

Challenges of personal protective equipment use among ophthalmologists during the COVID-19 pandemic: A multicenter international study

European Journal of Ophthalmology
2022, Vol. 32(3) 1398–1405
© The Author(s) 2021
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/11206721211028037
journals.sagepub.com/home/ejo
SAGE

Doaa Maamoun Ashour¹ , Rania Serag Elkitkat^{1,2,3} ,
Hesham Gabr^{1,4} , Mostafa Yosef⁵ , Dilraj Singh Grewal⁴
and Mohamed Ibrahim Saleh¹

Abstract

Purpose: To explore the possible challenges and difficulties of using Personal Protective Equipment (PPE) in ophthalmic practice during the Coronavirus disease 2019 (COVID-19) pandemic.

Methods: This is a multicenter, international survey among practicing ophthalmologists across different countries. The survey was conducted from September 9th to October 24th, 2020. It included a total of 23 questions that navigated through the currently adopted recommendations in different clinical situations. The survey also assessed the convenience of using various PPE in ophthalmic practice and addressed the clarity of the examination field while using various PPE during clinical or surgical procedures.

Results: One hundred and seventy-two ophthalmologists completed the survey (101 from Egypt, 50 from the USA, and 21 from four other countries). The analysis of the responses showed that most ophthalmologists use face masks without significant problems during their examinations, while face shields followed by protective goggles were the most inconvenient PPE in the current ophthalmic practice. Moreover, most of the participants (133, 77.3%) noticed an increase in their examination time when using PPE. Furthermore, a considerable percentage of the respondents (70, 40.7%) stopped using one or more of the PPE due to inconvenience or discomfort.

Conclusions: Due to the unique nature of the ophthalmic examination, certain PPE are not ophthalmologist-friendly. Innovative PPE should be tailored for prompt, more convenient, and clearer ophthalmological practice.

Keywords

COVID-19 pandemic, practice of ophthalmologists, protective goggles, face shields, challenges of PPE, proper PPE in ophthalmology

Date received: 5 January 2021; accepted: 5 June 2021

Introduction

Since the declaration of the Coronavirus Disease 2019 (COVID-19) pandemic by the World Health Organization (WHO) on March 11th, 2020, many strategies for limiting the elective medical services were applied in different countries, and special protective measures were recommended for safer performance of the urgent and emergency services in different specialties, including ophthalmology.^{1–3} After weeks of lockdown, elective medical services were resumed, yet considering the utmost safety measures and following the recommendations and guidelines of the

¹Department of Ophthalmology, Faculty of Medicine, Ain Shams University, Cairo, Egypt

²Watany Eye Hospital, Cairo, Egypt

³Watany Research and Development Center, Cairo, Egypt

⁴Department of Ophthalmology, Duke University, Durham, NC, USA

⁵Department of Community, Environmental and Occupational Medicine, Ain Shams University, Cairo, Egypt

Corresponding author:

Rania Serag Elkitkat, Department of Ophthalmology, Faculty of Medicine, Ain Shams University, Future City, Shorouk, Cairo, 11799, Egypt.

Email: raniaselkitkat@med.asu.edu.eg

infection control protocols, as we have a second wave of infections in many countries.^{4,5} With the application of those measures, Grosso et al.⁶ found that ophthalmic practice could be safely continued even during the peak of the pandemic.

Many international ophthalmological societies (including the American Academy of Ophthalmology “AAO” and the Royal College of Ophthalmologists) published their recommendations for the reopening era. They all emphasized that the medical services should be resumed in a “new normal atmosphere” which would differ from the era before the COVID-19 pandemic.^{4,7} Among these new normal requirements, the use of Personal Protective Equipment “PPE” is integral.^{2,8–10}

Recent publications highlighted the appropriate PPE in clinical practice, which varied among different countries.¹¹ While the AAO suggested the use of protective eye goggles or face shields for safer resumption of elective surgeries; it also acknowledges that this may not be appropriate in all situations.¹² Proper visualization with the slit lamp or operating microscope requires the eyes to be in close contact with the oculars, which might be difficult while using protective eye goggles or face shields.¹³ Moreover, the problem of fogging is a significant challenge during the use of face masks as demonstrated in prior studies.^{14,15} In a recent study by Yáñez Benítez et al.,¹⁶ surgeons reported limitations in both visibility and communication while using PPE during emergency surgery in COVID-19 patients.

As the PPE is currently an integral part of the eye clinic and operating room (OR) settings, it is essential to investigate the potential limitations that might be associated with their use. Not only may these limitations disturb the ophthalmologists while examining and operating on their patients, but they may also interfere with the proper management of cases and efficient clinical practice.

Consequently, we set out to perform the present study to assess the challenges that ophthalmologists could face while using PPE during this era of the COVID-19 pandemic. The primary outcome was to identify the suitability of the recommended PPE use in the eye clinic and OR, including the convenience to clinical and surgical procedures, and the clarity of visualization during examination and surgeries. The secondary outcome was to identify the factors that could hinder the use of PPE by ophthalmologists and accordingly could adversely affect their compliance to use this equipment, which could compromise the safety of the patient and the ophthalmologist.

Subjects and methods

This prospective cross-sectional multicenter international study was performed via a self-administered anonymous web survey (Google forms) that was distributed to the participants from September 9th, 2020 to October 24th,

2020 (available as an Supplemental Appendix). The study abided by the tenets of the Declaration of Helsinki and was approved by both the Institutional Review Board (IRB) of Watany Eye Hospital, Cairo, Egypt and the IRB of Duke University, Durham, NC, USA. A separate question existed in the Google form to ensure the acceptance of the potential participants before starting the survey.

The survey was distributed via personal emails or the WhatsApp application among currently practicing ophthalmologists across different countries, including mainly Egypt and the United States of America, with some other contributions from the United Kingdom, Iraq, Brazil, and Morocco. Only one submission per respondent was allowed. The survey consisted of five sections with a total of 23 questions. It started with a cover page that included the title of the study, its aim, and a statement of agreement to perform the survey. The cover page was followed by questions regarding the participants’ demographic data. Then, the survey navigated through the recommendations and the various guidelines that the participating ophthalmologists follow in their clinical practice. The participants were then asked about the availability of PPE fitting tests and consequently fitted-size PPE at their institutions. Afterward, detailed questions about the convenience and clarity while performing any clinical examination or surgical procedure with the use of variable PPE were asked. Within the survey, “convenience” was defined as being able to proceed with the various clinical procedures without difficulty, in a state of physical ease and freedom from pain or constraints during work. Finally, an open-ended question was asked about any PPE that could not be used by the participating ophthalmologists. The data were revised and coded. Statistical analysis was done using the Statistical Package for Social Science (SPSS 20). Descriptive statistics were presented as frequency and percentages. Bar graphs and stacked bar charts were used where appropriate.

Results

We received 174 responses for the survey out of 440 invitations sent, which corresponds to a response rate of 39.5%. Two invitees declined to participate, and no responses were recorded. The analysis was thus performed on the results obtained from 172 ophthalmologists (39.1%).

The demographic data of the participants are shown in Table 1. A significant portion of the participating ophthalmologists (72 participants, 41.9%) was in the age range of 30–40 years. Also, there was no significant difference between the responders regarding their gender. Besides, the current position of 71 participants (41.3%) was a consultant or an attending physician.

According to the participants’ institutional guidelines, we plotted Figure 1 to show the results for the currently recommended infection control measures during their routine practice and while dealing with COVID-19 confirmed

Table 1. Demographic data of the participating ophthalmologists.

Demographic data of the participating ophthalmologists	N	%
Gender		
Male	75	43.6
Female	97	56.4
Country of your current practice		
Egypt	101	58.7
USA	50	29.1
Other	21	12.2
Age		
25–30	44	25.6
30–40	72	41.9
40–50	35	20.3
50–60	13	7.6
>60	8	4.7
Current position		
Resident	37	21.5
Consultant or attending physician	71	41.3
Specialist or fellow	64	37.2
Subspecialty		
General	70	40.7
Anterior segment (Cataract, Glaucoma, Cornea)	49	28.5
Investigative	12	7.0
Medical retina and uveitis	7	4.1
Neuro-ophthalmology	3	1.7
Oculoplasty	8	4.7
Oncology	1	.6
Squint and pediatrics	10	5.8
Vitreoretinal	12	7.0

or suspected cases. Further analysis of these responses was done to compare the results obtained from the ophthalmologists in Egypt and the USA (the two countries with the major contributions), as shown in Figure 2. Generally, the most recommended measures were performing frequent hand hygiene and using face masks, with no statistically significant differences between Egypt and the USA. Slit-lamp shield use was the third most recommended measure during routine practice (88.4%) or while dealing with COVID-19 confirmed or suspected cases (97.1%). All the other PPE were more recommended while dealing with confirmed or suspected cases rather than the routine practice.

Regarding the availability of fitting tests and fitted-size PPE, only 67 ophthalmologists (39%) reported their availability.

The responses of the participants regarding the convenience of variable PPE to their practice and the clarity of the clinical procedures while using PPE are detailed in Figure 3. Face masks were the most convenient PPE for use during the various clinical procedures, with the highest scores for clarity. Contrarily, both face shields and protective

goggles had very comparable low scores regarding the convenience and clarity of various procedures while using them.

For our recruited participants, the most common types of masks currently used, either while examining patients in clinics or during performing surgeries, were the surgical masks (79.7% and 78.6%, respectively), followed by the N95 respirator masks (18.6% and 20%, respectively). Most of the participants (133 responders, 77.3%) noticed that using PPE in general increases the time of their clinical examination. Furthermore, 28 out of 156 (17.9%) reported an increase in the time of performing surgeries with the currently used face masks, where N95 masks were used during surgeries by 16 out of these 28 (57%) ophthalmologists, and only one participant was using a reusable half-face respirator.

Among the study participants, 75 ophthalmologists (43.6%) reported spectacles use during their practice. A significant portion (46%) of spectacles users reported inconvenience of spectacles use with face masks, and a greater portion (62.7%) noted inconvenience or discomfort when using both protective goggles and face shields.

We also inquired about the existence of any chronic illness among the responders to the survey. Chronic sinusitis was positive in 29 participants (16.9%), while the other chronic illnesses which were included (bronchial asthma, cardiac diseases, or others to be added by the participants) had negligible percentages among the enrolled ophthalmologists in the study.

In response to another question regarding the PPE challenges, 70 ophthalmologists (40.7%) (41 from Egypt, 22 from the USA, and 7 from other countries) reported that they stopped using one or more types of the PPE because of inconvenience or discomfort, with no statistically significant differences among different countries. Face shields were the most abandoned PPE, as reported by 38 out of 70 (54.2%) ophthalmologists, followed by protective goggles (32 responses 45.7%). On the contrary, face masks and reusable half-face respirators were mentioned by very few responders (6 (8.5%) and 2 (2.8%) responders, respectively).

In the end, we compared the negative impact of PPE use between the participants from Egypt and the USA, as shown in Figure 4.

Discussion

Difficulties and challenges associated with PPE use among healthcare providers were previously reported, including -but not limited to- early fatigue, thermal discomfort, ill-fitted PPE, lack of proper training on fitting them, and uncertainty of the effectiveness of the used PPE.^{14–18} In a recent survey that was performed on 24 ophthalmologists, all practicing in Nepal, participants reported problems related to discomfort and difficulty in performing

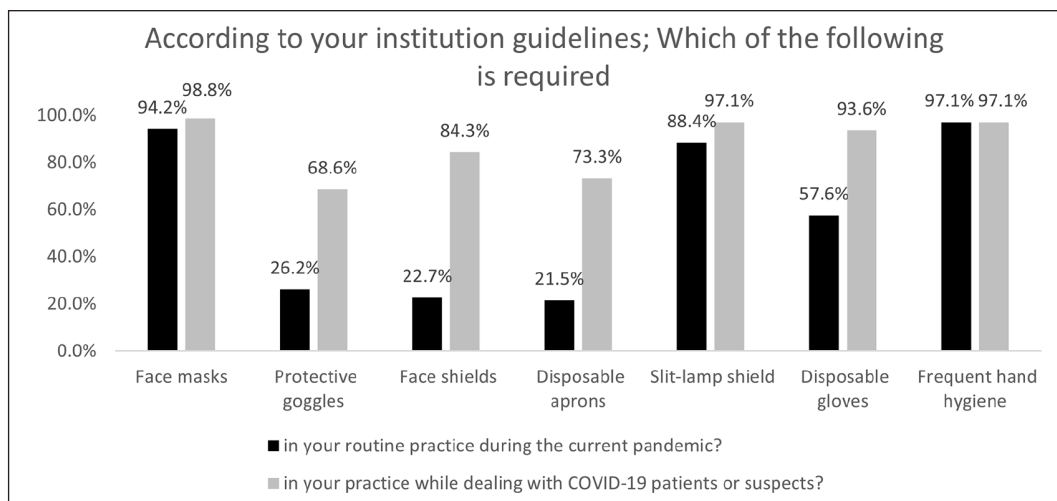


Figure 1. Recommended personal protective equipment (PPE) according to participants’ institutional guidelines, in routine practice during the current pandemic and while dealing with COVID-19 patients or suspects.

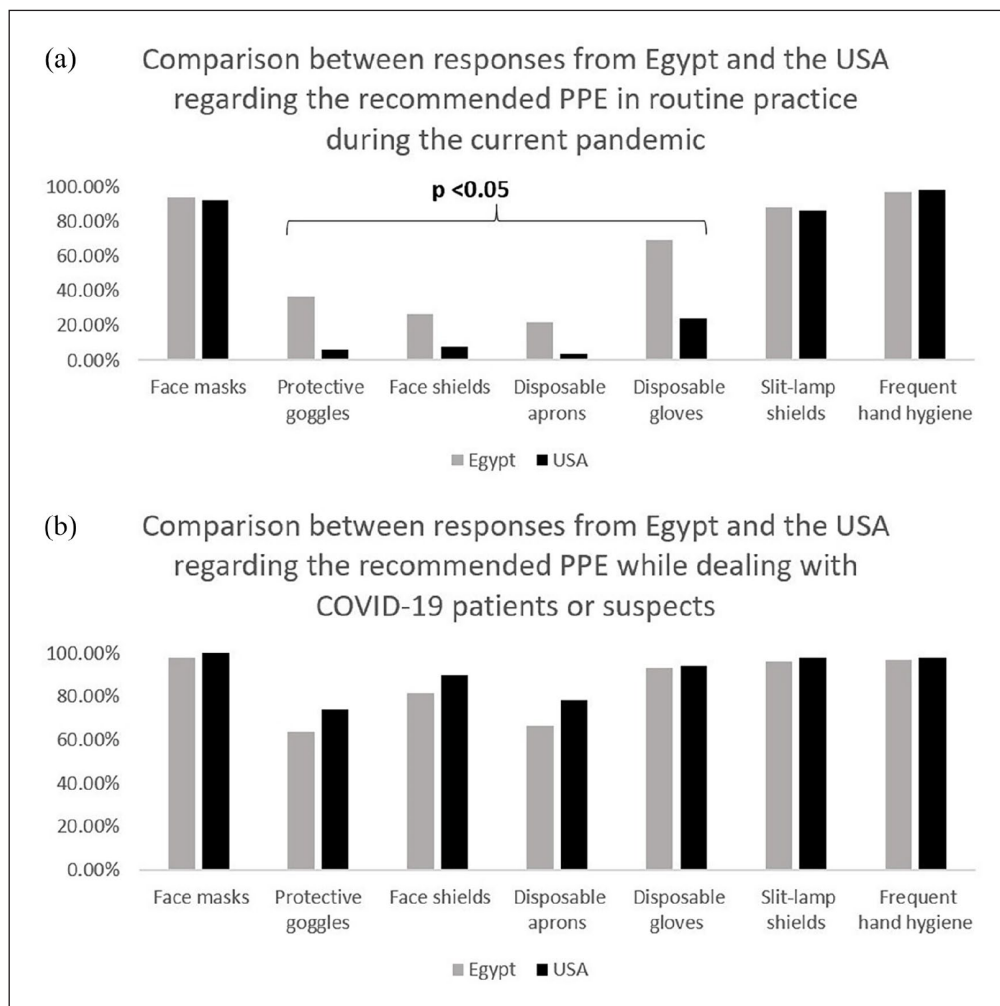


Figure 2. Comparison between responses from Egypt and the USA regarding the recommended personal protective equipment (PPE) in routine practice during the current pandemic (a) and while dealing with COVID-19 patients or suspects (b).

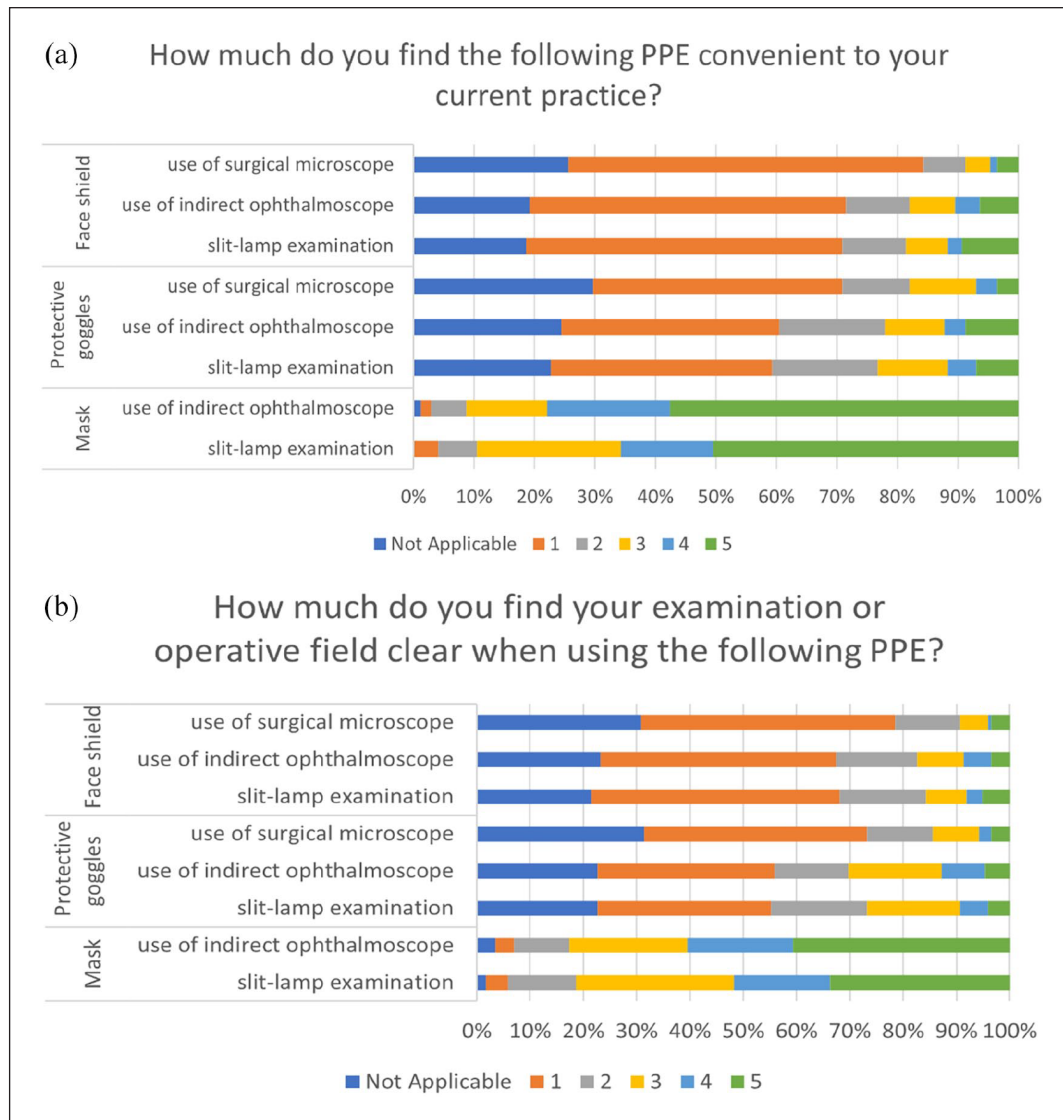


Figure 3. Responses regarding the convenience of various personal protective equipment (PPE) to ophthalmological examination and the clarity of examination with variable PPE. Data presented as a stacked bar: (a) showing the responses regarding the convenience of the various PPE to practice, 1 means not convenient at all, 5 means totally convenient, not applicable if this type of PPE has not been used by the participant and (b) showing the responses regarding the clarity during examination with different PPE, 1 means not clear at all, 5 means clear as without PPE and not applicable if this type of PPE has not been used by the participant. PPE: personal protective equipment.

regular examination with the use of PPE.¹⁷ However, to the authors' knowledge, the suitability and convenience of the commercially available PPE to the ophthalmic practice as well as the clarity of visualization of various ophthalmic procedures while using PPE, were not explored on a large scale before. This study is the first multi-center international study to highlight the detailed challenges of using PPE in ophthalmology.

In the present study, we explored the recommended guidelines and the possible challenges which could face ophthalmologists while using different PPE during the COVID-19 pandemic. Data analysis showed that the most

recommended institutional infection control measures were frequent hand hygiene, face masks, and using slit-lamp shields, without statistically significant differences between Egypt and the USA (being the two countries with the major contributions in our survey). Furthermore, face masks were shown to be the most convenient form of PPE for use among ophthalmologists, and they also provided the clearest field for various ophthalmic procedures compared to other available PPE. Currently, various studies support the use of face masks, with growing evidence supporting their preventive role while dealing with patients.^{19,20} Recent experimental studies, specifically

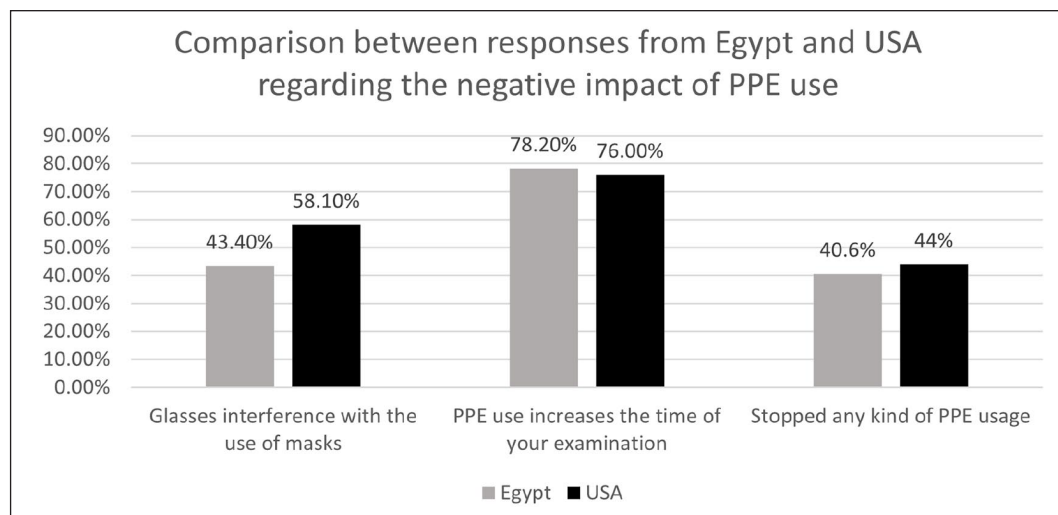


Figure 4. Comparison of the personal protective equipment (PPE) negative impact reported in our study between the participants from Egypt and the USA.
PPE: personal protective equipment.

related to ophthalmic practice, have shown that face masks for doctors and patients have got a significant effect in minimizing the spread of respiratory droplets, and the slit-lamp shields were also shown to contribute in preventing the droplet infections when used with the face masks.^{21,22}

Almost 80% of the participants in the present survey use surgical masks either in outpatient clinics or during surgeries. This came following many guidelines that save N95 respirators to the frontline healthcare providers.²³ Additionally, when considering outpatient services, surgical masks were as effective as N95 respirators as shown in a previous randomized controlled trial.²⁴ Less than a quarter of our participants (28 out of 156, 17.9%) found that the mask they are currently using during surgeries either negatively affects their surgical performance or increases the time of performing surgeries. Twelve of them are currently using N95 respirators and only one is using a half-face reusable respirator. The reported negative impact could be related to recently adopted extra precautions, like using double masks or extra sealing of masks with tape. It is also possible that this negative impact could be related to the associated use of other PPE types while wearing face masks.

Nearly 60% of the participating ophthalmologists do not have access to fitted PPE. This is a disquieting finding, as the role of mask fitting was found as an important factor in the functional efficacy of masks.²⁵ Also, ill-fitted PPE might induce more fogging which impairs clear visibility.

While dealing with COVID-19 confirmed or suspected cases, using disposable gloves was stated as a highly recommended safety precaution by 93.6% of our participants, followed by the face shields (84.3%) and the protective goggles (68.6%). These findings are following the standard precautions recommended by the Center for Disease

Control and Prevention (CDC).²⁶ The protective role of face shields is still controversial. A previously published review concluded that face shields have a minimal protective role in the prevention of viral transmission.²⁷ Contrarily, an experimental study showed that face shields could reduce the risk of inhalational exposure by 95%, though less protection was encountered with smaller particles.²⁸

Among our participants, 44% were using eyeglasses. Almost half of them thought that their eyeglasses interfere with the use of face masks. This percentage increased to more than 60% when it came to the use of face shields or protective goggles. Fogging with eyeglasses could significantly impede adequate visualization which could impair optimal patient care and increase the examination time. Accordingly, several methods were proposed to overcome the fogging of the eyeglasses with masks and face protective PPE, including the use of hand sanitizers or the application of antifogging agents.²⁹

One of the reported limitations of PPE in our study was increased examination time (78% of the participants). This could be explained by the time spent on donning and doffing, PPE fitting, reported difficulties in communication with the patients,¹⁷ and impaired visualization due to fogging. Owing to these challenges with PPE use, 40% of our participants reported that they stopped the use of one or more of the PPE, with face shields being the most intolerable.

We explored the presence of chronic illnesses among the responders that could hinder their ability to tolerate various PPE. Chronic sinusitis was present in 16.9% of the participants. However, it was not associated with higher rates of abandoning any of the PPE. This might be due to being controlled on medications, though this was not further explored in the survey.

The participants of the current study represent different age groups, although 67.5% of them were below the age of 40 years. This could be representative of the age of the major portion of practicing ophthalmologists. Also, 58% of the participants were residents and fellows. Corradetti and Corvi³⁰ recently reported the challenges facing the young trainees during the COVID-19 pandemic as per the educational demands. Our study results added to these reported challenges due to the difficulties they face with the PPE use. It is also noteworthy that our survey included few responses from ophthalmologists above the age of 60 years (4.7%). Future studies might be more representative of this age group, especially since the elderly population is at a higher risk for developing COVID-19 complications.³¹

The participants of this survey represent practicing ophthalmologists in different countries, mainly those practicing in Egypt and the USA. Responses from Egypt came from 10 different hospitals and centers while responses from the USA came from Duke University and the University of North Carolina. Despite this diversity, we did not find statistically significant differences when we compared the responses obtained from both countries regarding the effect of PPE use on the examination time, the obstacles faced with the use of eyeglasses, and if the participants stopped using any kind of PPE. This obviously shows that PPE use is a worldwide problem that should be well addressed.

In conclusion, our study highlighted the main challenges with PPE use among ophthalmologists. Impaired visualization is a real concern with certain PPE use such as protective goggles and face shields. Moreover, wearing eyeglasses is another significant limitation while using PPE. The increased examination time with PPE use might be cumbersome for both ophthalmologists and patients. These challenges could limit the adherence of ophthalmologists worldwide to the recommended infection control guidelines.

As we are still trying to control the COVID-19 pandemic, adopting new strategies in patients' care like telemedicine, using fundus photography, and smartphone assisted slit-lamp examination instead of conventional methods has become essential.^{32–35} Industrial incorporations of protective equipment like slit-lamp shields in the ophthalmic clinic settings should be implemented. Further studies regarding the real protective value of the currently used PPE are needed which could help with optimizing the PPE designs to obtain adequate protection with better compliance among healthcare workers.

Authors' note

We ensure that this manuscript has not been published before and is not currently under consideration for any other publication elsewhere.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.


Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

ORCID iDs

Doaa Maamoun Ashour  <https://orcid.org/0000-0003-0338-2668>

Rania Serag Elkitkat  <https://orcid.org/0000-0001-7808-6658>

Hesham Gabr  <https://orcid.org/0000-0002-1200-8267>

Mostafa Yosef  <https://orcid.org/0000-0002-9774-924X>

Supplemental material

Supplemental material for this article is available online.

References

- Lai THT, Tang EWH, Chau SKY, et al. Stepping up infection control measures in ophthalmology during the novel coronavirus outbreak: an experience from Hong Kong. *Graefes Arch Clin Exp Ophthalmol* 2020; 258(5): 1049–1055.
- Veritti D, Sarao V, Bandello F, et al. Infection control measures in ophthalmology during the COVID-19 outbreak: a narrative review from an early experience in Italy. *Eur J Ophthalmol* 2020; 30(4):621–628.
- Borrelli E, Sacconi R, Querques L, et al. Taking the right measures to control COVID-19 in ophthalmology: the experience of a tertiary eye care referral center in Italy. *Eye (Lond)* 2020; 34(7): 1175–1176.
- Parke DW; American Academy of Ophthalmology. Returning to Ophthalmology Practice, <https://www.aaopt.org/about/governance/academy-blog/post/returning-to-ophthalmology-practice> (2020, accessed 30 June 2020).
- Lim LW, Yip LW, Tay HW, et al. Sustainable practice of ophthalmology during COVID-19: challenges and solutions. *Graefes Arch Clin Exp Ophthalmol* 2020; 258(7): 1427–1436.
- Grosso A, Rigoli R, Formentini S, et al. Suppression of Covid-19 outbreak among healthcare workers at the Treviso Regional Hospital, Italy and lessons for ophthalmologists. *Eur J Ophthalmol*. Epub ahead of print 15 December 2020. DOI: 10.1177/1120672120982520.
- RCOphth. Reopening and redeveloping ophthalmology services during Covid recovery-Interim guidance, <https://www.rcophth.ac.uk/wp-content/uploads/2020/04/Reopening-and-redeveloping-ophthalmology-services-during-Covid-recovery-Interim-guidance-1.pdf> (2020, accessed 14 August 2020).
- Daigle P, Leung V, Yin V, et al. Personal protective equipment (PPE) during the COVID-19 pandemic for oculo-facial plastic and orbital surgery. *Orbit (London)* 2021; 40(4): 281–286.
- Chandra A, Haynes R, Burdon M, et al. Personal protective equipment (PPE) for vitreoretinal surgery during COVID-19. *Eye* 2020; 34(7): 1196–1199.
- Corradetti G, Corvi F, Nguyen TV, et al. Management of neovascular age-related macular degeneration during the COVID-19 pandemic. *Ophthalmol Retina* 2020; 4(8): 757–759.
- Olivia Li JP, Shantha J, Wong TY, et al. Preparedness among ophthalmologists: during and beyond the COVID-19 pandemic. *Ophthalmology* 2020; 127(5): 569–572.

12. Chodosh J, Holland GN and Yeh S. Special consideration for ophthalmic surgery during COVID-19 pandemic, <https://www.aao.org/headline/special-considerations-ophthalmic-surgery-during-c> (2020, accessed 14 August 2020).
13. Carobbio ALC, Filauro M, Parrinello G, et al. Microsurgical procedures during COVID-19 pandemic: the VITOM[®] 3D-HD exoscopic system as alternative to the operating microscope to properly use personal protective equipment (PPE). *Eur Arch Otorhinolaryngol* 2021; 278(6): 2129–2132.
14. Crebolder JM and Sloan RB. Determining the effects of eyewear fogging on visual task performance. *Appl Ergon* 2004; 35(4): 371–381.
15. Jordan DJ and Pritchard-Jones R. Tying a surgical mask to prevent fogging. *Ann R Coll Surg Engl* 2014; 96(2): 165.
16. Yáñez Benítez C, Güemes A, Aranda J, et al. Impact of personal protective equipment on surgical performance during the COVID-19 pandemic. *World J Surg* 2020; 44(9): 2842–2847.
17. Khatri A, Kharel M, Chaurasiya BD, et al. COVID-19 and ophthalmology: an underappreciated occupational hazard. *Infect Control Hosp Epidemiol* 2021; 42(6): 789–790.
18. Kang J, Kim EJ, Choi JH, et al. Difficulties in using personal protective equipment: training experiences with the 2015 outbreak of middle east respiratory syndrome in Korea. *Am J Infect Control* 2018; 46(2): 235–237.
19. Offeddu V, Yung CF, Low MSF, et al. Effectiveness of masks and respirators against respiratory infections in healthcare workers: a systematic review and meta-analysis. *Clin Infect Dis* 2017; 65(11): 1934–1942.
20. Bartoszko JJ, Farooqi MAM, Alhazzani W, et al. Medical masks vs N95 respirators for preventing COVID-19 in healthcare workers: a systematic review and meta-analysis of randomized trials. *Influenza Other Respir Viruses* 2020; 14(4): 365–373.
21. Ong SC, Razali MAB, Shaffiee L, et al. Do slit-lamp shields and face masks protect ophthalmologists amidst COVID-19? *Ophthalmology* 2020; 127(10): 1427–1429.
22. Shah SH, Garg AK, Patel S, et al. Assessment of respiratory droplet transmission during the ophthalmic slit-lamp exam: a particle tracking analysis. *Am J Ophthalmol* 2020; 222: 76–81.
23. World Health Organization (WHO). Rational use of personal protective equipment for coronavirus disease 2019 (COVID-19): Interim guidance, 6 April 2020. WHO, 1–7. https://apps.who.int/iris/bitstream/handle/10665/331695/WHO-2019-nCov-IPC_PPE_use-2020.3-eng.pdf (accessed 14 August 2020).
24. Radonovich LJ, Simberkoff MS, Bessesen MT, et al. N95 respirators vs medical masks for preventing influenza among health care personnel: a randomized clinical trial. *JAMA* 2019; 322(9): 824–833.
25. Brosseau LM. Fit testing respirators for public health medical emergencies. *J Occup Environ Hyg* 2010; 7(11): 628–632.
26. Center for Disease Control and Prevention. Standard precautions for all patient care, <https://www.cdc.gov/infectioncontrol/basics/standard-precautions.html> January 2016 (accessed 20 October 2020).
27. Roberge RJ. Face shields for infection control: a review. *J Occup Environ Hyg* 2016; 13(4): 239–246.
28. Lindsley WG, Noti JD, Blachere FM, et al. Efficacy of face shields against cough aerosol droplets from a cough simulator. *J Occup Environ Hyg* 2014; 11(8): 509–518.
29. Hu Y, Wang L and Hu S. Prevention of fogging of protective eyewear for medical staff during the COVID-19 pandemic. *J Emerg Nurs* 2020; 46(5): 564–566. DOI: 10.1016/j.jen.2020.05.003.
30. Corradetti G and Corvi F. The impact of COVID-19 on retina trainees. *Retina Today* 2020; September: 30–31.
31. Cummings MJ, Baldwin MR, Abrams D, et al. Epidemiology, clinical course, and outcomes of critically ill adults with COVID-19 in New York City: a prospective cohort study. *Lancet* 2020; 395(10239): 1763–1770.
32. Saleem SM, Pasquale LR, Sidoti PA, et al. Virtual ophthalmology: telemedicine in a COVID-19 era. *Am J Ophthalmol* 2020; 216: 237–242.
33. Kern C, Fu DJ, Kortuem K, et al. Implementation of a cloud-based referral platform in ophthalmology: making telemedicine services a reality in eye care. *Br J Ophthalmol* 2020; 104(3): 312–317.
34. Chandra A, Romano MR, Ting DS, et al. Implementing the new normal in ophthalmology care beyond COVID-19. *Eur J Ophthalmol* 2021; 31(2): 321–327.
35. Damodaran S, Babu N and Arthur D. Smartphone assisted slit lamp evaluation during the COVID-19 pandemic. *Indian J Ophthalmol* 2020; 68(7): 1492.