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J Bone Joint Surg Am. 2008;90:307-315. doi:10.2106/JBJS.G.00472

This information is current as of February 6, 2008

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Publisher Information

The Journal of Bone and Joint Surgery
20 Pickering Street, Needham, MA 02492-3157
www.jbjs.org

Impact of Clinical Electives and Residency Interest on Medical Students' Education in Musculoskeletal Medicine

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Investigation performed at Harvard Medical School, Boston, Massachusetts

Background: Despite the frequency of musculoskeletal conditions seen in a broad spectrum of medical practice, there is compelling evidence that medical schools are inadequately preparing students in this field. We compared medical students across all residency interests with respect to their clinical confidence, cognitive mastery, and perception of education in musculoskeletal medicine.

Methods: A cross-sectional survey study of third and fourth-year students at Harvard Medical School was conducted during the 2005-2006 academic year. Two hundred and forty-nine of 337 students completed the survey, yielding an overall response rate of 74%. All participants were asked to complete a nationally validated objective examination in musculoskeletal medicine and a thirty-question survey soliciting their top residency choice, all of the musculoskeletal electives that they had taken, their clinical confidence, and their attitudes toward musculoskeletal education.

Results: Residency interest significantly affected the third-year students' performance on the cognitive mastery examination ($p = 0.018$) and also significantly affected both the third and the fourth-year students' clinical confidence in their ability to perform an examination of the musculoskeletal system ($p = 0.023$ and $p = 0.015$, respectively). The students' perception of the importance of musculoskeletal medicine, regardless of their residency interest, correlated with their decision to take musculoskeletal clinical electives ($p = 0.009$ and $p < 0.001$ for third and fourth-year students, respectively). Perceived importance was also correlated with higher clinical confidence for third-year students ($p = 0.043$) and increased examination scores for fourth-year students ($p < 0.001$). However, only students who listed orthopaedic surgery as their top residency choice demonstrated cognitive mastery in musculoskeletal medicine and reported above-average clinical confidence in their ability to conduct an examination of the musculoskeletal system.

Conclusions: Students' residency interest and their perception of the importance of musculoskeletal medicine to their future career influence the education that they receive in this field. In particular, students interested in non-orthopaedic residencies failed to demonstrate cognitive mastery and lacked clinical confidence. Possible approaches for medical schools to tackle this important issue that merit further exploration include requiring additional time for education in musculoskeletal medicine and providing a more structured musculoskeletal curriculum.

The prevalence of musculoskeletal disease seen across a wide range of clinical practice dictates that entering residents should possess a basic understanding of musculoskeletal medicine and the ability to recognize and treat common musculoskeletal conditions. According to the 2004

National Ambulatory Medical Care Survey, musculoskeletal symptoms accounted for approximately 92.1 million cases seen by physicians annually and were the number-one reason for visits to physicians' offices¹. Musculoskeletal conditions have also been reported to account for about one-fifth of the

Disclosure: The authors did not receive any outside funding or grants in support of their research for or preparation of this work. Neither they nor a member of their immediate families received payments or other benefits or a commitment or agreement to provide such benefits from a commercial entity. No commercial entity paid or directed, or agreed to pay or direct, any benefits to any research fund, foundation, division, center, clinical practice, or other charitable or nonprofit organization with which the authors, or a member of their immediate families, are affiliated or associated.



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symptoms and injuries that are encountered in the emergency room setting², during nonroutine pediatric visits³, and during other primary care visits⁴.

Despite the frequency of musculoskeletal conditions seen in medical practice, there is compelling evidence that medical schools fail to provide adequate musculoskeletal education in their curricula⁵⁻⁸. Graduating students from highly regarded medical institutions lacked clinical confidence in their ability to conduct an examination of the musculoskeletal system⁵, failed to demonstrate cognitive mastery in musculoskeletal medicine⁵⁻⁷ as measured with the nationally validated musculoskeletal examination developed by Freedman and Bernstein⁸, and thought that the amount of curricular time spent on musculoskeletal medicine was poor⁵. In light of these findings, it is not surprising that studies have shown that resident physicians in the United States felt poorly prepared to conduct a musculoskeletal examination of various parts of the body⁹ and also failed to demonstrate basic competency in musculoskeletal medicine⁷⁻⁸.

To our knowledge, previous studies have primarily focused on medical students as an entire group and have not analyzed individual students' attitudes and knowledge with respect to their residency interest. A medical student's interest in musculoskeletal medicine as a residency choice and perception of the importance of the field to his or her career is likely to influence his or her decision to take clinical electives related to musculoskeletal medicine. To address the unanswered question regarding the influence of a student's residency interest on musculoskeletal education, we compared third and fourth-year medical students across residency interests with respect to their clinical confidence in their ability to conduct a musculoskeletal examination, their cognitive mastery of musculoskeletal medicine, and their perception of education in musculoskeletal medicine.

Materials and Methods

We conducted a cross-sectional survey of first, second, third, and fourth-year medical students at Harvard Medical School during the 2005-2006 academic year. Data analysis with respect to residency interest was reported for only the third and fourth-year students, as we thought that those students were more certain about their career choice. We recruited third-year students at the end of their mandatory general surgery rotation, as this was the only mandatory rotation that offered explicit instruction in musculoskeletal medicine in the form of an orthopaedic clerkship elective. Fourth-year students were recruited from clinical electives, United States Medical Licensing Examination Step-2 review sessions, and personal contacts. All participating students completed a thirty-question survey that addressed their perception of the importance of musculoskeletal education, their confidence in their ability to perform a musculoskeletal physical examination, and their satisfaction with the undergraduate medical curriculum. In order to assess cognitive mastery in musculoskeletal medicine, third and fourth-year students also took a nationally validated musculoskeletal basic competency examination consisting

of twenty-five short-answer questions, developed by Freedman and Bernstein⁸. Thirty-seven students reported prior exposure to the examination, most commonly from reading the original article by Freedman and Bernstein, which includes the correct responses. We excluded the examination scores of those students from the cognitive mastery analysis.

Population Subgroup

Third-year students were divided into those who had completed clinical rotations at a hospital with a mandatory two-week orthopaedic clerkship (Massachusetts General Hospital) and those who had completed rotations at a hospital without an orthopaedic clerkship requirement (Beth Israel Deaconess Medical Center and Brigham and Women's Hospital). Fourth-year students who had taken various one-month clinical electives related to musculoskeletal medicine were separated into an "electives" subgroup. (All fourth-year students surveyed had been required to take a two-week orthopaedic clerkship during their third year.) One-month electives included advanced clinical anatomy, advanced musculoskeletal physical diagnosis, and adult or pediatric orthopaedics.

Questionnaire

The questionnaire asked students to list their top three residency choices and rank the importance of musculoskeletal education with regard to their future medical career with use of a 5-point Likert scale ranging from 1 ("no importance") to 5 ("critical importance"). Students were also asked to estimate the percentage of the time that musculoskeletal symptoms were the primary reason for patients to visit a primary care physician's office. Clinical confidence was measured by taking the average of the scores on two 5-point Likert scales (both ranging from "none" to "complete" confidence) regarding the student's confidence in (1) his or her ability to perform a musculoskeletal physical examination and (2) his or her ability to generate a differential diagnosis for musculoskeletal pain. Student participants also rated the amount of time that they spent on musculoskeletal pathophysiology and medicine with use of a 5-point Likert scale (ranging from "inadequate" to "excellent").

Statistical Methods

We used two-tailed Student *t* tests to compare self-reported clinical confidence, cognitive mastery examination scores, perceived importance of musculoskeletal medicine, and satisfaction with the amount of curricular time spent on musculoskeletal medicine between students who had taken a clerkship or other electives and those who had not. Correlation between perceived importance of musculoskeletal medicine and the decision to take a clerkship or other electives, the score on the cognitive mastery examination, and clinical confidence were calculated with use of the Spearman coefficient for nonparametric tests. All analyses with regard to residency interest were based on each student's top residency choice. We used one-way analysis of variance to compare clinical confidence and examination scores with respect to the student's top residency choice. Significance was assessed at the $p < 0.05$ level for all analyses.

TABLE I Third-Year Student Characteristics According to Residency Interest

Group/Residency Interest	No. of Students	Perceived Importance of Musculoskeletal Medicine*	Took Orthop. Clerkship (no. of students)	Curricular Time Spent on Musculoskeletal Education†	Clinical Confidence‡	Examination Score (%)
2-wk orthop. surg. rotation optional§						
Orthopaedic surgery	2	5.0	2	1.5	2.5	76.1 (p < 0.001)#
Other surgery	3	4.3	2	2.0	3.2	64.9
Emergency medicine	9	4.1	4	1.8	2.3	62.8
Pediatrics	15	4.1	3	1.9	2.5	52.3
Undeclared	6	4.0	2	2.0	2.3	50.6
Neurology	4	4.0	1	2.0	2.4	51.8
Aerospace medicine	1	4.0	0	2.0	2.5	49.4
General surgery	14	3.9	1	1.7	2.1	49.8
Radiology	4	3.8	1	2.3	2.8	63.2
Internal medicine	37	3.6	14	1.7	2.1	54.5
Psychiatry	3	3.7	0	1.0	1.7	50.2
Obstetrics/gynecology	4	3.5	1	2.0	2.2	36.8
Anesthesiology	3	3.3	1	2.0	2.2	50.8
Research	2	2.0	0	2.5	2.2	41.6
Ophthalmology	2	2.0	0	2.0	3.0	46.6
Dermatology	1	1.0	0	3.0	2.0	63.5
Total	110					
Average		3.8	32 (29%)	1.8	2.3	53.5
2-wk orthop. surg. rotation mandatory§						
Orthopaedic surgery	7	5.0	7	2.3	3.2 (p = 0.004)#	68.0**
General surgery	17	4.0	17	2.1	2.6	60.8
Internal medicine	9	4.0	9	1.9	2.7	64.2
Undeclared	3	4.0	3	2.3	3.0	38.3
Other surgery	9	3.8	9	2.7	2.8	64.4
Pediatrics	2	3.5	2	2.0	2.2	61.0
Emergency medicine	1	3.0	1	2.0	3.0	–
Obstetrics/gynecology	1	3.0	1	2.0	2.5	–
Ophthalmology	1	3.0	1	2.0	2.0	–
Anesthesiology	2	2.5	2	2.5	2.8	–
Total	52					
Average		4.1	52 (100%)	2.2	2.8	61.1

*1 = no importance, 2 = minor importance, 3 = average importance, 4 = major importance, and 5 = critical importance. †1 = inadequate, 2 = poor, 3 = adequate, 4 = good, and 5 = excellent. ‡1 = none, 2 = low, 3 = adequate, 4 = high, and 5 = complete. §Statistical analysis demonstrated a significant difference between the optional and mandatory groups with regard to perceived importance of musculoskeletal medicine (p = 0.042), rating of curricular time spent on musculoskeletal education (p = 0.004), clinical confidence (p < 0.001), and examination scores (p = 0.028). #There was a significant difference between this subgroup's score and the overall score for third-year students. **The sample size for this group was one. The other six students had had prior exposure to the examination.

Results

Response Rates and Elective Subgroups

One hundred and sixty-two (88%) of 184 third-year students and eighty-seven (57%) of 153 fourth-year students completed the questionnaire, yielding an overall response rate

of 74% (249 of 337). Thirty-four third-year students and three fourth-year students reported that they had been previously exposed to the cognitive mastery examination developed by Freedman and Bernstein⁸, and only their responses to the attitudes questionnaire were included in the analysis. Thirty-

TABLE II Fourth-Year Student Characteristics According to Residency Interest

Residency Interest	No. of Students	Perceived Importance of Musculoskeletal Medicine*	Took Orthop. Clerkship (no. of students)	Curricular Time Spent on Musculoskeletal Education†	Clinical Confidence‡	Examination Score (%)
Emergency medicine	4	5.0	1	1.8	2.4	63.9
Neurology	1	5.0	1	1.0	3.0	90.6
Orthopaedic surgery	8	4.9	8	1.8	3.3	73.5
General surgery	6	4.5	2	1.7	2.8	63.8
Undeclared	4	4.3	1	2.0	2.5	69.3
Ophthalmology	1	4.0	0	2.0	2.0	46.2
Other surgery	7	3.9	3	2.5	2.9	55.9
Anesthesiology	4	3.8	0	2.0	2.6	53.9
Internal medicine	29	3.7	5	1.8	2.4	60.3
Pediatrics	6	3.7	0	2.0	2.4	66.5
Radiology	8	3.6	2	2.0	2.7	63.9
Family medicine	2	3.0	0	2.5	2.5	60.8
Psychiatry	1	3.0	0	1.0	3.0	52.9
Dermatology	3	2.7	2	2.0	2.7	62.4
Obstetrics/gynecology	3	2.7	0	2.3	2.2	50.9
Total	87					
Average		3.9	25 (29%)	1.9	2.6	62.1

*1 = no importance, 2 = minor importance, 3 = average importance, 4 = major importance, and 5 = critical importance. †1 = inadequate, 2 = poor, 3 = adequate, 4 = good, and 5 = excellent. ‡1 = none, 2 = low, 3 = adequate, 4 = high, and 5 = complete. §There was a significant difference between this subgroup's score and the overall score for fourth-year students.

two (29%) of 110 third-year students at institutions where a two-week orthopaedic clerkship was not required elected to take the clerkship. The remaining students completed their rotations at a hospital that required an orthopaedic clerkship. Twenty-five (29%) of the eighty-seven fourth-year students elected to take at least one additional one-month musculoskeletal clinical elective; these electives included advanced clinical anatomy (thirteen students), adult orthopaedics (nine), advanced physical diagnosis (two), and pediatric orthopaedics (two). One student chose to take both the adult and the pediatric orthopaedics electives.

Students' Perception of Importance of Musculoskeletal Medicine

The only subgroup of third-year students who thought that musculoskeletal medicine was of "critical importance" (≥ 4.5 of 5 points on the Likert scale) to their future career were those interested in orthopaedic surgery as their top residency choice. Students who were interested in other residencies most commonly rated musculoskeletal medicine to be of "major importance" (3.5 to 4.5 points). These residencies included primary care fields such as internal medicine and pediatrics (Table I). Fourth-year students who thought that musculoskeletal medicine was of critical importance to their future

career included those interested in emergency medicine, neurology, orthopaedic surgery, and general surgery (Table II). Both third and fourth-year students thought that musculoskeletal symptoms account for approximately 45% of visits to a primary care physician's office.

Results from the third-year class demonstrated a correlation between perceived importance of musculoskeletal medicine and clinical confidence (Spearman rho = 0.161, $p = 0.043$; Table I); however, there was no significant correlation between these students' perception of the importance of musculoskeletal medicine and their performance on the cognitive mastery examination ($p = 0.053$; Table I). Results from the fourth-year class demonstrated a correlation between the perceived importance of musculoskeletal medicine and students' performance on the cognitive mastery examination (Spearman rho = 0.398, $p < 0.001$; Table II), although there was no significant correlation between the students' perception of the importance of musculoskeletal medicine and their clinical confidence ($p = 0.24$; Table II).

Impact of an Orthopaedic Clinical Clerkship on Musculoskeletal Education

Third-year students who had completed their clinical rotations at a hospital where an orthopaedic clerkship was required

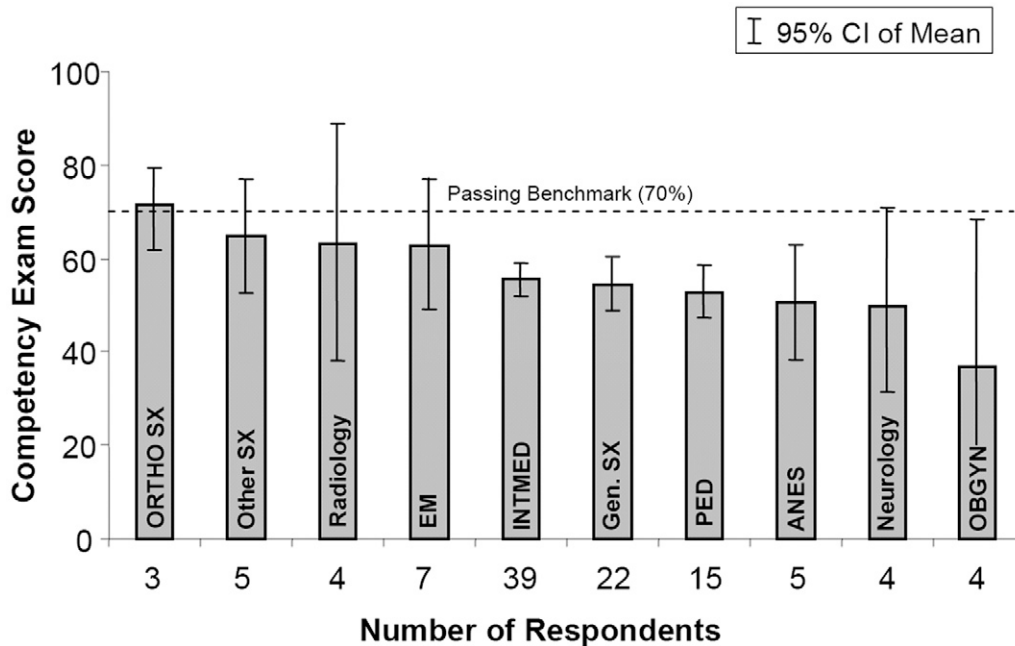


Fig. 1-A

Competency examination scores of third-year students across residency interests. Excluding orthopaedic surgery, only groups with more than three students were considered. The mean examination scores were 71.5% for orthopaedic surgery (ORTHO SX), 64.7% for other surgery (Other SX), 63.2% for radiology, 62.8% for emergency medicine (EM), 55.6% for internal medicine (INTMED), 54.3% for general surgery (Gen. SX), 52.9% for pediatrics (PED), 50.8% for anesthesiology (ANES), 51.8% for neurology, 36.8% for obstetrics/gynecology (OBGYN), and 48.8% for undecided. One-way analysis of variance showed a significant effect ($p = 0.018$).

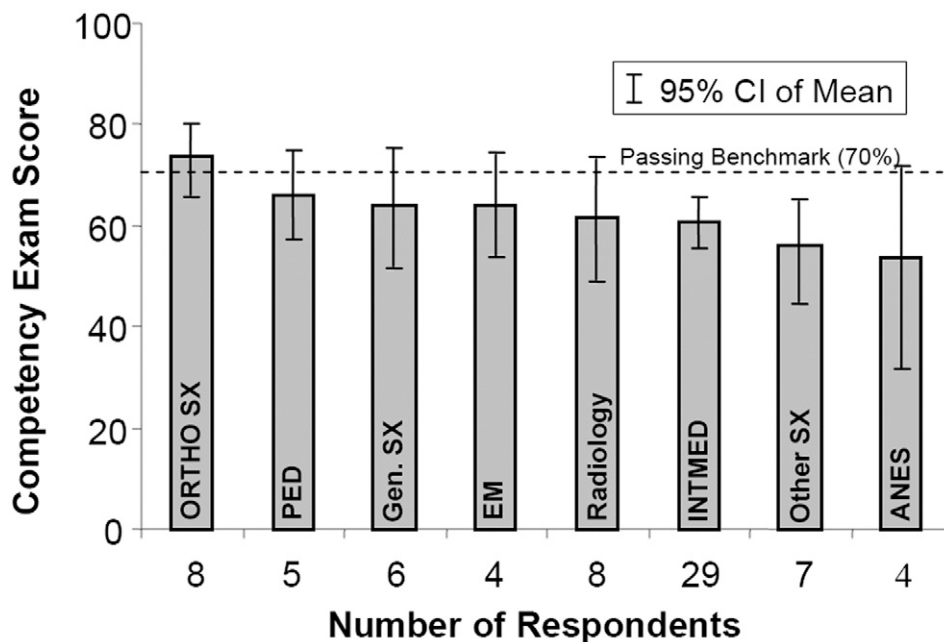


Fig. 1-B

Competency examination scores of fourth-year students across residency interests. Only groups with more than three students were considered. The mean examination scores were 73.5% for orthopaedic surgery (ORTHO SX), 66.5% for pediatrics (PED), 63.9% for general surgery (Gen. SX), 63.9% for emergency medicine (EM), 61.7% for radiology, 60.3% for internal medicine (INTMED), 55.9% for other surgery (Other SX), and 53.9% for anesthesiology (ANES). One-way analysis of variance showed no significant effect ($p = 0.171$).

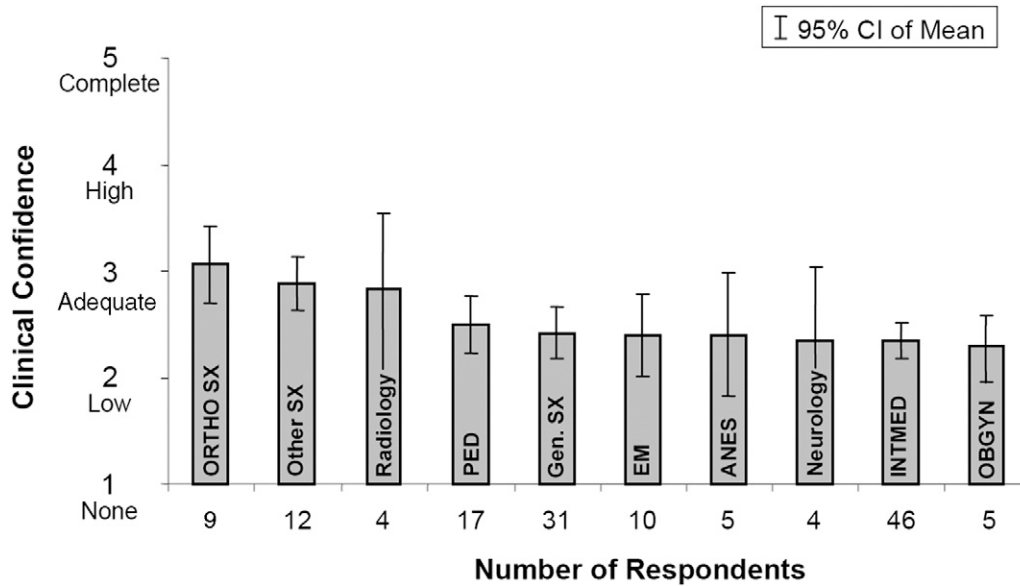


Fig. 2-A

Clinical confidence of third-year students across residency groups. Only groups with more than three students were considered. The mean scores for clinical confidence levels were 3.06 points for orthopaedic surgery (ORTHO SX), 2.88 points for other surgery (Other SX), 2.83 points for radiology, 2.50 points for pediatrics (PED), 2.42 points for general surgery (Gen. SX), 2.40 points for emergency medicine (EM), 2.40 points for anesthesiology (ANES), 2.38 points for neurology, 2.35 points for internal medicine (INTMED), and 2.30 points for obstetrics/gynecology (OBYN). One-way analysis of variance showed a significant effect ($p = 0.023$).

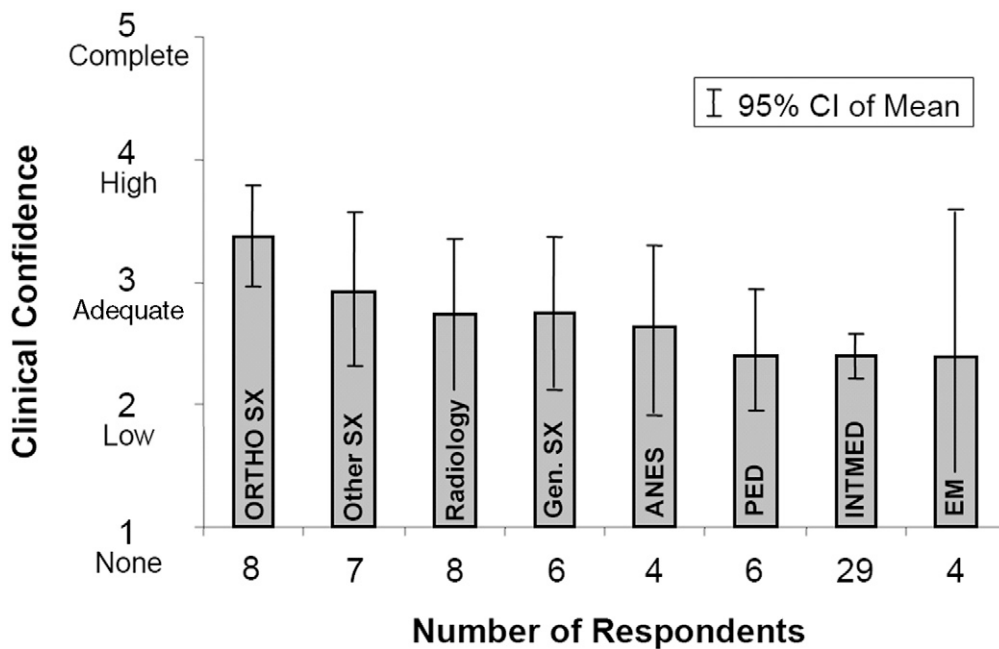


Fig. 2-B

Clinical confidence of fourth-year students across residency groups. Only groups with more than three students were considered. The mean scores for clinical confidence levels were 3.31 points for orthopaedic surgery (ORTHO SX), 2.93 points for other surgery (Other SX), 2.69 points for radiology, 2.75 points for general surgery (Gen. SX), 2.62 points for anesthesiology (ANES), 2.42 points for pediatrics (PED), 2.41 points for internal medicine (INTMED), and 2.38 points for emergency medicine (EM). One-way analysis of variance showed a significant effect ($p = 0.015$).

performed significantly better on the competency examination ($p = 0.028$), reported higher clinical confidence ($p < 0.001$), perceived musculoskeletal medicine to be more important to their future career ($p = 0.042$), and were more satisfied with the amount of curricular time spent on musculoskeletal medicine ($p = 0.004$) than those who had completed their rotations at hospitals not requiring the clerkship (Table I).

In the two hospitals where an orthopaedic clerkship was not required, 29% of the students chose to take the clerkship (Table I). There was a correlation between the students choosing to take the clerkship and their perception of the importance of musculoskeletal medicine to their future career (Spearman $\rho = 0.250$, $p = 0.009$; Table I). Compared with students who chose not to take the clerkship, these students perceived musculoskeletal medicine to be more important to their future career (4.2 compared with 3.5 points; $p < 0.001$), although they did not perform significantly better on the competency examination (56% compared with 52%; $p = 0.21$), report a significantly higher level of clinical confidence (2.5 compared with 2.3 points; $p = 0.14$), or demonstrate a significant increase in their satisfaction with the amount of curricular time spent on musculoskeletal medicine (1.9 compared with 1.8 points; $p = 0.59$).

Impact of Clinical Electives on Musculoskeletal Education

Twenty-nine percent of fourth-year students took at least one one-month-long musculoskeletal elective, and there was a correlation between the students' choice to take such an elective and their perception of the importance of musculoskeletal medicine to their future career (Spearman $\rho = 0.386$, $p < 0.001$; Table II). Fourth-year students who took a one-month elective related to musculoskeletal medicine performed significantly better on the competency examination ($p < 0.001$), reported a significantly higher level of clinical confidence ($p < 0.001$), and perceived musculoskeletal medicine to be more important to their future career ($p < 0.001$) than did those who did not take such an elective (Table II). However, there was no significant difference between these two groups with respect to satisfaction with the curricular time spent on musculoskeletal education ($p = 0.694$; Table II); both groups thought that the amount of time spent on musculoskeletal education throughout their four years was "poor" (2 of 5 points).

Influence of Residency Interest on Students' Cognitive Mastery and Clinical Confidence

Residency interest had a significant effect on the third-year students' performance on the cognitive mastery examination ($p = 0.018$; Fig. 1-A) but not on the fourth-year students' performance ($p = 0.171$; Fig. 1-B). Both third and fourth-year students who listed orthopaedic surgery as their top residency choice had the highest overall examination score (average, 71.5 and 73.5 points, respectively). Furthermore, these were the only residency-interest subgroups to score above the suggested

passing criterion (70%) set by Freedman and Bernstein⁸ (Figs. 1-A and 1-B). Residency interest also significantly affected both third and fourth-year students' clinical confidence in their ability to conduct an examination of the musculoskeletal system ($p = 0.023$ and $p = 0.015$, respectively; Figs. 2-A and 2-B). Both third and fourth-year students who listed orthopaedic surgery as their top residency choice reported the highest self-assessed rating of clinical confidence, which was "adequate confidence" (Figs. 2-A and 2-B). All other subgroups reported less-than-adequate clinical confidence.

Discussion

Our data suggest that medical students' residency choice can affect their cognitive mastery of basic musculoskeletal knowledge and their clinical confidence in their ability to conduct an examination of the musculoskeletal system. The absence of a significant effect of residency choice on cognitive mastery in the group of fourth-year students may be due to the relatively smaller sample size (eighty-four students compared with 135 in the third-year class), as separating students by residencies resulted in small subgroups (Fig. 1-B). In order to obtain a more quantifiable representation of student attitudes, we analyzed student ratings of the importance of musculoskeletal education toward their future medical careers. The results show that the perceived level of importance positively correlated with the third and fourth-year students' choices with regard to taking musculoskeletal electives, with third-year students' clinical confidence, and with fourth-year students' cognitive mastery of basic musculoskeletal information. A student's perception of the importance of his or her musculoskeletal education is only one factor that can influence cognitive mastery and clinical confidence. Other important factors may include variation in musculoskeletal clinical education at the various teaching hospitals and the specific musculoskeletal electives that the student has taken.

Although the student's perception of the importance of musculoskeletal education correlated with increased clinical confidence in the third-year class and with cognitive mastery in the fourth-year class, only students interested in orthopaedic surgery scored above the suggested passing criterion of 70% on the Freedman and Bernstein basic competency examination and reported an "adequate" level of clinical confidence. The passing criterion for the Freedman and Bernstein examination was based on the recommendations of 240 U.S. internal medicine residency program directors and what they thought all medical school graduates should know, regardless of residency interest. Our results suggest that the current medical school curricula may not be adequately preparing all medical students to deal with common musculoskeletal conditions. Although we did not analyze solutions to this problem in the present study, possible approaches to addressing this issue include increasing the exposure that students receive in this field, such as by requiring an orthopaedic clerkship, or more effectively integrating fundamental concepts and skills into the preclinical and clinical curricula, as suggested by the Association of American Medical Colleges¹⁰.

A change in policy at two of three major teaching hospitals affiliated with Harvard Medical School eliminated the third-year orthopaedic clerkship requirement during the 2005-2006 academic year and allowed us to compare the outcomes between students from two different musculoskeletal clinical curricula. (It should be noted that all fourth-year students in this study had taken the orthopaedic clerkship during their third year.) This is of substantial interest as only 20% of American medical schools currently require a clinical course in musculoskeletal medicine¹¹. Results from the third-year class show that such a required course improves the student's cognitive mastery, clinical confidence, and satisfaction with the curricular time spent on musculoskeletal medicine. However, two weeks of required clinical instruction may not be enough as fourth-year students, who were all required to take the orthopaedic clerkship when they were third-year students, still reported less-than-adequate confidence in their ability to conduct an examination of the musculoskeletal system and failed to demonstrate basic cognitive mastery of the field. There are other clinical settings, such as rotations in family practice and emergency medicine, that can offer students substantial exposure to musculoskeletal conditions. However, not all medical schools require these rotations, and what the students actually learn can vary.

The same percentages (29%) of third and fourth-year students chose to take musculoskeletal electives, which may indicate some degree of similarity between the students' view on the importance of musculoskeletal education. Taking electives varied in effectiveness, however. While fourth-year students who had taken a one-month musculoskeletal elective demonstrated significant improvement in knowledge and clinical confidence compared with those who had not taken such an elective, third-year students who had completed an orthopaedic clerkship elective at hospitals that did not require such a rotation did not perform significantly better on the examination or show higher clinical confidence than did those who had not taken such an elective at the same hospitals. Notably, third-year students at the hospital that required the two-week orthopaedic clerkship outperformed students at the other two hospitals, which had no such requirement, suggesting that a mandatory orthopaedic clerkship can play a significant role in enhancing the musculoskeletal education that medical students receive.

As the Association of American Medical Colleges emphasized in their 2005 Medical School Objectives Project report on musculoskeletal medicine, medical schools should "address fragmentation of musculoskeletal content in the curriculum by explicitly identifying the different points in the curriculum this content instruction is occurring and plan for insertion throughout all four years of the curriculum."¹⁰ The challenge that remains is how to devise an organized method to integrate fundamental musculoskeletal concepts and important skills in both the clinical setting and the preclinical curriculum so that critical components are not overlooked. One specific concern, for example, may be how to recruit more orthopaedists to teach certain aspects of the musculoskeletal

physical examination. The best way to address these issues may vary across institutions, but, as we have experienced, drawing attention to evidence that suggests that the current approach to teaching musculoskeletal medicine is inadequate can increase institutional support for improvement.

Limitations

Because our assessment was performed at only one medical school, our study population may not be representative of other medical schools. Although the musculoskeletal medicine curriculum can vary from school to school, Harvard Medical School's requirement of two weeks of preclinical instruction focused on musculoskeletal medicine is similar to the national average of 2.7 weeks devoted to this field¹¹. Furthermore, correlation methodology was used for several of the analyses, such as those of the relationship between perceived importance of musculoskeletal medicine and performance on the cognitive mastery examination and the relationship between perceived importance and taking clinical electives. Only limited conclusions can be drawn from these observations. For example, although perceived importance may influence the student's choice with regard to taking electives, the converse may also be true. Our intention is only that our findings bring to attention certain factors that should be kept in mind as educators address the limitations of the current musculoskeletal curriculum.

Although we have shown significant relationships between residency interest and performance on examinations as well as clinical confidence, it is possible that it is not just the students' residency interest that affects their performance. The relationship may apply in the other direction as well—that is, the students' overall academic performance may influence what residency they choose, and those who are more competitive may be the ones who decide to pursue orthopaedics. We were not able to further analyze this possibility, although our findings show that students who were interested in orthopaedics outperformed those interested in other highly competitive residencies.

It is important to note that the thirty-four third-year students who had reported prior exposure to the examination showed a bias toward pursuing a surgical residency. All of these students had been required to take a two-week orthopaedic clerkship during their general surgery rotation. Considering that only nine third-year students reported an interest in orthopaedics, the heavy bias toward orthopaedic surgery in this subgroup of students may indicate the influence that taking the two-week orthopaedic clerkship can have on a student's residency choice.

Our study is, to our knowledge, the first to examine the effect of medical students' residency interest on the musculoskeletal education that they receive during medical school. As musculoskeletal conditions are relevant not only to orthopaedic surgery but also to a broad spectrum of medicine, medical schools should educate all students to be well-versed in this important field. However, our data suggest that not all students are adequately prepared to address the basic mus-

culoskeletal conditions that they may encounter. In concordance with several other studies of musculoskeletal education in medical schools, we recommend that medical schools provide more effective preparation in this field, either by increasing instruction time or by improving the integration of musculoskeletal medicine into the four-year medical curriculum¹⁰. ■

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