COVID-19 and eye care

Scientific brief
31 March 2023

World Health Organization

Background

Coronavirus disease (COVID-19) has spread dramatically over the entire globe affecting all healthcare systems, since it was first identified in Wuhan, China in December 2019. The health implications have been of unprecedented magnitude, with the virus causing severe acute respiratory syndrome and the potential to affect almost every organ in the body. Significant progress has been made in understanding the disease, with reported cases of ocular involvement. It is beneficial to also examine the impact on eye care services to better understand the short to long-term impacts for persons needing to access eye care services.

A rapid systematic review was undertaken to inform this scientific brief. The review set out to assess the available peer-reviewed literature to analyze evidence on the following questions.

- What are the ocular manifestations associated with COVID-19 infection and the environmental restrictions placed?
- How has COVID-19 impacted eye care service delivery and education?
- What have been some alternative models of eye care service delivery that have been used during the COVID-19 pandemic?

Methods

An extensive literature review was performed on MEDLINE (via PubMed), EMBASE (via Elsevier), Cochrane Library (via Wiley), CINAHL (Cumulative Index to Nursing and Allied Health Literature), ARVO and AAO annual meeting Open Grey database, and medRxiv and bioXiv preprint platform during January 2021 – March 2023. 223 studies were screened, of which 103 were deemed relevant to the research questions listed in the introduction. Three reviewers screened titles and abstracts, and full texts of selected references. Data management included the removal of duplicates, the development of a database inclusion and exclusion criteria, and data for final inclusion in the study. No conflicts of interest were identified with the reviewers.

Review of the evidence

Ocular manifestations associated with COVID-19 infection

There are several ocular manifestations reported from people being infected with SARS-CoV-2 virus (COVID-19) infection, which include certain ocular diseases and refractive error. Ocular manifestations may be a presenting feature of COVID-19 or they may develop and persist several weeks after recovery *(1,2*).

Conjunctivitis has been widely reported across the world, in both children and adults, and was found to develop at any stage of the COVID-19 infection *(3-9)*. The incidence of conjunctivitis varied between studies, some reporting about 15% in a sample of children with a mean age of seven years infected with COVID-19 in Rome, Italy *(10)*, and as high as 31.6% in a sample of adults with a mean age of 66 years infected with COVID-19 in Hubei province, China *(11)*. In selected cases, this led to keratitis *(12)*. Three common ocular symptoms experienced were photophobia, sore eyes and itchy eyes *(13)*. Posterior eye manifestations were detected in some instances, including retinal haemorrhages, cotton wool spots, changes in retinal microvasculature and nerve fibre layer, and changes in choroidal vessels and thickness *(14-18)*, while vision-threatening manifestations included endogenous endophthalmitis, candida retinitis and tubercular choroidal abscess *(19)*. In persons with severe COVID-19, a significant incidence of rhino-orbital-cerebral mucormycosis was identified, requiring a multidisciplinary and resource-intensive approach due to its high mortality nature *(20,21).*

Eye care practitioners should be aware of the possible associations of ocular diseases with COVID-19, so that they ask relevant history, look for specific signs, advise appropriate tests and thereby mitigate the

spread of infection as well as diagnose and initiate early treatment for life and vision-threatening complications *(1)*.

Ocular manifestations associated with environmental restrictions placed during the COVID-19 pandemic

In response to the COVID-19 pandemic, governments around the world introduced travel restrictions, lockdowns, quarantine and stay-at-home orders in an attempt to minimize the spread of the virus. Ocular trauma occurring at home saw an increase during this period, with a study from Wenzhou City, China showing a significant rise in injuries from home improvement projects during the stay-at-home order *(22)*.

In the peak months of the pandemic, where there were heightened infection rates, 192 countries/territories elected to close schools, affecting nearly 1.5 billion children and young people *(23)*. Many schools enforced remote learning and children received their education virtually through digital devices.

During this period, studies showed an increase in myopia and myopia progression of school-age children *(24)*, particularly for younger school-age children *(25-28)*, although the rate was significantly reduced for children who participated in open-air activities for at least two hours per day and those who lived in detached houses *(29-31)*. Moreover, there were indications of potential myopia progression in children already receiving 0.01% atropine for myopia control *(32)*, while a slower progression was observed with children who were corrected with specialized lenses *(33).* Given the various factors at play, eye care personnel are strongly encouraged to consider multiple aspects in the management of myopia.

It is well documented that environmental factors, such as time spent outdoors and doing near work that includes screen-viewing activities, influence the development of myopia in children *(34)*. While digital device usage and staying indoors may not be the exclusive reasons for myopia progression, there is evidence supporting the importance of increased outdoor time and regulating children's exposure to digital screens *(35-37).*

Increased screen time during the period of COVID-19 restrictions, were also associated with an increase in dry eye symptoms *(38-40)* and digital eye strain *(41-44),* particularly for remote e-learners *(45)*.

Another restriction placed by governments was the wearing of face masks to minimize spread of COVID-19. Ocular discomfort often associated with dry eye disease was experienced by wearers of face masks (*46-48)*.

A positive outcome observed in Republic of Korea with the social distancing restrictions placed, was the significant reduction of infectious eye disease in all ages group, which saw an increase again once the social distancing restrictions were relaxed *(49).*

Impact of COVID-19 on eye care service delivery

The pandemic has a made a significant disruption to the delivery of eye care services. Although the health industry was deemed to be essential to continue operating, health resources were re-directed towards dealing with people with COVID-19 infections. Medical professions that weren't directly dealing with COVID-19 infections commonly saw drastic modifications to the nature of their work, particularly during the early stages of the pandemic. In some instances, eye care practitioners were deployed to provide care for COVID-19 patients *(50)*.

The number of patient visits and eye care treatments decreased considerably, and eye care services were de-prioritised in many instances. The severity of COVID-19 infection rates had a direct impact on the patient volume in many countries. In ophthalmology, visits were largely limited to urgent and emergent patients, with most routine check-ups and elective procedures being postponed *(51-55).* Cataract surgery volumes dropped significantly during certain periods of the pandemic with countries such as Australia, and India, reporting a 60-70% reduction compared to pre-pandemic level *(56,57)*. This had an economic impact on service providers, affecting the financial sustainability of services *(58).* The limitations on patients accessing services also affected vulnerable populations such as children, as the number of paediatric cases seen were significantly reduced during the peaks of the pandemic *(59,60)*. People who were not regarded to require immediate treatment, such as those with keratoconus, commonly had their condition worsen because of the delay in treatment *(61)*. Moreover, even when a person's condition rendered them eligible for care or if services remained open, people were hesitant to seek it *(62)*, often resulting in worsening of vision *(63)*.

Supply of medications and other critical services, such as corneal donation saw a decrease in some countries *(64)*.

Patient volumes of eye care services did increase following the lockdown periods *(65)*, however it has taken time to reach a complete recovery to pre-pandemic numbers in some places *(66)*. Access to eye care services has been hampered by staffing shortages at health care facilities caused by workers being exposed to and infected with COVID-19 *(67)*.

Depending on resources available, safety and hygiene protocols of eye care services were enhanced to minimize risk of exposure of COVID-19 to other patients and healthcare staff *(68-70)*, such as promoting physical distancing within the facility, installing protective barriers, and allowing for additional time for staff to clean surfaces. Clinical protocols were streamlined and alternative modes of service delivery such as telehealth were introduced to reduced number of patients at the facility at a given time *(71,72)*. Innovative methods were used to manage patient flow such as the use of text messages *(73)*.

Impact of COVID-19 on eye care education

With the suspension of face-to-face learning for training institutions particularly during the peaks of the pandemic, eye care education was still able to be maintained through remote learning as the mode of delivery *(74,75)*. Certain practical training and group study were rendered through video conferencing, and learners were able to see patients through telehealth platforms *(76)*. However, aspects of surgical training were delayed during the suspension periods *(77)*, leading to extensions of some training programs *(78)*. Continuing medical education also progressed through the lockdown periods, with a surge in online webinars *(79)*. Conferences and meetings (both scientific and clinical) were cancelled during the early peaks of the pandemic and returned to a hybrid mode allowing attendants to participate face-to-face or virtually. Tele-education which has emerged through the pandemic, has provided a unique opportunity and an overall positive impact on eye care education *(80)*.

Going forward, e-learning has enormous potential to supplement traditional education, with a significant number of virtual courses available to anyone with an internet connection and a willingness to learn wherever on the globe, with some limitations. The pandemic brought about new ways of learning through virtual simulators and tele-mentoring *(81)*. By embracing these changes, training programmes have been able to meet the difficulties of the pandemic and can continue to provide high-quality education in the future *(80-83)*. Many of these innovations will continue to be used long after the pandemic is over because they have shown that not all parts of the programme require face-to-face learning *(84)*.

Impact of COVID-19 on eye care research and existing gender inequities

The COVID-19 pandemic has had a profound impact on eye care research, and amplified the gender gaps that existed pre-pandemic. Research indicates that women were disproportionately burdened by the societal changes brought on by the pandemic, leading to a greater decline in women's productivity in research literature compared to men. For instance, the proportion of women first and corresponding authors in ophthalmology journals decreased from pre-pandemic levels of 31.1% and 24.6% to 27.4% and 20.4%, respectively, during the first 9 months of 2020 *(85)*. It is essential to closely monitor and address these gender gaps to ensure that women's contributions to eye care research are not undervalued or overlooked.

Eye care service delivery through telehealth during the COVID-19 pandemic

The pandemic led eye care services to drastically restrict patient volumes. Where resources were available, telehealth or video consultations were quickly deployed across routine and emergency eye care services to promote continuity of care and to assist patients who were reluctant or unable to leave their homes *(86)*.

Video consultations proved to be more useful than predicted in the remote management of eye conditions, resulting in a significant decrease in the number of patients attending the hospital and potentially reducing the risk of infection *(86-88).* Patients with ocular surface conditions, oculoplastic conditions and those who needed follow-up management benefited from the telehealth consultations *(89-91)*. Studies showed there was modest correlation between the virtual systems measuring visual acuity compared to in-clinic measurements *(92,93)*.

Based on finding from several studies, eye care practitioners and patients, were both satisfied with the service delivered through telehealth, and would consider it for future consultations *(94-96)*. Combining telehealth with other technical devices to support patient management and patient education, may improve overall patient outcomes *(97,98).* Adequate practitioner training and support will also determine the successful application of telehealth for eye care service delivery *(99)*.

Prior to the pandemic, existing telehealth and other virtual systems commonly had a low uptake. The pandemic has propelled the use and uptake of telehealth and other virtual systems to address the demands and have been further developed to grow into long-term solutions as countries and systems adjust to the new normal. The added benefits of telehealth should be considered when evaluating its role in eye care service delivery. Telehealth can make services more streamlined by triaging patients prior to arrival into the service to avoid unnecessary visits and exposure risks. It also reduces travel and its associated carbon footprints. Telehealth has the potential to make the distribution of scarce healthcare resources more efficient and equitable, increasing access for patients in remote areas where there is a shortage of eye care practitioners *(100)*.

Persistent disparities in accessing telehealth services among ethnic/racial minorities, older patients, and non-English-speaking individuals highlight the need for addressing these issues as telehealth continues expands in the future *(101,102)*. Investment into telehealth systems and infrastructure need to be made across different settings, including those with limited resources for services to be equitable and accessible. This investment will also build the resilience of our health systems to face future challenges and disruptions.

Limitations

Many of the studies were focused on tertiary eye care services of ophthalmology, limiting the knowledge on the impact of COVID-19 on primary and secondary eye care services. Many of the studies also had a small sample size; were cross-sectional or retrospective in nature; and selection of study participants were preferential on the basis of the exposure to COVID-19 in some cases *(103)*.

Conclusions

The COVID-19 pandemic has impacted eye care in several ways including ocular manifestations associated with SARS-CoV-2 virus itself, and ocular manifestations associated with environmental restrictions placed during the pandemic, leading to a worsening of certain conditions such as conjunctivitis and myopia. Eye care services mostly showed a reduction in patient volume as resources were re-directed to accommodate patients with COVID-19 infections. Eye care education was largely unaffected as courses and seminars continued through remote learning. A promising outcome from the pandemic is the emergence of telehealth, which shows potential to positively disrupt and build resilience in the delivery of eye care services going into the future.

Plans for updating

WHO continues to monitor the situation closely for any changes that may affect the information in this Scientific brief. Should any factors change, WHO will issue a further update. Otherwise, the expected validity of this brief will be reviewed 1 year after the date of publication.

Acknowledgments

The resource was developed by Mitasha Yu, Andreas Mueller, Stuart Keel, and Alarcos Cieza, of the Vision and Eye Care Programme, WHO. Valuable contributions were made by WHO staff members, Bente Mikkelsen, Director Department of Noncommunicable Diseases; and Dr Jérôme Salomon, Assistant Director-General Universal Health Coverage/Communicable and Noncommunicable Diseases. WHO acknowledges Zhongshan Ophthalmic Centre –Sun Yat-sen University, for their contributions to the identification of evidence.

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COVID-19 and eye care: scientific brief

ISBN 978-92-4-008741-5 (electronic version)
ISBN 978-92-4-008742-2 (print version)
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