Research Article

Trends in the Orthopaedic Surgery Fellowship Match 2013 to 2017

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Abstract

Introduction: This study describes trends in the postgraduate orthopaedic surgery fellowship match from 2013 to 2017.

Methods: We determined the numbers of applicants and positions in Adult Reconstruction/Oncology, Foot and Ankle, Pediatrics, Shoulder and Elbow, Spine, Sports Medicine, and Trauma. We also defined the odds of matching in each subspecialty. We determined the applicant’s odds of matching in their first or second choice by year and specialty. We also determined the number of applications made by applicants in each subspecialty. Data were obtained from the San Francisco Match.

Results: In 2017, Adult Reconstruction/Oncology was the most selective, with a 68% match rate in 2017, whereas Pediatric Orthopaedic Surgery had a 93% chance of matching. The odds of matching in one’s first (14% to 41%) or second (8% to 16%) choice was low in the study period. The average range of applications made by applicants varied from 18 to 28 applications, depending on year and specialty. Sports applicants made significantly more mean number of applications than all specialties (range 1.5 to 9.8 applications; \( P < 7.59 \times 10^{-7} \) to 0.011).

Discussion: The numbers of positions and odds of matching in postgraduate orthopaedic surgery fellowships are variable by year and subspecialty. Applicants need to consider their entire match list carefully due to low odds of matching in their first or second choice. These trends are valuable to applicants and training programs when selecting the numbers of applications and interviews for a successful match.

Postgraduate fellowships in orthopaedic surgery have become important to trainees seeking advanced subspecialty training after residency. However, a paucity of data exists on overall numbers of applicants and match rates in each subspecialty. Therefore, fellowship programs and applicants have little information to guide their choices with regard to number of applications, interviews, or rank lists.

Fellowship training in orthopaedic surgery is a topic of interest. Several articles, regarding the current fellowship match process have been published in recent years. Before the advent of an organized fellowship match process, the system was broken, with exploding match offers and
residents being forced to make decisions earlier in their training without adequate exposure to all subspecialties. An organized match process allows for a more equitable process for applicants and programs alike.

The additional year of training for residents comes with a significant time commitment and financial burden to the applicant. Orthopaedic surgery has the highest rate of subspecialty training of all surgical subspecialties.\(^1\) In addition, the American Academy of Orthopaedic Surgeons (AAOS) Orthopaedic Practice Survey in 2016 indicated that most orthopaedic surgeons in the United States are specialists (58%), with 73% of those younger than 40 years who responded to the survey indicating that they are specialists.\(^2\) The trend in specialization has been consistently increasing with each survey. Over the past several years, interest in each specialty has waxed and waned. This trend may be dependent on multiple factors, including perception for specialty saturation in the job market. However, in most subspecialty matches, consistently there are more applicants than positions.

With most orthopaedic residents pursuing fellowships, accurate data on matching must be available for the applicants. From 2010 to 2016, all specialties but Hand and Shoulder and Elbow participated in the San Francisco (SF) Match, so accurate data were available from the SF Match. For the 2017 Match, Shoulder and Elbow joined the SF Match. Previously, the American Shoulder and Elbow Surgeons administered its own fellowship match process. The Board of Specialty Societies Match Committee has compiled match data annually since 2010 on many data points, including number of applicants, programs, applicants submitting rank lists, and applicants who matched in the surgical specialties. This information is not widely available. Therefore, training programs and trainees have little information to guide their choices with regard to number of applications, interviews, or rank lists.

### Objectives

The purpose of this study was to describe trends in postgraduate orthopaedic surgery fellowship applications and match rates in the United States over a 5-year period. Specifically, we sought to quantify the numbers of applicants in each subspecialty and the numbers of positions in each specialty during the study period. We also sought to define the odds of matching successfully in Adult Reconstruction/Oncology, Foot and Ankle, Pediatrics, Shoulder and Elbow, Spine, Sports Medicine, and Trauma. Furthermore, we sought to determine the odds of an applicant matching in their first or second choice by specialty during the study period. Finally, we determined the number of applications made by applicants in each subspecialty.

### Methods

Fellowship match data were gathered from each of the specialty societies participating in the SF Match. The SF Match has been involved in the postgraduate match for both residency positions and fellowships since 1977. They reside within the American Academy of Ophthalmology. The program handles the match for three residency disciplines and 19 fellowship programs. Seven orthopaedic fellowship disciplines currently use this service. For data collection purposes, the Orthopaedic Oncology Match is run with the Adult Reconstruction Match because of the small size of the Oncology Match (ie, 14 programs, 21 positions in 2017 match). The SF Match runs the fellowship match process for Orthopaedic Surgery Specialties apart from Hand. The hand surgery match is run through the National Resident Matching Program, and we were unable to obtain the data needed for this study. Data for Shoulder and Elbow were obtained from the American Shoulder and Elbow Surgeons data for 2013 to 2016 and from the SF Match for 2017.

The AAOS Healthcare Statistics and Surveys Research Unit staff analyzed the data and calculated the odds of matching within each specialty for first choice, second choice, and overall. Data from the past 5 years were reviewed (2013 to 2017). Total numbers of applicants who applied and matched and match rates were calculated for Adult Reconstruction/Oncology, Foot and Ankle, Pediatrics, Shoulder and Elbow, Spine, Sports Medicine, and Trauma. Analysis of variance was used to determine the differences between the numbers of applications made by applicants in each subspecialty match.

Data points used include number of positions available in each specialty, number of positions filled, number of applicants, number of applicants matched, number of applicants who matched to their first choice, number of applicants who matched to their second choice, and overall number of applicants. Additional data were obtained from the SF Match for 2017.
second choice, number of applicants who did not match, mean number of programs applied, and number of applicants who withdrew for each specialty. The number applied and matched was broken down to non-IMG (international medical graduate) applicants when possible. If there were inconsistencies, AAOS staff attempted to trace individual information if it could be found from the SF Match.

Results

The number of non-IMG applicants in each subspecialty varied as follows during the study period: Adult Reconstruction/Oncology 204 to 268, Foot and Ankle 62 to 105, Pediatrics 75 to 104, Shoulder and Elbow 36 to 63, Spine 117 to 151, Sports 202 to 258, and Trauma 94 to 134 (Tables 1–7 [SDC 1: http://links.lww.com/JG9/A35; SDC 2: http://links.lww.com/JG9/A36; SDC 3: http://links.lww.com/JG9/A37; SDC 4: http://links.lww.com/JG9/A38; SDC 5: http://links.lww.com/JG9/A39; SDC 6: http://links.lww.com/JG9/A40; SDC 7: http://links.lww.com/JG9/A41; Figures 1–7). The numbers of positions increased generally from 2013 to 2017 as follows: Adult Reconstruction/Oncology 137 to 176, Foot and Ankle 66 to 75, Pediatrics 66 to 75, Shoulder and Elbow 41 to 44, Spine 100 to 124, Sports 222 to 230, and Trauma 76 to 84 (Tables 1–7; Figures 1–7). Please see Tables 1–10 in online appendix (SDC 1: http://links.lww.com/JG9/A35; SDC 2: http://links.lww.com/JG9/A36; SDC 3: http://links.lww.com/JG9/A37; SDC 4: http://links.lww.com/JG9/A38; SDC 5: http://links.lww.com/JG9/A39; SDC 6: http://links.lww.com/JG9/A40; SDC 7: http://links.lww.com/JG9/A41; Figures 1–7). The number of non-IMG applicants in each subspecialty varied as follows during the study period: Adult Reconstruction/Oncology 204 to 268, Foot and Ankle 62 to 105, Pediatrics 75 to 104, Shoulder and Elbow 36 to 63, Spine 117 to 151, Sports 202 to 258, and Trauma 94 to 134 (Tables 1–7 [SDC 1: http://links.lww.com/JG9/A35; SDC 2: http://links.lww.com/JG9/A36; SDC 3: http://links.lww.com/JG9/A37; SDC 4: http://links.lww.com/JG9/A38; SDC 5: http://links.lww.com/JG9/A39; SDC 6: http://links.lww.com/JG9/A40; SDC 7: http://links.lww.com/JG9/A41; Figures 1–7). The numbers of positions increased generally from 2013 to 2017 as follows: Adult Reconstruction/Oncology 137 to 176, Foot and Ankle 66 to 75, Pediatrics 66 to 75, Shoulder and Elbow 41 to 44, Spine 100 to 124, Sports 222 to 230, and Trauma 76 to 84 (Tables 1–7; Figures 1–7). Please see Tables 1–10 in online appendix (SDC 1: http://links.lww.com/JG9/A35; SDC 2: http://links.lww.com/JG9/A36; SDC 3: http://links.lww.com/JG9/A37; SDC 4: http://links.lww.com/JG9/A38; SDC 5: http://links.lww.com/JG9/A39; SDC 6: http://links.lww.com/JG9/A40; SDC 7: http://links.lww.com/JG9/A41; Figures 1–7).

The odds of matching were highly variable per year and subspecialty ranging from a low of 0.64 for pediatric orthopaedics in 2015 to a high of 1.26 for foot and ankle surgery in 2016. In the most recent year (2017), the odds of matching ranged from a low of 0.68 in Adult Reconstruction/Oncology to a high of 0.93 for pediatric orthopaedic surgery. See Table 8 (http://links.lww.com/JG9/A42) and Figure 8 for a summary of the odds of matching for each subspecialty and year 2013 to 2017.

The odds of an applicant matching in their first choice varied from a low of 0.08 (Trauma 2013) to a high of 0.5 (Sports 2014). See Table 9 (http://links.lww.com/JG9/A43) and Figure 9 for a summary on the odds of matching at one’s first choice during the study period.

The odds of an applicant matching in their second choice was also variable
with a range of 0.02 (Shoulder and Elbow 2014) to 0.21 (Foot and Ankle 2015 to 2016, Spine 2016). These data include IMG applicants. See Table 10 (http://links.lww.com/JG9/A44) and Figure 10 for a summary on the odds of marching at one’s second choice 2013 to 2017.

The raw number of applications made by applicants ranged from 17 (Foot and Ankle, Pediatrics 2013) to 30 (Sports 2016). The mean number of applications ranged from 18.6 (Pediatrics) to 28.4 (Sports) (Table 10, http://links.lww.com/JG9/A44). Analysis of variance indicates that a difference is found between the subspecialties in terms of number of applications made by applicants. Applicants in Adult Reconstruction/Oncology made significantly more applications than pediatric orthopaedics (mean, +4.8 applications; P < 0.016) and less applications than Sports (mean, −5 applications; P < 0.011). Applicants in Foot and Ankle made significantly fewer applications than Sports (mean, −7.2 applications; P < 1.35 × 10^{-4}). Applicants in Pediatric Orthopaedics made significantly fewer applicants than Adult Reconstruction/Oncology (mean, −4.8 applications; P < 0.016), Spine (mean, −4.4 applications; P < 0.033), and Sports (mean, −9.8 applications; P < 7.59 × 10^{-7}). Applicants in Shoulder and Elbow made significantly fewer applications than Sports (mean, −7.8 applications; P < 3.97 × 10^{-5}). Spine applicants made significantly greater applications than Pediatric Orthopaedics (mean, + 4.4 applications; P < 0.033) and fewer than Sports (mean, −5.4 applications; P < 0.005). Sports applicants made significantly more mean number of applications than all specialties (range, +5 to 9.8 applications; P < 7.59 × 10^{-7} to 0.011). Trauma applicants made significantly fewer applications than Sports (mean, −8.2 applications; P < 1.77 × 10^{-5}).

Discussion

Despite the large numbers of orthopaedic residents applying for postgraduate fellowships, inadequate information is available on the overall process. For example, 86% of websites are accessible from Google and the Fellowship and Residency Electronic Interactive Database with respect to the orthopaedic trauma fellowship match alone. However, accessible websites feature only 40% of fellowship application content.3 Similarly, orthopaedic surgery residency websites also lack consistency and information for residency applicants.4 Applicants and training

Figure 3

Graph showing the trends of all applicants, positions, non-IMG applicants, and non-IMG matched in pediatric orthopaedics.

Figure 4

Graph showing the trends of all applicants, positions, non-IMG applicants, and non-IMG matched in the shoulder and elbow.
programs who are trying to gauge the competitiveness of their application will still benefit from this information on the numbers of available positions and number of applicants in each orthopaedic subspecialty. The impact of the current fellowship match process in orthopaedic surgery is notable both in terms of expense and numbers of interviews undertaken by applicants and programs. According to a survey-based investigation, applicants completed 19 applications, received 14 offers, and attended 11 interviews. The impact on the applicants and programs included missing 11 days of training and spending $5,875 on travel. Similar concerns about the burden of a large quantity of interviews have been identified in general surgery where time away from training is usually covered by other residents. Again, most general surgery residents spent more than $4,000 on the interview process. Similarly, program directors rated fellowship burden as an average of 6.7 on a 1-to-10 scale of disruption, with 10 being a significant disruption. When asked, most general surgery residents favored the concept of a change in the interview process. These potential areas for improvement include coordinated interviews and improved content on program websites. In an effort to reduce the burdens of time and cost associated with the match, one program implemented a videoconference interview. However, they had mixed results from their initial experience, with 30% of applicants expressing that the format was not good for this type of interview. The main concern for programs and applicants alike is that no consensus exists on an appropriate number of applications, interviews, or time away from training related to the match.

To the best of our knowledge, this is the most complete summary of the postgraduate orthopaedic surgery match with respect to applicants, programs, and success rates in matching. Our results are different from those of previously reported articles on the Orthopaedic Fellowship Match because they included data on IMG and non-IMG applicants. We wanted to provide information to applicants and programs alike regarding the fellowship match for non-IMG applicants. Although beyond the scope of this investigation, future work may be helpful with respect to match rates and preferred specialties of IMG versus non-IMG applicants.

Previous work on the Orthopaedic Fellowship Match process covered 2010 to 2013 and corresponded the
postgraduate match in its early years. The information provided from our study demonstrates that a general trend existed toward both more applicants and positions in the postgraduate orthopaedic surgery match. However, the odds of matching in one’s first or second choice are low. We were surprised to find that the odds of an applicant matching in his or her first choice over this 5-year study ranged from 8% to 50%, depending on year and subspecialty. Similarly, the odds of matching in one’s second choice ranged from 2% to 21%. These daunting numbers may reinforce the perception among trainees and programs that they need to partake in a large number of interviews to be successful in the fellowship match. Clearly, residents want to maximize their odds of matching higher on their match lists. However, selectivity is variable. For some programs, all applicants are offered an interview. For more competitive programs, the process may be more selective. This study provides insight into the odds of success by providing the odds of matching in a first or second choice. Moreover, raw numbers with the available spots versus applicants over time are now available for the past 5 years. These numbers suggest that applicants need to consider their entire match list carefully because matching at the top of their lists is challenging.

The limitations of this study stem from the inability of these trends to predict future selectivity in each subspecialty match. In other words, these data suggest that the match rates in a number of fields such as Trauma, Foot and Ankle, Adult Reconstruction/Oncology, and Spine all trended down by 2017. However, there is no clear subspecialty that is the most or least competitive. Therefore, the available data do not support firm recommendations to residency training programs or applicants on how many interviews are appropriate to undertake in each specialty. Hand surgery and orthopaedic oncology are special cases with respect to the fellowship match. The hand surgery match is conducted through the National Resident Matching Program, so we were unable to report or compare the odds of success compared with the seven subspecialties administrated by the SF Match. In a similar manner, oncology is grouped with adult reconstruction; however, 1.5% of practicing orthopaedic surgeons specialize in oncology, whereas 11.5% specialize in the area of “total joint.”

Although this overall subspecialty match seemed to be competitive, a dearth of information is available on
orthopaedic oncology applicants who are diluted within the adult reconstruction match. Additional research on the orthopaedic oncology workforce and fellowships is needed.

Predicting social and economic needs for subspecialists in orthopaedic surgery is difficult. In some fields, such as adult reconstruction, the trend toward increased demand is clear. A shortage of surgeons has been predicted for years with predictions for massive increases in primary hip, primary knee, and revision arthroplasty cases by 2030.9,10 A corresponding selectivity reflected in large numbers of applicants, lower odds of matching, and low odds of an applicant matching in their first or second choice. Adult Reconstruction/Oncology match rates in this study reflect a competitive match process with a downward trend toward a 68% match rate in 2017. On the other hand, a bias toward market saturation may in part explain how the pediatric orthopaedic surgery fellowship match has trended in recent years. Applicants should be aware that the pediatric orthopaedic surgeon workforce also expects robust demands evidenced by a 155% increase in the Pediatric Orthopaedic Society of North America membership from 1993 to 2014.11 However, pediatric orthopaedic surgeons represent only 5.8% of the workforce, which may be associated with regional concentrations and shortages of practitioners.2

With varying trends in the odds of matching at their first or second choice, applicants need to consider that fellowship directors ranked the following criteria in selecting an applicant for an interview: (1) a letter of recommendation from the subspecialty faculty (1.38 points), (2) the quality of the residency program (2.02 points), and (3) a letter of recommendation from the residency program director (2.12 points). After the interview, the rank order list was most influenced by (1) the letter of recommendation from the subspecialty faculty (1.46 points), (2) the letter of recommendation from the residency program director (2.16 points), and (3) that the applicant expressed interest in the program (2.16 points). However, that study was limited by a poor response rate of 46.5%.12 With this information in mind, programs and applicants need to consider their rank lists beyond the first few programs on their rank lists and communicate their interests effectively within the rules of the SF Match. Similarly,
fellowship directors should consider what is the good number of applicants to interview based on previous trends in their subspecialty.

**Conclusion**

The odds of matching in postgraduate orthopaedic surgery fellowships are variable by year and specialty. In 2017, Adult Reconstruction was the most selective, with only 68% match rates in 2017, whereas Pediatric Orthopaedic Surgery had a 93% chance of matching in 2017. These trends are valuable to applicants and training programs because they determine the numbers of applications and interviews for a successful match. Applicants need to consider their entire match list carefully because of the low odds of matching at their first or second choice. The average range of applications made by applicants varied from 18 to 28 applications, depending on year and specialty.

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