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Subspecialty Rotation Exposure Across Accreditation Council for Graduate Medical Education-Accredited Orthopaedic Surgery Residency Programs

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Abstract

Introduction: The Accreditation Council for Graduate Medical Education (ACGME) mandates certain procedural minimums for graduating residents of orthopaedic surgery programs and provides residency programs with comparative data on surgical case volume. It provides much less guidance and feedback to programs regarding the amount of time residents should spend on different rotations during residency. Comparative data regarding how much time residents are spending on general and subspecialty rotations may be of use to educational leadership as they consider curriculum changes and alternative training structures. The purpose of this study is to summarize the subspecialty rotation exposure across ACGME-accredited orthopaedic residency programs and to correlate the subspecialty rotation exposure with available program-specific factors.

Methods: This study contacted 162 ACGME-accredited orthopaedic residency programs and received rotation schedules from 115 programs (70.1%). Rotation schedules for postgraduate year 2 to 5 residents were categorized into the number of months spent on the following rotations: general orthopaedics, trauma, pediatrics, hand, sport, foot and ankle, arthroplasty, oncology, spine, research, and elective. The percentage of residency spent in each category was then calculated as the number of months divided by 48 months. Differences in the percent of residency spent on subspecialty rotations were compared for the following variables: program size and presence of subspecialty fellowships at the institution.

Results: On average, the greatest percentage of residency spent was in the following categories: trauma (16.6%; 8.0 months), general orthopaedics (13.7%; 6.6 months), and pediatrics (12.5%; 6.0 months). Rotations with the highest variation between programs included the following: general orthopaedics (SD 5.8 months; range 0 to 30 months), sport (SD 2.5 months; range 0 to 15 months), and arthroplasty (SD 2.3 months; range 0 to 11.8 months). Sixty-seven programs (63.2%) had dedicated blocks for research, and 25 programs (23.6%) had dedicated blocks for electives. No notable correlations were found between subspecialty exposure and program size or availability of subspecialty fellowship training at the program.

Conclusion: Variability exists between ACGME-accredited orthopaedic surgery residency programs in subspecialty rotation exposure. Summarizing the subspecialty rotation exposure across accredited orthopaedic residency programs is useful to graduate medical education leadership for comparative purposes because they design and modify resident curricula.

According to a 2010 orthopaedic residency program directors' forum, the top concerns among programs include potential compromises to resident learning experience caused by work-hour restrictions and the need to identify a body of core knowledge with specific goals and expectations that all residents should meet.¹ Similar challenges in Canada and Europe have resulted in some programs transitioning from a time-based structure to a competency-based medical education model, where residents progress at an independent pace by demonstrating the required knowledge and skills.²⁻⁴ It remains unclear whether US programs will eventually transition to a competency-based medical education. Canadian and European examples demonstrate the challenge in the lack of reliable evaluation tools or standardized curriculum to cover the breadth of orthopaedic education.⁵

The Accreditation Council for Graduate Medical Education (ACGME) provides guidelines indicating graduating resident case log minimums for certain core competency procedures. National summative case log data are available publicly (Figure 1), and individual programs also receive their specific data with which they can compare with national averages. By way of comparison, the ACGME provides much less guidance about the amount of time residents do and should spend on different rotations throughout residency. Currently, the ACGME and American Board of Orthopaedic Surgery (ABOS) provide only broad guidelines indicating the number of months postgraduate year (PGY) 2 to 5 residents should spend on general orthopaedic services^{6,7} (Table 1). However, there are no guidelines outlining the amount of time residents should spend on subspecialty services such as hand, arthroplasty, foot and ankle, sport, spine, and oncology. Furthermore, orthopaedic residency

programs are increasingly offering elective and research rotations, but little is known about how variable these practices currently are.⁸

The purpose of this study is to summarize the subspecialty rotation exposure across ACGME-accredited orthopaedic residency programs and to examine associations between rotation schedule structure and available program-specific factors. Characterizing variation in resident rotation exposure is useful to residency program administrators because they compare their practices with other ACGME-accredited programs and work toward developing new and potentially more standardized orthopaedic residency training structure. Applicants to orthopaedic surgery residencies may also benefit from knowledge of this variability as they compare programs.

Methods

The ACGME Accreditation Data System website was used to generate a list of the 165 ACGME-accredited US orthopaedic surgery residency programs (updated August 2017) and their program coordinators' contact information. Programs for D.O. medical graduates only were excluded ($n = 3$). Programs were included if the rotation schedules for PGY 2 to 5 showing the number of weeks spent on distinct rotations could be obtained from the residency program coordinator, from the program's website, or from faculty and residents at the program. Regardless of the method of collection, programs were excluded if the obtained schedule did not clearly outline the amount of time residents spend on each rotation throughout PGY 2 to 5. PGY-1 schedules were excluded from the analysis, given the time spent on nonorthopaedic specialty services during the intern year.

Schedules were reviewed to categorize the number of months that

PGY-2, PGY-3, PGY-4, and PGY-5 residents spent on each of the following rotations: general orthopaedics, trauma, pediatrics, hand, sport, foot and ankle, arthroplasty, oncology, spine, research, and elective. The percentage of residency spent in each category was then calculated as number of months divided by 48 months. Rotations that were unable to be placed into one of the aforementioned 11 categories were noted. These included rotations that were listed by hospital name in their program schedules for which it was not possible to determine the types of cases residents were specifically involved with at these locations. Programs were excluded from analysis if >3 months of the rotation schedule across the 4 years could not adequately be categorized with the rotation schedule information.

A total of 115 rotation schedules were obtained, representing 70.1% of all ACGME-accredited orthopaedic surgery residency programs. Forty-eight (42%) schedules were obtained from program coordinators, 53 (46%) were obtained from the program website, and 14 (12%) were obtained from program faculty or residents. Of the 115 programs, 9 programs were excluded because of the inability to accurately categorize >3 months of time in their rotation schedules. Therefore, a total of 106 rotation schedules (65.4% of accredited programs) were included in the analysis. Of the 106 included programs, 15 (14.2%) had between 1 and 3 months of time in their rotation schedules across the 4 years that were unable to be adequately categorized.

The total percent of time spent on subspecialty rotations (including hand, pediatrics, arthroplasty, sport, foot and ankle, spine, and oncology) was then compared for the following program-specific variables: program size and presence of orthopaedic subspecialty fellowships at the program's institution.

Programs were divided into three groups based on size: group 1, 1 to 3 residents/yr; group 2, 4 to 5 residents/yr; and group 3, ≥ 6 residents/yr based on the interquartile range. A Kruskal–Wallis test was performed to compare the percentage of residency spent on subspecialty rotations between the three groups. A Mann–Whitney *U* test was performed to compare the percentage of residency spent on subspecialty rotations in programs with orthopaedic subspecialty fellowships at their institution with programs without any subspecialty fellowships.

Results

Subspecialty Rotation Exposure

The average percentage of residency and the number of months spent on each rotation are presented in Figures 2 and 3. The greatest percentage of residency spent was in the following categories: trauma (16.6%; mean 8.0 months), general orthopaedics (13.7%, mean 6.6 months); and pediatrics (12.5%, mean 6.0 months). Rotations with the highest variation between programs included the following: general orthopaedics (SD 5.8 months; range 0 to 30 months), sport (SD 2.5 months, range 0 to 15 months), and arthroplasty (SD 2.3 months, range 0 to 11.8 months). Sixty-seven programs (63.2%) had dedicated blocks for research (mean 1.65 months, range 0 to 6.25 months), and 25 programs (23.6%) had dedicated blocks for electives (mean 0.60 months, range 0 to 5 months).

Relationship Between Subspecialty Rotation Exposure and Program-specific Factors

Of the 106 programs, 45.3% ($n = 48$) had 4 to 5 residents/yr, 30.1% ($n = 32$) had ≥ 6 residents/yr, and 24.5%

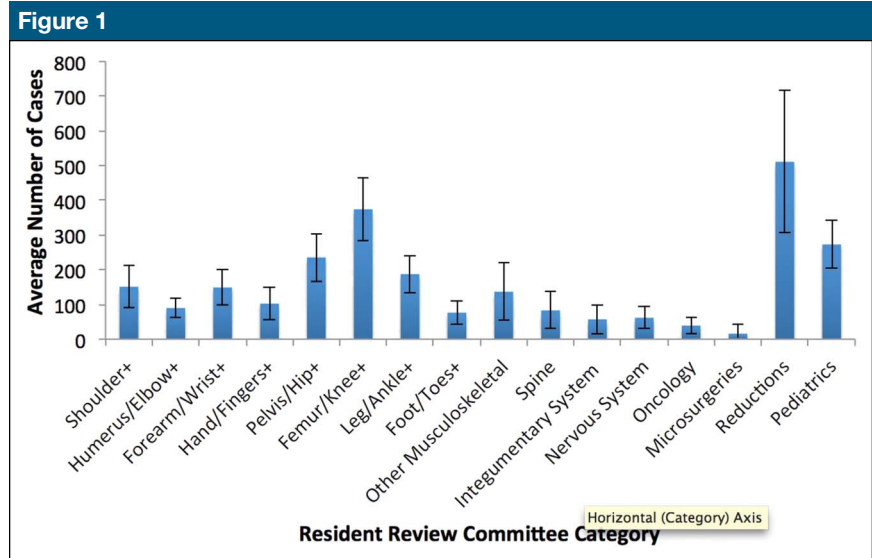


Chart showing national resident case log volumes for 2018 as published by the ACGME. This figure represents data published by the ACGME, detailing the national resident average number of cases performed per residency review committee designated area. ACGME = Accreditation Council for Graduate Medical Education. + Area further subcategorized by the following procedures: Incision, Excision, Intro or Removal, Repair/Revision/Reconstruction, Fracture and/or dislocation, Manipulation, Arthrodesis, Amputation, Arthroscopy, Other procedures.

($n = 26$) had 1 to 3 residents/yr (Figure 4). There were no significant differences in the percentage of residency spent on subspecialty rotations based on program size (1 to 3 residents, mean 62.3%; 4 to 5 residents, mean 63.9%; and ≥ 6 residents, mean 62.9%; $P = 0.80$). Programs with subspecialty fellowships at their institution spent an average percentage of time on subspecialty rotations of 63.9% compared with programs without subspecialty fellowships in which 61.4% of time was spent on subspecialty rotations. This difference was not statistically significant ($P = 0.77$).

Discussion

The purpose of this study was to summarize the current subspecialty rotation exposure between ACGME-accredited orthopaedic surgery programs. We found that residents on average spent the most time on trauma rotations, followed by general orthopaedics and pediatrics.

Subspecialty rotation exposure among programs was highly variably; as such, we found no notable correlations between subspecialty rotation exposure and program size or presence of fellowship training at the corresponding institution. Our study also demonstrated that most programs have dedicated time for research (63.2%) and about a quarter of the programs offer residents dedicated elective time.

Our finding that 63.2% of programs offer dedicated research time is consistent with that of Williams et al.,⁸ who reported that 69.6% of ACGME-accredited orthopaedic programs offer residents protected research time. This percentage is likely higher than ours because Williams et al.⁸ included programs with longitudinal research time across the 5 years, which was not represented on the block rotation schedules that we analyzed. Previous literature has not characterized how common it is among orthopaedic programs to offer elective time for residents. In the landscape of increasing

Table 1**ACGME and ABOS Requirements for Curriculum Organization in Orthopaedic Surgery Residency Programs: Postgraduate Years 2 to 5**

ACGME	ABOS
At least 36 months of rotations on orthopaedic services	At least 12 months of adult orthopaedics
Final 24 months of education must be obtained in a single program	At least 12 months of fractures/trauma
Each resident's experience must include the diagnosis and management of adult and pediatric orthopaedic disorders including ^a : <ul style="list-style-type: none"> • Joint reconstruction • Trauma • Surgery of the spine • Hand surgery • Foot surgery • Athletic injuries • Orthopaedic rehabilitation • Orthopaedic oncology • Amputations and postamputation care 	At least 6 months of children's orthopaedics
Each resident must have at least one half day per week and should have two half days per week of outpatient clinical experience in physician offices or hospital clinics	At least 6 months of basic and/or clinical specialties

ABOS = American Board of Orthopaedic Surgery, ACGME = Accreditation Council for Graduate Medical Education

^a Does not specify amount of time that should be spent on each category

competition for orthopaedic fellowships and specialization by practicing orthopaedic surgeons, these trends may increase moving forward.

Dedicated research and elective time provide residents with more autonomy and may help to position them more favorably for fellowship applications. Increased autonomy is also known to increase motivation, which may increase general resident experience and well-being. Protected research time has been associated with an increased number of publications in residency,⁸ and electives offer residents an opportunity to gain additional experience in research or their subspecialty interests. Our study showed that both research and elective rotations are variable between programs. Program administrators may take these data in to consideration because they modify and enhance their curricula.

This study has several limitations. Our findings are only as strong as was our ability to accurately categorize each rotation listed on the rotation schedule. Several programs' rotation schedules categorized rotations by hospital name instead of the nature of the clinical experience. As a result, we excluded programs in which we were unable to adequately categorize over 3 months of time in the rotation schedule over the course of the 4 years examined. However, for included programs where between 1 and 3 months of time was unable to be categorized, it is possible that the time spent on subspecialty rotations was underestimated, unaccounted for, or inappropriately represented. Another limitation was the heterogeneity in means by which rotation schedules were obtained and reported and the fact that program

curriculum may change from year to year. Although sources such as websites may not reflect the most current program practices, a recent study showed that orthopaedic surgery residency program websites have markedly increased in comprehensiveness over the past 10 years.⁹

We also acknowledge some limitations in appropriate categorization of trauma. Although the ABOS requires a minimum of 12 months, our study found an average of 8 months across programs. This discrepancy may be linked to the fact that trauma is incorporated into many general orthopaedics rotations and as such, residents are exposed to additional trauma on these rotations. The sum of the average number of months spent on general orthopaedics and trauma in our study equals 14.4 (closer

to the 12-month ABOS requirement), suggesting that a large overlap exists between general orthopaedics and trauma. Because of this overlap, we decided to exclude the time spent on trauma from the total time spent on subspecialty services in our analyses examining the association between subspecialty rotation exposure and program size/fellowship availability. In support of these methodological decisions, our data closely parallel the ABOS requirement for months spent on pediatric orthopaedics (6.0 months), and this subspecialty rotation also had less variation between programs. This consistency indicates two important points. First, this suggests generalizability of accuracy in our ability to categorize the other subspecialty services, and second, less variation exists in the categories in which the ABOS provides guidelines.

It is important to underscore that the time spent on subspecialty rotations does not equate with resident surgical or educational experience on the rotation. The aim of this study was to provide summative information regarding the amount of time residents are being exposed to different subspecialty rotations between programs where these data are not publicly available from the ACGME. Our study found a relatively smaller variation in exposure to pediatric orthopaedic surgery, likely because that it is the only subspecialty in our analysis for which the ACGME provides guidance to programs regarding resident exposure. To better understand the educational impact of subspecialty rotation exposure, it would be important to study how the amount of time spent on a rotation correlates with the number and type of surgical cases residents performed or performance on standardized tests of knowledge. Unfortunately, although the ACGME provides national average case log data, program-specific information is not publicly available and

Figure 2

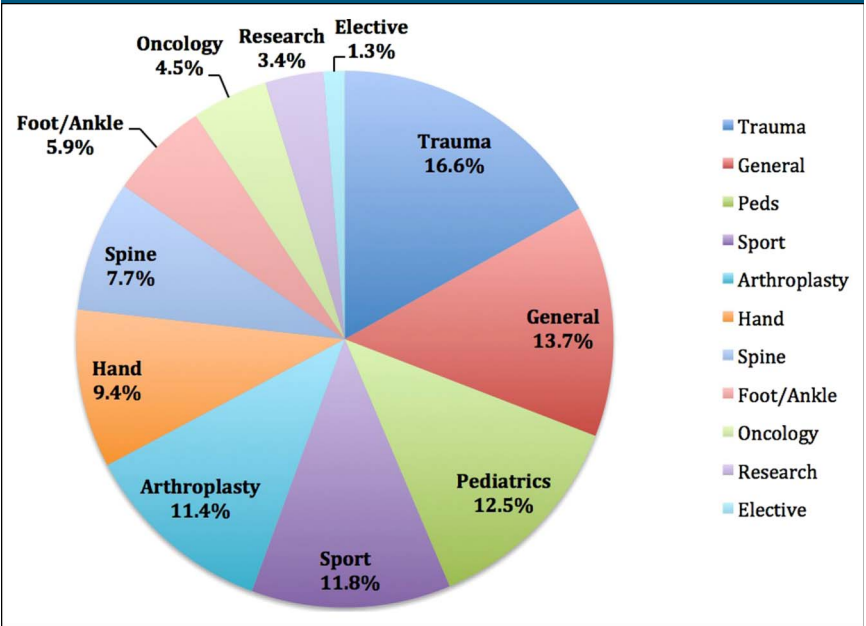


Chart showing the average percentage of time in residency spent on each rotation in ACGME-accredited programs. This figure represents the average percentage of time spent on each rotation in ACGME-accredited orthopaedic programs. The greatest percentage of time is spent on trauma, followed by general orthopaedics and pediatrics. ACGME = Accreditation Council for Graduate Medical Education.

Figure 3

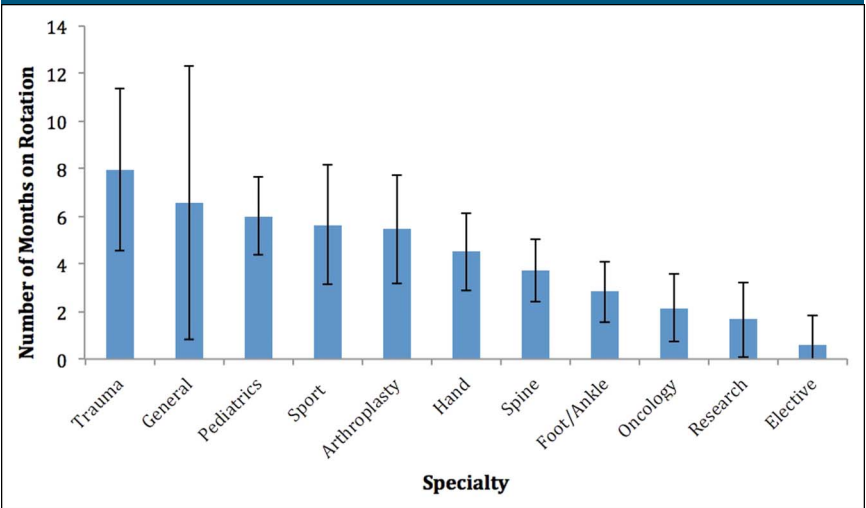


Chart showing the average number of months on each rotation in ACGME-accredited programs. This figure represents the average number of months spent on each rotation in ACGME-accredited orthopaedic programs. The greatest number of months is spent on trauma, followed by general orthopaedics and pediatrics. The error bars represent SD; rotations with the largest variation include general orthopaedics, sport, and arthroplasty. ACGME = Accreditation Council for Graduate Medical Education.

Figure 4

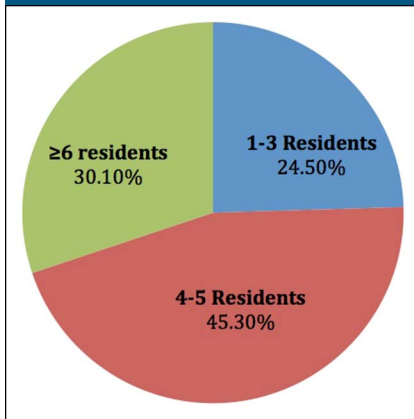


Chart showing the size distribution of ACGME-accredited orthopaedic surgery residency programs. This figure represents the distribution of program sizes across accredited orthopaedic residency programs. Programs with 4 to 5 residents make up 45.3% of total programs, programs with ≥ 6 residents make up 30.1%, and programs with 1 to 3 residents make up 24.5%. ACGME = Accreditation Council for Graduate Medical Education.

was therefore not feasible in the present study of 115 residency programs. Furthermore, as demonstrated in Figure 1, ACGME's representation of the case log data does not allow one to understand where the case exposure is coming from for the different rotations.

Finally, there are likely many more factors contributing to the current variation in subspecialty exposure between programs than

those measurable in this study, including the specific hospital and patient care environment, teaching faculty, and the available volume and diversity of clinical opportunities between programs.

Conclusion

Our study found a high variability in the subspecialty rotation exposure among ACGME-accredited orthopaedic surgery residency programs. Additional research should be conducted to investigate the impact of this variation on resident experience, competency, and satisfaction. It is important for graduate medical education leadership to understand and appreciate this variation as they consider alternative training structures. Program directors receive data from the ACGME, detailing how their program case volumes compare with national averages. The ACGME does not currently provide summative national program data regarding rotation structure. In combination with available case log data, program directors can use the information presented in this study to compare their rotation structure with other ACGME-accredited programs to inform changes to their curriculum. Furthermore, applicants to orthopaedic surgery residencies may also benefit from knowledge of this variability as they compare programs.

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