitral Valve Prolapse
   ii. Electrical Heart Disease
      1. Long QT Syndrome
      2. Catecholaminergic Polymorphic Ventricular Tachycardia
      3. Wolfe-Parkinson-White Syndrome
      4. Brugada’s Syndrome
   iii. Traumatic or Infectious Cardiomyopathies
      1. Commotio Cordis
      2. Myocarditis
   iv. Vascular Disease
      1. Exertional Compartment Syndromes
2. Popliteal Artery Entrapment
3. Effort Thrombosis/Paget-Schroetter Syndrome
4. Thoracic Outlet Syndrome
5. Vertebral Artery Dissection
f. Heat illness risk factors, prevention, recognition, and treatment
g. Exercise related collapse and syncope
h. Sickle-cell disease in athletes
i. Rhabdomyolysis
j. Mononucleosis and sports/exercise participation
k. Infectious and Non-Infectious Dermopathies
l. Exercise Induced Ischemic Bowel Disease
m. Exercise Induced Anaphylaxis
n. Exercise associated GERD and PUD
o. Osteomyelitis and Septic Arthritis
p. Osteoporosis and Low Bone Density
q. Paget’s Disease

Problems associated with exercise
1. Abuse of anabolic steroids and other performance enhancing drugs
2. Mental health, depression, and anxiety in athletes
3. Alcohol and illicit drug use and abuse in athletes
4. Female athlete triad, relative energy deficiency, and eating disorders
5. Bone health, stress fractures, low bone density, and osteoporosis

Testing
1. Interpretation of radiographs
2. Use of magnetic resonance imaging, computed tomography, musculoskeletal ultrasound, and bone scans in an evidence-based, value-based fashion
3. Application of electromyography (EMG) and nerve conduction studies (NCS)
4. Indications for exercise testing and applications in practice

Management and therapy
1. Outline expected course with and without therapy
2. Patient education for acute and chronic problems
3. Use and risks of targeted pharmacologic treatment
   a. NSAIDs and Acetaminophen
   b. Corticosteroid injections
   c. Viscosupplementation injections
   d. Oral Corticosteroids
   e. Nerve Stabilizing Agents
   f. Narcotics and Other Medications for Acute or Chronic Pain
4. Supportive/corrective devices including braces, casts, splints and orthotics
5. Prevention
   a. Pre-participation screening
   b. Conditioning, acclimatization, and training
   c. Injury prevention
d. Physical fitness/exercise prescription  
e. Bone loss  
   i. Nutrition  
   ii. Exercise  
   iii. Pharmacology  
   iv. Clinical evaluation, laboratory work-up, and imaging

Procedures (indications, contraindications and complications) 
1. Joint aspiration (arthrocentesis)  
2. Joint injection  
3. Common injections for bursitis  
4. Common injections for tendonopathy  
5. Splints (upper and lower extremity)

Rehabilitation 
1. Physical therapy  
   a. Cold, heat  
   b. Exercises  
2. Occupational therapy  
3. Psychosocial aspects of trauma and injury

Functional rehabilitation 
1. Prescription of home exercise programs  
2. Prescription of physical therapy

**Implementation**

This curriculum guideline should be implemented longitudinally throughout the three years of residency training. The continuing patient care experience in ambulatory continuity and musculoskeletal medicine clinics provides the principle site for training. Residents should have at least minimal experience in outpatient orthopaedics, ideally with Primary Care Sports Medicine physicians given the common training background and the general variety of musculoskeletal conditions treated by these physicians. Preceptors who are competently trained must be available to work individually with residents, and to teach and assess performance of residents’ attitudes, knowledge, and skills. The teaching of musculoskeletal care lends itself well to hands-on training in core conferences and workshops, using films, patient demonstrations and models. Experience can be provided in bone, muscle and joint examination, splinting, arthrocentesis and rehabilitative measures. Additional training sites that have proved useful include private Orthopaedic offices, emergency departments, sports medicine and rehabilitation centers, and specialized clinics. Elective rotations can serve to consolidate musculoskeletal training, to expose the resident to a greater concentration of common problems, or to provide experience with unusual problems (e.g., acute ski injury clinics, military bases, training paratroopers, gait and balance clinics for the elderly).
Web-based Resources, Key Articles, and Books by Topic

General Musculoskeletal Medicine


American Medical Society for Sports Medicine Patient Education: http://www.sportsmedtoday.com

University of California, San Diego, A Practical Guide to Clinical Medicine: http://meded.ucsd.edu/clinicalmed

The Physician and Sports Medicine: http://www.physsportsmed.com


Physical Exam


University of West Alabama Department of Sports Medicine and Athletic Training, Online Musculoskeletal Exam List and Explanation with Video (joint-specific physical exam test listing with detailed explanations and short video clips of the exam being performed): http://at.uwa.edu/CurrHome/AH323/skillsshoulder.asp


Procedures


Radiology

University of California, Los Angeles, Online Library of Radiographic Signs (listing of radiographic signs by location and diagnosis, peer reviewed by the American Journal of Radiology): http://www.gentili.net/signs/

Preparticipation Physical Exam


Faculty Development


Exercise Is Medicine and Exercise Testing


http://www.exerciseismedicine.org

https://www.acsm.org/about-acsm/initiatives/eim

Sideline and Orthopaedic Emergencies


Concussion


Cardiology In Sports

EKG Interpretation In Athletes, British Medical Journal Learning
http://learning.bmj.com/learning/course-intro/.html?courseld=10042239


Diabetes In Sports


Nutrition, Supplements, Ergogenic Aids


Shoulder


Elbow

Bissett, L, et al, Mobilization with movement and exercise, corticosteroid injection, or wait and see for tennis elbow: randomized trial, BMJ Sept 29, 2006

Wrist


**Hand**


**Spine**


**Knee**


Ankle


Rehabilitation


Fracture Care


Organizations
American College of Physicians: http://www.acp.org
American Board of Internal Medicine: http://www.abim.org
American Academy of Family Physicians: http://www.aafp.org
American Academy of Orthopaedic Surgeons: http://www.aaos.org
American College of Sports Medicine: http://www.acsm.org
American Medical Society for Sports Medicine: http://www.newamssm.org
American College of Radiology: http://acr.org
American College of Rheumatology: http://www.rheumatology.org
Arthritis Foundation: http://arthritis.org
References


3. Charles S. Day, MD, MBA; Yangyang R. Yu, BA; Albert C. Yeh, BA; Lori R. Newman, MEd; Ronald Arky, MD; David H. Roberts, MD, Musculoskeletal Preclinical Medical School Education: Meeting an Underserved Need, *J Bone Joint Surg Am*, 2009 Mar 01; 91 (3): 733 -739

