



## AOA Critical Issues in Education

# The Fate of Unmatched Orthopaedic Applicants

## Risk Factors and Outcomes

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**Introduction:** Orthopaedic surgery residency has become increasingly competitive for medical school applicants with at least one in five applicants not matching annually. For unmatched applicants, the new application cycle is a perplexing and disconcerting period, where unique decisions must be addressed by the applicant. We aimed to investigate the risk factors and outcomes of unmatched orthopaedic applicants.

**Methods:** This was a retrospective study using a survey-based questionnaire administered electronically to medical students annually from 2016 to 2019 immediately after match day. Applicant responses totaled 934 completed surveys, of which 81 identified themselves as unmatched from the previous year and reapplied for a subsequent cycle. Variables collected through the survey included demographics, United States Medical Licensing Examination scores, Electronic Residency Application Service application characteristics, and interim year pursuits. A univariate analysis was performed with an alpha level of 0.05 denoting statistical significance.

**Results:** Overall, 58.0% of unmatched applicants subsequently matched into an orthopaedic residency. Applicants who pursued a research year or surgical internship after initially not matching had a subsequent match rate of 52.1% and 64.0%, respectively ( $p = 0.46$ ). Of those who matched, 19.1% were Alpha Omega Alpha (AOA) compared with 2.9% in the unmatched group ( $p = 0.04$ ). When stratified by gender, 83.3% of women matched subsequently compared with 50.8% of men ( $p = 0.02$ ). There were no differences in Step 1 scores (242.5 vs. 240.7,  $p = 0.60$ ), Step 2 clinical knowledge (CK) scores (248.3 vs. 244.5,  $p = 0.60$ ), or the number of publications (15.6 vs. 10.9,  $p = 0.25$ ) between applicants who matched or did not match, respectively.

**Discussion:** Our findings demonstrate that most orthopaedic applicants matched during their subsequent attempt. Women and those with AOA status had a significantly higher match rate than their counterparts. There was no difference in outcomes between those who pursued a research year or surgical internship, Step 1 or 2CK scores, or the number of publications. Further study is warranted to properly analyze risk factors for not matching on a subsequent attempt.

**Level of Evidence:** Prognostic Level IV.

**Disclosure:** The **Disclosure of Potential Conflicts of Interest** forms are provided with the online version of the article (<http://links.lww.com/JBJSOA/A177>).

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Obtaining an orthopaedic residency is extremely competitive and is one of the most applied to surgical subspecialties. This has led to increasing competition for an orthopaedic residency position. Thus, as expected, the average United States Medical Licensing Examination (USMLE) Step 1 and 2 scores continue to increase for this cohort, as does the proportion of those achieving Alpha Omega Alpha (AOA) status during their medical school tenure<sup>1</sup>. There is increasingly more preparation that must be done by the applicant including research involvement early in medical school and making the decision to apply to more programs in the fear of not matching. In the 2019 National Resident Matching Program (NRMP) Applicant Survey Report, matched applicants had applied for a median number of 84 programs, whereas unmatched applicants had applied to 92 programs and matched applicants attended a median of 13 interviews, whereas unmatched applicants attended 6 interviews<sup>2</sup>. Similarly, successfully matched applicants in 2018 were able to rank 12.5 programs, whereas unmatched applicants ranked 6.6 programs<sup>2</sup>. Hence, the “magic number” of interviews yearly is approximately 13 to have a greater than 90% chance of matching. However, this must be viewed in light of the fact that more attractive candidates are often offered more opportunities to interview. In 2018, matched applicants had higher Step 1 scores (248 vs. 240 points), Step 2 scores (255 vs. 246 points), more research projects (11.5 vs. 6.7 projects), and were more likely to have AOA status (40.4% vs. 15.9%)<sup>2</sup>.

However, because the number of orthopaedic applicants increases yearly, there is a disproportionately lagging increase in the number of residency positions available. In the past 3 years of the NRMP, there were 987 total applicants for 742 allopathic orthopaedic residency positions in 2018 compared with 1,037 applicants for 755 positions in 2019. With the recent allopathic-osteopathic merger, the most recent data from the NRMP for 2020 demonstrate 1,192 total applicants for 849 spots. This has led to approximately 25% to 30% of orthopaedic applicants not matching yearly with usually no unfilled positions in orthopaedic residency programs. Furthermore, these are mostly US graduates. The total number of US orthopaedic applicants in 2018 were 839, which represents 85% of all orthopaedic applicants; 149 of these applicants did not match, leading to an unmatched rate of 18%, which is the lowest match rate among all surgical specialties<sup>2</sup>.

Multiple studies exist regarding factors important for orthopaedic resident selection and subsequent performance for first-time applicants<sup>3-5</sup>. However, for these unmatched applicants who are reapplying, the new application cycle is a perplexing and disconcerting period, where unusual decisions and tailored strategies must be constructed by the applicant. Were there weaknesses or flaws in the application that could be addressed to improve their chance at matching next year? How persistent or passionate are these applicants about orthopaedic surgery that they are willing to wait an entire year to reapply for the orthopaedic residency match? Can these

individuals realistically “give up” another year and accrue more loans in the interim? Should they settle for another career option in the postmatch scramble known as the Supplemental Offer and Acceptance Program? What should they do in the interim year before reapplying, if they choose to reapply? Although many of these questions are personal and specific to each individual applicant, for those who want to pursue orthopaedic surgery residency, there is currently sparse literature on how they will fare as unmatched applicants reapplying for the match.

A study by Amin et al.<sup>6</sup> is the first study that addressed the unmatched applicant and consisted of orthopaedic program director responses indicating that most programs recommend an unmatched applicant do a surgery internship for 1 year to increase their chances of matching. However, this was based on survey results and not on objective match statistics on this specific population. A study by Rivero et al.<sup>7</sup> attempted to determine more objective answers; however, the authors examined an older period and used third-party websites to obtain their information on applicants because of the retrospective nature of their study.

Thus, the aims of our study were to investigate the risk factors and outcomes of unmatched orthopaedic applicants through anonymous questionnaires immediately after each Match Day annually from 2016 to 2019. Furthermore, we present a discussion regarding measures to prevent an applicant from not matching and next steps for unmatched applicants who are still interested in pursuing a residency in orthopaedic surgery.

## Methods

A retrospective survey-based questionnaire (Appendix 1) was administered to medical students applying into orthopaedic surgery residency in the United States annually from 2016 to 2019 immediately after Match Day. In total, there were 3,194 recipients of the survey; 934 anonymous orthopaedic applicants completed the survey (29.2% response rate), of which 81 of these applicants identified themselves as unmatched from the previous year and had reapplied for the subsequent cycle. The questionnaire was administered anonymously through a secure, web-based electronic survey platform. Thus, the study was blinded to the study personnel regarding applicant name, institution, and certain demographics, including race and location of residence.

Variables collected in the questionnaire included demographics (age, gender, geographic location, domestic versus international medical graduate, and medical school ranking according to U. S. News that year), USMLE scores (Step 1 and Step 2 clinical knowledge [CK] scores), Electronic Residency Application Service (ERAS) application characteristics (AOA status, clerkship scores, the number of residency applications submitted, number of interviews offered, and number of publications as defined by ERAS), interim year pursuits (research year, surgical internship, etc.), and changes made to their application during the subsequent cycle

including new letters of recommendation or personal statements.

Univariate analyses were performed with the use of Student *t*-test for continuous variables and Fisher exact test for categorical variables. All statistical analyses were performed using IBM SPSS version 23.0 statistical software (SPSS). An alpha level of 0.05 was used to determine the statistical significance in all aforementioned instances.

## Results

Overall, 58.0% (47/81) of unmatched applicants subsequently matched into an orthopaedic residency after reapplying the subsequent year. Of the 47 successful reapplicants, 43 matched when they entered the match a second time, 3 matched on their third attempt, and one matched after more than 5 attempts. After not matching, applicants most commonly pursued either a research year or surgical internship, whereas few applicants had other pursuits. Applicants who pursued a research year ( $n = 48$ ) or surgical internship ( $n = 25$ ) after initially not matching had a subsequent match rate of 52.1% (25/48) and 64.0% (16/25), respectively ( $p = 0.46$ , Fig. 1). Furthermore, 29.2% (14/48) of applicants who reapplied were subsequently matched at the institution where they pursued their research year or surgical internship. Applicants were more likely to be interviewed at different programs than their first application because they were only offered on average 1.7 interviews from same programs as their first attempt.

Although unmatched students reapplied to more programs on their subsequent attempt (84.6 first attempt vs. 107.2 second attempt,  $p < 0.001$ ), there was no increase in the number of interviews (8.1 vs. 8.0,  $p = 0.93$ ). Unmatched applicants who subsequently matched had more interviews when reapplying compared with those who did not match

(9.3 vs 6.0,  $p = 0.03$ ). There were 40/81 applicants who were interviewed by their home program; 65% of these applicants (26/40) then subsequently matched into orthopaedic surgery. For the 41 applicants who were not interviewed by their home program, 21 (51.2%) of them subsequently matched into orthopaedic surgery; this was not statistically different from those who were interviewed by their home program ( $p = 0.26$ ).

Of those who subsequently matched, 19.1% (9/47) were AOA compared with 2.9% (1/34) in the unmatched group ( $p = 0.04$ ); thus, applicants with AOA status had a 90.0% match rate (9/10) during their subsequent cycle, which was significantly higher than those without AOA status (38/71 [53.5%],  $p = 0.04$ ). When stratified by sex, 83.3% of women (15/18) subsequently matched compared with 50.8% of men (32/63,  $p = 0.02$ , Fig. 1). There were no differences in Step 1 USMLE scores (242.5 vs. 240.7,  $p = 0.60$ ), Step 2 CK scores (248.3 vs. 244.5,  $p = 0.60$ ), or number of publications (15.6 vs. 10.9,  $p = 0.25$ ) between applicants who subsequently matched or did not match, respectively. However, both groups had an increased number of publications compared with their first application cycle (15.6 vs 6.0 publications for subsequently matched applicants,  $p < 0.01$ ; 10.9 vs 4.8 publications for unmatched applicants,  $p = 0.04$ ).

When reapplying, 96.3% (78/81) of applicants used at least one new letter of recommendation. By the same token, 92.6% (75/81) changed their personal statement when reapplying, 65.4% (53/81) of applicants mentioned “not matching” in their personal statement, and 62.3% (33/53) of these applicants subsequently matched into orthopaedic surgery. 91.4% (74/81) applicants mentioned “not matching” during their interviews and 62.2% (46/74) of these applicants subsequently matched, whereas all applicants who did not mention this during their interviews did not match.

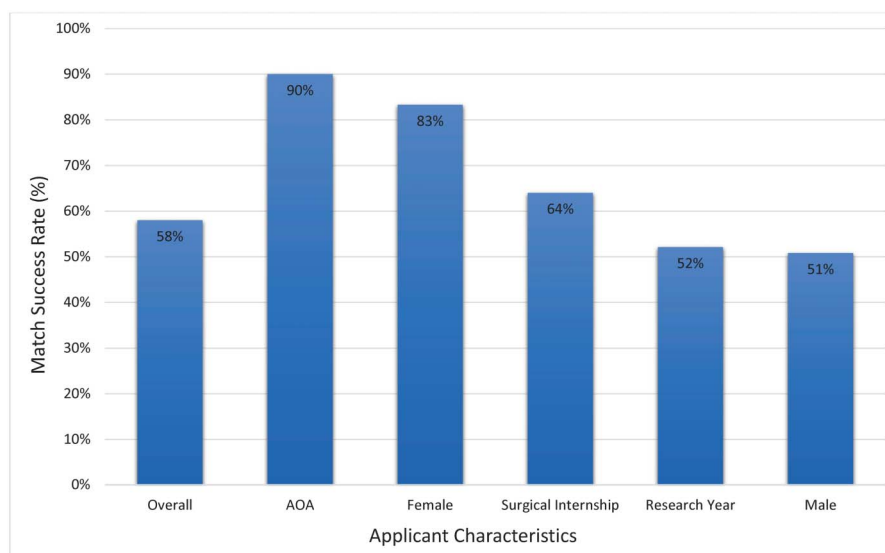


Fig. 1

Subsequent match rates based on specific applicant factors.

## Discussion

This is the first study on the fate of unmatched orthopaedic surgery applicants through applicant-reported responses. The aim of this study was to ultimately provide an objective guide for unmatched applicants as they navigate their paths post-Match Day. We examined applicant factors and their association with the match outcome for each applicant. Overall, although the odds of matching in a subsequent cycle were lower than matching in the initial cycle, there was still greater than 50% chance of matching, which may be more than enough odds for some applicants to pursue a second attempt at matching in orthopaedic surgery.

Most unmatched applicants will either pursue a surgical internship year or a dedicated research year. What may be reassuring from this study is that there was no statistical difference in match outcome rates regardless of either pursuit. Therefore, based off of our results, the applicant should choose a pursuit that they are interested in and aim to excel during that year. Furthermore, based on a recent study on unmatched orthopaedic residency applicants<sup>7</sup>, there was no observed difference in the match success rate between pursuing a research year versus surgical internship. The lack of a statistical difference between both of these pursuits suggests that they are similarly beneficial to the match outcome. Interestingly, our study also showed that nearly 30% of subsequently matched applicants matched at the institution where they pursued their research year or surgical internship. This may demonstrate that familiarity with the applicant and observation of their performance during this interim year plays an important role in achieving a successful match outcome. However, this further raises ethical questions regarding programs interviewing numerous applicants despite planning to highly rank students who have spent a year with them, whether on a clinical service or in research. Because orthopaedic residency continues to be more competitive, this factor can certainly affect future matches and the potential for new rules needed for the match process.

Applicants should plan to apply to more programs on their subsequent attempt because they are more likely to be interviewed at different programs than their first application. Unfortunately, applicant-specific factors that increased the odds of matching were nonmodifiable: AOA status and female sex. Although the reason remains unclear from the data, female sex may have improved an applicant's chances in matching to an orthopaedic surgery residency because this has been a traditionally male-dominated specialty; with increased demands for diversity in programs, this could be one beneficial factor for female applicants. There were no differences in Step 1 or 2 CK scores or research publications between those who subsequently matched and those who did not. Applicant candidness regarding their unmatched status in their personal statement or during interviews interestingly seemed to correlate with a positive match outcome in our results. Perhaps, a discussion regarding their interim year pursuits and how they are a stronger candidate this year reflects strong work ethic and persistence, which is admired in any medical field.

Although our study highlights the outcomes of unmatched applicants, it would be beneficial to discuss measures to prevent an applicant from not matching in the first place, including mentoring and parallel planning. The 2018 NRMP Charting Outcomes presentation states "If you are applying to a competitive specialty (or are less competitive for your chosen specialty) and you want to have a residency position in the event you are unsuccessful in matching to a program in your preferred specialty, also rank your most preferred programs in an alternate specialty"<sup>8</sup>. For an applicant applying for a competitive subspecialty, the following advice is provided: rank all programs in which you would accept a position, include a mix of highly competitive and less competitive programs, and if you want a residency position in the event you are unsuccessful in matching to your preferred specialty, then also rank your most preferred programs in an alternate specialty. Programs cannot see the other specialties applied to, so it may be important to have parallel planning. However, if the applicant is considering this, they may be less likely to match according to the NRMP. In 2018, unmatched applicants applied to 1.3 distinct specialties, whereas matched applicants applied to 1.1 specialties<sup>2</sup>. This may imply that applicants who applied to another specialty while applying into orthopaedics were less likely to match into orthopaedics, and this may be because of weaker applications. If that is the case, the applicant should give long thought to their application process and discuss their application with a trusted mentor.


Before applying for orthopaedic surgery, the applicant should build relationships and connections with people in the field. A mentor who can provide advice throughout the application process can be invaluable and perhaps can even advocate on behalf of the applicant. Equally important is connecting with current senior medical students or junior residents who successfully navigated the application process and can provide valuable and contemporary insight into the application process and residency.

There are several limitations to this study, and our findings should be viewed in light of these. Our results were based on applicant responses to our survey that was distributed online. Therefore, there is some selection bias because every applicant did not respond to the questionnaire. Over a 4-year period, we had only 81 responses from unmatched applicants. The questionnaire was sent online immediately after the Match Day to obtain accurate information; however, this is an emotional time for many of these applicants and may have affected the response rate. However, because we acquired our data through applicant responses and in a timely manner, our data are more likely to be accurate. We attempted to mitigate the small sample size by sending the survey over a 4-year period to acquire as much data as possible. Our data are also based on contemporary outcomes because we included match days from 2016 to 2019. However, because of our small sample size, some of our data may not have been sufficiently powered. For instance, there was a higher proportion of applicants who matched after pursuing a surgical year compared with those who pursued a research year.

Although there was no statistical difference, we may not have been powered to detect a difference. Last, resident selection encompasses factors that are nonquantifiable, and we could not accurately study factors such as letters of recommendation, interview skills, interpersonal relationships, and other similar factors that go into ranking an applicant.

In conclusion, our findings demonstrate that most orthopaedic applicants matched during their subsequent attempt, which involved applying to more programs and increasing their number of publications. Women and those with AOA status had a significantly higher match rate than their counterparts. There was no difference in the outcomes between those who pursued a research year or surgical internship, Step 1 or 2 CK scores, and the number of publications. Applicants are unlikely to be interviewed by the same programs as the first cycle. Further study is needed to properly analyze the risk factors for not matching on a subsequent attempt.

### Appendix

 Supporting material provided by the authors is posted with the online version of this article as a data supplement

at [jbjs.org \(http://links.lww.com/JBJSOA/A178\)](http://links.lww.com/JBJSOA/A178). This content was not copy-edited or verified by JBJS. ■

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