A Cross-sectional Study on the Knowledge in Musculoskeletal Medicine of Undergraduate Medical Students in a National University

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ABSTRACT

Objectives. This study aimed to compare the evaluation results of University of the Philippines - College of Medicine (UPCM) Learning Unit VI (LU VI) students in their Musculoskeletal (MSK) year-end module examination and final module grade to their results in the MSK 30 examination. It likewise sought to assess the adequacy of the institution's current curriculum on the basis of the most clinically relevant MSK topics included in the MSK 30.

Methods. The knowledge of the students in Musculoskeletal medicine was determined using the MSK 30 validated exam and this was compared to their results in the various evaluation tools of the present MSK curriculum. The results were subjected to statistical analysis using (1) the Pearson correlation coefficient and (2) item analysis.

Results. Despite exhibiting above average performance in the MSK module, the performance of the 66 (N=187) LU VI students in the MSK 30 showed otherwise with a passing rate of only 48.48%. There was no statistically significant correlation between the MSK 30 and the year-end module examination (p value = 0.77, CI 90%, ME 8%), and the final module grade (p value = 0.92, CI 90%, ME 8%). It was noted that the students did poorly in the following topics: Environmental Injury, Head Injury, Infection, Pediatrics, Spine, and Sports Injuries.

Conclusion. Undergraduate medical students of the University of the Philippines - College of Medicine performed poorly in the MSK 30 despite a generally good performance in the prescribed MSK module. Whether this is indicative of inadequacies in the existing MSK curriculum or is due to the MSK 30 not being appropriate to the local setting will need to be determined.

Keywords: musculoskeletal medicine, musculoskeletal education, MSK 30, undergraduate medical education, clinical clerkship

INTRODUCTION

In the United States, majority of patient consults and treatment occurs in the outpatient setting, which has been consistent over the past 40 years.[1-3] Large-scale initiatives have thus been implemented to address perceived inadequacies in the teaching of Musculoskeletal Medicine.[4] However, studies have shown that even amidst such efforts, undergraduate medical education is failing to provide thorough instruction on musculoskeletal medicine which is needed to address the high frequency of musculoskeletal-related complaints in primary care.[5,6]

The time allotted for the teaching of musculoskeletal medicine in both basic medical education as well in the postgraduate setting is thought to be inadequate,[6-9] leading to the students' and residents' lack of confidence in dealing with musculoskeletal complaints.[7,9-11] Sabesan

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et al. attributed the lack of confidence in dealing with musculoskeletal complaints of students, despite their having a dedicated module for these problems, to the absence of a well-defined set of competencies or criteria to define what adequate training in musculoskeletal medicine is for medical schools to base their curriculum on. As such, they concluded there is a need for a standardized evaluation tool to assess these often variable modules to ensure that medical school graduates are sufficiently trained even if teaching styles and methods of instruction differ.[10]

In 1998, Freedman and Bernstein tried to determine whether newly-graduated physicians (PGY-1 residents at the University of Pennsylvania) were adequately prepared regarding musculoskeletal disorders.[5] They used an open response format 25-item examination which they designed and validated. Only 18% of the PGY-1 residents obtained a passing score using this University of Pennsylvania (UPenn) examination. Those who had taken an elective course in orthopaedic surgery in medical school scored higher than those who did not, but most still had a failing grade. These scores were much lower than those obtained by the Orthopedic residents at the same institution (average score of 98.5%). They concluded that the resources and effort devoted to ensuring that all physicians have a basic familiarity with musculoskeletal disorders upon completion of medical training (with the average Orthopedic rotation lasting 2.1 weeks) were inadequate.

Studies done in various medical schools and residency training programs showed rather poor results.[12-14] Whether the disheartening results of the cited studies showing consistently that medical school graduates were unprepared as regards musculoskeletal medicine is due to an actual lack in preparation, or is attributable to the quality of the examination used for evaluation, may be questioned. The findings of Weiss, et al. of lower post-module scores may point to the test's lack of validity and reliability owing to its open-format design.[14]

A recently unpublished study at our institution showed that majority of the clinical clerks (4th year medical students) who took the UPenn exam had a failing grade. This despite having had a total of 8 weeks dedicated to musculoskeletal medicine. The results of the exam were not consistent with how well or poorly the students were doing in their current year-level's module.[15]

After an extensive descriptive review of the available literature, Hift found that well-constructed and context-rich multiple-choice questions were both highly valid and very reliable. He then recommended that open-ended format questions not be used for summative assessment.[16]

Doubting the examination's validity as well as the reliability of an open–format examination, faculty members at the Uniformed Services University formulated a 30-item multiple choice assessment of knowledge in musculoskeletal medicine (MSK 30). Using a modified Delphi technique, 30 questions were included in the final form of the MSK exam, the topics which they covered were listed in Table 1. The authors conclude and recommend that this tool be used for both the trainees' self-evaluation and basis for the institutions' musculoskeletal curriculum design and assessment. Using a validated tool such as the MSK 30, to evaluate individual MSK knowledge as well as to assess educational curricula and training programs, allows for the identification of specific problem areas and topics that need further reinforcement.[17]

Table 1. Topics in Musculoskeletal Knowledge Assessment Included in the Final Version of the MSK 30

Topics included in the MSK 30	
• Trauma	• Osteoarthritis
• Infection	• Rheumatologic disease
• Pediatrics	• Environmental injury
• Overuse injuries	• Head injury
• Sports injuries	• Low back pain

Aside from the MSK 30, the test designed and used in the study of Basu et al. among medical students in Sheffield University is the only other evaluation tool described in recent literature to assess the level of musculoskeletal medicine knowledge in medical students at different levels. In comparison to the MSK 30, this has only been used in one institution and no further reports on validation and reliability have been conducted.[18] Although efforts have not been made to establish the MSK 30 as the gold standard in determining the level of musculoskeletal knowledge, it is currently the most useful tool to serve that purpose.

The objectives of the current study are to compare the evaluation results of UPCM Learning Unit VI students in their MSK year-end module examination and final module grade to their results in the MSK 30 examination as well as to assess the adequacy of the institution's current curriculum on the basis of the most clinically relevant MSK topics included in the MSK 30.

METHODS

The protocol for this study had been approved by the UP Manila Research Ethics Board (UPMREB).

The study was conducted at the Department of Orthopedics, Philippine General Hospital, Manila, over the course of 1 year. This was a cross-sectional study involving 4th year medical students. These participants were Learning Unit VI (LU VI) students taking their clinical clerkship under the University of the Philippines College of Medicine (UPCM) Doctor of Medicine program at the time. The details of the study were discussed with each participant and written informed consent was obtained (Appendix A).

Inclusion Criteria were as follows: UP College of Medicine LU VI students, taking their year-end Musculoskeletal Module Examination, who consented in taking part in the study which involved the investigators recording the results of their exam, their scores in the MSK 30, and their final

module grades. Those who have previously taken the MSK 30, who have previously taken the LU VI year-end MSK module examination, who have received additional training or studies in Musculoskeletal Medicine outside of what is provided in the UPCM curriculum, and/or who were unable to physically take the examination on-site under the supervision of the primary investigator were excluded.

Given the limitations brought about by the COVID-19 pandemic, and the protocols on face-to-face interaction implemented by the IATF, only 66 LU VI medical students (N=187) were able to participate. As such, the findings in this study are made with the following parameters: 90% confidence interval and 8% margin of error.

Each student was assigned an examinee number which was used as the identifier for all of their data in the study. The students were then asked to answer the MSK 30 (Appendix B) on Google Forms with a time allotment of 30 minutes (approximately 1 minute/question). Examinations were conducted in person under the supervision of the principal investigator and assigned proctors using the following online platforms: University Virtual Learning Environment (UVLê) for the module quizzes and year-end examination, Google Forms for the MSK 30. The final grade for the module was computed on Microsoft Excel with the following breakdown: knowledge, skills, attitude, and community output. The LU VI module coordinator provided the following data: total quiz scores, year-end module examination, and final module grade.

After recording the required information, the signed informed consent forms and the copies made of the answer sheets of those students who consented to participate in the study are being securely stored by the investigators and shall be properly disposed of two years after the study's completion.

Statistical Analysis

The final module grades, scores in the year-end module examination, and scores in the MSK 30 were presented using the following measures of spread – median, range, 25th and 75th percentile, mode. The categorical equivalents of these numerical grades were presented in frequency and percentage. The correlation between the scores in the MSK 30 and their performance in the evaluation tools used in the module – quiz total scores, year-end module examination scores, and final module grades were analyzed using the Pearson's product moment correlation coefficient. The questions of the MSK 30 as accomplished by the participants were subjected to multivariate item analysis in order to determine their level of difficulty and discrimination. Finally, Cronbach's alpha was computed as a measure of reliability.

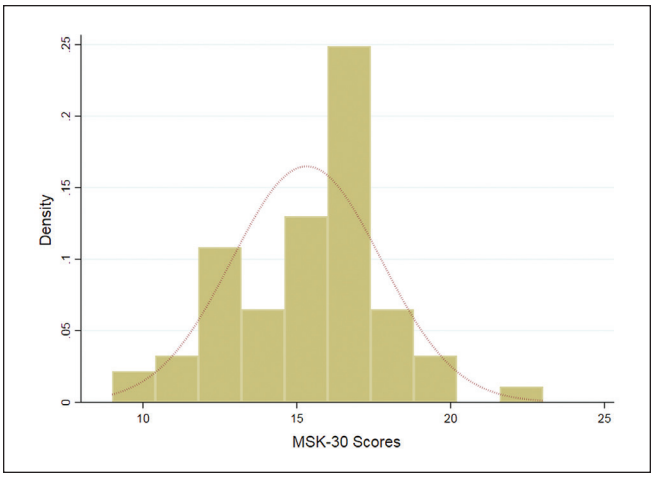

Figure 1. Distribution of MSK 30 scores.

Supplementary histograms and complex stacked bar plots were created to demonstrate the distribution of scores and responses for each topic in the evaluation tool. Statistical analysis was done using the software: Stata 13.

RESULTS

Only 66 of a class of 187 LU VI medical students were able to participate in the study. This limited number was due to the cancellation of face-to-face activities of the students due to a surge of COVID-19 cases while the study was being conducted.

The distribution of the scores in the MSK 30, quiz, year-end module examination, and final module grades are presented in Table 2.

As illustrated in Figure 1, the scores on the MSK 30 approximates that of a normal bell curve, with majority of the participants scoring approximately 50% (15-16 out of 30).

Less than 50% of the participants correctly answered more than 50% of the MSK 30 questions, while having relatively high scores in the quiz and year-end module examination, as well as exhibiting considerably good overall performance as reflected in their final module grade. In the same manner, as seen in Table 3, the distribution of the categorical equivalent of these grades showed that majority of the participants were within the 1.75 and 2.00 range (numerical equivalent: 80-89).

Table 2. Distribution of Grades and Scores

Metric	Min	25th	Median	75th	Max	Mode
MSK-30 Score	9	14	15	17	23	15
Quiz (total) Grade	26.41	66.03	71.22	80	100	68.30
Year-end Module Examination	36.15	44.90	47.10	49.43	56.07	48.14
Final Module Grade	71.31	80.85	84.49	86.84	95.04	84.54

Table 3. Distribution of Final Module Grade Categorical Equivalents

Grade Equivalent	n	%
1.25	3	4.55
1.50	5	7.58
1.75	24	36.36
2.00	21	31.82
2.25	10	15.15
2.50	3	4.55

Table 4. Correlation of the Concurrent Measures with MSK-30 Scores

Concurrent Measure	ρ	95% Interval	p-value
Quiz Total	0.0101	-0.232 to 0.252	0.94
Module Exam	0.0372	-0.207 to 0.277	0.77
Final Grade	-0.0121	-0.253 to 0.231	0.92

Table 5. Distribution of Correct Responses per Topic on the MSK 30

MSK Topic	Number of Questions	Number of Correct Responses	Proportion of Correct Responses (%)
Environmental Injury	1	28	42.42
Head Injury	1	26	39.39
Infection	1	10	15.15
Low Back Pain	4	190	71.97
Osteoarthritis	1	49	74.24
Overuse Injuries	3	113	57.07
Pediatrics	6	149	37.63
Spine	1	30	45.45
Sports Injuries	8	263	49.81
Trauma	4	153	57.95
Total	30	1,011	51.06

The respective Pearson's product moment correlation coefficient (ρ) computed for each shows that there is no statistically significant correlation between the MSK-30 scores and (1) the year-end module examination scores, and (2) the final module grades (Table 4).

The distribution of correct responses across the different topics included in the MSK 30 is presented in Table 5. The questions on "Low Back Pain" and "Osteoarthritis" have the highest proportion of correct responses, while that on "Infection" has the lowest proportion of correct responses. The question on Sever's Disease under "Pediatrics" has the lowest percentage of correct responses at 12.12% (8/66), while the 4th question on the MSK 30 on "Low Back Pain" has the highest at 100%.

For the purposes of this study, "difficulty" was defined by a cut-off value of 50% such that questions that were answered correctly <50% of the time were considered "difficult," and those that were answered correctly ≥50% of the time were considered "not difficult." Questions on the following topics: Environmental Injury, Head Injury, Infection, Pediatrics, Spine, and Sports Injuries are considered difficult for this particular sample of LU VI students. On the other hand, questions on the following topics: Low Back Pain, Osteoarthritis, Overuse Injuries, and Trauma are considered "not difficult" for the same sample of students.

Based on further multivariate item analysis, as detailed in Tables 6 and 7, the participants found 53.33% (16 of 30) of the questions difficult, 33.33% (10 of 30) moderately difficult, and 13.33% (4 of 30) not difficult. Discrimination refers to the ability of a specific question or item to differentiate between high and low performance in a given test. 80% (24 of 30) of the questions poorly discriminated between those participants who had relatively high outcomes in the MSK 30 and those who had relatively low outcomes, with 63.33% having negative values of discrimination (19 of 30).

DISCUSSION

The mission of the UP College of Medicine reads: "leadership and excellence in community-oriented medical education directed to the underserved." In line with this, the Department of Orthopedics of the Philippine General Hospital aims to prepare its medical students and trainees as primary care physicians with the adequate knowledge in musculoskeletal medicine to competently diagnose and manage these patients at the emergency and outpatient level.

If we rely on our students' results in the MSK 30 validated examination, the current MSK curriculum implemented by our institution may need improvement. Only 44 out of 66 participants, or 67.67%, obtained scores of 50% or higher in the MSK 30. Moreover, the department sets the passing grade for the curriculum at 60%. Applying the same standard to the MSK 30, only 32 out of 66 participants, or 48.48%, passed the validated evaluation tool. The students' poor performance in the validated exam was similar to the results seen by other authors.[13-15]

Table 6. Multivariate Item Analysis of the MSK 30

Item	Mean	Standard Deviation	Difficulty	Discrimination	% Correct
Q01	0.15	0.36	15	0.00	15.15
Q02	0.52	0.50	52	-0.10	51.52
Q03	0.39	0.49	39	-0.05	39.39
Q04	1.00	0.00	100	-0.57	100
Q05	0.45	0.50	45	0.05	45.45
Q06	0.41	0.50	41	-0.29	40.91
Q07	0.88	0.33	88	-0.29	87.88
Q08	0.32	0.47	32	0.05	31.82
Q09	0.88	0.33	88	-0.38	87.88
Q10	0.62	0.49	62	-0.14	62.12
Q11	0.42	0.50	42	-0.10	42.42
Q12	0.56	0.50	56	-0.43	56.06
Q13	0.39	0.49	39	0.00	39.39
Q14	0.29	0.46	29	0.19	28.79
Q15	0.39	0.49	39	0.29	39.39
Q16	0.80	0.40	80	-0.48	80.30
Q17	0.98	0.12	98	-0.52	98.48
Q18	0.23	0.42	23	0.19	22.73
Q19	0.61	0.49	61	0.14	60.61
Q20	0.62	0.49	62	-0.19	62.12
Q21	0.12	0.33	12	-0.05	12.12
Q22	0.55	0.50	55	-0.10	54.55
Q23	0.45	0.50	45	-0.14	45.45
Q24	0.61	0.49	61	-0.14	60.61
Q25	0.77	0.42	77	-0.33	77.27
Q26	0.33	0.48	33	0.00	33.33
Q27	0.41	0.50	41	-0.05	40.91
Q28	0.23	0.42	23	0.29	22.73
Q29	0.74	0.44	74	-0.33	74.24
Q30	0.18	0.39	18	0.19	18.18

Table 7. Distribution of Items across Difficulty and Discrimination Categories

Discrimination	Difficulty		
	Difficult (0 - 50)	Moderately Difficult (51 - 85)	Not difficult (86 – 100)
Poor (<0.10)	01, 03, 05, 06, 08, 11, 13, 21, 23, 26, 27	02, 10, 12, 16, 20, 22, 24, 25, 29	04, 07, 09, 17
Fair (0.10-0.30)	14, 15, 18, 28, 30	19	-
Good (>0.30)	-	-	-

The poor results in the validated exam were despite the students' above average performance in the MSK module as measured by their module examination scores and final module grades. There was no significant correlation between the scores in the concomitant measures and in the MSK 30, demonstrating that our students were not learning about the musculoskeletal topics deemed important by those who formulated the examination.

More specifically, while the participants consistently showed adequate knowledge in "Low Back Pain" and "Osteoarthritis," problematic areas include "Infection" and "Pediatrics." Using the apparent level of difficulty of each question as an indicator of adequacy of knowledge in the topic it represents gives us an objective measure of which topics are effectively learned by the students. The following topics: Environmental Injury, Head Injury, Infection, Pediatrics,

Spine, and Sports Injuries were considered "difficult" for this sample of students and; therefore, may need to be reinforced in the present curriculum. On the other hand, questions on the following topics: Low Back Pain, Osteoarthritis, Overuse Injuries, and Trauma were considered "not difficult", indicating that they are sufficiently covered and taught in the present curriculum.

Moreover, it was noted that there was a high number of items (80%) in the test which were unable to differentiate the students who did and did not do well in the MSK 30. As such, the test itself may need to be reviewed and be made more useful to our students. Admittedly, none of the previous studies which administered the MSK 30 on medical students did an item analysis similar to what the present investigators have done. However, improving the actual content of the MSK 30 examination is beyond the scope of this study.

Given the rather contradictory outcomes of our students doing poorly in the MSK 30, and the test having a high number of items with negative discriminatory indices, the authors will have to recommend that those handling the musculoskeletal medicine module consider several possibilities. The first is that the present curriculum might not be adequately equipping undergraduate medical students with the Musculoskeletal knowledge they will need in their practice as primary physicians in the Philippines. The topics covered by each major division in Orthopedics for their respective small group discussions with the students is listed in Appendix C. As such, by whatever means deemed appropriate, the content of the MSK curriculum be reviewed. The second is, whether the curriculum is modified or not, a more valid evaluation tool may have to be developed. Ideally, this tool be designed to measure knowledge regarding MSK conditions commonly encountered in general practice in the Philippines (i.e., based on the DOH census).

This study only compared evaluation tools that measure knowledge. Written examinations are unable to adequately measure, and are not representative of, the other domains of learning such as skills and attitude. Participants were limited to LU VI students as they are easier to gather and ask to participate in the study. Moreover, only students who were able to participate in face-to-face activities and be physically present in the department were included in the study. This was subject to the changing safety restrictions as determined by the IATF and relevant medical regulatory institutions, which was outside the mandate of the investigators. As such, only 66 LU VI medical students (N=187) were able to participate with a 90% confidence interval and 8% margin of error.

CONCLUSION

Undergraduate medical students (LU VI) of the University of the Philippines – College of Medicine (Manila) performed poorly in the MSK 30 despite a generally good performance in the prescribed MSK module. Whether this is indicative of inadequacies in the existing MSK curriculum or is due to the MSK 30 not being appropriate to the local setting will need to be determined.

Statement of Authorship

Both authors have substantial contributions to the conception or design of the work; the acquisition, analysis, or interpretation of data for the work; drafting the work or revising it critically for important intellectual content; final approval of the version to be published; and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Author Disclosure

Both authors declared no conflicts of interest.

Funding Source

None.

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APPENDICES

Appendix A. Informed Consent Form

Examinee Number: _____

INFORMED CONSENT FORM TO PARTICIPATE IN THE STUDY ENTITLED
"KNOWLEDGE IN MUSCULOSKELETAL MEDICINE OF UNIVERSITY OF THE PHILIPPINES MEDICAL STUDENTS"

Investigators:
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Purpose
This study aims to assess how well the UP College of Medicine prepares and evaluates medical students as regards Musculoskeletal Medicine. The results of the study may be used as part of the evaluation of the current Musculoskeletal Medicine curriculum.

Procedure
The combined exam you are all about to take is a random combination of the module's actual questions and those of a 30-item validated test called the MSK 30. You will have 45 minutes to answer all 60 questions. For those who have consented to participate in the exam, your scores (for the module exam and the MSK 30) as well as your module grade will be recorded. The scores and grade will be correlated.

Confidentiality
The scores and grades will be de-identified. Only the examinee number assigned to you today will be used in the study's records. When not being used for the study, all records will be kept in a locked cabinet for two years and will then be destroyed. Only the study's investigators will have access to these records.

Benefits of Participation
There will be no direct benefit to you from participating in this study. Any benefit will be for students who come after you who may have an improved Musculoskeletal medicine curriculum. However, you may request for the data collected from you during this study and/or a copy of the final output. Participation in this study is voluntary.

Consent
You understand the purpose and procedures of this study and agree to participate in it for the duration stipulated above.

Signature: _____ Date: _____

The UPMREB Ethics Review Panel (specify) has approved the study, and may be reached through the following contact for information regarding rights of study participants, including grievances and complaints:

Name of UPMREB Panel Chair
Address: Room 126, Ground Floor
National Institutes of Health, UP Manila
623 Pedro Gil St., Ermita 1000 Manila
Email: upmreb@post.upm.edu.ph
Tel: +63 2 526-4346

Appendix B. MSK Knowledge Assessment (MSK 30)

1) A 41-year-old woman presents with a 1-day history of a painful and swollen left elbow. She reports sustaining a puncture wound to her elbow several days prior but denies any major trauma. On exam, her elbow is erythematous and extremely tender to palpation with a deep puncture wound noted on the lateral aspect of the elbow. Active and passive range of motion is markedly limited by pain. Vitals signs notable for temperature of 38°. What is the best next step in management?
   A. Prescribe a course of antibiotics and follow up after completed
   B. Treat empirically with colchicine and allopurinol
   C. Arthrocentesis
   D. Relative rest, ice, and NSAID's

2) A 22-year-old male soccer player falls on an outstretched hand. He comes to clinic the next day complaining of wrist pain. On exam, he has tenderness over the anatomic snuffbox. X-rays of the wrist are negative. Of the choices below, the best next step in management is:
   A. Immediate referral to orthopedics for surgical management
   B. Relative rest and NSAID's for pain
   C. Short-arm thumb Spica cast and follow up in 2 weeks
   D. Long-arm cast for 6-8 weeks

3) A 17-year-old rugby player catches his ring finger on an opponent's shorts and feels immediate pain. On sideline examination, there is swelling of the distal ring finger. When the DIP joint is isolated, the patient is unable to flex. Most appropriate management after the match is:
   A. Buddy tape the ring finger to the long finger until symptoms resolve
   B. Place in extension splint for 6 weeks
   C. Referral to orthopedics
   D. Relative rest for 2 weeks and re-evaluate

4) A 43-year-old male comes into clinic with worsening back pain for the last week. The pain is located in the lumbar region and is noted to be severe in nature. On exam, there is no bony tenderness but there is decreased sensation on the medial aspect of the thighs bilaterally. Review of systems reveals overflow incontinence for 2 days. What is the most appropriate next step in management?
   A. NSAID's and follow up in 2 weeks
   B. Physical therapy
   C. Corticosteroid injection
   D. Urgent MRI

5) A 16-year-old female distance runner comes into clinic with left-sided anterior knee pain. She says the pain feels like it is beneath her knee-cap and is worse with going up and down stairs and running. What is the most appropriate management of this condition?
   A. Addressing the underlying cause and targeted physical therapy
   B. Order MRI now
   C. Referral to orthopedics for surgical management
   D. Straight knee immobilizer for 2 weeks and gradual resumption of activity

6) An 18-year-old football player injured his foot and ankle after it was stepped on during a game. He is able to bear weight on the foot but has significant pain in the midfoot region. Which of the following findings on history and physical exam would be an indication for x-rays?
   A. Pain with weight-bearing on injured foot/ankle
   B. Tenderness on palpation of the 1st/2nd metatarsal bases
   C. Tenderness over the lateral foot distal to the fibula
   D. Tenderness at the anterior aspect of the medial malleolus

7) A 28-year-old new mother presents with right sided wrist pain. She locates the pain to the distal aspect of her radius. On exam, forced ulnar deviation of the wrist with the thumb grasped in a fist reproduces the patient's pain. The most likely diagnosis is:
   A. Arthritis of the 1st carpometacarpal (CMC) joint
   B. Distal radioulnar dissociation
   C. De Quervain's tenosynovitis
   D. Triangular fibrocartilage complex injury

8) A 17-year-old high school football player is tackled and lands directly on the point of his left shoulder, causing him immediate pain. He points to the superior aspect of his shoulder when asked to locate the pain. On exam, his pain is reproduced when he attempts to reach across his body with the affected arm. What is the most likely diagnosis?
   A. Deltoid muscle tear
   B. Acromioclavicular joint sprain
   C. Rotator cuff tear
   D. Labral tear

9) A 64-year-old male with past medical history of hypertension, hyperlipidemia, and prostate cancer comes to the clinic complaining of new onset back pain that has woken him up from sleep on multiple occasions. Physical exam is unremarkable. The best next step in management is:
   A. Physical Therapy
   B. NSAID's
   C. Imaging of spine
   D. Rest and follow up in 2 weeks

10) An 18-month-old toddler is brought to the emergency department for irritability, fever of 101.5°F, and refusal to walk or bear weight. The infant refuses to move the right hip and cries with passive motion. Ultrasound of the hip shows fluid in the joint. Of the choices listed, what is the most likely diagnosis?
   A. Septic hip
   B. Transient synovitis
   C. Legg-Calve-Perthes disease
   D. Developmental dysplasia of the hip

11) A man collapsed near the finish line of a marathon and was brought to the race medical tent. On exam, he is confused and has hot, dry skin. His core temperature is 105°F, what is your next immediate step in management?
   A. Transfer to closest emergency department 30 minutes away
   B. Immediate cooling with best method available
   C. Administration of IV fluids
   D. Rehydrate with oral fluids

12) A high school football player comes into clinic after injuring his knee when he was tackled during practice. On inspection of the knee, he has a moderate effusion. Examination of the knee is limited by guarding and he has pain with motion of the knee. Which of the following should be included high on the differential diagnosis?
   A. ACL tear
   B. Osteochondral lesion
   C. Medial meniscus tear
   D. All of the above

13) An athlete who suffered a concussion and is still symptomatic with some light sensitivity and mild exertional headache. He can be allowed to return to play if:
   A. The athlete's symptoms have been improving for at least 2 weeks
   B. Imaging of the head is normal
   C. The athlete has physically and mentally rested for at least 1 week
   D. The athlete should never return to play while symptomatic

14) A 42-year-old woman comes into clinic with 3 weeks of right-sided anterolateral shoulder pain that is made worse when reaching overhead and laying on the affected side at night. Forward flexion of the shoulder to 90 degrees and forced internal rotation reproduces her pain. What is the initial step in management of this condition?
   A. Intraarticular corticosteroid injection
   B. MRI for suspected rotator cuff tear
   C. Arthroscopic subacromial decompression
   D. Activity modification and physical therapy

15) A 31-year-old male comes into clinic with 2 weeks of lower back pain after helping a friend move into a new house. He describes the pain as dull and says it is diffuse but does not radiate down his leg. Physical exam reveals tenderness to the paraspinal muscles in the lumbar region but is otherwise unremarkable. What is the most appropriate next step in management?
   A. X-rays of lumbar spine
   B. Oxycodone
   C. Referral for epidural steroid
   D. None of the above

16) An 18-year-old female who runs cross country comes into clinic with 1 month of worsening right-sided deep groin pain. Pain is made worse with any weight-bearing activities. Review of systems is remarkable for amenorrhea and a BMI of 19. What is the best next step?
   A. Imaging
   B. Physical therapy
   C. NSAIDs
   D. Intra-articular corticosteroid injection

17) Last night, a 25-year-old male sustained a displaced tibial fracture after a fall which was surgically repaired. Today, he complains of increasing pain in his leg and some tingling in his toes. On physical exam, he is afebrile and has a tense anterior compartment. When you consult the on call orthopaedic surgeon, what diagnosis are you most concerned about?
   A. Infection
   B. Deep venous thrombosis
   C. Redisplacement of the fracture
   D. Compartment syndrome

18) A 15-year-old girl fell off her bike and landed on her shoulder. She complains of severe pain with movement of the shoulder. There is bruising and tenderness over the midpoint of the clavicle. X-ray shows a nondisplaced midshaft clavicle fracture. Which of the following is the most appropriate treatment for this patient?
   A. Sling for comfort and early range of motion as pain improves
   B. Referral to orthopedics for surgical repair
   C. Shoulder immobilization for 4-6 weeks until evidence of fracture healing
   D. Return to activity as tolerated without restrictions

19) A 21-year-old male presents with severe back and leg pain as well as dark urine after a strenuous weightlifting workout yesterday. His initial creatine kinase (CK) level is 17,523U/L (reference 25-90U/L). What is the next step in management for this patient?
   A. Aggressive hydration
   B. Muscle biopsy
   C. NSAID's and reassurance
   D. Follow up CK measurement in 72 hours

20) A 45-year-old female who recently started playing tennis regularly comes into clinic with pain in her Achilles tendons bilaterally. Ultrasound confirms mid-substance Achilles tendinopathy bilaterally. The most appropriate initial management of this condition is:
   A. Referral to orthopedics for surgical management
   B. Corticosteroid injection
   C. Rehabilitation focused on eccentric exercises
   D. Platelet-rich plasma injection

21) A 10-year-old basketball player comes in to clinic with gradual onset of left heel pain which is worse with running and jumping. On examination, he has tightness of the gastroc-soleus complex and pain with the calcaneal squeeze test. What is the most likely diagnosis?
   A. Sever's disease
   B. Calcaneal stress fracture
   C. Achilles tendinopathy
   D. Plantar fasciopathy

22) A 59-year-old woman comes in to clinic with 2 weeks of pain and numbness in her thumb, index finger, and long finger. She says the pain is worse at night and is relieved by shaking or flicking her wrist. Inspection of the hand reveals atrophy of the thenar eminence. What is the next best step in management?
   A. Refer to occupational therapy
   B. Corticosteroid Injection
   C. Lifestyle modification
   D. Referral to orthopedics

23) A 68-year-old male comes to the physician with worsening neck pain with radiation down his right arm, consistent with cervical radiculopathy. Which of the following findings would necessitate immediate referral to a spine surgeon?
   A. Pain exacerbated by forced extension of the neck
   B. Hyperreflexia of the lower extremities
   C. Decreased sensation to light touch in the lateral arm
   D. Pain isolated to the shoulder girdle

24) A 24-year-old male presents with several months of low back pain which lasts for 60 minutes in the morning and improves with activity but not with rest. Physical exam is remarkable for tenderness at the SI joints and positive FABER test. Review of systems is positive for increased fatigue lately. What x-ray finding is characteristic of this condition?
   A. Sclerosis of iliac side of sacroiliac joints
   B. Anterior displacement of L5 on S1
   C. Excessive lumbar lordosis
   D. Fracture of the pars interarticularis

25) A tall, lanky 13-year-old boy presents with vague left knee pain and a limp for one week, but a normal knee exam and pain with internal rotation of the hip. AP pelvis and frog-leg view of the L hip are shown below. What is the next step in management?
   A. Allow to return to sports as tolerated
   B. Refer for physical therapy and follow up in 4-6 weeks
   C. Joint aspiration and synovial fluid analysis
   D. Immediately make non-weightbearing and refer to orthopedics

26) A 12-year-old boy severely twists his ankle. Radiographs show only soft-tissue swelling. He is only tender at the distal aspect of the fibula. What diagnosis must be considered in addition to ligament sprain?
   A. Physeal injury
   B. Syndesmotic disruption
   C. Peroneal tendon tear
   D. Tarsal tunnel syndrome

27) During a physical altercation, a 21-year-old male sustains a 5th metacarpal neck fracture and a 3-mm wound proximal to the fracture. What is the next step in management?
   A. Closed reduction and casting
   B. Reduce and splint fracture plus oral antibiotics
   C. Irrigation and debridement of 5th MCP joint
   D. Open reduction and internal fixation of fracture

28) A 32-year-old male begins training for his first marathon and after 2 weeks experiences left-sided heel pain that is worse with his first few steps in the morning and gets better as the day goes on. Tenderness to what area of the foot would most likely confirm your diagnosis?
   A. Medial calcaneal tubercle
   B. Achilles tendon insertion
   C. Navicular tuberosity
   D. Lateral calcaneal tuberosity

29) A 62-year-old female with hypertension, diabetes, and obesity comes into clinic with chronic left knee pain. Anterior-posterior weight bearing radiograph of the knee shows medial joint space narrowing and osteophyte formation. Which of the following is the most appropriate initial management?
   A. Referral to orthopedics for joint replacement
   B. Obtain MRI of the knee
   C. Limit weight bearing until pain resolves
   D. Recommend weight loss and exercise program

30) Which of the following findings during a pre-participation physical for a 16-year-old male does not require further investigation before clearing the individual to participate?
   A. A blood pressure of 138/89
   B. A systolic murmur that increases in intensity with the valsalva maneuver
   C. History of a recent concussion without successful completion of return to play protocol
   D. Family history of an uncle who died unexpectedly at age 26

Appendix C. LU VI Topics per Division

Adult Orthopedics	DM foot, septic arthritis, osteomyelitis, osteoarthritis
Trauma	Open and closed long bone fractures (humerus, radius and ulna, femur, tibia), hip fractures, ankle fractures, shoulder injuries
Pediatric Orthopedics	Hip dislocation, Clubfoot, Cerebral Palsy, Developmental Dysplasia of the Hip, Legg Calve Perthes Disease, Slipped Capital Femoral Epiphysis, Blounts Disease
Spine	Cervical spine trauma, spinal cord injury
Hand	Distal radius fractures, fingertip injuries, DIPJ dislocation, metacarpal fractures, flexor tenosynovitis, CMCJ fracture-dislocation, acute and chronic flexor and extensor tendon injuries