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Medical Student Attitudes Toward the Use of Peer Physical Exam for Learning Fundoscopy

Daniel Henick, BS[1] Margarita Labkovich, BA[1] Jake E. Radell, MA[1] Nitin Chopra, MD, MBA[2] Nisha Chadha, MD[1,2]

[1] Department of Medical Education, Icahn School of Medicine at Mount Sinai, New York, New York
[2] Department of Ophthalmology, Icahn School of Medicine at Mount Sinai/New York Eye and Ear Infirmary, Eye and Vision Research Institute, New York, New York

Address for correspondence Nisha Chadha, MD, Department of Ophthalmology, Icahn School of Medicine at Mount Sinai, 1 Gustave L. Levy Place, New York, NY 10029 (e-mail: nisha.chadha@mssm.edu).

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Abstract

Background Peer physical examination learning is commonly practiced in medical schools during preclinical curricula and has been shown to improve empathy for patients. While there is literature regarding medical student attitudes toward peer physical exam learning, no studies to date have specifically examined student attitudes toward fundoscopy and dilation of the eyes for the purposes of learning fundoscopy. This study evaluates medical student preferences with regards to learning fundoscopy on peers and explores attitudes toward alternate approaches.

Methods First year medical students at the Icahn School of Medicine at Mount Sinai participated in a 2-hour fundoscopy skills workshop in March 2020. Following the session, the authors administered a voluntary survey querying students on attitudes toward peer physical exam learning and its use in learning peer fundoscopy. Primary study endpoints evaluated (1) student attitudes toward the use of peer physical exam learning, (2) learning benefit of the session, including student comfort with conducting the fundoscopy exam, and (3) empathy toward patients experiencing dilation. Secondary endpoints focused on alternative teaching methods and preferences for nonmydriatic fundoscopy. Analysis of survey data was performed using nonparametric Spearman's correlations, chi-square tests, *t*-tests, and Mann–Whitney *U* tests.

Results A total of 51/138 (37%) students completed the survey, with 78% indicating they felt peer physical exam learning was a helpful instructional method, including for the fundoscopic exam. The session led to improved self-rated fundoscopy skills and empathy for patients. However, when considering learning with dilation versus alternative nonmydriatic techniques, 96% of students indicated a preference for using alternative nonmydriatic techniques.

Conclusion This study found that students' attitudes toward fundoscopy generally aligned with their overall peer physical exam preferences. However, they preferred not

Keywords
- peer physical exam
- fundoscopic exam
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- empathy
- pupillary dilation

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using dilation and learning with nonmydriatic fundoscopic techniques. Assessing student learning preferences and incorporating novel instructional tools can help facilitate more successful fundoscopy skills acquisition. These considerations are particularly important in the context of COVID-19 and with advances in teleophthalmology.

During the preclinical curriculum of medical school, students are introduced to the patient interview and physical exam. There are various approaches to teaching these skills, such as the use of didactic sessions, practicing with standardized patients, and peer physical exam (PPE) exercises.[1] In PPE sessions, medical students first receive a didactic lesson and then practice the exam skills taught on each other as peer teacher and peer learner.[2,3] In this approach, students can reflect on the experience of assuming the patient's role.[4] In comparison to standardized patients, PPE exercises are more readily available, less expensive, and easier to implement.[5]

Studies on the effectiveness of PPE teaching methods have demonstrated that both the peer teacher and peer learner gain confidence in their skills, resulting in improved performance during clinical examinations and teaching of other students.[1,2,6] Additionally, PPE has been shown to positively impact the development of empathy toward future patients.[4]

Most students agree that PPE is an important aspect of medical training, and over 97% of students are comfortable allowing their peers to practice most components of the physical exam on them.[5,7,8] Reasons for discomfort with PPE include discomfort examining peers of the opposite gender, discomfort exposing one's body in front of colleagues, and religious or cultural values discouraging physical contact.[7] This is particularly applicable to the breast and genitourinary exams which are more sensitive and invasive. As such, these examination techniques are typically taught by trained standardized patients.[9]

In teaching the direct fundoscopic exam, peer pupillary dilation has been utilized for optimal visualization of the fundus. In one meta-analysis, 33% of studies that involved the use of nonsimulator-based techniques for teaching direct ophthalmoscopy to medical students involved peer physical examination, while the others employed the use of standardized patients.[10] Fundoscopy and dilation may be considered a more sensitive exam technique due to photophobia with examination, blurred vision for hours postdilation, and the close proximity at which one must approach their peer to perform the exam.[8] While medical students' attitudes toward some forms of PPE have been studied, to date there is a paucity of literature specifically exploring students' attitudes toward learning fundoscopy on peers and participating in pupillary dilation.

Considering the inherent discomforts experienced with fundoscopy and dilation, it is important to assess how students view PPE use for learning fundoscopy, particularly given this is often the first meaningful exposure to ophthalmology for medical students. Furthermore, fundoscopy is likely to become even more relevant with advances in telemedicine, which are likely to include acquisition and interpretation of fundoscopic images. Therefore, it is essential to consider the effectiveness of existing paradigms in fundoscopy education.[11] Unfortunately, due to limited curricular time, many medical students express discomfort in conducting the basic ophthalmic exam, including fundoscopy.[12–14]

A variety of instructional methods have been employed in attempting to improve fundoscopy education, including viewing fundus images in a small group setting, followed by guided peer fundoscopy.[15–17] These approaches increased student confidence and technical ability with the direct ophthalmoscope.[14] More recently, nonmydriatic smartphone fundoscopy has been identified as an additional learning tool.[16]

As medical education evolves due to advancements in diagnostic approaches, especially in the context of COVID-19 with transitions to virtual learning formats, understanding the best way to teach each component of the physical exam can result in more effective doctoring across all levels of physician training.[18–21] Even though the introduction of fundus photography and other new technologies have modified the fundoscopic exam, the ability to examine the fundus using the direct ophthalmoscope remains important. It is a particularly relevant skill in resource-limited areas and in urgent situations. Therefore, in this study we aim to explore student attitudes toward peer fundoscopy to better inform future fundoscopy education and curriculum development.

Methods

The fundoscopic exam is taught as part of a 2-hour ophthalmology workshop in the clinical skills course for first year medical students at the Icahn School of Medicine at Mount Sinai. As part of this workshop, which is the students' first formal introduction to ophthalmology, students learn basic fundus anatomy and pathology, along with fundoscopy exam technique. In March 2020, 138 first year medical students participated in the workshop. The fundoscopic exam was learned and practiced on peers in small groups of 7 to 8 students, facilitated by a small group preceptor and an ophthalmologist. Students were encouraged to dilate their nondominant eye for better visualization of the fundus by peers using the direct ophthalmoscope. During the session, they also had the opportunity to practice direct fundoscopy using the PanOptic ophthalmoscope which offers a less magnified view of the fundus, sometimes making visualization of structures easier for the novice learner.

Each small group preceptor recorded the number of students in their group who participated in dilation. The

next day, we sent all students an optional anonymous survey via email. The survey employed Likert scale questions and queried participants on their attitudes toward PPE in the context of the cardiac and head and neck (head, eyes, ears, nose, and throat [HEENT]) exams that they had previously learned, PPE with fundoscopy, participation in pupillary dilation, and interest in alternate fundoscopic techniques. The specific survey items are detailed in ►**Appendix 1**. Using this cross-sectional study design, we analyzed all of the survey data in Excel 2019 (Microsoft, Redmond, WA) using nonparametric Spearman's correlations, chi-square tests, *t*-tests, and Mann–Whitney *U* tests. This study was determined to be exempt by the institutional review board at the Icahn School of Medicine at Mount Sinai.

Results

The overall survey response rate was 51/138 (37%). A post hoc analysis using a Cohen-d of 0.8 and α of 0.05 revealed a power of 100% for this sample size. The overall dilation participation rate was 122/138 (88%), and similarly the dilation participation rate in the survey cohort was 43/51 (84%). The dilation participation rate in the survey cohort was representative of the dilation participation rate in the overall class cohort using a chi-square test ($X^2 = 0.37$, $p > 0.05$). We summarize the survey results in the following subsections.

General Student Attitudes toward PPE

Students first reflected on their attitudes toward the use of PPE techniques in learning the cardiac and HEENT exams, as these were physical exam sessions they had previously participated in at the time of the study (►**Tables 1** and **2**). On a 5-point Likert scale, the average responses to statements regarding willingness to have medical students practice on them and the educational value of PPE exercises were 4.45 (standard deviation [SD] 0.73) and 4.41 (SD 0.96) out of 5, respectively. Furthermore, the use of PPE exercises in learning the cardiac and HEENT exams was reported to be helpful in learning the requisite skills with a mean response of 4.39 (SD 0.75). Students acknowledged that use of PPE in learning these exams increased their understanding of the patient experience, with a mean response of 3.96 (SD 1.11) out of 5. However, preferences to educational approach were mixed. When asked about their preferred learning method, 23 students (45%) preferred "peers" while 28 (55%) selected "standardized patient."

The most common reasons students did not endorse the use of PPE were discomfort with having to change into a gown in front of classmates (18 students, 35%), discomfort with practicing on other peers (11 students, 21%), and gender identity of peer (10 students, 20%). Nevertheless, 46 students (90%) said they agreed with the utility of PPE learning.

Student Attitudes toward the Use of PPE in Fundoscopy and Dilation Participation Data

We then asked students to reflect on the use of PPE exercises specifically in the learning of fundoscopy, and they demonstrated a similarly overall positive response (►**Tables 2** and **3**). Survey results indicated that performing the fundoscopic exam on their peers' eyes was helpful in learning the necessary technical skills with a mean response of 4.10 (SD 0.88), and developing empathy toward the patient experience, with a mean response of 4.08 (SD 0.98). Using Spearman's rank-order correlation tests, we found that students who viewed PPE as a valuable form of learning in the cardiac and HEENT exams agreed that the use of PPE in fundoscopy helped to learn technical exam skills, $r(51) = 0.43$, $p < 0.01$, and develop empathy by understanding the patient experience with fundoscopy, $r(51) = 0.57$, $p < 0.01$. However, students did not feel particularly strongly that dilating one's own eye was important to learning fundoscopy, with a mean response of 3.02 (SD 1.05). Of note, students who were more likely to endorse the importance of dilating one's own eye for learning fundoscopy were more likely to also endorse the use of PPE in the cardiac and HEENT exams using a Spearman's rank-order correlation test, $r(51) = 0.31$, $p = 0.03$.

Table 1 General student attitudes toward PPE

Survey question	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean (/5)	Standard deviation
Willing to have students practice PPE skills on me	31 (60.8%)	15 (29.4%)	2 (3.9%)	1 (2%)	2 (3.9%)	4.41	0.96
PPE is a valuable form of learning for me	29 (56.9%)	17 (33.3%)	4 (7.8%)	1 (2%)	0 (0%)	4.45	0.73
Learning and practicing physical exam (HEENT, cardio) with peers helped to learn skills better	27 (52.9%)	18 (35.3%)	5 (9.8%)	1 (2%)	0 (0%)	4.39	0.75
Learning and practicing physical exam (HEENT, cardio) with peers helped to better understand patient experience	20 (39.2%)	17 (33.3%)	8 (15.7%)	4 (7.8%)	2 (3.9%)	3.96	1.11

Abbreviations: HEENT, head, eyes, ears, nose, and throat; PPE, peer physical exam.

Table 2 Non-Likert scale questions of fundoscopy survey

Survey question	Responses
Do you prefer to practice physical exam skills on standardized patients or peers?	Peers = 23 (45.1%) SPs = 28 (54.9%)
Are there any reasons you might feel uncomfortable with participating in the peer physical exam (general)?	Gender identity = 10 (19.6%) Changing into a gown = 18 (35.3%) Discomfort practicing with classmates = 11 (21.6%) Religious beliefs = 0 (0%)
Did you get your own eye dilated during today's session? Which one?	Left eye = 22 (43.1%) Right eye = 21 (41.2%) No = 8 (15.7%)
If you answered no or were hesitant to participate, why?	Concern about getting work done later = 6 (11.8%) Prior social engagements = 6 (11.8%) Medical contraindication = 3 (5.9%) Religious beliefs = 0 (0%) Not wanting to be examined by someone of the opposite gender = 0 (0%)
If you had an equally accurate and accessible tool that did not involve dilation, would you choose to perform a dilated fundoscopic exam or use the alternate technique?	Dilate the patient = 2 (3.9%) Alternate technique = 49 (96.1%)
What would you prefer out of the following options?	Practice dilated fundoscopy on peers = 16 (31.4%) Practice fundoscopy on peers without dilation = 8 (15.7%) Practice dilated fundoscopy on standardized patients = 26 (51%) Practice fundoscopy on standardized patients without dilation = 1 (2%) Not have fundoscopy as part of the medical school curriculum = 0 (0%)
Would you be interested in participating in a focus group session to learn how to perform fundoscopy using newer technologies without the need for dilation?	Yes = 21 (41.2%) No = 30 (58.8%)

Abbreviation: SP, standardized patient.

The 8 students (16% of the survey cohort) who chose to not participate in the dilation activity indicated one or more of the following reasons: concerns about getting work done later in the day (6 students, 75%), prior social engagements (3 students, 38%), and medical contraindication (3 students, 38%). No students (0%) identified religious beliefs or not wanting to be examined by someone of the opposite gender as reasons for not participating in the activity. These responses were distinct from those of the general PPE exam, with gender differences being slightly less relevant for learning this exam technique in a chi-square analysis, $p > 0.05$.

Efficacy of the PPE Fundoscopy Learning Session

When comparing students' understanding of fundoscopic technique before and after the learning session using a Mann–Whitney *U* test, their self-rated confidence and technique score increased from 1.49 (SD 0.95, median = ⅕) to 2.96 (SD 0.94, median = ⅗), $U = 368$, $p < 0.01$. Additionally, students' self-rated empathy scores increased from 3.08 (SD 1.45, median ⅗) to 4.29 (SD 0.99, median 5/5) after the fundoscopy session, $U = 677$, $p < 0.001$. These results are summarized in ►**Table 4**.

Additional Considerations and Secondary Endpoints

Using additional survey questions, we explored students' interest in learning about alternative nonmydriatic fundoscopic techniques, the potential use of standardized patients in learning the fundoscopic exam, and the role that dilation plays in modulating students' attitudes toward peer learning of fundoscopy (►**Tables 2** and **5**).

When given the choice to participate in PPE exercises with or without dilation, students strongly preferred not to be dilated in a Mann–Whitney *U* analysis, as they were more willing to be a fundoscopy peer patient with a nonmydriatic technique (median = 5/5) than with the traditional dilated fundoscopic technique (median = 4/5), $U = 812.5$, $p = 0.001$. Furthermore, when asked whether they would prefer to perform fundoscopy on a hypothetical patient using a dilated technique or an alternative nonmydriatic technique, 49 students (96%) preferred the alternate technique.

While students were amenable to learning via PPE exercises, 28 students (55%) also reported a preference toward learning fundoscopy with the use of standardized patients. At the end of the survey, we gave students the choice to further develop their fundoscopic technique using peers or standardized patients by performing either dilated or nondilated fundoscopy. When prompted to perform either

Table 3 Student attitudes toward the use of PPE in fundoscopy

Survey question	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean (/5)	Standard deviation
Performing fundoscopy on peers helped me to learn skills	19 (37.3%)	21 (41.2%)	8 (15.7%)	3 (5.9%)	0 (0%)	4.1	0.88
Performing fundoscopy on peers helped to better understand patient experience	22 (43.1%)	14 (27.5%)	13 (25.5%)	1 (2%)	1 (2%)	4.08	0.98
Do you feel that dilating your own eye is important to learning fundoscopy?	2 (3.9%)	17 (33.3%)	17 (33.3%)	10 (19.6%)	5 (9.8%)	3.02	1.05

Abbreviation: PPE, peer physical exam.

Table 4 Effect of PPE fundoscopy session on student learning and empathy

Survey question	Very comfortable	Comfortable	Neutral	Uncomfortable	Very uncomfortable	Mean (/5)	Standard deviation
Comfort performing fundoscopy before session	1 (2%)	1 (2%)	7 (13.7%)	4 (7.8%)	38 (74.5%)	1.49	0.95
Comfort performing fundoscopy after session	2 (3.9%)	12 (23.5%)	22 (43.1%)	12 (23.5%)	3 (5.9%)	2.96	0.94
Comfort when fundoscopy was being performed on you?	14 (27.5%)	20 (39.2%)	10 (19.6%)	4 (7.8%)	3 (5.9%)	3.75	1.13
Survey question	**Very aware**	**Aware**	**Neutral**	**Unaware**	**Very unaware**	**Mean (/5)**	**Standard deviation**
Did you understand what it was like to have fundoscopy performed on you before the session?	12 (23.5%)	9 (17.6%)	11 (21.6%)	9 (17.6%)	10 (19.6%)	3.08	1.45
Do you understand what it is like to have fundoscopy performed on you after the session?	27 (52.9%)	17 (33.3%)	4 (7.8%)	1 (2%)	2 (3.9%)	4.29	0.99

Abbreviation: PPE, peer physical exam.

dilated or nondilated fundoscopy on a standardized patient or peer, paradoxically only 9 students (18%) indicated that they would use nondilated techniques even though 49 (96%) students previously said they would be interested in using a nonmydriatic technique on a hypothetical patient, revealing a significant difference using a chi-square analysis, χ^2 (1, $n = 51$) = 63.95, $p < 0.01$.

Lastly, we asked students about participating in an optional follow-up session to learn about fundoscopy with novel nonmydriatic technologies and diagnostic approaches, and 21 students (41%) indicated interest in attending. We did not find significant differences with respect to attitudes toward PPE between students who did or did not wish to attend using a chi-square analysis, $p = 0.83$.

Discussion

In this study, we found that the unique nature of fundoscopy does not preclude it from being incorporated in a general PPE learning model. Students had overall favorable attitudes toward PPE both in the context of the cardiac and HEENT exams as well as the fundoscopic exam. However, reservations regarding peer learning of this technique were distinct from those related to learning other physical exam techniques. The PPE-based fundoscopy session at the Icahn School of Medicine at Mount Sinai led to improved student-rated comfort with fundoscopy and increased empathy for the patient experience. Of note, the learning session did not alter students' preferred learning styles, either for peer-based or

Table 5 Additional results and secondary endpoints of fundoscopy survey

Survey question	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean (/5)	Standard deviation
I am willing to participate in fundoscopy PPE exercises with dilation	19 (37.3%)	16 (31.4%)	8 (15.7%)	4 (7.8%)	4 (7.8%)	3.92	1.24
I am willing to participate in fundoscopy PPE exercises without dilation	35 (68.6%)	12 (23.5%)	4 (7.8%)	0 (0%)	0 (0%)	4.61	0.63

Abbreviation: PPE, peer physical exam.

standardized patient learning. Preference toward learning on peers for cardiac and HEENT exams was associated with preference toward learning on peers for the fundoscopic exam. The same trend was observed for learning on standardized patients. This is particularly relevant because recent trends in medical education have shifted away from PPE learning toward incorporating more standardized patient or simulation encounters in an effort to eliminate the onus of student teaching each other.[22–24] Attitudes toward alternative nonmydriatic techniques were largely positive as well.

On a spectrum from the cardiac and HEENT exams to the more invasive breast and genitourinary exams, fundoscopy would be expected to be found in the middle due to discomfort with dilation and close face-to-face contact. Despite concerns about getting work done or participating in social engagements due to discomfort from dilation, or potentially being in close proximity to a classmate of the opposite gender for fundus visualization, in this study, attitudes toward the use of PPE in learning fundoscopy were largely positive, similar to students' attitudes toward the use of PPE in learning the cardiac and HEENT exams.

However, even though students' responses and attitudes suggest that dilating one's own eye is an effective way to teach fundoscopy skills through a PPE learning model, 49 students (96%) expressed wanting to practice fundoscopy on a peer and were more willing to serve as a peer patient, if they did not have to be dilated. This could be explained by the fact that students preferred not being dilated themselves and likewise did not want to subject their peers to this potentially uncomfortable aspect.

Given students' interest in nonmydriatic fundoscopy, we were surprised that most students actually expressed a preference toward traditional dilation technique when practicing on a standardized patient. This disconnect can possibly be explained by the fact that students did not get to practice fundoscopy without being dilated. Therefore, they may consider dilation essential to successfully learning fundoscopy technique. It is also possible that student misinterpretation of the question could have led to these disparate findings.

The results of this study have implications for how fundoscopy can best be taught early in the medical school curriculum. Peer learning is utilized in approximately 33% of medical student nonsimulator-based fundoscopy learning curricula.[10] Gauging a medical student cohort's attitudes toward PPE prior to a fundoscopy session can help inform fundoscopy curriculum design. Ultimately, students largely had positive responses toward the use of both PPE learning and standardized patients meaning that an effective fundoscopy curriculum could theoretically utilize either PPE or standardized patient learning. A significant advantage of PPE use for fundoscopy is its facilitation of greater empathy and understanding of the patient experience, a key finding that has been replicated in several other studies on PPE learning.[1,4,5] This empathy can help medical trainees to better understand how to perform the fundoscopic exam in a way that is more comfortable for their patients. Furthermore, students' responses to attending an optional follow-up session about nonmydriatic fundoscopic techniques reveal a genuine enthusiasm for learning more about fundoscopy and novel technologies. The interest in this follow-up session may have been influenced by the discussion about the incorporation of telemedicine and novel diagnostic approaches into ophthalmology practice during the didactic session.[25–27] These alternative approaches are important to explore, especially those amenable to remote learning given traditional physical exam teaching methods have become more challenging in the COVID-19 era.[20]

Our study's findings and conclusions are limited by a lower than expected response rate and sample size, which we attributed to the survey timing coinciding with the peak of the COVID-19 pandemic in New York City and disruption of in-person medical student education. Although the participating cohort was 37% of all students invited to participate, a post hoc analysis of sample size revealed 100% power for our given sample size. This suggests that the study cohort was complete and that participation in this study was random, as opposed to being influenced by certain factors such as a student's particular interest in ophthalmology. Nonetheless, a larger sample size and the inclusion of multiple institutions would allow for a more robust analysis. Furthermore, there is potential for recall bias because we asked students to retroactively rate both their perceived comfort and ability with the fundoscopic exam before and after the learning session. Other limitations include single-site data gathering, as well as a lack of an objective measure of student skill acquisition. Additionally, some students may have had previous exposure to fundoscopy prior to this educational session, such as through shadowing experiences, which may have impacted their responses to the survey items.

Despite these limitations, our study is the first to evaluate medical student learning preferences with respect to the

fundoscopic exam and can inform future curriculum development. Additionally, given the great promise that smartphone fundoscopy has shown in teaching ophthalmology and its potential utility in nonmydriatic fundoscopy, integration of this tool into medical education is an area of potential future investigation.[18] Future studies evaluating both student attitudes as well as skills in performing fundoscopy and interpreting fundoscopic images would provide further insight.

Finally, in addition to teaching medical students the basics of fundoscopic technique, it is important to impart the broader relevance of fundoscopy to their medical education.[28,29] In doing so, students can recognize the value of these skills which they may find themselves employing in the primary care or emergency department settings. Incorporating newer methods and teaching tools, such as smartphone fundoscopy, should be considered in developing future fundoscopy curricula. Use of such tools may better align with student learning preferences and may be more adaptable to necessary COVID-19-related precautions. Indeed, fundoscopy education is likely to become even more optimized with advances in fundus photography, nonmydriatic smart phone fundoscopy, artificial intelligence, and teleophthalmology. Students have previously reported increased satisfaction and retention when learning from fundus photos as compared with performing and interpreting the fundoscopic exam themselves.[30] These technologies should be embraced and integrated into the fundoscopy curriculum. However, the ability to use the direct ophthalmoscope remains an important skill for medical trainees, particularly in resource-limited areas or in urgent situations when immediate visualization of the fundus is needed.[30] Adapting fundoscopy education to student learning preferences may lead to more successful skills acquisition, ultimately leading to improved patient care.

Ethics Approval and Consent to Participate

This study was prospectively deemed exempt from full review by the PPHS office at the Icahn School of Medicine at Mount Sinai IRB [GCO#1: 20–0622(0001)] on 3/10/2020. Students read an electronic research information sheet with details about consent at the beginning of the survey. Participants provided informed consent prior to completing the survey. All methods were performed in accordance with relevant guidelines and regulations.

Additional Information

A copy of the survey instrument is included in **Appendix 1**.

Authors' Contributions

All authors made substantial contributions to study conception and design, data acquisition and analysis, manuscript composition, and critical revision for important intellectual content, and approved the final version to be published.

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Conflict of Interest

None declared.

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Appendix 1

A copy of the Fundoscopy Survey is shown below:

Please indicate the extent to which you agree or disagree with the following statements about learning physical exam skills

1. I am willing to have medical students practice physical exam skills on me

Mark only one oval
Strongly disagree • • • • • Strongly agree

2. Peer physical exam (PPE) exercises are a valuable form of learning for me

Mark only one oval
Strongly disagree • • • • • Strongly agree

3. Do you prefer to learn and practice physical exam skills with standardized patients or peers?

Mark only one oval

- • Standardized patients
- • Peers

4. Learning and practicing the physical exam (i.e., HEENT and cardiac exams) with my peers helped me to learn the exam skills better

Mark only one oval
Strongly disagree • • • • • Strongly agree

5. Practicing physical exams (i.e., HEENT and cardiac exams) with my peers helped me to understand the patient experience with the physical exams

Mark only one oval
Strongly disagree • • • • • Strongly agree

6. Are there any reasons you might feel uncomfortable with participating in the physical exam?

Check all that apply

- • N/A
- • Religious beliefs
- • Gender identity of peer
- • Discomfort with having to change into a gown with classmates
- • Discomfort with practicing physical exam skills with classmates

7. Performing the fundoscopic exam on my peers' eyes was helpful in learning exam skills

Mark only one oval
Strongly disagree • • • • • Strongly agree

8. Practicing the fundoscopic exam with my peers helped me to understand the patient experience with fundoscopy

Mark only one oval
Strongly disagree • • • • • Strongly agree

9. How comfortable did you feel performing a fundoscopic exam before the session? (confidence and technical skills)

Mark only one oval
Not comfortable at all • • • • • Very comfortable

10. How comfortable did you feel performing a fundoscopic exam after the session? (confidence and technical skills)

Mark only one oval
Not comfortable at all • • • • • Very comfortable

11. Did you understand what it was like to have a fundoscopic exam performed on you before the session?

Mark only one oval
Not at all • • • • • Very aware

12. Do you understand what it is like to have a fundoscopic exam performed on you after today's session?

Mark only one oval
Not at all • • • • • Very aware

13. How comfortable did you feel when the fundoscopic exam was performed on you?

Mark only one oval
Not comfortable at all • • • • • Very comfortable

The following questions are about the fundoscopy session and whether you had your eye dilated. We ask for honest responses, as this information is not used in any way and will have no impact on your standing in ASM. These responses will not be shared with anyone except for the study coordinators and will not be attached to personal information.

14. Did you get your eye dilated during today's session? Which one? *Mark only one oval*

- • Yes – right eye
- • Yes – left eye
- • No

15. If you answered no, why did you choose not to? Please rate the following factors on a scale from 1 (not relevant to my choice) to 5 (very relevant to my choice). *Check all that apply*

N/A 1 (Not relevant) 2 3 4 5 (Very relevant)
I didn't want to be dilated • • • • • •
Religious beliefs • • • • • •
Medical contraindication to dilation • • • • • •
I didn't want to be examined by someone • • • • • •
of the opposite gender
Concern about getting work • • • • • •

done/studying
I had plans or social engagements later • • • • • •
in the day

16. If there were reasons that you chose to not participate but they were not included in the above options, please indicate them here:

Please indicate the extent to which you agree or disagree with the following statements about learning fundoscopy.
17. I am willing to participate in peer physical exam learning exercises for the fundoscopy exam with dilation

Mark only one oval
Strongly disagree • • • • • Strongly agree

18. I am willing to participate in peer physical exam learning exercises for the fundoscopy exam without dilation

Mark only one oval
Strongly disagree • • • • • Strongly agree

19. If you had an equally accurate and accessible tool that did not involve dilation, would you choose to perform a dilated fundoscopic exam or use the alternate technique?

Mark only one oval

- • Dilate the patient
- • Alternate technique

20. How important do you feel dilating one's own eye is to learning fundoscopy?

Mark only one oval
Not important at all • • • • • Very important

21. What would you prefer out of the following options? Mark only one oval

- • Practice dilated fundoscopy on peers
- • Practice fundoscopy on peers without dilation
- • Practice dilated fundoscopy on a standardized patient
- • Practice fundoscopy on a standardized patient without dilation
- • Not have fundoscopy as a part of the medical school curriculum

22. When comparing the panoptic ophthalmoscope to the direct ophthalmoscope, did you find the panoptic easier to use? (please rate on scale). *Mark only one oval*

Not much easier • • • • • Much easier

Some final reflections—thanks again for participating!

23. Would you be interested in participating in a focus group session to learn how to perform fundoscopy using newer technologies without the need for dilation? Due to COVID19 we do not have an established date for this session yet, but it will likely be on a Saturday afternoon and we will send a follow up email to the entire class when we have more information. For now, please just indicate if this is something you would be interested in. *Mark only one oval*

- • Yes
- • No

24. Please provide any suggestions or feedback on how you think this session should be taught in future years. Thank you!