

TOPICS IN TRAINING

THE RELATIONSHIP BETWEEN REQUIRED MEDICAL SCHOOL INSTRUCTION IN MUSCULOSKELETAL MEDICINE AND APPLICATION RATES TO ORTHOPAEDIC SURGERY RESIDENCY PROGRAMS

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Background: Orthopaedic residency programs lack gender and race diversity. This study examines the hypothesis that exposure to a required course in musculoskeletal medicine in medical school is associated with a higher rate of application to orthopaedic surgery residency programs by underrepresented groups.

Methods: All 122 medical schools in the United States were surveyed in 2001 to determine whether they required dedicated course work in musculoskeletal medicine, defined as a preclinical module or clinical clerkship in orthopaedic surgery, rheumatology, or physiatry. Data from the Electronic Residency Application Service were obtained for the class of 2002. From these two sources, the rate of applications from students to orthopaedic surgery residency programs was calculated as a function of exposure to a required course in musculoskeletal medicine. Subgroup analysis was further carried out for women and for African Americans, Latinos, and Native Americans.

Results: In 2002, there were 16,294 graduates of American medical schools, of whom approximately 55% had mandatory instruction in musculoskeletal medicine. The rate of application to orthopaedic surgery residency programs was 5.7% among the students with required instruction compared with a rate of 5.1% for students without such required instruction. The rate of application for female students was 2.0% for those who had required courses and 1.1% for the female students who had not had the required courses. The rate of application for minority students in schools with required courses was 8.2% compared with a rate of 6.1% for those students without such exposure.

Conclusions: Required instruction in musculoskeletal medicine was associated with a 12% higher rate of application to orthopaedic surgery residency programs among all students (5.7% of those who received required instruction compared with 5.1% of those who did not). The relative difference was more pronounced among women (a 75% difference in the rate of application) and minorities (a 35% difference in the rate of application). This study suggests that required instruction in musculoskeletal medicine can help to promote diversity in orthopaedic surgery residency programs.

Orthopaedic residency programs lack gender and race diversity. Approximately one-half of the population of the United States is female, and approximately one-quarter comprises African Americans, Native Americans, and Lati-

nos. Nonetheless, orthopaedic residencies do not come close to matching these national norms^{1,2}.

The present study examines the premise that the number of women and underrepresented minorities who

choose orthopaedic surgery as a career may be increased by increasing the required exposure of such students to musculoskeletal instruction in medical school. Specifically, we tested the hypothesis that the presence of a required

TABLE I Rate of Application to Orthopaedic Residency Programs as a Function of Exposure to Required Instruction in Musculoskeletal Medicine

	All Schools	Students with Required Instruction	Students with No Required Instruction
Total number of students	16,294	8945	7349
Number of applicants to orthopaedic residency programs	881 (5.4)	508 (5.7)	373 (5.1)

course in musculoskeletal medicine in medical school is associated with a higher rate of application to orthopaedic surgery residency programs by the underrepresented groups.

The goal of ensuring that all American medical schools require instruction in musculoskeletal medicine in their curriculum can be justified on many grounds³⁻⁵. Enhancing the diversity of orthopaedic surgery residency programs may be yet another benefit of such an effort.

Materials and Methods

As part of a previously published study⁶, all 122 medical schools in the fifty United States were surveyed in 2001 to determine whether their curriculum required instruction in musculoskeletal medicine. Required instruction in musculoskeletal medicine was defined in that previous study as a required preclinical module dedicated to musculoskeletal medicine or a required clinical clerkship in orthopaedic surgery, rheumatology, or physiatry. (To maintain consistency, this definition was applied in the current study, although it should be noted that in fact no school was credited as offering required musculoskeletal instruction on the basis of a required rheumatology clerkship alone and only two schools were so designated on the basis of a physiatry clerkship.)

Data regarding American medical

school graduates who applied to orthopaedic surgery residency programs were acquired from the 2002 Electronic Residency Application Service⁷. For each applicant, data on race, gender, and school of graduation were recorded. Data describing the racial and gender composition of each of the medical school classes were also obtained^{8,9}. From these two sources, the rate of applications to orthopaedic surgery residency at each school was calculated, as was the overall rate of application as a function of exposure to a required course in musculoskeletal medicine. Further subgroup analysis was carried out for women and underrepresented minorities. The chi-square test was used to assess p values for all proportions, and p values were reported explicitly.

Results

In 2002, there were 16,294 American medical school graduates, of whom approximately 8945 (55%) had mandatory instruction in musculoskeletal medicine. (The reason that this number is given only as an approximation is discussed below.)

A total of 881 American medical students applied to orthopaedic surgery residencies by means of the Electronic Residency Application Service. Thus, the rate of application among all students was 5.4% (Table I).

Among students who graduated from

a school with required instruction, the rate was 5.7%. The rate of application to orthopaedic surgery residency programs among students who graduated from a school with no required instruction, by contrast, was 5.1% ($p = 0.090$).

Of the 16,294 graduates of American medical schools, 8473 (52%) were women (Table II). The overall rate of application to orthopaedic surgery residency programs for female graduates was 1.5%. Of the 3175 women who graduated from a school with required instruction, sixty-three applied to orthopaedic surgery residency programs, yielding a rate of 2.0%. The rate of application to orthopaedic surgery residency programs among the 5298 female students who graduated from a school with no required instruction was 1.1% ($p = 0.002$).

A total of 1793 graduates (11%) of American medical schools were from an underrepresented minority group (Table III). The overall rate of application to orthopaedic surgery residency programs among minority applicants was 6.7%. The rate of application to orthopaedic surgery residency programs among minority applicants who graduated from a school with required instruction was 8.2%. The rate of application to orthopaedic surgery residency programs among minority applicants who grad-

TABLE II Rate of Application to Orthopaedic Residency Programs by Women as a Function of Exposure to Required Instruction in Musculoskeletal Medicine

	All Schools	Students with Required Instruction	Students with No Required Instruction
Total number of female students	8473	3175	5298
Number of female applicants to orthopaedic residency programs	123 (1.5)	63 (2.0)	60 (1.1)

TABLE III Rate of Application to Orthopaedic Residency Programs by Minority Candidates as a Function of Exposure to Required Instruction in Musculoskeletal Medicine

	All Schools	Students with Required Instruction	Students with No Required Instruction
Total number of minority students	1793	546	1247
Number of minority applicants to orthopaedic residency programs	121 (6.7)	45 (8.2)	76 (6.1)

uated from a school with no required instruction was 6.1% ($p = 0.095$).

Discussion

Required instruction in musculoskeletal medicine was associated with an overall 12% higher rate of application to orthopaedic surgery residency programs among all students (5.7% of those who had required courses compared with 5.1% of those who did not). The difference in application rates was more pronounced among women (2.0% compared with 1.1%, respectively; a 75% relative difference) and minorities (8.2% compared with 6.1%, respectively; a 35% relative difference). This study therefore suggests that required instruction in musculoskeletal medicine can help to promote diversity in orthopaedic surgery residency programs.

One limitation of this study is that these comparisons merely demonstrate an association between required instruction and application to orthopaedic surgery residency programs. They do not prove a cause-and-effect relationship, and indeed inferring a relationship may not be justified. For instance, a college student with an interest in orthopaedic surgery who applies to medical school may choose to attend a given medical school on the basis of that school's strong musculoskeletal curriculum. This is a self-selection bias. A confounding effect may also be present. That is, schools with a talented faculty in orthopaedic surgery may use that talent and require instruction in musculoskeletal medicine. The talented faculty may also strongly attract applicants to orthopaedic surgery residency. As such, the presence of a course per se cannot be said to attract the applicants.

Another limitation is that the

data on a medical school's curriculum may imperfectly reflect the instruction at a given school. To be sure, the methods of assessing curricula used previously made no attempt to ascertain anything about quality. Furthermore, although the type and duration of instruction were noted previously, all schools with any required instruction whatsoever were considered comparable in this study. For instance, a school with a brief clinical rotation in the fourth year would be granted the same credit as a school that had an elaborate preclinical course and lengthy clinical rotation. Needless to say, the latter likely would impact career choice more than a brief senior-year exposure.

In addition, it is possible that a given graduate in 2002 was not exposed to the curriculum that the previous survey attributed to his or her school. That is because the student may have transferred from another school or may have sought a second degree—beginning medical school perhaps as early as 1993—and therefore did not share the same course of study as the other 2002 graduates. From our experience, this is apt to be a small source of error. It is, however, the main reason that we did not analyze the application rate of MD/PhD students (the other “underrepresented” group). It would be difficult to determine the courses to which these students were exposed short of interviewing them.

Although this study describes the relative dearth of female and minority applicants in orthopaedic surgery, the shortage of each is a problem of a distinct type. Women are already adequately represented in the medical school class; in 2002, in fact, the majority of medical school graduates were women. Nonetheless, women are not

applying to orthopaedic surgery in numbers commensurate with their representation in the graduating class. Minorities, on the other hand, represented only 11% of the graduating medical school population but about 25% of the country's population. In addition, the rate of applications from minority candidates to orthopaedic programs is not disproportionately low; in fact, it is above average. Accordingly, the absolute shortage of minorities in orthopaedic residency can be solved only with increased recruitment to medical school, not by selective recruitment within the medical school class. It can be argued that because orthopaedic surgeons are among the few specialists with whom young people interact, increasing the number of minority orthopaedic surgeons may assist with such a generalized recruitment effort—thereby benefiting all fields.

It should be noted that, even if the rate of applications from schools currently not requiring instruction were brought up to the level of applications from schools that do require instruction, the problem of inadequate diversity would not be solved. Specifically, increasing the rate of women and underrepresented minorities from schools without instruction by 75% and 35%, respectively, would still augment the pool of applicants by only forty-five women and twenty-seven underrepresented minority candidates. In order to attain an applicant pool that is approximately 50% women and 25% underrepresented minorities, an additional 650 female and 135 underrepresented minority applicants would be required (assuming the number of male applicants were to be held constant). In sum, required instruction in musculoskeletal medicine may help to achieve diversity in orthopaedic

surgery residency programs but, in and of itself, is not sufficient.

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