



Advising Students Interested in Ophthalmology: A Summary of the Evidence

Joseph R. Grubbs, Jr., MD, MPH - Ann Arbor, Michigan
Shahzad I. Mian, MD - Ann Arbor, Michigan

Despite an 81% successful match rate among United States senior medical students in 2016 in the ophthalmology match (the San Francisco Match), the average number of programs each applicant applies to increased from 45 to 68 from 2006 through 2016, an increase that likely indicates a perceived increase in the competitiveness of matching into an ophthalmology residency program.^{1,2} This perception is likely at least in part a result of the general increase in competitiveness in the National Resident Matching Program for other specialties.³ This trend has led to an increased financial burden on students and an administrative burden on residency programs. The increase has occurred despite many ophthalmology faculty advising that students apply to far fewer programs and despite the percentage of students successfully matching remaining approximately the same for the past decade.^{1,2} Given this increasing administrative burden on programs and the perception of competitiveness for matching, providing comprehensive and accurate advice to medical students interested in ophthalmology is crucial. However, the advice given to students often is subjective and sometimes even conflicting.² This editorial reviews and summarizes the current literature on factors potentially affecting match outcomes in an effort to provide objective data to assist faculty and residents in advising students pursuing careers in ophthalmology.

What the Data Clearly Show

Medical School Matriculation

A study of 2011 match outcomes showed that United States seniors at allopathic medical schools successfully matched into allopathic ophthalmology residencies at a significantly higher rate than non-United States seniors (83% and 41%, respectively).⁴ In addition, a recent multivariate analysis of factors found to be associated with increased odds of a successful match demonstrated that attending an allopathic medical school versus an osteopathic medical school was associated with a 4-fold increased odds of matching into an allopathic ophthalmology residency.⁵ Having an ophthalmology residency present at one's medical school also was associated with a 1.4-fold increased odds of matching.⁵ Attending a medical school considered to be a top 25 or top 10 medical school by the *U.S. News and World Report* rankings also was associated with 1.4 and 1.6 times increased odds of matching, respectively.⁵ The aforementioned 2011 study showed similar data by demonstrating that attending a top 40 National Institutes of Health-funded medical school was associated with a

2.25-fold increased odds of matching.⁴ Finally, the geographical location of medical schools did not seem to be a predictive factor of matching into a residency.⁵

United States Medical Licensing Examination Board Scores

A 2010 survey of 65 residency selection committee members (RSCMs), 75% of whom were program directors, revealed that more than one quarter of residency programs use a United States Medical Licensing Examination board score cutoff for selecting applicants for interviews and that these committee members consider board scores to be one of the most important selection factors.² Not surprisingly, the average step 1 score among matched applicants has gone up each year from 2006 through 2016.¹ In 2016, the average step 1 score of matched applicants was 244, compared with an average score of 229 for unmatched applicants.¹ Many of these applicants would have taken their step 1 examination in 2014, a year in which the national average step 1 score was 229 (standard deviation, 20), and a score of 243 or higher would be in the top 30%.⁶ Finally, a recent study showed that applicants whose step 1 scores were at least 1 standard deviation more than the mean were more than twice as likely to match as applicants whose step 1 scores were at least 1 standard deviation less than the mean (94% vs. 43%, respectively).⁵

In 2011, nearly half (46%) of applicants did not report their step 2 Clinical Knowledge scores, but there was a correlation coefficient of 0.73 between step 1 and step 2 scores among those who did report them.⁴ Although there are fewer data for step 2 than for step 1 scores, the average step 2 Clinical Knowledge score of United States seniors who matched in 2011 was 246, compared with an average of 230 among unmatched United States seniors ($P < 0.001$).⁴ Thus, United States Medical Licensing Examination board scores, especially step 1 scores, seem to be important factors in residency selection and successful matching.^{4,5}

Clinical Grades

Although there is no reported direct correlation between the odds of matching and clinical grades, the RSCM survey found that 94% of committee members believed that a student's clinical course grades were extremely important in residency selection.² In addition, this study found that clinical course grades were the second most highly weighted applicant characteristic in predicting future resident performance.² Therefore, students at medical

schools with a pass-or-fail grading policy for clinical courses may be at a disadvantage.

Alpha Omega Alpha Selection

There are still more non-Alpha Omega Alpha (AOA) applicants who match into ophthalmology residencies than AOA applicants, but being an AOA member has been associated with a 2.6 to 2.9 increased odds of matching.^{4,5} Specifically, from 2003 through 2008, 93% of applicants who were AOA members matched, as compared with 69% of applicants who were not AOA members.⁵ These data are particularly important because AOA selection occurs in February and March of the third year of medical school and late August and early September of the fourth year.⁷ For the spring selection of AOA members, preclinical grades are a factor as well as fall third-year core rotation grades; for fall selection, third-year grades are a much more substantial factor.⁷ Because many students submit their applications to the San Francisco Match before the fall AOA selection, spring AOA selection becomes more important, which in turn is dependent on achieving good preclinical grades in addition to clinical grades.⁴ Medical schools also may choose to set an earlier fall AOA selection date.

Number (and Importance) of Interviews

In recent analyses of applicants who ranked at least 6 programs, approximately 80% matched, and of those who ranked 11 programs, more than 95% matched.^{4,5} For applicants who ranked more than 11 programs, there was no consistent increase in percentage successfully matching.^{4,5} The RSCM survey found the interview to be the most important factor in selecting future residents, and this same study found that the interview was the most heavily weighted factor in predicting future resident performance.² Therefore, it is essential that career advisors and ophthalmology faculty prepare applicants for the residency interview process.

Where the Data Are Unclear

Research, Publications, and Devoting Elective Time to Research

Although there are no definitive data that dedicated research time, publications in peer-reviewed journals, or both increase a United States medical student's odds of matching, a recent study of international medical graduates showed that research experience and publication in a high-impact journal each individually increased the odds of matching 3-fold.⁸ The RSCM survey found that 64% of committee members thought that 1 year of research before applying for residency could help a borderline candidate match successfully, and 25% of these members thought 1 year of research could help turn a good application into a great one; however, nearly half of those surveyed (41%) thought a candidate should devote 1 year to research only if the candidate was genuinely interested in research or

academics.² Therefore, there may be some potential benefit for medical students who are interested in ophthalmology of performing at least some research before applying for residency to enhance competitiveness.

Away Rotations

Although not specific to ophthalmology, a recent study discovered that more than half of medical students complete at least 1 away rotation.³ The RSCM survey found that 40% of committee members strongly recommended that students perform rotations in ophthalmology away from their own medical school, whereas 47% recommended doing away rotations only under special circumstances such as geographical limitations on matching.² Surveyed respondents from larger programs were even less likely generically to recommend doing away rotations and more likely to recommend doing them only in special circumstances (23% and 62%, respectively).² Despite these mixed recommendations, more than half of the respondents (58%), stated that they were more comfortable ranking an applicant with whom they had interacted on a rotation.² In addition, more than half of the represented institutions (52%) usually interviewed applicants who completed away rotations at their program.² Thus, the data are conflicting regarding away rotations; however, there may be potential benefit to such "audition" electives.²

Letters of Recommendation

The international medical graduate study mentioned above found that having 3 letters of recommendation (LORs) from United States ophthalmologists increased the international applicant's odds of matching by 6-fold as compared with applicants with only 1 LOR from a United States ophthalmologist.⁸ Obviously, the results of this study should be interpreted cautiously for United States medical students because they represent a different portion of the applicant pool than international medical graduates. The RSCM survey also found that 70% of committee members thought that the most important recommendation letters were those written by fellow ophthalmologists—especially if the letter writers were known by some of the committee members.² In addition, 97% of these members encouraged students to obtain at least some of their LORs from ophthalmologists within their own department.² Therefore, although it is unclear how many of an applicant's LORs should be written by ophthalmologists, it is clear that selection committees consider LORs from ophthalmologists important in selecting future residents.²

Where the Data Are Lacking

Despite having learned much in recent years about factors that likely influence an applicant's odds of matching successfully, there are still many areas where the data are unclear. First, more specific data need to be acquired on the value of research, publications, devoting elective time to research, away rotations, and who writes students' LORs. Analyses should be performed on the influence of factors

such as community service, extracurricular activities, dual degrees, involvement in ophthalmology student interest groups, and Gold Humanism Honor Society selection. The Program Director's Council of the Association of University Professors of Ophthalmology is in the process of designing a survey of both students and program directors to assess the influence of several of these factors.

The average number of programs to which students are applying continues to increase, but it is unclear whether qualified applicants need to apply to so many programs.¹ Because more than 95% of applicants who interview at 11+ programs go on to match, it is clear that receiving and being able to attend interviews is the rate-limiting step for matching. Therefore, studies should be designed to analyze the association between the number of interview offers received and factors such as board scores, AOA

status, clinical grades, and attending a highly ranked medical school. These factors all have been associated with improved chances of matching, and if they could be associated clearly with receiving interview offers, more competitive students may be comfortable applying to fewer programs.

In addition, applicants seem to match more frequently into residency programs located in the geographical region of their medical school (58%) than would occur by chance alone.⁵ It is unclear whether this local predilection represents applicants' desires to remain in the same geographical area for residency or that applicants are offered more interviews within the geographical region of their medical school, and thus are more likely to match within that same area.⁵ Attending a top 10 medical school and achieving a higher step 1 score has been associated

Throughout Medical School:

- Seek counseling from career advisors and ophthalmology faculty
- Seek advice from more senior medical students and residents

First Year of Medical School:

- Focus on achieving good preclinical grades
- Pursue extracurricular activities (e.g. charity work, research, hobbies, global work, etc.)
- Join an ophthalmology student interest group

Summer between First and Second Year:

- Pursue research, charity work, and/or global opportunities

Second Year of Medical School:

- Focus on achieving good preclinical grades
- Begin studying for the USMLE® Step 1 exam

Third Year of Medical School:

- Focus on achieving good clinical grades
- Consider asking for recommendation letters from non-ophthalmology physicians as oftentimes physicians with whom a student rotates during his/her third year know the student well and can thus write a strong, personal letter of recommendation
- Begin studying for the USMLE® Step 2 exams
- Meet with an ophthalmology career advisor to discuss fourth year goals and/or taking time off from medical school to pursue other opportunities (e.g. research, another degree, etc.)

One Year Prior to Ophthalmology Match Day*:

- Schedule at least one ophthalmology rotation at home institution
- Consider applying for away rotations with advice from career advisors
- Schedule fourth year rotations to allow time for interviews

March – August Prior to Match Day:

- Complete ophthalmology rotations
- Ask for at least one or two recommendation letters from ophthalmologists
- Begin SF Match application and personal statement
- Submit application by mid-August

September – December Prior to Match Day:

- Submit Electronic Residency Application Service (ERAS®) application
- Schedule at least 6 and preferably at least 11 ophthalmology interviews (Note: having a pre-made calendar with possible interview dates may assist in optimizing an applicant's interview schedule)
- Schedule preliminary year interviews

January of Match Day:

- Organize and submit rank list
- Continue preliminary year interviews
- Celebrate matching and begin planning ERAS® rank list of preliminary year programs

Figure 1. Timeline Advice for Medical Students Pursuing Ophthalmology Residency. *The timeline framework shifts here as the advice from this point forward is more relevant in relation to Ophthalmology Match Day rather than year of medical school, as some applicants will have taken time off from medical school to pursue other opportunities.

with lower odds of matching in the same geographical area as one's medical school—perhaps indicating that the aforementioned geographical predilection does not apply as strongly to more competitive applicants.⁵ Overall, however, the data on geography and matching remain unclear. Therefore, the aforementioned study proposals on factors associated with interview offers also should assess the frequency of interview offers within applicants' current geographical regions as compared with offers outside of their regions. If it could be demonstrated clearly that applicants receive more interview offers from nearby programs, applicants who apply to most programs within their geographical region likely could apply to fewer total programs and receive enough interviews to maximize their odds of matching.

Conclusions

This review of the literature highlights the importance of many factors that are associated with successful matching, including attending a highly ranked medical school, doing well on board examinations, being selected for AOA membership, and earning good clinical grades. In addition, other factors, such as performing research, having ophthalmologists write at least some of an applicant's LORs, and possibly performing away rotations, also may play an important factor in successful matching. Finally, as highlighted above, there are many areas where there are virtually no data in the current literature.

Based on the above data, Figure 1 provides the authors' recommendations on advising medical students (and the timeline for providing this advice). The authors also propose the following suggestions to residency programs in an effort to help applicants assess their own competitiveness and improve the residency selection process:

1. As proposed recently in the *New England Journal of Medicine*, residency programs should post on their web sites clearly the variables they are looking for in applicants.³ Specifically, they should post information such as the average board scores and clinical grades, frequency of AOA membership and dual degrees, and average number of peer-reviewed publications of matched (and interviewed) applicants.
2. Similar to the program summary submitted for accreditation to the Accreditation Council for Graduate Medical Education, programs should post information on annual program changes; participating sites, including educational rationale; faculty and teaching staff, including time spent teaching; evaluation tools; duty hours; training in patient safety; and learning environment.
3. We concur with a recent academic plea that residency programs re-evaluate their emphasis on step 1 scores for selecting residents.⁹ This examination was not designed to be used as a residency screening tool, despite its frequent use as one today.⁹ Residency

programs at least should post any minimum requirements they have for board scores or any other variables so that applicants who do not meet these minimum requirements do not apply needlessly.

4. Instead of such high emphasis on board scores, more emphasis could be placed on LORs, because program directors have found this to correlate more strongly with residency performance.² Given that 80% of RSCM respondents desire a standard LOR template to compare applicants better, we propose that the Association of University Professors of Ophthalmology develop a recommended standard format for LORs as currently used by emergency medicine and plastic surgery.²
5. The San Francisco Match charting of outcomes should provide meaningful information regarding matched and unmatched applicants similar to the National Resident Matching Program, including probability of matching by number of programs ranked; United States Medical Licensing Examination step 1 and 2 scores; number of abstracts, presentations, and publications; number of work and volunteer experiences; AOA membership; and other graduate degrees.¹⁰

This review and these recommendations should assist faculty and residents in advising students attempting to match into ophthalmology residencies. Ultimately, providing more objective advice to students and implementing the suggestions above may decrease students' perceived need to apply to an excessive number of programs while also continuing to ensure successful match rates among qualified applicants.

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Correspondence:

Shahzad I. Mian, MD, Ophthalmology and Visual Sciences, University of Michigan, 1000 Wall Street, Ann Arbor, MI 48105. E-mail: smian@umich.edu.