Asian J Ophthalmol. 2021;18:54-74
© Asian Journal of Ophthalmology

Review Article
https://doi.org/10.35119/asjoo.v18i1.787

Changes in practice guidelines and regulations in ophthalmology due to COVID-19

Brian E. Yu[1], **Bahaaldin Helal**[1], **Monali Malvankar-Mehta**[2,3]
[1]Schulich School of Medicine and Dentistry, The University of Western Ontario, London, ON, Canada; [2]Department of Ophthalmology, Schulich School of Medicine and Dentistry, The University of Western Ontario, London, ON, Canada; [3]Department of Epidemiology and Biostatistics, Schulich School of Medicine and Dentistry, The University of Western Ontario, London, ON, Canada

Abstract

Purpose: *Coronavirus disease 2019 (COVID-19) is caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and has been declared as a pandemic by the World Health Organization (WHO). The purpose of the study was to summarize the current recommendations and practice guidelines to be implemented in ophthalmology due to COVID-19.*

Study design: *A systematic review of literature.*

Methods: *A systematic literature search was performed using MEDLINE, EMBASE, CINAHL, Clinical Trials.gov, and ProQuest Dissertations and Theses until May 25, 2020. All conferences held through Association for Research in Vision and Ophthalmology, American Academy of Ophthalmology, and Canadian Society of Ophthalmology were also searched until May 25, 2020. Eligible articles were identified by reviewing the retrieved results.*

Results: *In total, 57 records were retrieved from multiple databases and 0 records were identified through grey literature search. Ten articles were included for analysis. Rigorous hand hygiene, proper screening, and proper use of protective personal equipment by both staff and patients were strongly advised. Careful triage of patients upon arrival to facilities based on screening was advised along with deferral of any non-urgent appointments and implementing measures to limit exposure in waiting rooms. Routine disinfection of equipment, use of shields or barriers on slit lamps, and limiting the use of instruments and tests were strongly recommended and advised.*

Conclusions: *The implementation of guidelines should be in place for ophthalmologic staff, facilities, and visitors to help minimize the spread of COVID-19 and promote a safer environment in ophthalmology.*

Keywords: *COVID-19, coronavirus, guidelines, ophthalmology, practice*

Correspondence: Monali S. Malvankar-Mehta, Department of Ophthalmology, Ivey Eye Institute, St. Joseph's Hospital, 268 Grosvenor Street, London, Ontario, N6A 4V2, Canada.
E-mail: Monali.Malvankar@schulich.uwo.ca

Introduction

Coronavirus disease 2019 (COVID-19) is caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).[1] On March 11, 2020, the World Health Organization (WHO) declared COVID-19 outbreak a pandemic. COVID-19 can cause severe acute respiratory infection with an incubation period of 1–14 days.[2] Common symptoms of COVID-19 can consist of fever, dry cough, and fatigue.[3] It can be mainly spread through respiratory droplets; however, spread through various discharges, feces, aerosol, and conjunctiva have also been suspected.[4] Early on, in February 2020, it was reported by the National Health Commission of the People's Republic of China that 3,387 healthcare workers had confirmed infected COVID-19.[3] More recently, since April 2020, over 2,000,000 people from 210 countries have been infected.[1] The death toll has been shown to be greater than 140,000 people worldwide, with a case fatality rate of 6.7%.[1]

With health care workers operating on the frontlines, they are constantly at high risk of infection to the SARS-CoV-2. Like many health care workers, ophthalmologists are very much at risk of COVID-19 infection. In fact, the ophthalmologist Li Wenliang was one of the first people to recognize the outbreak of COVID-19 and become infected.[5] Since many ophthalmic examinations such as slit-lamp examinations are commonly performed in a setting with close contact with patients, the risk of exposure of ophthalmologic staff to infection can be quite high.

Various recommendations and guidelines have been put in place to help protect both health care workers as well as patients from the spread of COVID-19. Currently, there is a need to address how to best provide ophthalmic care for patients during this pandemic. Establishing guidelines is necessary to ensure that there is a strategy of protection during clinical practice. The purpose of this study is to summarize the current practice guidelines and recommendations to be implemented in ophthalmology due to COVID-19 by systematically reviewing the literature.

Methods

Search methods

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statements[6] were used to conduct this systematic review. Database searches were executed on MEDLINE, EMBASE, CINAHL. Clinical Trials.gov, and ProQuest dissertations and theses to locate studies investigating ophthalmology, practice, guidelines, and COVID-19. Search strategies were designed for each database (Appendix A) to find the most relevant studies until May 25, 2020. OVID® AutoAlerts for MEDLINE and EMBASE were set up to send monthly

updates regarding any relevant new literature. No limits were placed throughout the searches.

A grey literature search was performed through conferences held by the Association for Research in Vision and Ophthalmology (ARVO) and the American Academy of Ophthalmology (AAO) in all years available. Conferences held through the Canadian Society of Ophthalmology (COS) were searched from the year 2010 to 2020. Keywords that were used to search through conference abstracts were "covid-19 or coronavirus or coronavirus infection* or 2019-nCoV or SARS-CoV-2 or nCoV or covid*", "regulation* or guideline* or practice*", and "ophtha*". The searches for ARVO, AAO, and COS were all done until May 25, 2020.

Study inclusion and exclusion criteria

Studies pertaining to changes in guidelines, practice, or regulations in ophthalmology were included with this being the primary focus of the current study. Clinical trials, comparative studies, and case series were included. Narrative reviews, perspectives, and articles where large groups convened to establish guidelines were also included. Editorials and letters on any relevant recommendations or guidelines in ophthalmology were included. Non-human studies were excluded from analysis. Only studies with full text articles in English were included and no restrictions were placed on the country in which the study was performed.

Screening

The results of each database search were imported into Covidence (Covidence Systematic Review Software, Veritas Health Innovation, Melbourne, Australia). Upon import, duplicates were removed, and the systematic screening was performed by two independent reviewers (B.Y and B.H). Title and abstract screening were then carried out, and Cohen's kappa coefficient was calculated after each level of screening before resolving conflicts. Conflicts were resolved by consensus and if consensus was not reached, then a third reviewer was required to resolve any disagreements. For full-text screening, the full texts of any studies that had made it past abstract screening were uploaded. Cohen's kappa was once again calculated before conflicts were resolved. A finalized list of literature was then scored for quality.

Risk of bias assessment and data extraction

Risk of bias (RoB) was assessed to ensure completeness of our methodology. The RoB assessment was performed using the AMSTAR quality assessment tool[7] for the review articles. Various items were examined using the AMSTAR tool, including question and inclusion, protocol, study design, comprehensive search, study selection, data extraction, excluded studies justification, included studies details, RoB, funding sources, statistical methods, RoB on meta-analysis, RoB in individual studies, explanation for heterogeneity, publication bias, and conflict

of interest. All studies were then given an overall quality rating. Due to limited evidence, none of the lesser quality articles were excluded from the analysis.

One investigator (B.Y) performed the data extraction. Information on the characteristics of each study was extracted from the ten articles. This information included the first author's last name, year of publication, country of origin, study design, and sources of funding. Other data extracted included the specific guidelines, changes in practice, and regulation changes applicable to ophthalmologic staff, patients, and facilities.

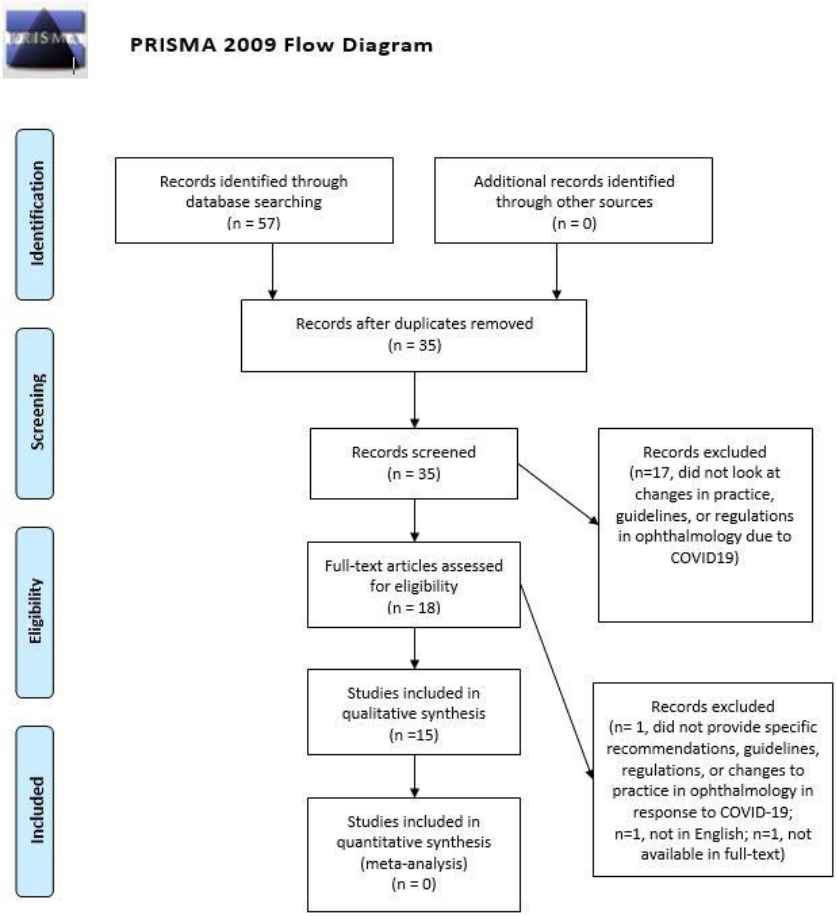

Fig. 1. PRISMA flowchart summarizing the results of the literature search.

Results

Search results and study characteristics

Upon completing database searches, 57 potentially relevant studies were produced (Fig. 1). All studies were imported into Covidence, where 22 duplicates were removed before screening. The remaining 35 studies underwent level 1 screening for their titles and abstracts. Seventeen studies were excluded because they did not look at changes in practice, guidelines, or regulations in ophthalmology due to COVID-19. The remaining 18 studies underwent level 2 screening for their full texts. One study was excluded because it did not provide specific recommendations or changes to practice in ophthalmology in response to COVID-19, another study was excluded because the full-text article was not available in English, and another one study was excluded because the full-text article was unavailable.[8] The final 15 studies were included in data extraction. Five of the studies were reviews and their RoB was assessed using AMSTAR risk of bias assessment instruments[7] (Appendix C). For the rest of the ten studies, five studies were letters and opinion pieces and the other five were perspective studies.

Cohen's kappa values for the agreement between the two reviewers were 0.52 and 1.00 for levels 1 and 2 screening, respectively (Appendix B).

The characteristics of ten included studies (out of a total of 15, since five were letters, comments, and opinions) are summarized in Table 1. These studies were conducted in various countries, including the United Kingdom, United States, China, France, Singapore, Italy, Iran, and India. Five studies were review articles, two studies were editorials, two studies were letters to the editor, one study was a commentary, and five studies were perspective articles. Data pertaining to specific guidelines or changes in practice applicable to ophthalmologic staff, patients, and facilities can be found summarized in Table 2, Table 3, and Table 4 respectively.

Guidelines for practice for staff and patients in ophthalmology

Eleven articles[1,9,10–18] emphasized rigorous hand hygiene practice for staff as a key preventive measure. Ten articles[9,11,13–16,18–21] recommended regular symptom and temperature screening of staff. All 15 articles[1,9–22] encouraged the use of personal protective equipment (PPE) by working staff with the use of face masks being particularly emphasized to prevent droplet transmission. It is recommended by one article[9] for staff to wear a N95 or FFP2 mask wherever possible. However, nine articles[1,11–14,16,18–22] recommended for staff to wear such masks and full PPE (including a cap, gloves, gowns, eye protection, and face shields) when attending persons under investigation and confirmed with COVID-19. It is also recommended by three[13,20,22] of the previous nine articles to simply wear surgical masks during low-risk encounters rather than N95 or FFP2 masks.

Table 1. Characteristics of included studies

Author	Year	Study design	Study location	Funding information	Primary focus
Bacherini *et al.*[15]	2020	Perspective	Italy	-	To review how SARS-CoV-2 affects the eye and discuss implications for ophthalmologists.
Korobelnik *et al.*[9]	2020	Review	France	Writing and editorial assistance was provided by Hollie Robinson, PhD of Complete Health-Vizion, Ltd., McCann Health Medical Communications, funded by Bayer Consumer Care AG, Pharmaceuticals, Basel, Switzerland.	To discuss key considerations for managing patients with retinal disease during the COVID-19 pandemic.
Lai *et al.*[16]	2020	Perspective	China	-	To share the experience of a single center's infection control measures in ophthalmology.
Lam *et al.*[1]	2020	Perspective	China	-	To share protocols and experiences in the prevention of infection in the current COVID-19 outbreak. To answer the key frequently asked questions in relevant areas.
Lim *et al.*[11]	2020	Perspective	Singapore	-	To describe the impact of COVID-19 in a single practice and share strategies and guidelines to maintain a sustainable ophthalmology practice.
Mishra *et al.*[10]	2020	Perspective	United States	None.	To list practice considerations to limit COVID-19 transmission in the proton ocular treatment setting for uveal melanoma.
Romano *et al.*[12]	2020	Review	Italy	None.	To provide useful guidelines, targeted at ophthalmology professionals, to minimize COVID-19 infection of both health-care workers and patients based on literature and experience.
Safadi *et al.*[17]	2020	Review	Israel	None.	To present an established practice protocol for ophthalmic practice during the COVID-19 pandemic.
Sengupta *et al.*[14]	2020	Review	India	None.	To develop a preferred practice pattern based on consensus discussion between some of the leading ophthalmologists in India, major institutional representatives, and the AIOS leadership.
Yu *et al.*[21]	2020	Review	China	Supported by the Natural and Science Foundation of China (Grant No. 81570869), and Wenzhou Key Team of Scientific and Technological Innovation (Grant No. C20170002).	To summarize the Chinese experience against SARS-CoV-2 in ophthalmology in a literature review.

-: information not present; SARS-CoV-2: severe acute respiratory syndrome coronavirus 2

Table 2. Guidelines and recommendations for ophthalmologic staff

Author	Year	Rigorous hand hygiene	Symptom and/or temperature screening	PPE
Bacherini *et al.*	2020	Yes.	Yes.	Yes. Surgical masks and goggles for ophthalmologists. Surgical/N95 respirator masks, as well as gloves and water-resistant gowns and visors.
Korobelnik *et al.*	2020	Yes.	Yes.	Yes. N95 or FFP2 mask is preferable wherever possible. If either are unavailable, then a surgical mask should be worn. Full PPE worn when dealing with COVID-19 cases.
Lai *et al.*	2020	Yes.	Yes.	Yes. Face masks for all personnel. Isolation gowns, N95 respirators and protective eyewear when attending COVID-19 cases.
Lam *et al.*	2020	Yes.	-	Yes. Face masks should be worn by all personnel. Full PPE worn when dealing with COVID-19 cases.
Li *et al.*	2020	-	Yes.	Yes. Proper use of PPE with proper training. N95 mask and eye protection for staff dealing with persons under investigation and confirmed with COVID-19.
Lim *et al.*	2020	Yes.	-	Yes. For high-risk patients, full PPE is always worn by all involved health care workers. Use of visor masks or coverspecs over the use of goggles during surgery. Use of goggles and N95 masks for all staff within the operating theater during emergency surgery.
Ma *et al.*	2020	-	-	Yes. Low-risk encounter PPE: gown, surgical mask, disposable cap. Moderate-risk encounter PPE: water-repellent gown, barrier apparel, surgical mask or N95 respirator, disposable cap, gloves, goggle or face shield, shoe covers. High-risk encounter PPE: water-repellent gown, barrier apparel, N95 respirator, disposable cap, double gloves, goggle or face shield, shoe covers.
Mishra *et al.*	2020	Yes.	Yes.	Yes. Appropriate masking. Gloves, mask, face shield, goggles, hair cover when in close contact with patients.
Moravvej *et al.*	2020	-	Yes.	Yes. Latex gloves, eye protection, a surgical-style face mask, a long-sleeved fluid-resistant gown, and disposable shoe covers for attending staff.
Romano *et al.*	2020	Yes.	Yes.	Yes. Ophthalmologists attending patients with suspected or confirmed cases of COVID-19 need to wear at least FFP2. Long-sleeved waterproof gowns and gloves should be used if exposed to COVID-19 positive patients. Goggles and eye protection for ophthalmologists.
Safadi *et al.*	2020	Yes.	Yes.	Yes. Masks and eye protection when caring for patients potentially infected with COVID-19.
Seah *et al.*	2020	Yes.	-	Yes. Full PPE for emergency operations.
Sengupta *et al.*	2020	Yes.	Yes.	Yes. Protections for head, mouth, nose, and eye (with a surgical cap, three-ply surgical mask, goggles/face shield) for the examiner and a three-ply surgical mask for the patient.
Williams *et al.*	2020	Yes.	-	Yes. General cases: disposable cap, eye protection, surgical mask, gown. Suspect cases: use of a face shield, an N95 mask, and disposable gloves.
Yu *et al.*	2020	-	Yes.	Yes. Caps, respiratory protection, gloves, gowns, eye protection, and face shields are used for personal protection.

-: information was not present; PPE: personal protective equipment

Table 3. Guidelines and recommendations for ophthalmologic patients

Author	Year	Rigorous hand hygiene	Symptom and/or temperature screening	Use of PPE
Bacherini *et al.*	2020	-	Yes.	Yes. Surgical masks and gloves should be worn by patients.
Korobelnik *et al.*	2020	Yes.	Yes.	Yes. Surgical mask should be worn patient.
Lai *et al.*	2020	-	Yes.	Yes. Surgical masks.
Lam *et al.*	2020	Yes.	Yes.	Yes. Face masks should be worn by all personnel and visitors.
Li *et al.*	2020	-	Yes.	Yes. Masking of urgent patients with respiratory symptoms, suspect or confirmed with COVID-19.
Lim *et al.*	2020	Yes.	-	-
Ma *et al.*	2020	-	Yes.	Yes. Patients should wear masks.
Mishra *et al.*	2020	Yes.	Yes.	Yes. Appropriate masking.
Moravvej *et al.*	2020	-	Yes.	-
Romano *et al.*	2020	Yes.	Yes.	Yes. Surgical mask for patients.
Safadi *et al.*	2020	Yes.	Yes.	-
Seah *et al.*	2020	Yes.	-	-
Sengupta *et al.*	2020	Yes.	Yes.	Yes. Three-ply face masks for all patients.
Williams *et al.*	2020	Yes.	Yes.	Yes. Masks.
Yu *et al.*	2020	-	Yes.	Yes. Every patient should wear a mask.

PPE: personal protective equipment; -: information was not present

Table 4. Guidelines and recommendations for ophthalmologic facilities

Author	Year	Triage of patients based on screening	Surface and equipment disinfection	Slit-lamp shield	Deferral of non-urgent appointments	Limiting use of equipment and testing	Minimizing the number patients and distancing in waiting rooms	Telemedicine consultation
Bacherini *et al.*	2020	Yes.	Yes.	Yes.	Yes.	-	Yes.	-
Korobelnik *et al.*	2020	-	Yes.	Yes.	Yes.	Yes.	Yes. Enforcing a 1- or 2-meter distance between people.	Yes.
Lai *et al.*	2020	Yes.	Yes.	Yes.	Yes.	-	Yes.	-
Lam *et al.*	2020	Yes.	Yes.	Yes.	-	-	Yes. Keeping at least 1-meter distance from others.	-
Li *et al.*	2020	-	Yes.	Yes.	-	-	-	Yes.
Lim *et al.*	2020	Yes.	Yes.	-	-	-	-	-
Ma *et al.*	2020	Yes.	Yes.	Yes.	Yes.	-	-	-
Mishra *et al.*	2020	-	Yes.	-	Yes.	-	Yes.	Yes.
Moravvej *et al.*	2020	-	Yes.	Yes.	Yes.	-	Yes. Safe distance (1.5 meters) was assured between patients.	-
Romano *et al.*	2020	-	Yes.	Yes.	-	-	Yes. At least 2 meters from one another.	-
Safadi *et al.*	2020	Yes.	Yes.	Yes.	Yes.	-	Yes.	Yes.
Seah *et al.*	2020	-	Yes.	-	Yes.	-	-	-
Sengupta *et al.*	2020	Yes.	Yes.	Yes.	Yes.	Yes.	Yes. Maintain 1-meter distance.	Yes.
Williams *et al.*	2020	Yes.	Yes.	Yes.	Yes.	Yes.	Yes. Six feet apart.	Yes.
Yu *et al.*	2020	-	Yes.	Yes.	Yes.	Yes.	Yes. At least 1.5 meters apart from one another when in registration and waiting area.	-

PPE: personal protective equipment; -: information was not present

Nine[1,9–13,16–18] of the eleven articles that emphasized hand disinfection for staff also emphasized this practice for patients and visitors. Thirteen articles[1,9,10,12,14–21] recommended that regular symptom and temperature screening be done for patients prior to or upon arrival to their appointments. The use of PPE by patients and visitors is strongly recommended by eleven articles;[1,9,10,12,14–16,18,19,21,22] however, these articles simply advised patients and visitors to wear surgical masks during visits.

Guidelines for facilities in ophthalmology

Proper triage of patients based on temperature and symptom screening upon entry to an ophthalmologic facility is advised in eight articles.[1,10,13–17,22] These same eight articles recommended that patients negative for COVID-19-suspect criteria can pass through with their visit; however, the attending physician should be informed about any suspect patient and assess their need for a same-day consultation. For patients who cannot but should attend a clinic in person, the use of telemedicine consultations was strongly encouraged by six articles.[9,13,16–19] Telemedicine consultations were also encouraged to be used whenever possible to reduce the number of visitors. Routine and proper disinfection of equipment and surfaces that are commonly touched is strongly advised in all included articles.[1,9–22] It is recommended that povidone-iodine, a combination of chlorhexidine with ethanol and cetrimide, alcohol-based solutions (75% ethanol), or other lipid solvents ether (chlorine disinfectant, peracetic acid, chloroform) be used as disinfectants.[10,22] Exposure of equipment to 56°C for 30 min was also advised by one article.[22] Twelve articles[1,9,11,13–17,19–22] advised the use of shields or barriers on slit-lamps due to there being a large risk of exposure during this type of examination. It was also advised in four articles[9,13,17,21] to limit the use of instruments and tests to only those deemed as critical for decision-making.

Eleven articles[9,12,13–18,20–22] strongly recommended or implemented the differing of any non-urgent appointments. It was recommended by Ma *et al.*[22] to only consider taking cases that were ocular emergencies, such as eye traumas, acute glaucoma, rhegmatogenous retinal detachment, and central retinal artery occlusion. In the article by Korobelnik *et al.*,[9] it was noted that patients with neovascular age-related macular degeneration, neovascular glaucoma, new cases with significant vision loss, new central retinal vein occlusion cases, as well as monocular or quasi-monocular patients were considered as emergent and should be prioritized. Finally, it is also advised by six articles[1,9,11,13–18,20,21] to limit exposure in waiting rooms by enforcing a safe distance between visitors and minimizing the number of people within these rooms.

Discussion

The rapid spread of COVID-19 resulted in a multitude of recommendations and guidelines to be followed in the practice of ophthalmology. In this report, we summarized the current general recommendations as well as changes implemented in practice guidelines due to COVID-19 in ophthalmology for staff, patients, and facilities. Various bibliographic database searches as well as the grey literature search were performed.

Fifteen studies were included for qualitative analysis in this review. Characteristics of the included studies such as study design, study location, and primary focus were summarized. The findings from this study demonstrated rigorous hand hygiene,[1,9,10–18] temperature and symptom screening,[1,9,10,12,14–21] and proper use of PPE[1,9–22] by both staff and patients as important preventative measures that are currently recommended. The proper triage of patients upon arrival to ophthalmologic facilities based on screening[1,10,13–17,22] in conjunction with the deferral of non-emergent visits[9,12–18,20–22] are also important measures that should be taken to minimize exposure. Implementing measures such as distancing and limiting the number of people in waiting rooms is a commonly used strategy in many ophthalmologic facilities.[1,9,11,13,20,21] The routine disinfection of equipment using proper cleaning solutions,[1,9–22] the use of shields or barriers on slit-lamps,[1,9,11,13–17,19–22] and limiting the use of instruments and tests[9,13,17,21] were strongly recommended and advised.

Limitations of the present study include the deficits of the literature that were included. COVID-19 is a new disease with minimal research currently available. As a result, some of the articles included were letters to the editor and editorials.[12,19,20,22] Many of the articles[9–11,13] were reviews lacking a thorough search strategy or were perspectives and opinions based off clinical experience only. However, many of these strategies and guidelines were put together by professional clinicians and institutional representatives. Most of the included articles were from countries in Asia or Europe. However, it should be noted that the articles by Korobelnik *et al.*,[9] Li *et al.*,[19] and Mishra *et al.*,[10] were written by authors from a mixture of various countries, potentially providing a somewhat global perspective.

Conclusions

This systematic review has shown that proper precautions and guidelines should be taken by ophthalmologic staff, facilities, and visitors to help minimize the spread of COVID-19 and promote a safer environment in ophthalmology. In the event of a future outbreak of SARS-CoV-2 or another infectious agent, effective changes to practice guidelines should be established quickly.

Declarations

Ethics approval and consent to participate
Not required.

Consent for publication
Not required.

Competing interests
The authors have no conflicts of interests to declare that may be affected by the publication of the paper.

Funding
The authors received no specific funding for this work.

Acknowledgements
None to disclose.

References
1. Lam DSC, Wong RLM, Lai KHW, et al. COVID-19: Special Precautions in Ophthalmic Practice and FAQs on Personal Protection and Mask Selection. Asia Pac J Ophthalmol (Phila). 2020;9(2):67–77. https://doi.org/10.1097/APO.0000000000000280
2. Chen N, Zhou M, Dong X, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. Lancet. 2020;395:507–513. https://doi.org/10.1016/S0140-6736(20)30211-7
3. Alyward B, Liang W. Report of the WHO-China Joint Mission on Coronavirus Disease 2019 (COVID-19)World Health Organization. WHO; 2020. Available from: https://www.who.int/publications-detail/report-of-the-who-china-joint-mission-on-coronavirus-disease-2019-(covid-19)
4. Li Q, Guan X, Wu P, et al. Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. N. Engl. J. Med. 2020;382:1199–1207. https://doi.org/10.1056/NEJMoa2001316
5. Green A. Li Wenliang. Lancet. 2020;395(10225):682. https://doi.org/10.1016/s0140-6736(20)30382-2
6. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. J Clin Epidemiol. 2009;62(10): P1006–1012. https://doi.org/10.1016/j.jclinepi.2009.06.005
7. Shea BJ, Reeves BC, Wells G, et al. AMSTAR 2: a critical appraisal tool for systematic reviews that include randomised or non-randomised studies of healthcare interventions, or both. BMJ. 2017;358:j4008. https://doi.org/10.1136/bmj.j4008
8. Liebmann J. Ophthalmology and Glaucoma Practice in the COVID-19 Era. J. Glaucoma. 2020;29(6): 404–408. https://doi.org/10.1097/IJG.0000000000001519
9. Korobelnik JF, Loewenstein A, Eldem B, et al. Guidance for anti-VEGF intravitreal injections during the COVID-19 pandemic. Graefes Arch. Clin. Exp. Ophthalmol. 2020;258:1149–1156. https://doi.org/10.1007/s00417-020-04703-x

10. Mishra KK, Afshar A, Thariat J, et al. Practice considerations for proton beam radiation therapy of uveal melanoma during the coronavirus disease pandemic: particle therapy co-operative group ocular experience. Adv Radiat Oncol. 2020;5(4):682-686. https://doi.org/10.1016/j.adro.2020.04.010
11. Lim LW, Yip LW, Tay HW, et al. Sustainable practice of ophthalmology during COVID-19: challenges and solutions. Graefes Arch Clin. Exp Ophthalmol. 2020;258:1427–1436. https://doi.org/10.1007/s00417-020-04682-z
12. Romano MR, Montericcio A, Montalbano C, et al. Facing COVID-19 in Ophthalmology Department. Curr Eye Res. 2020;45:1–6. https://doi.org/10.1080/02713683.2020.1752737
13. Seah I, Su X, Lingam G. Revisiting the dangers of the coronavirus in the ophthalmology practice. Eye. 2020;34:1155–1157. https://doi.org/10.1038/s41433-020-0790-7
14. Sengupta S, Honavar S, Sachdev M, et al. All India ophthalmological society – Indian journal of ophthalmology consensus statement on preferred practices during the COVID-19 pandemic. Indian J Ophthalmol. 2020;68:711. https://doi.org/10.4103/ijo.IJO_871_20
15. Bacherini D, Biagini I, Lenzetti C, Virgili G, Rizzo S, Giansanti F. The COVID-19 pandemic from an ophthalmologist's perspective. Trends Mol Med. 2020;26:529–531. https://doi.org/10.1016/j.molmed.2020.03.008
16. Lai THT, Tang EWH, Chau SKY, Fung KSC, Li KKW. Stepping up infection control measures in ophthalmology during the novel coronavirus outbreak: an experience from Hong Kong. Graefes Arch Clin Exp. Ophthalmol. 2020;258:1049–1055. https://doi.org/10.1007/s00417-020-04641-8
17. Safadi K, Kruger JM, Chowers I, et al. Ophthalmology practice during the COVID-19 pandemic. BMJ Open. 2020;5:e000487. https://doi.org/10.1136/bmjophth-2020-000487
18. Williams AM, Kalra G, Commiskey PW, et al. Ophthalmology practice during the coronavirus disease 2019 pandemic: the university of Pittsburgh experience in promoting clinic safety and embracing video visits. Ophthalmol Ther. 2020. https://doi.org/10.1007/s40123-020-00255-9
19. Li JPO, Shantha J, Wong TY, et al. Preparedness among ophthalmologists: during and beyond the COVID-19 pandemic. Ophthalmology. 2020;127:569–572. https://doi.org/10.1016/j.ophtha.2020.03.037
20. Moravvej Z, Soltani Moghadam R, Ahmadian Yazdi A, Shahraki K. COVID-19 pandemic: ophthalmic practice and precautions in a tertiary eye hospital in Iran. Infect Control Hosp Epidemiol. 2020:1–6. https://doi.org/10.1017/ice.2020.164
21. Yu AY, Tu R, Shao X, Pan A, Zhou K, Huang J. A comprehensive Chinese experience against SARS-CoV-2 in ophthalmology. Eye Vis (Lond). 2020;7:1–9. https://doi.org/10.1186/s40662-020-00187-2
22. Ma X, Lin J, Fang S. Precautions in ophthalmic practice in a hospital with the risk of COVID-19: experience from China. Acta Ophthalmol. 2020:52052–1. https://doi.org/10.1111/aos.14436

Appendix A. Search strategies for all databases

Table 1. Medline

#	Searches	Results
1	Coronavirus Infections/ or Coronavirus/ or covid-19.mp.	20044
2	(2019-nCoV or SARS-CoV-2 or nCoV or covid*).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	16453
3	1 or 2	21659
4	ophtha*.mp. or Ophthalmology/	153175
5	3 and 4	103
6	regulation*.mp. or Government Regulation/	1452528
7	Social Control, Formal/	11787
8	Health Plan Implementation/ or implementation*.mp.	250514
9	practice.mp. or Practice Guideline/	1017263
10	6 or 7 or 8 or 9	2650124
11	5 and 10	28 (05/25/2020)

Table 2. EMBASE

#	Searches	Results
1	SARS coronavirus/ or Coronavirinae/ or Coronavirus infection/ or covid-19.mp.	19009
2	(2019-nCoV or SARS-CoV-2 or nCoV or covid*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]	18642
3	1 or 2	25940
4	ophthalmology/ or ophtha*.mp.	212824
5	3 and 4	166
6	regulation*.mp.	1632394
7	practice.mp. or practice guideline/ or clinical practice/	1599841
8	6 or 7	3195651
9	5 and 8	27 (05/25/2020)

Table 3. CINAHL

Search ID#	Search terms	Results
S1	(MH "Coronavirus Infections") OR (MH "SARS Virus") OR "covid-19 or coronavirus or 2019-ncov" OR (MH "Coronavirus")	1,605
S2	"ophtha*" OR (MH "Ophthalmic Nursing") OR (MH "Ophthalmic Equipment and Supplies")	24,261
S3	(MH "Ophthalmology") OR "ophthalmology"	7,959
S4	(S2 OR S3)	24,261
S5	(MH "Practice Guidelines") OR "practice guidelines" OR (MH "Rules and Regulations")	92,433
S6	"regulation" OR (MH "Government Regulations")	88,532
S7	S5 OR S6	177,977
S8	S1 AND S4	1
S9	S7 AND S8	1 (05/25/2020)

Grey literature

1. **Clinical Trials – https://clinicaltrials.gov/ (Searched May 25, 2020)**
    a. (regulation* or guideline* or practice*) and ophtha* | Covid-19|
    b. 0 results

2. **ProQuest – Dissertations and Theses (Searched May 25, 2020)**
    a. (covid-19 or coronavirus or coronavirus infection* or 2019-nCoV or SARS-CoV-2 or nCoV or covid*) AND (regulation* or guideline* or practice*) AND ophtha*
        i. 319 results
    b. noft(covid-19 or coronavirus or coronavirus infection* or 2019-nCoV or SARS-CoV-2 or nCoV or covid*) AND noft(regulation* or guideline* or practice*) AND noft(ophtha*)
        i. 0 results

3. **Conference Proceeding Searches**

Conference	Link	Years searched	Search terms	Results/Comments
ARVO	https://arvojournals.org/index.aspx	All years	"Meeting abstract" AND (covid-19 or coronavirus or coronavirus infection* or 2019-nCoV or SARS-CoV-2 or nCoV or covid*) AND (regulation* or guideline* or practice*) AND (ophtha*)	Searched through meeting abstracts 0 results (05/25/2020)
AAO All Meetings	https://secure.aao.org/aao/meeting-archive	"All years available"	Topic: All topics Keywords: "covid-19 or coronavirus or coronavirus infection* or 2019-nCoV or SARS-CoV-2 or nCoV or covid*", "regulation* or guideline* or practice*", "ophtha*"	No relevant abstracts/presentations found (05/25/2020)
COS	http://www.cos-sco.ca/cpd/annual-meeting/	010-2020	"covid-19 or coronavirus or coronavirus infection* or 2019-nCoV or SARS-CoV-2 or nCoV or covid*", "regulation* or guideline* or practice*", "ophtha*"	Searched through abstracts and presentations No relevant abstracts/presentations found (05/25/2020)

Appendix B. Cohen's Kappa statistic for screening

Table 4. Kappa statistics (title screening)

Review authors	B.H.				
B.Y.		Include	Exclude	Unsure	Total
	Include	12	2	3	**17**
	Exclude	2	12	2	**16**
	Unsure	1	0	1	**2**
	Total	**15**	**14**	**6**	**35**

$$Kappa = \frac{P(O) - P(E)}{1 - P(E)}$$

$$P(O) = \frac{12 + 12 + 1}{35}$$

$$P(O) = 0.714285714$$

$$P(E) = \frac{(17x15) + (16\,x14) + (2\,x6)}{35^2}$$

$$P(E) = 0.400816327$$

$$Kappa = \frac{P(O) - P(E)}{1 - P(E)}$$

$$Kappa = \frac{0.714285714 - 0.400816327}{1 - 0.400816327}$$

$$\underline{\boldsymbol{Kappa = 0.523160763}}$$

Table 5. Kappa statistics (full-text screening)

Review authors		B.M.		
B.Y.		Include	Exclude	Total
	Include	15	0	**15**
	Exclude	0	3	**3**
	Total	15	3	**18**

$$\underline{\boldsymbol{Kappa} = \mathbf{1}}$$

Appendix C. Scores from study quality assessment

Table 6. Scores from study quality assessment

Study	Year	Question and inclusion	Protocol	Study design	Comprehensive search	Study selection	Data extraction	Excluded studies justification	Included studies details	RoB	Funding sources	Statistical methods	RoB on meta-analysis	RoB in individual studies	Explanation for heterogeneity	Publication bias	Conflict of interest	Overall quality
Korobelnik *et al.*	2020	Yes	Partial yes	No	No	Yes	Yes	No	No	No	No	N/A	N/A	No	No	N/A	Yes	Critically low
Romano *et al.*	2020	Yes	Partial yes	Yes	Yes	Yes	Yes	No	No	No	No	N/A	N/A	No	No	N/A	Yes	Critically low
Safadi *et al.*	2020	Yes.	Partial yes	No	Yes	No	No	No	No	No	No	N/A	N/A	No	No	N/A	Yes	Critically low
Sengupta *et al.*	2020	Yes	Partial yes	Yes	No	Yes	Yes	No	No	No	No	N/A	N/A	No	No	N/A	Yes	Critically low
Yu *et al.*	2020	Yes.	Partial yes	Yes	Yes	Yes	Yes	No	No	No	No	N/A	N/A	No	No	N/A	Yes	Critically low

N/A: not applicable, RoB: risk of bias