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Virtual Ophthalmology Rotation for Visiting Medical Students: An Opportunity to Enhance Diversity in the Workforce

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Abstract

Introduction We created a virtual rotation to facilitate the exposure of ophthalmology to medical students and serve as a pilot program to help attract students from under-represented in medicine (URM) backgrounds. In addition to the rotation eliminating the financial burdens associated with in-person away rotations, we offered a not-for-credit (i.e., drop-in) option that included sessions outside the typical clinic hours. This option reduced scheduling conflicts as a barrier to enrollment and allowed junior medical students and postgraduates to participate and hopefully further develop an interest in ophthalmology.

Methods Before the rotation, participants completed a pre-test and a survey to collect data on learners' backgrounds and interest in applying for ophthalmology residency. The rotation included live lectures, case-based discussions, chart reviews, and guided self-study. Following the rotation, participants completed a post-test and a survey to query applicants on the online rotation's utility and delivery.

Results Eleven learners enrolled in the course and completed the prerotation survey and test. Approximately one-third (4/11; 36%) were URM students and two-thirds (7/11; 64%) were female. All responded they were planning to apply for ophthalmology residency. All responded they strongly agreed that the rotation increased their general knowledge in ophthalmology, and 89% (9/11) strongly agreed that it improved their ability to diagnose and manage actual patients. Nearly all (7/8; 87.5%) strongly agreed the rotation provided the opportunity to seek support for the residency application process, and all found the online platform reliable and easy to access. Exam scores improved significantly from pre- to post-tests (60 vs. 79%; $p < 0.01$).

Conclusions The rotation attracted a substantial proportion of URM students. Learners reported that the virtual rotation effectively taught and supported their endeavors to

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become ophthalmologists. Virtual rotations for visiting students can reduce barriers such as travel, financial costs, and time constraints that might otherwise hinder exposure to specialty training that is not offered or is underrepresented at students' home institutions. Increasing exposure and offering mentorship through this novel platform deserves further study to enhance diversity and inclusion in medicine.

Recent studies have highlighted the pressing need to improve racial diversity and inclusion in ophthalmology. While individuals from under-represented in medicine (URM) backgrounds contribute to over 30% of the U.S. population, they comprise only 13.5% of all physicians and just 6% of ophthalmologists in the United States—this lack of racial representation is especially apparent for African Americans, who comprise 13.4% of the U.S. population but only 2 to 3% of practicing or resident ophthalmologists.[1]

One approach to improve diversity has been to promote exposure of URM students to ophthalmology during medical school. However, this has become increasingly difficult. The requirement for clinical ophthalmology rotations has decreased from 60% in 2000 to 18% in 2014 among U.S. medical schools.[2] Medical students seeking exposure to ophthalmology through their own volition, especially those attending institutions without academic ophthalmology departments, have traditionally pursued away rotations in ophthalmology. However, the Coalition for Physician Accountability halted away rotations with the onset of the COVID-19 (coronavirus disease 2019) pandemic.[3] While many institutions have now resumed offering rotations to visiting students, they remain cost-prohibitive for many students, disproportionately impacting those with limited resources. This situation has worsened with the recent rise in economic inflation.

In response, we created a virtual away rotation in ophthalmology for medical students to serve as a pilot program to attract more URM students to ophthalmology. The advantages of our virtual rotation included reducing financial barriers by eliminating costs associated with travel and boarding and offering a not-for-credit (i.e., drop-in) option. That option included sessions before and after typical clinic hours, reducing scheduling conflicts, and opening the rotation to students in any year of medical school and those who recently graduated from medical school.

Historically Black colleges and universities (HBCUs) have played a vital role in medical education. The nation's four historically Black medical schools have graduated more Black physicians over the last 10 years than the top 10 predominantly White medical schools combined.[4] Our institution is the only HBCU with an ophthalmology residency program. Therefore, we hoped this virtual rotation would increase URM students' exposure to ophthalmology and provide access to relatable mentors to create a pathway to foster diversity and inclusion in ophthalmology.

Methods

The Howard University Institutional Review Board approved this study. All participants provided informed consent. The course description, syllabus, and schedule were submitted and approved by the curriculum planning committee at our college of medicine as a novel, 4-week, online-only rotation in ophthalmology. Participants interested in earning credit had to apply for the rotation through Visiting Student Application Service (VSAS), sponsored by the AAMC. Participants were required to participate in daily live sessions, a self-study program, and deliver a 15-minute presentation to earn credit. Participants who did not seek credit contacted our program directly to enroll and join sessions as their schedules permitted. Participants were recruited by advertising the rotation on the Association of University Professors in Ophthalmology website as a virtual elective.

The course schedule is presented in ►**Fig. 1**. Each day included a faculty-led lecture or small group discussion and assigned reading for self-study. Fifteen live lectures of 60 to 90 minutes each were given. The course director provided a series of introductory lectures to ophthalmology for medical students and covered the following topics: ocular anatomy and physiology, ophthalmic examination, ocular trauma, red eye, acute vision loss (retinal vascular occlusions, retinal detachments, retinitis, giant cell arteritis, optic neuritis), chronic vision loss (cataracts, glaucoma, age-related macular degeneration), and ophthalmic manifestations of systemic diseases. Additional lectures were given to medical students and ophthalmology residents by eight different department faculty members chosen for their areas of expertise in ophthalmology.

Eight live sessions were devoted to case-based discussions, each 60 to 90 minutes. These were also faculty-led and were of two types. The first type was representative cases based on assigned readings. These cases allowed learners the opportunity to review a question stem that provided a common ocular complaint or a characteristic presentation of an ophthalmic disease. Learners were then encouraged to interpret exam findings, develop a differential diagnosis, and initiate management for common and emergent ophthalmic conditions. The second type of case-based activity was a detailed chart review of actual patients from our retina clinic. Patients with retinal diseases frequently undergo multimodal imaging, allowing learners to view images that closely simulate what they would see in a clinical examination along with additional testing that can be viewed remotely the same as if viewed in-person. For these cases, the patient's chief complaint and fundus photos were presented to learners, who were then asked to interpret the findings, request and interpret additional testing, make the correct diagnosis, and initiate a treatment plan.

The self-study portion of the curriculum consisted of assigned readings from Basic Ophthalmology.[5] Learners

Week 1	AM: Orientation PM: Self-study (Eye Exam)	AM: Pediatric Oph Lecture PM: Clinic Rounds	AM: Self-study (Red Eye) PM: Case Discussions	Cataract and Glaucoma Surgery Wet Lab	AM: Intro to Oph – Part 1 PM: Imaging Webinar
Week 2	AM: Cornea Lecture PM: Self-study (Acute vision loss)	AM: Pediatric Oph Lecture PM: Clinic Rounds	AM: Intro to Oph – Part 2 PM: Self-study (Glaucoma)	AM: Self-study (Cataract) PM: Grand Rounds	AM: Neuro-oph Lecture PM: Self-study (AMD)
Week 3	AM: Case Discussions PM: Self-study (Trauma)	AM: Pediatric Oph Lecture PM: Clinic Rounds	AM: Self-study (Oculoplastics) PM: Case Discussions	AM: Oculoplastics Lecture PM: Grand Rounds	AAO Annual Meeting
Week 4	AM: Cornea Lecture PM: Self-study (Pediatric Oph)	AM: Pediatric Oph Lecture PM: Clinic Rounds	AM: Case Discussions PM: Self-study (Neuro-oph)	AM: Retina, Glaucoma, and Lens Lectures PM: Grand Rounds	AM: Neuro-oph Lecture PM: Exit Interviews

Fig. 1 Four-week virtual ophthalmology rotation schedule. AAO, American Academy of Ophthalmology; AMD, age-related macular degeneration; Oph, ophthalmology.

were encouraged to utilize the open-access education resources provided by the American Academy of Ophthalmology,[6] and they received links to open-access educational webinars in ophthalmic imaging.[7]

Learners participated in weekly departmental grand rounds, which typically included case-based discussions with departmental faculty and residents. Learners were given the opportunity to give a 15-minute presentation based on their topic of interest to the department during grand rounds. In addition, a special session included observation of cataract and glaucoma surgery wet labs designed for residents. During this session, learners logged in to observe live instruction and feedback from faculty given to residents as they practiced doing cataract and/or glaucoma surgery under a microscope using eyes made from synthetic materials.

Before the rotation, learners received a brief survey, which queried their educational background and demographics. Following the rotation, learners received another survey which included questions using a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree) and had open-ended questions evaluating the rotation's strengths and limitations. Completion of the surveys was voluntary, and responses were collected anonymously to maintain participant confidentiality. The pre- and post-course exam questions were not designed to be identical but were matched so that they covered the same topics and were of the same level of difficulty. Pre- and post-course performance was compared using a student's *t*-test; $p < 0.05$ was considered statistically significant. Students were invited to an exit interview at the end of the rotation to provide feedback about the rotation and ask questions about ophthalmology as a career and seek advice on applying for a residency in ophthalmology. All online meetings were conducted using the university's Zoom account (San Jose, CA) and were password-protected. The course schedule and reading assignments were stored on a Google Drive account (Mountain View, CA). Surveys and exams were administered by the Qualtrics XM platform (Seattle, Washington; Provo, Utah).

Results

Eleven learners completed the prerotation survey (►**Table 1**). Approximately 73% (8/11) identified as U.S. fourth-year medical students. All except one learner were United States-based: two from the mid-Atlantic, six from the south-Atlantic, one from the Midwest, one from the West, and one from the Caribbean. Approximately one-third (36%) of learners identified as belonging to a URM and approximately two-thirds (64%) were female.

The postrotation survey was initiated by nine learners and completed by eight learners. The responses to the multiple-choice sections are presented in ►**Table 2**. Learners responded that they agreed with queries regarding the rotation improving their ophthalmic knowledge, clinical skills, and exposure to cataract and glaucoma surgery. Learners also agreed with the following: the rotation provided them with the opportunity to seek support for the residency application process, faculty were available to address questions or concerns, the assigned textbook was

Table 1 Participant demographics and educational backgrounds

Characteristic	Participants, % (*n*)
Age	
22–26	55 (6)
27–31	36 (4)
32+	9 (1)
Gender	
Female	64 (7)
Male	36 (4)
URM	
No	64 (7)
Yes	36 (4)
U.S.-based	
Yes	91 (10)
No	9 (1)
Level of training	
MS 1–3	18 (2)
MS 4	73 (8)
Postgraduate	9 (1)

Abbreviations: MS, medical student Year; URM, under-represented in medicine.

at the appropriate level for their background and interest, and the online meeting platform and online storage site were efficiently and reliably accessible. Approximately 78% (7/9) responded that they agreed, and 22% (2/9) neither agreed nor disagreed that the rotation provided adequate exposure to different subspecialties in ophthalmology. All responded that they would consider our program for residency training in ophthalmology.

Learners most commonly responded that chart and imaging reviews of actual patients and small-group discussions of representative cases were the most valuable parts of the rotation (quote from learner: "I felt very comfortable going through images of the anterior segment or retina because of the patients we went over after clinic"). Other responses emphasized the course's flexibility and faculty mentorship (quote from learner: "The course was extremely helpful in both enhancing my understanding of ophthalmology as well as answering questions about residency"). Learners most commonly responded that more time with residents and more time with live patients would improve future rotations. Other suggestions included recording lectures and more time with some subspecialties.

Exam scores improved significantly from pre- to post-tests (60 vs. 79%; $p < 0.01$). In the pre-test, only three questions were answered correctly by greater than 75% of learners. While in the post-test, eight questions were answered correctly by greater than 75% of learners. Similarly, seven questions were answered correctly by fewer than 50% of learners in the pre-test, and only one question was answered by fewer than 50% of learners in the post-test. Notable examples of improvement include learners answering questions correctly about the management of acute bacterial corneal ulcers (45% pre- and 75% postrotation) and contraindications to prescription glaucoma medications (36% pre- and 88% postrotation).

Discussion

Overwhelmingly, our learners strongly agreed that the rotation increased their general and practical knowledge in ophthalmology. This perception was supported by the improvement in pre- and post-course exam scores. The open-ended questions helped reveal the strengths and limitations of the rotation. Learners highlighted the rotation's flexibility as a unique advantage of the virtual rotation; flexibility referred to not being physically present at the rotation site and the many live sessions before or after typical clinic hours. This flexibility contributed to the virtual rotation attracting more away students from more diverse regions of the country than our department has experienced in the past. Another cited strength was their ability to review actual patient charts and images, which helped compensate for some of the limitations of virtual exams and allowed them to review more teaching cases than a student can typically see when shadowing a resident in a clinic. Finally, while an abundance of recorded instructional videos and large group

Table 2 Responses to postrotation survey

Question	% Strongly agree	% Somewhat agree	Neutral
Increased my general knowledge in ophthalmology	100	0	0
Improved my ability to clinically evaluate real patients	89	11	0
Exposure to different subspecialties	33	45	22
Introductory exposure to surgery	25	75	0
Faculty were available	100	0	0
Support in applying for residency	88	12	0
Online platforms easily accessible	100	0	0
Appropriateness of assigned text	100	0	0
Would consider residency at our program	100	0	0

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webinars are available to students, the mentorship and personalized feedback that has been the bedrock of our teaching model in clinical medicine was preserved through one-on-one live instruction and was cited as a strength of the rotation.

Our report helps substantiate the value of virtual education in ophthalmology. DeVaro et al[8] demonstrated how student telehealth can be implemented as a viable alternative learning platform and Tsui et al[9] and Frisbie et al[10] demonstrated how innovative approaches with mobile devices can be utilized to perform virtual slit lamp examinations and interact with patients in real time. As was the case in the above studies, the most significant limitation of our rotation was the inability of participants to practice hands-on physical examinations; the development of these skills was deferred to residency training. In the present study, the same questions were not used for the pre- and postrotation exams to prevent students simply memorizing the answers from the pretest. In the future, we would consider using a question bank that randomly generates questions for testing purposes to minimize any potential biases that can arise from faculty writing questions. As is the case with all anonymous surveys, individual response accuracy cannot be verified. A small sample size was a limitation of this study.

Virtual rotations for visiting medical students, such as this one, also provide an opportunity to reduce barriers and increase exposure for URM groups interested in specialty training that is not offered, or is underrepresented, at their home institution. By participating in virtual rotations, students can more easily obtain access to teaching, networking, and mentorship. Additional benefits include eliminating financial barriers, such as travel and housing costs incurred with away rotations and reducing scheduling conflicts that may prevent a student from enrolling in a full-time away rotation by offering a noncredit (i.e., drop-in) option that can be accessed when the student's schedule allows. Therefore, virtual rotations may be of value to students of all backgrounds, especially those who have financial limitations, family obligations, or other limitations for travel.

Given the lack of African American physicians in ophthalmology and the fact that certain ophthalmic diseases, such as glaucoma[11] and diabetic retinopathy[12] disproportionately affect African Americans, enhanced representation of African Americans in the workforce is needed. Recent publications in ophthalmology have called for greater racial diversity in the workforce, citing minority ophthalmologists are more likely to practice in underserved communities and patients of URM backgrounds report improved communication and greater satisfaction when their providers are of the same background.[13] Additionally, attracting a diverse workforce in academic ophthalmology may help foster further inclusion as female and URM applicants often place greater importance on diversity in faculty and residents by sex and ethnicity.[14] The Rabb-Venable Excellence in Ophthalmology Research Program[15] and the Minority Ophthalmology Mentoring (MOM)[16] program have proven invaluable in recruiting and mentoring African Americans in ophthalmology. We hope that virtual rotations hosted by programs interested in enhancing diversity in the workforce will also help contribute to this mission.

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Conflict of Interest

No authors have any conflict of interest.

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