




Perspectives of U.S. Ophthalmology Residents and Medical Students on Ophthalmology Exposure during Medical School

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Abstract

Introduction In recent decades, ophthalmology exposure in medical school has been increasingly reduced. In turn, medical students have expressed concern over their ophthalmic skills. Research investigating the status of ophthalmology education in U.S. undergraduate medical curricula is limited to institutional data devoid of the student or resident perspective. This study seeks to gain a better understanding of current ophthalmology education for U.S. medical students from the trainee point of view.

Methods A cross-sectional survey was distributed to current U.S. medical students interested in ophthalmology and U.S. ophthalmology residents. Demographic data, ophthalmology curriculum information, respondent learning preferences, and personal reflections were recorded. Thematic analysis and chi-square tests were utilized.

Results In total, 387/4,482 (8.6%) surveys were completed by respondents from 75 U.S. medical institutions. Most respondents were exposed to formal ophthalmology curriculum (63%), research (89%), mentorship (84%), and clinical experiences (87%) during medical school, and medical school curriculum was ranked the third most helpful resource for students to learn about ophthalmology. Yet, 29% of residents ($n = 55$) did not feel confident in their diagnostic ophthalmology skills based on their medical school exposure. Student and resident recommendations for improving ophthalmology education delivery commonly referenced nontraditional ophthalmology resources such as online videos ($n = 83$) to supplement traditional learning materials such as lectures ($n = 56$).

Discussion These findings suggest that primary ophthalmology exposure in medical school has shifted toward extracurricular activities such as research and clinical

Keywords

- ▶ ophthalmology undergraduate medical education
- ▶ ophthalmology exposure
- ▶ student perspectives
- ▶ trainee perspectives

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observation. Considering the increasing time demands placed on the medical education system, utilizing nontraditional educational materials to supplement current undergraduate medical education in ophthalmology may provide educators with a resource to improve learner confidence and resident preparedness.

Attention allotted to ophthalmology in medical school curricula has decreased over recent decades.^{1,2} In fact, some medical schools offer no didactic ophthalmology curriculum,³ and fewer than 20% of medical schools in the United States offer ophthalmology as a mandatory clinical rotation.^{4,5} Recently, a single-center study revealed that 64% of survey respondents did not feel comfortable diagnosing emergent eye conditions.⁶ These statistics reveal a deficiency in current undergraduate ophthalmology medical education.

Previous reports investigating ophthalmology exposure in medical school have focused on the self-reported confidence of medical students—regardless of their specialty interest⁶—and educators,⁷ but none have looked at the opinions of current U.S. ophthalmology residents or students planning to apply to ophthalmology residency. Without this perspective, it is impossible to accurately describe how the dilution of undergraduate ophthalmology medical education impacts student learners.

This study sought to gain a richer understanding of the medical student and resident physician perspective of ophthalmology education during medical school and potential strategies for improvement.

Methods

We distributed our online survey via email to U.S. ophthalmology residents and medical students using email listservs. See ► **Supplementary Appendix A** (available in the online version only) for a copy of our survey questions and ► **Supplementary Appendix B** (available in the online version only). Medical student responses were acquired from the Minority Ophthalmology Mentoring (MOM) program, independent ophthalmology interest groups, and subscribers of *The Lens* (a free online newsletter designed for student learners). Residents were recruited through email addresses provided during their Bascom Palmer Eye Institute residency applications from 2018 to 2022. To avoid overlapping responses in our cohort, a unique identifier was created for each survey response and suspected duplicates were deleted. See ► **Supplementary Appendix C** (available in the online version only) for a flowchart describing our process.

Current U.S. medical students with self-reported interest in ophthalmology and U.S. ophthalmology residents were included in our analysis. Demographic data, ophthalmology curriculum information, Likert-style questions regarding clinical skills, and personal reflections were recorded.

This study was approved by the University of Miami Institutional Review Board, adhered to the tenets of the Declaration of Helsinki, and was performed in accordance

with the Health Insurance Portability and Accountability Act of 1996. Pearson chi-square tests for independence were used for group comparisons. All quantitative statistics were conducted using GraphPad Prism (GraphPad Software, La Jolla, CA; www.graphpad.com). All statistical tests were two-sided, and a p -value < 0.05 was considered statistically significant. Thematic analysis was conducted for the two free response questions using previously published methods,⁸ and major themes and subthemes were identified. Responses that did not fit into the thematic framework were categorized as “miscellaneous,” and responses lacking suggestions or preferences were categorized as “no response.” Some responses fit into more than one theme and were categorized and counted in multiple themes.

Results

Respondent Demographics

Overall, 387/4,482 (8.6%) surveys were completed. Of the 387 survey respondents, 332 (85%) were medical students with a self-proclaimed interest in ophthalmology and 55 (14%) were current ophthalmology residents. The median age of all respondents was 27.0 years (range: 20–51). Most participants in our study identified as Native American or Native Hawaiian/Pacific Islander (35%) or White (34%). Geographic location of medical school was composed of 94 (24%) respondents from the Northeast, 88 (23%) from the Midwest, 141 (36%) from the South, and 64 (16%) from the West. See ► **Table 1** for a summary of respondent demographics. In total, 75 U.S. medical institutions across 34 states, Puerto Rico, and the District of Columbia were represented by survey respondents.

Ophthalmology Curriculum and Resources

Most survey respondents received a formal preclinical ophthalmology curriculum (63%) during medical school, while 45% were offered a core ophthalmology rotation as a part of their clinical coursework, and 50% were offered ophthalmology as a clinical elective. Only 2% of respondents were offered no formal ophthalmology curriculum at their institution. Overall, most students received their ophthalmology curriculum in-person (44%) or both in-person and virtual (39%), with 15% of respondents receiving their curriculum entirely online.

Eighty-three percent of respondents were offered ophthalmology mentorship. Most respondents agreed that their academic institutions provided accessible ophthalmology research opportunities (87%) and they were offered ample opportunities to engage in clinical ophthalmology

Table 1 Demographics of all survey respondents

Demographics	n (%) of respondents (total respondents, N = 387)
Gender	
Female	216 (56%)
Male	168 (43%)
Nonbinary	2 (0.5%)
Transgender	1 (0.3%)
Ethnicity	
Hispanic	150 (39%)
Non-Hispanic	222 (57%)
Prefer not to answer	15 (4%)
Race	
African American (AA) or Black	54 (14%)
Hispanic AA or Black	21 (5%)
Non-Hispanic AA or Black	33 (8%)
East Asian	34 (9%)
Native American or Native Alaska	108 (28%)
Hispanic Native American or Alaskan	56 (14%)
Non-Hispanic Native American or Alaskan	47 (12%)
Native Hawaiian or Pacific Islander	27 (5%)
Hispanic Native Hawaiian or Pacific Islander	18 (5%)
Non-Hispanic Native Hawaiian or Pacific Islander	8 (2%)
South Asian	20 (5%)
White	130 (34%)
Hispanic White	42 (11%)
Non-Hispanic White	87 (22%)
Other	7 (2%)
Middle East	1 (0.3%)
Biracial (Black and White)	1 (0.3%)
Southeast Asian	1 (0.3%)
Prefer not to answer	8 (2%)
Location of medical school (by region)	
Northeast	94 (24%)
Midwest	88 (23%)
South	141 (36%)
West	64 (16%)

observation (87%), with respondents who identified as Underrepresented in Medicine (URiM) more likely to agree than their non-URiM counterparts ($p < 0.001$ and $p < 0.001$).

Table 2 Resources found most helpful to students to learn about the field of ophthalmology

Resources	n (%) of respondents (total respondents, N = 387)
Research	244 (63%)
Mentors	221 (57%)
Medical school curriculum	183 (47%)
Online videos	154 (40%)
Academic associations	138 (36%)
Books	123 (32%)
Interest groups	110 (28%)
Other online materials	52 (13%)
Unspecified other	7 (2%)

Respondent Learning Preferences

Of the ophthalmology resources available to students, 63% cited research as the most helpful tool to learn more about the field of ophthalmology, with mentors (57%), medical school curriculum (47%), and online videos (40%) to follow (► **Table 2**).

There were 309 free-text responses from medical students pursuing ophthalmology and ophthalmology residents on their suggestions and preferences for delivery of ophthalmology content. From these, seven major themes and corresponding subthemes emerged, as outlined in ► **Fig. 1**. Interestingly, most respondents favored nontraditional ophthalmology content such as videos, podcasts, and the use of online platforms. Traditional lectures, journal articles, and clinical experiences were also highlighted. Of the 14 respondents who specified a preference for “professional development,” 42% further specified a desire to develop “structured mentorship programs.”

Resident Reflections

Certain questions were reserved for the 55 ophthalmology resident respondents. When asked to identify the top resource they would choose to prepare for clinical ophthalmology experiences in residency, the most common response was online videos or lecture series (25%) (► **Table 3**).

Respondent Reflections

Most respondents agreed that academic advisors provide helpful ophthalmology-specific advice during training (90%). Interestingly, when analyzing this question based on respondents who are URiM versus those who are not, URiM respondents felt significantly more supported by advising when compared with non-URiM peers (93 vs 84%, $p < 0.01$). Overall, 89% of survey participants felt satisfied with the quality of ophthalmology opportunities they had as students, and there was no statistically significant difference for students who identified as URiM compared with non-URiM peers ($p = 0.11$).

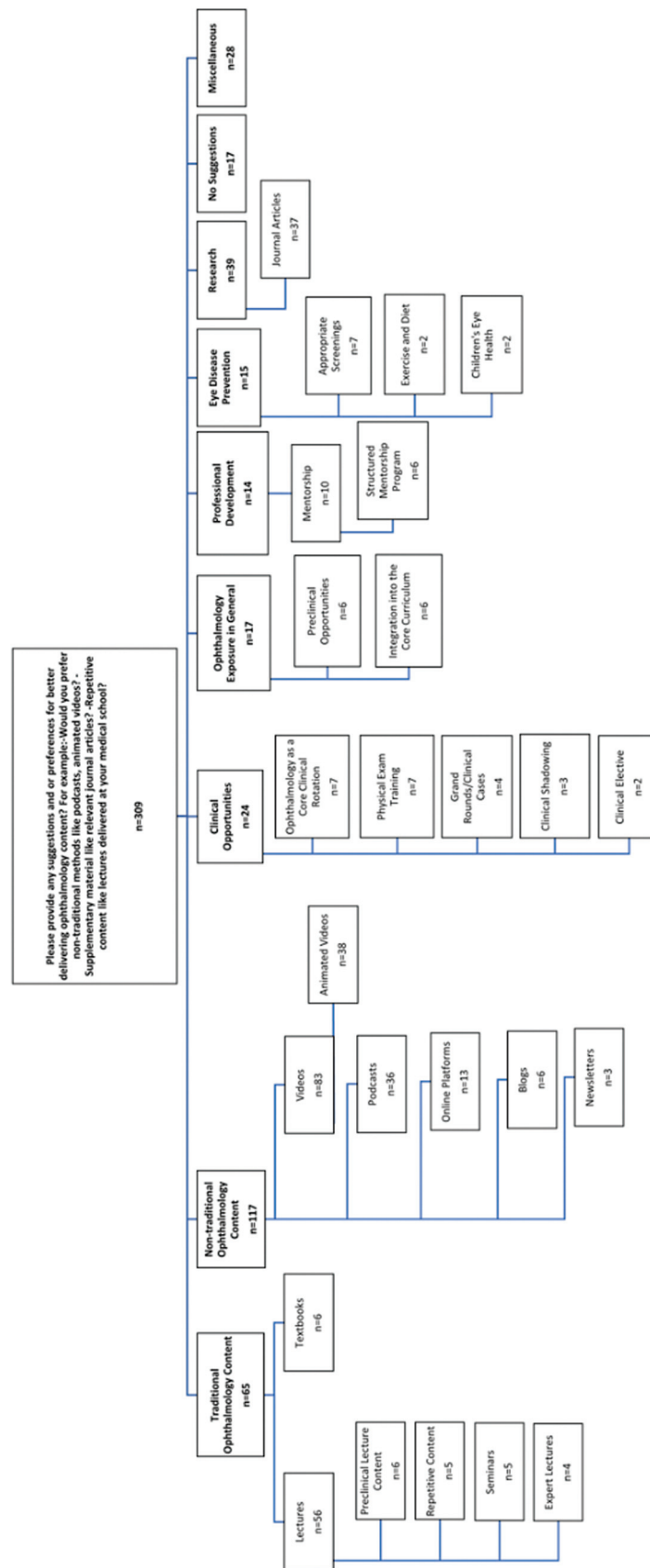


Fig. 1 Themes and subthemes identified from free-text responses by medical students and ophthalmology resident respondents on their suggestions and/or preferences for better delivering ophthalmology content.

Table 3 Resources found most helpful to resident learning to prepare for clinical ophthalmology experiences

Resources	n (%) of respondents (total respondents, N= 55)
Online video or lecture series	14 (25%)
Board review books (BCSC)	13 (24%)
On-call manuals (<i>Wills Eye Manual</i>)	12 (22%)
Web sites	10 (18%)
Primary research journals	4 (7%)
Compiled research format (The Lens newsletter)	1 (2%)
OphthoBook	1 (2%)
Social media	0 (0%)

When current ophthalmology residents were asked about their ophthalmic clinical skills before entering residency, 71% felt confident in their abilities to develop a broad differential

for basic ophthalmology diagnoses and 76% felt confident in their technical exam skills (slit-lamp and indirect ophthalmoscope).

Qualitative analysis also revealed that residents wished they had more knowledge about the science and clinical practice of ophthalmology before entering residency ($n = 25$), with multiple responses alluding to more technical exam training, improved surgical knowledge and skill development, improved clinical reasoning, and more exposure to the basic science of ophthalmology (► Fig. 2). Additionally, residents referenced a desire to be better oriented to hospital procedures and equipment ($n = 8$) and to be provided with a more robust understanding of professional expectations ($n = 8$) (► Fig. 2).

Discussion

Time dedicated to ophthalmology in medical school curricula is declining in the United States, despite graduating medical students expressing concern over their lack of ophthalmic knowledge. Current explanations for this

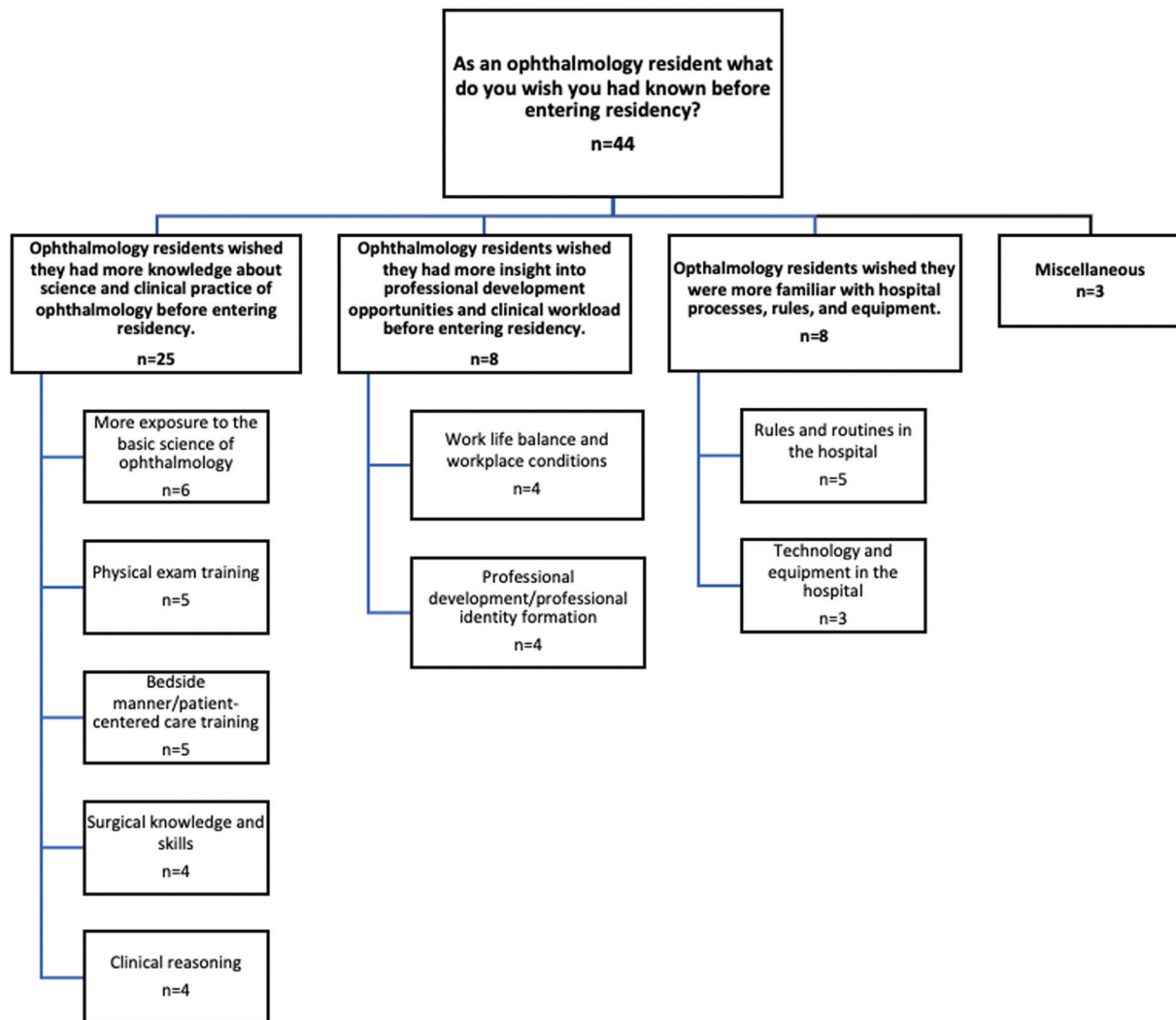


Fig. 2 Themes and subthemes identified from free-text responses by ophthalmology resident respondents on what they wished they had known before entering residency.

downward trend reference the transition to shorter preclinical education and the presence of extracurricular ophthalmology opportunities available to students.⁴ However, no reports mention the student's opinion of this transition or the impact of this change on disadvantaged learners.

Ophthalmology exposure was relatively strong in our study population, with greater than 80% of respondents having access to research, mentorship, and clinical observation. Research was also the number one resource favored by respondents to learn about ophthalmology. This observation highlights a potential disadvantage, notably for students who come from an institution without an ophthalmology residency program or without research affiliations.

Mentors, medical school curriculum, and online content were other commonly referenced resources. These results are promising given the rise of mentorship programs such as the MOM Program and the Women in Ophthalmology Mentorship program. Additionally, the establishment of formal mentorship programs was a frequent recommendation among free-text responses for improving ophthalmology content delivery, suggesting that the creation of more mentorship programs should be explored.

Exposure through medical school curriculum was the third best resource reported by respondents to learn about ophthalmology. When it came to formal ophthalmology curriculum, fewer respondents were exposed to preclinical curriculum and clinical ophthalmology rotations, but this percentage was still greater than the national average. As of 2017, only 7% of institutions surveyed about their ophthalmology curriculum offerings mentioned a mandatory clinical ophthalmology rotation³; yet our study found that 46% of respondents had a required ophthalmology rotation during medical school. This observation was unsurprising given our survey population consisted of aspiring ophthalmologists. This finding also suggests the importance of ophthalmology presence in undergraduate medical education to foster interest. A lack of early exposure is especially threatening to students from smaller medical schools and has proven to be a limitation for those who are underrepresented minorities in medicine.⁹

Overall, most students and residents were satisfied with their ophthalmology opportunities during medical school, including those URiM. Free-text responses from all respondents highlighted nontraditional teaching methods such as videos and podcasts to improve current ophthalmology education. Notably, animated videos were commonly referenced. Additionally, traditional lectures were endorsed by 20% of respondents and the integration of journal articles into standard teaching was a popular suggestion for improvement. Other recommendations focused on clinical experiences such as clinical observation, physical exam practice, and participation in case discussions or grand rounds.

When residents were asked what they wish they had have known before residency, the majority alluded to the science and clinical practice of ophthalmology. This knowledge gap revisits our earlier point that medical school curriculum is lacking pertinent ophthalmology instruction, and this is affecting not only medical students' engagement with the

field but also their preparedness for ophthalmology residency. A potential solution to this issue is online, educational ophthalmology content designed for medical students. Online videos were a top learning resource cited by all respondents, especially residents. Additionally, online videos are beneficial to trainees because they are often free, instructional, and highly accessible.

This study offers a unique perspective. For one, it is the only study focusing on the insights of student learners with a keen interest in ophthalmology. This evaluation is valuable because students interested in ophthalmology typically have the most to gain from a robust ophthalmology education early in training and are therefore incentivized to offer practical and applicable suggestions. Also, it represents a significant proportion of URiM medical students from over 70 academic institutions across the United States. For instance, 35% of respondents identified as Native American or Hawaiian. Upon further review, we identified that a large percentage of these applicants identified as Native and Hispanic, suggesting they may be Central or Latin American with Indigenous heritage (e.g., Brazilian, Mexican, Puerto Rican). Nonetheless, 14% of our respondents identified as being non-Hispanic Native American, despite zero Native American applicants participating in the SF Match from 2016 to 2019, and 14% of our participants identified as African American or Black, despite only 3% of matched ophthalmology applicants identifying as African American or Black in 2019.¹⁰

There are important limitations to this study. First, our study had sampling bias, with a disproportionate amount of URiM responses due to our distribution to the MOM Program listserv. While beneficial to our perspective and generalizability to URiM students, these numbers do not reflect current demographic representation in the field of ophthalmology. Second, our response rate was low, which may also contribute to bias. It is worth noting that while our completion rate was 9%, the number of survey respondents reflects a large proportion of ophthalmology trainees and our survey captured nearly 400 individual perspectives. Despite these limitations, we believe our study offers valuable insights regarding this topic.

Conclusion

In summary, ophthalmology exposure in medical school has shifted toward nontraditional methods, and students appear to support this transition. When it comes to ophthalmic skills and clinical knowledge, however, residents find this exposure insufficient. Current resources appreciated by medical student learners and ophthalmology trainees include research, online videos, and mentors. More attention focusing on these resources and their potential role in supplementing current medical school curriculum to improve preparedness for residency is an important next step in improving ophthalmology education. Future investigations should review less traditional ophthalmology resources geared toward learners and perceived accessibility before new platforms are constructed. In an era of continuous technological

advancement, the opportunity to reach trainees through online resources is encouraging.

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Conflict of Interest

None declared.

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