


# Musculoskeletal Knowledge on the in-Training Examination Improves in Family Medicine Residents Participating in a Longitudinal Sports Medicine Clinical Track

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## ABSTRACT

**OBJECTIVES:** The study aims to assess the impacts of a sports medicine (SM) track on musculoskeletal (MSK) knowledge of family medicine (FM) residents. In-training examination (ITE) results were used to compare the MSK knowledge of FM residents with and without SM track participation.

**METHODS:** A single-center, retrospective study was completed on 85 FM residents from the 2018 to 2024 graduating classes who completed the ITE from 2017 to 2021. Residents were categorized by participation in the SM track, where half a day of FM continuity clinic per week is replaced with an SM clinic, supervised by a fellowship-trained SM physician. ITE scores throughout training were compared between the 2 groups using mixed-effects regression.

**RESULTS:** The ITE MSK scores increased among both SM track participants (+77 points/year,  $p = .001$ ) and nonparticipants (+39 points/year,  $p = .001$ ) throughout their training. By postgraduate year 3, SM track participants performed significantly better on the MSK portion of the ITE (+87 points compared to non-participants,  $p = .045$ ). No significant difference in total ITE scores was seen between groups.

**CONCLUSIONS:** Our data demonstrates that participation in an SM track is associated with an increase in MSK knowledge of ITE, suggesting that an SM track may provide FM residents with a better understanding of MSK conditions.

**KEYWORDS:** Musculoskeletal, sports medicine, in-training examination, resident education

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## Introduction

The importance of sports medicine (SM) and musculoskeletal (MSK) education is highlighted through studies demonstrating a high prevalence of MSK conditions among primary care patients and low confidence in caring for these conditions among primary care physicians.<sup>1–4</sup> Data on the influence of SM clinical tracks on the MSK knowledge of family medicine (FM) residents are limited, but some evidence suggests that additional MSK experiences throughout residency increase knowledge.<sup>5–7</sup> The Accreditation Council for Graduate Medical Education (ACGME) guidelines require FM residencies to dedicate 2 months of training or 200 h to the care of MSK conditions, including an SM experience.<sup>8</sup> There is limited available data or literature that provides a comprehensive list of programs offering specific SM-specific rotations and tracks. It is unknown how a formal SM clinical track in residency education could enhance MSK knowledge among FM residents. Furthermore, it is unknown whether emphasizing MSK conditions in an SM clinical track limits education in other areas of residency training. Administration of the American Board of FM (ABFM) in-training examination (ITE) tests the breadth of FM knowledge, including

knowledge of the MSK system.<sup>9</sup> This study evaluated the effectiveness of an SM clinical track in FM residency in increasing the level of MSK knowledge of residents by comparing the ITE performance of FM residents with and without SM track participation over the course of 5 years. As the SM track increases exposure to MSK conditions, we hypothesized that track participants would demonstrate higher MSK knowledge scores on the ITE than nonparticipants.

## Methods

### (i) Program Setting and Features

As previously described,<sup>10</sup> the SM track is a specialized, longitudinal program within the FM residency program at a single academic institution that augments exposure to treatment and management of sports-related injuries and conditions. Each residency class can host 12 residents, and each year the SM track can accept 1 to 2 participants.<sup>10</sup> All residents in the FM program complete an SM rotation and orthopedic rotation in their postgraduate year (PGY) 2, each 1 month long, that covers skills on the evaluation of common MSK complaints,



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skills, and procedures. SM track participants begin their clinical experience in PGY2; one-half day of FM continuity clinic is replaced with SM clinic through the end of PGY3, precepted by a fellowship-trained FM-SM physician. The SM track consists of a mix of outpatient clinics, sideline coverage, scholarly activity involvement, and training room experiences, providing comprehensive exposure to SM practice. A single-center, retrospective study was completed on FM residents, with participation in the SM track as the exposure and ITE scores as the outcome. The study was approved by the University and Medical Center Institutional Review Board under approval number UMCIRB 21-000026. The original date of approval was 24 February 2021. The IRB was approved through the exempt pathway, exemption category 4c, for the analysis of previously collected data. The requirement of written informed consent was waived by the IRB.

### (ii) Variables

Data from residents in the 2018 to 2024 graduating classes who completed the ITE from 2017 to 2021 were used for comparison and analysis. Demographic data were obtained from the ABFM and residency program records. Variables included total ITE and MSK section scores, PGY status, medical training (MD/DO), gender, and participation in the SM track. Residents who had interrupted or nontraditional residency schedules were excluded. ITE scores collected were used to compare knowledge between residents. ITE MSK scores were analyzed using mixed-effects regression to control for

**Table 1.** Mixed-effects linear regression of musculoskeletal subscores on in-training examination of family medicine residents ( $N = 78$  residents, 164 scores).

Comparison	Score difference	95% CI	<i>P</i>
<i>SM track versus non-SM track</i>			
At PGY1	+13 points	-64, +90	.743
At PGY2	+50 points	-13, +113	.117
At PGY3	+87 points	+2, +173	.045
<i>Annual trend</i>			
Among residents on SM track	+77 points/year	±31, +123	.001
Among residents not on SM track <sup>a</sup>	+39 points/year	+17, +62	.001
<i>Male versus female</i>	+5 points	-40, +50	.840
<i>MD versus DO</i>	-7 points	-56, +42	.778

Abbreviations: CI, confidence interval; DO, Doctor of Osteopathic Medicine; MD, Doctor of Medicine; PGY, postgraduate year; SM, sports medicine. <sup>a</sup>interaction term for difference in trends between SM track participants and nonparticipants was not statistically significant (coefficient = 37; 95% CI: -14, 89;  $p = .158$ ).

gender and degree, and account for clustering of multiple scores within residents. The estimated trend in scores over year (PGY) was interacted with track (SM vs non-SM) to determine if scores increased differentially based on SM track participation. Data analysis was completed in Stata/SE 16.1, and  $P < .05$  was considered statistically significant.

## Results

### (iii) Demographics

Eighty-five FM residents were evaluated for inclusion, with 7 excluded due to disruptions in their residency education or missing some of the required ITEs. Of the 78 included residents, 64% were MD trained, and 59% were female. Eleven of the residents (14%) participated in the SM track, of whom 5 were MD trained (46%) and 6 were female (55%).

### (iv) Statistical Analysis

Table 1 summarizes the regression analysis of the 164 ITE scores collected (55 PGY1, 55 PGY2, and 54 PGY3). ITE MSK scores increased among both SM track participants (+77 points/year,  $P = .001$ ) and nonparticipants (+39 points/year,  $p = .001$ ). By PGY3, SM track participants performed significantly better on the MSK portion of the ITE (+87 points compared to nonparticipants,  $p = .045$ ). No significant differences were noted in ITE MSK scores between MD and DO

**Table 2.** Mixed-effects linear regression of total scores on in-training examination of family medicine residents ( $N = 78$  residents, 164 scores).

Comparison	Score difference	95% CI	<i>P</i>
<i>SM track versus non-SM track</i>			
At PGY1	+14 points	-44, +72	.635
At PGY2	+20 points	-29, +70	.421
At PGY3	+27 points	-27, +80	.327
<i>Annual trend</i>			
Among residents on SM track	+45 points/year	+23, +68	<.001
Among residents not on SM track <sup>a</sup>	+39 points/year	+28, +50	<.001
<i>Male versus female</i>	-22 points	-51, +7	.143
<i>MD versus DO</i>	+30 points	-1, +60	.057

CI, confidence interval; DO, Doctor of Osteopathic Medicine; MD, Doctor of Medicine; PGY, postgraduate year; SM, sports medicine. <sup>a</sup>interaction term for difference in trends between SM track participants and nonparticipants was not statistically significant (coefficient = 6; 95% CI: -19, 32;  $p = .623$ ).

residents ( $-7$  points,  $p = .778$ ) or between male and female residents ( $+5$  points,  $p = .840$ ).

The analysis of total ITE scores for FM residents is shown in Table 2. Both groups (SM participants and nonparticipants) demonstrate significant increases in total ITE scores over time, which is expected as residents progress through the residency program. However, no significant differences in total ITE scores were noted between SM track participants and nonparticipants at any timepoint.

## Discussion

The SM track is intended to enhance exposure to MSK conditions and provide opportunities to expand MSK knowledge and skills.<sup>10</sup> Our study shows that by PGY3, SM track participants score higher on the MSK portion of their ITE versus nonparticipants. This suggests that increase in MSK exposure from the SM track is associated with an increase in MSK knowledge as measured by ITE scores.

Our comparison of total ITE scores for FM residents showed that overall scores increased as expected through residency training, with no significant differences between SM track participants and nonparticipants. We believe this highlights the benefit of the SM track in enhancing residents' MSK education without compromising their overall training and education. However, it is unknown if there were any significant changes in other domains on the ITE, therefore a more in-depth analysis of the test data in the future could better inform other changes.

While our study benefited from the inclusion of multiple years of data and highlights a unique longitudinal SM track, some limitations are innate to the program setting and study design. These include single-center study design, small sample size, and the use of a singular knowledge measurement tool. Future studies should involve multiple centers to enhance the generalizability of the results to different residency program settings. It is possible that excluding residents with either disruptions in their residency education or missing ITE scores may introduce selection bias, however augmenting the sample size in the future could help alleviate this potential for bias.

In the multivariable analysis, we did not find statistically significantly faster acquisition of knowledge in the SM group based on ITE scores, but only that by PGY3, the SM group reached a higher level of MSK knowledge. Moving forward, future studies should consider a wider range of measures when evaluating a resident's knowledge and abilities, such as combining verbal and written preceptor feedback with standardized test results.<sup>11</sup> As well, a comparison between SM track and other educational tracks within residency programs would provide valuable insights into the relative effectiveness of different educational approaches in preparing residents for clinical practice. Rather than solely evaluating ITE data, an analysis of patient outcomes and

clinical competencies of the FM residents in the SM track versus residents who are not in the SM track would further enhance this study. Considering resident factors, such as educational background and course, and future career and practice choices, could add to the knowledge of the effects of an SM track.

## Conclusion

In conclusion, our study demonstrates that an SM track enhances MSK knowledge among FM residents, as supported by standardized testing through the ITE. An SM track can provide residents with additional training and physical exam skills that may be beneficial in the care of a wide range of patients with MSK needs, potentially improving upon patient care. Our results underscore the significance of residency program curriculum design, suggesting that specialized tracks, such as the SM track, can effectively increase knowledge and address competency gaps. Further study into curriculum features and knowledge assessment methods is anticipated as medical educators continue to optimize education modalities in an effort to prepare resident physicians for the growing population, and with it, the greater need for MSK care.

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## Authors Contributions

Megan Ferderber conceived the presented idea. Megan Ferderber and Micah Furr collected the data and performed data entry. Dmitry Tumin analyzed statistical data. All authors contributed to the writing of the final manuscript, discussed the results, and approved the final manuscript.

## Informed Consent

This study was approved by the Institutional Review Board UMCIRB 21-000026 on February 24, 2021 through the exempt pathway, exemption category 4c, for the analysis of previously collected data.

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