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Evaluating Medical Students' Confidence in Musculoskeletal Examination: Implications for Improving Musculoskeletal Medicine Education

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Abstract

In response to feedback from previous medical students, the office of medical education at a state-funded medical school (University of Hawaii) conducted an IRB-approved survey study to formally evaluate the experience of current medical students regarding their confidence with MSK examination skills, and solicited suggestions for improvement. We collected data from students who were transitioning from second to third year regarding the following: (1) confidence in various physical exams, (2) perceived preparedness for clerkships, (3) usefulness of existing MSK clinical activities, and (4) suggestions for improvement. A majority of students expressed lack of confidence in the MSK physical exam, which was notably lower than other organ system exams. Recommendations for curriculum improvement included early integration of MSK examination teaching with corresponding anatomy laboratory sessions, inclusion of physiatry teaching, and increased small-group learning sessions. This study revealed the need for (1) synchronizing MSK clinical skills training with anatomy curriculum during the first year, and (2) inclusion of physiatry teaching in the MSK curriculum. Ideally, this study will serve as a starting point for further innovations and improvements in MSK medical education.

Abbreviations and Acronyms

HOME = Houseless Outreach & Medical Education
MSK = musculoskeletal
OME = Office of Medical Education
PBL = problem-based learning

Introduction

Musculoskeletal (MSK) conditions are common across various clinical settings.[1] About 20% of primary care and emergency department visits are related to MSK conditions.[2] However, several studies have revealed that medical students do not feel properly equipped with the knowledge and skills for MSK examination,[3,4] especially when compared with their physical examination skills of other organ systems.[3] Yu et al suggested that one of the challenges medical students face in learning MSK medicine is the complexity of integrating basic and clinical science knowledge and applying them in clinical scenarios.[3,4] There is no clear agreement on how to address this issue despite many endeavors to improve MSK curricula.

Traditionally, the Office of Medical Education (OME) at this institution incorporates several MSK cases into problem-based learning (PBL) sessions during the second year of medical school. MSK anatomy dissection sessions and their associated didactics take place weekly for 3 months during the first year of medical school. Pre-dissection didactics incorporate dissection techniques and anatomy structures as they relate to pathology presented in the concurrent PBL sessions. Preclinical students also attend 3 clinical education sessions, 2 of them during the second-year curriculum and 1 more session prior to starting third year rotations. These sessions include: (1) rheumatology clinical skills session (75 minutes per group), beginning with a didactic presentation followed by MSK examination supervised by 2 rheumatologists; (2) orthopedic clinical skills session (4 hours per group), during which students receive an introductory didactic presentation followed by rotations through various stations, led by orthopedic surgeons who provided hands-on demonstration of MSK examination on different body parts; and (3) "Transition to Clerkship" MSK clinical skills lab during their transition from second to third year, which is led by a primary care physician.

At this institution, medical students have informally expressed concerns over mastering the MSK clinical exam in feedback to the OME, however this has not been officially quantified. This survey aimed to provide a formal needs-assessment of MSK examination education, including curriculum adequacy and student self-confidence, in order to enhance MSK education in medical school curriculum.

Methods

This study was approved by the University's IRB office (Protocol ID: 2022-00761). Two fourth year medical students (KK and JW) worked with 3 faculty members (DL, RK and HL) to design this survey, which was modified from a previous questionnaire.[3] The overarching theme focused around the students' experiences and perspectives on their MSK teaching curriculum during the first and second years of medical school. A copy of the distributed survey is shown in **Appendix 1**. The survey included questions on institution-specific curriculum and activities surrounding educa-

tion of MSK examinations. Questions 1-5 determined the respondents' level of confidence with various physical exams, from cardiovascular, respiratory, abdominal, neurological to MSK, and their perceived level of preparedness for clerkships. Questions 6-11 assessed the perceived usefulness of the existing MSK clinical activities at this institution, including the (1) orthopedics clinical skills lab and (2) rheumatology clinical skills lab, both of which occurred during the second year of medical school, as well as the (3) "Transition to Clerkship" MSK clinical skills lab, which occurred during the transition from second to third year of medical school. Question 12 asked whether the students feel it would be helpful to have the MSK clinical skills experience during their anatomy unit on the MSK system. After the 12 Likert scale questions, the survey concluded with open-ended questions that encouraged respondents to reflect on which parts of the MSK education curriculum were most helpful to their skill development and allowed students to provide suggestions for improving the curriculum. Answers were kept anonymous to ensure honest feedback.

The survey link was emailed to the third-year student class listserv and was administered via Google Forms (Google, LLC. Mountain View, CA.). Eligible participants included students who had completed: (1) 2 years of preclinical organ-system-based curriculum (including cardiovascular, respiratory, renal, hematology, gastrointestinal, MSK, nervous, endocrine and reproductive), (2) orthopedic clinical skills lab, (3) the rheumatology clinical skills lab, and (4) "Transition to Clerkship" MSK clinical skills lab. Responses were collected from June 9, 2023 through September 4, 2023.

Data analysis

Results of the survey were analyzed using Google Sheets (Google, LLC. Mountain View, CA.) and were reported using descriptive statistics. Responses were recorded and presented in a bar graph (questions 1-5) and a table (questions 6-12). The 3 open-ended, narrative questions at the end of this survey were summarized via brief thematic analysis.

Results

Sixty-four of the 77 students (83%) in the Class of 2025 completed this survey. Regarding questions on self-confidence for physical examination, 13% of the surveyed students disagreed or strongly disagreed that they felt confident performing the MSK physical exam, compared to 3% for cardiovascular, 2% for respiratory, 2% for abdominal, and 7% for neurological physical exams (**Figure 1**). The MSK physical exam was also the only item to receive a "strongly disagree" rating. The respiratory and abdominal exams yielded the highest rates of either "agree" or "strongly agree" (both 98%), while the respiratory exam yielded the highest rate of "strongly agree" (27%).

In questions 6-12, more than 90% of students reported positive feedback (strongly agree and agree) regarding their Orthopedics experience, Rheumatology clinical experience, and Transition to Clerkship MSK clinical skills lab (**Table 1**). The Orthopedics experience received the most strongly agree ratings (50%) and 42% agree ratings. Twenty five percent of students "strongly agreed" and 70% of students "agreed" that the Transition to Clerkship MSK clinical skills lab was helpful. For the Rheumatology experience, 22% strongly agreed that it was helpful, with 69% agreeing. Two students (3%) strongly disagreed that the Rheumatology experience was helpful. In question 12, 98% of students agreed (with 50% agreeing, and 48% strongly agreeing) that adding clinical MSK skills to their corresponding MSK anatomy unit would be helpful.

Finally, the students were asked 3 open-ended questions: (1) What part(s) of the MSK curriculum was/were the MOST helpful in strengthening your MSK physical exam skills?; (2) In what settings or situations, outside of formally scheduled class/curricular time, did you learn/practice the MSK physical exam?; and (3) Do you have any suggestions on how to improve the MSK curriculum? In response to open-ended question 1, the most helpful experiences in strengthening MSK clinical skills were the Orthopedic teaching experience and the "Transition to Clerkship MSK clinical skills lab." In open-ended question 2, students stated they learned/practiced MSK clinical skills in their Learning Communities and at Houseless Outreach & Medical Education (HOME) Clinic. In response to open-ended question 3, students reiterated that incorporating the MSK exam curriculum with the relevant anatomy unit would improve the curriculum. Students also indicated it was difficult to practice MSK examination on their own and wished to have more small group sessions, with tips to understand the knowledge behind specific joint maneuvers. In reviewing the open-ended questions, there were multiple positive comments from students about the added value of physiatry teaching in their Transition to Clerkship MSK clinical skills lab and in their PBL sessions.

Discussion

Results from this modified survey were consistent with the findings of recent publications on MSK medicine education.[3-8] Based on their educational experience in the first (2021) and second (2022) years of medical school, the students in the class of 2025 at this institution did not feel as confident in performing the MSK examination when compared to their confidence with examination of other organ systems.

It should be noted that in Question 12, almost all students (98%) strongly agreed or agreed that it would be helpful to have MSK clinical skills experience during the first year of medical school, in order to synchronize with their anatomy laboratory sessions. Other studies in the US and Canada report similar trends.[3-7] Almost all students (92%) agreed that the MSK curriculum provided adequate teaching of the MSK exam. However, they were the least confident in the physical exam when compared to other system exams. This could be because the MSK exam has a larger number of maneuvers and variation compared to other organ systems, which could contribute to decreased confidence. Additionally, while there were many opportunities for learning the MSK exam, there were fewer opportuni-

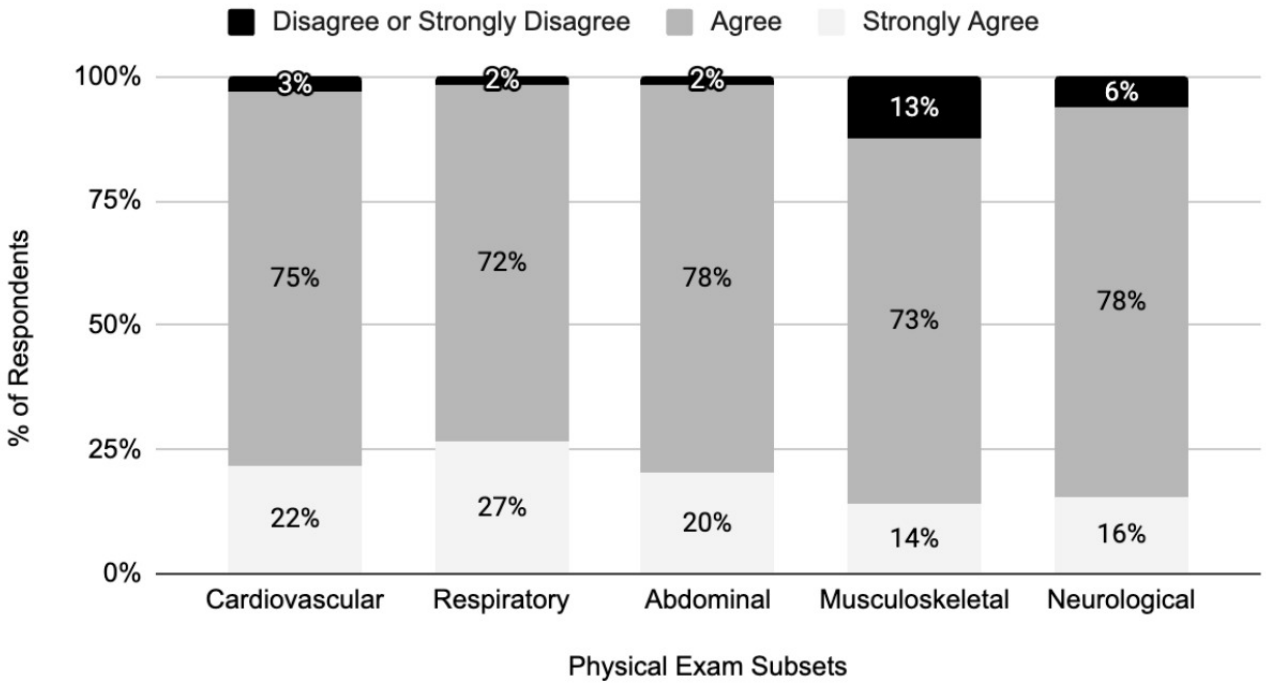

Figure 1. Student-Reported Agreement with Statements About Student Confidence in Performing Physical Exams of Different Systems (N=64) (Appendix 1, Questions 1-5).

Table 1. Student-Reported Agreement Rates with Statements About the Musculoskeletal (MSK) Curriculum at the Medical School (N=64).

Question	Strongly Agree n (%)	Agree n (%)	Disagree n (%)	Strongly Disagree n (%)
6. The MSK curriculum provided adequate teaching of the MSK physical exam.	12 (19%)	47 (73%)	5 (8%)	0 (0%)
7. I believe that my training in MSK clinical skills helped me anticipate the types of clinical issues I will encounter in my clerkships.	15 (23%)	43 (67%)	6 (9%)	0 (0%)
8. I believe that my training in MSK clinical skills has helped me develop my ability to hypothesize and generate a differential diagnosis around a patient's presenting problems.	16 (25%)	44 (69%)	4 (6%)	0 (0%)
9. I believe that the Orthopedics experience was a valuable learning experience for me.	32 (50%)	27 (42%)	5 (8%)	0 (0%)
10. I believe that the Rheumatology clinical skills lab was a valuable learning experience for me.	14 (22%)	44 (69%)	4 (6%)	2 (3%)
11. I believe that the Transition to Clerkship MSK clinical skills lab was a valuable learning experience for me.	16 (25%)	45 (70%)	3 (5%)	0 (0%)
12. It would be helpful to have MSK clinical skills experience during the anatomy unit on MSK system.	31 (48%)	32 (50%)	1 (2%)	0 (0%)

ties for practicing for the exam in full which may have further decreased confidence. Although most students felt the MSK curriculum was adequate, students' decreased confidence prompted the investigation into future curriculum improvements. Despite high curriculum approval rates, it is important that medical students feel equally confident performing all portions of the physical exam.

There are several limitations to the study. This survey was conducted at a single medical institution with a relatively small number of students, measuring student self-reported confidence and satisfaction. Descriptive statistics were used to summarize the student perspectives, but no objective measures of student competence or performance were included for comparison. In addition, this methodology did not allow for formal tests of statistical significance as there was no specific intervention or differentiating exposures being compared as all students experienced the same curriculum. Adding objective measures and correlating performance to students' confidence could be investigated in future studies. Another limitation of this study

is the potential social desirability bias among medical student survey respondents. Social desirability bias describes how survey respondents may provide a "socially acceptable" response rather than what they actually believe in order to gain approval.[9] This phenomenon is well-documented among students in higher education,[10] and could have contributed to high rates of agreement on the survey in this study. Selection bias may have been a contributory factor, as the students who chose to respond may have had stronger opinions (either positive or negative) about the MSK curriculum, potentially skewing the results. Response bias is possible as well, despite anonymous survey collection. Students could have responded more favorably to questions about curriculum effectiveness due to their familiarity with faculty members involved in curriculum design. Ideally this study will serve as a starting point for further innovations and improvements in MSK medical education.

Conclusion

This study showed a lack of confidence in performing a comprehensive MSK exam when compared to physical exams of other organ systems despite students feeling as though the curriculum itself was adequate. Students felt having more opportunities in small groups for practicing the MSK exam, as well as incorporating the MSK clinical exam into the MSK anatomy curriculum would be beneficial in increasing their confidence. Given this finding, interventions to target this lack of confidence will be implemented. These interventions include early introduction of MSK clinical examination skills to medical students during the first instead of second year of medical school. A physiatrist is assigned to work together with the anatomy department in teaching MSK examinations to future cohorts. Because the survey respondents from the class of 2025 did not have the opportunity to experience this added educational experience, the same survey will be provided to future cohorts to evaluate the effects of these additional interventions. To this end, the IRB application was updated to include the collection of objective outcomes such as anatomy examination results, and standardized patient examination results for future cohorts.

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Conflict of Interest and Disclosures

None of the authors identify any conflict of interest.

Disclaimers

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The datasets generated are available from the corresponding author upon reasonable request.

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Appendix 1

Multiple Choice Questions:

Multiple Choice Questions (A: Strongly disagree, B: Disagree, C: Agree, D: Strongly Agree)
1. I feel confident performing the Cardiovascular physical exam.
2. I feel confident performing the Respiratory physical exam.
3. I feel confident performing the Abdominal physical exam.
4. I feel confident performing the Musculoskeletal (MSK) physical exam.
5. I feel confident performing the Neurological physical exam.
6. The MSK curriculum provided adequate teaching of the MSK physical exam.
7. I believe that my training in MSK clinical skills helped me anticipate the types of clinical issues I will encounter in my clerkships.
8. I believe that my training in MSK clinical skills has helped me develop my ability to hypothesize and generate a differential diagnosis around a patient's presenting problems.
9. I believe that the Orthopedics experience was a valuable learning experience for me.
10. I believe that the Rheumatology clinical skills lab was a valuable learning experience for me.
11. I believe that the Transition to Clerkship MSK clinical skills lab was a valuable learning experience for me.
12. It would be helpful to have MSK clinical skills experience during the anatomy unit on MSK system.

Open ended questions:

1. What part(s) of the MSK curriculum was/were the MOST helpful in strengthening your MSK physical exam skills?
2. In what settings or situations, outside of formally scheduled class/curricular time, did you learn/practice the MSK physical exam?
3. Do you have any suggestions on how to improve the MSK curriculum?