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## Preparedness among Ophthalmologists: During and Beyond the COVID-19 Pandemic

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On February 7, 2020, Dr. Li Wenliang, a fellow ophthalmologist from Wuhan, China, died of infection with the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2; now termed COVID-19). Several months earlier, Dr. Li had attempted to warn his colleagues of a potential infectious disease outbreak, urging doctors to wear personal protective equipment while examining patients.<sup>1</sup> As 1 of 8 whistleblowers who attempted to sound the alarm about this unusual respiratory illness, Dr. Li is now considered a national and international hero for his efforts.

In fewer than 4 months, the outbreak has escalated rapidly from a World Health Organization Public Health Emergency of International Concern to the formal declaration as a Pandemic on March 11, 2020. As of March 26, 2020, there are 413 467 confirmed cases and 18 433 deaths worldwide.<sup>2</sup> A recent widely cited modeling study from Imperial College London suggests that without intervention, 8 of 10 people may be affected, resulting in 510 000 deaths in the United Kingdom and 2.2 million deaths in the United States by the end of the pandemic.<sup>3</sup>

In the midst of this chaotic pandemic, the health care systems and its providers are endangered. In particular, front-line health care workers—emergency medicine physicians, intensivists, anesthesiologists, nurses, and many others—have continued to care for massive surges of COVID-19 patients in the setting of health systems ill-prepared for the current level of disease severity. Providers are placed in danger because of worldwide shortages of personal protective equipment (PPE) and lack of well-established protocols that might attenuate health worker risk. Over 9000 health care workers have developed

infection internationally, including 3400 in China<sup>4</sup> and more than 6200 in Italy,<sup>5</sup> as well as hundreds of infections in United States personnel.

During this time of a global health emergency, rapid communication, international collaboration, and transparency are critical to inform and adapt better the guidance of precautionary measures when new evidence becomes available. Countries around the world have responded in different ways in managing risk to ophthalmologists and patients in the absence of signs or symptoms of COVID-19. Preparedness through risk mitigation strategies for the public, patient, and providers are warranted and should be informed by available evidence and by our collective, global experience. The gaps in evidence that we face also need to be addressed during this pandemic to guide international consensus and to inform preparedness measures for future outbreaks.

### Risk Mitigation Strategies: Protecting the Public, the Patient, and the Provider

#### Protection of the Public and the Patient

The rapidly growing number of COVID-19 patients throughout the world has prompted state and federal authorities to institute measures to contain, suppress, and mitigate the pandemic. Advisory measures include social distancing, working from home, and safe hygiene practices. Legal measures have included global travel restrictions, reduction or postponement of elective and nonurgent health services and surgeries, and government-mandated lockdowns and curfews.<sup>6</sup> Limiting

ambulatory care services to time-sensitive or urgent conditions, particularly in high-volume specialties such as ophthalmology, also have been recommended to reduce the potential for transmission in the community and physician offices. However, measures within the clinic also are needed to mitigate risk for patients with urgent or emergent symptoms and those who require routine evaluations as the outbreak abates.

Within the ophthalmology clinic, measures can be broadly divided into clinic management, staff protection, and environmental precautions.<sup>6–8</sup>

**Clinic Management.** Contacting patients before their appointments to ask those with fever or respiratory symptoms not to attend the clinic is essential. Cessation of elective care with telemedicine implementation in suitable eye conditions further reduces clinic crowding. Active screening of all patients and very limited companions can be instituted via a targeted questionnaire and noncontact temperature check at the clinic or hospital entrance. After check-in, having patients wait in their cars or in open spaces outside the office for cellular phone notification are options, as well as increased spacing between patients in office waiting rooms. For patients with respiratory symptoms or a fever and an urgent or emergent visual symptom, masking the patient, expedient patient movement to the examination room, a prompt focused examination by a provider, and equipment disinfection are critical.

**Staff Protection.** With the reduction in patient numbers, an accompanying reduction to only essential personnel limits staff risk. Conversion to virtual meetings often can meet administrative and educational priorities. Leaves of absence for respiratory symptoms or self-quarantine for individuals returning from high-risk travel advisory locations are necessary, whereas health declaration and temperature monitoring of staff should occur daily for those who are in the clinic. Judicious use of PPE, proper training in donning and doffing protocols, and avoidance of physical contact with patients should guide staff–patient interactions. For persons under investigation and those with a confirmed COVID-19 diagnosis, a mask for the patient and full PPE for the provider, including a single-use N95 mask and eye protection, are required.

**Environmental Precautions.** Droplet and fomite precautions are essential when managing patients with urgent or emergent eye disease. In all cases, a disinfection protocol for all potentially contaminated equipment (i.e., slit-lamp biomicroscope, surfaces, indirect ophthalmoscope, lenses) is needed. Large breath shields on slit lamps may act as a barrier to respiratory droplet transmission.

### Protecting the Patient: Subspecialty Guidance and Telemedicine

Within the United States, strategies are evolving rapidly to develop expert panel subspecialty guidelines that stratify the urgency of in-person examination. Moreover, the use of telemedicine, including home visual function testing, transmission of image and video, and face-to-face interactions via widely available applications, can provide ophthalmologists with opportunities to provide limited care and counseling. Importantly, these interactions may provide reassurance to patients about their disease or may identify symptoms that require an in-person evaluation. To broaden

access through widespread use of technology, federal authorities in the United States have waived normal privacy guidelines with categories of telemedicine (Medicare telehealth, virtual check-in, and E-visits).<sup>9</sup>

### Protecting the Provider

Risk reduction strategies during this outbreak should follow Centers for Disease Control and Prevention standard precautions and transmission-based precautions for contact and respiratory routes of transmission of SARS-CoV2. However, an imperative also exists to use PPE judiciously, given the worldwide shortages for front-line providers.

Patients with SARS-CoV-2 infection may be asymptomatic,<sup>10–12</sup> and shedding seems to be highest in the earliest stage. Thus, asymptomatic carriers of SARS-CoV-2 may confer a particular risk to ophthalmologists during examination.<sup>12</sup> Specific factors may place ophthalmologists at increased risk of infection during examination of patients compared with the risk experienced by clinicians in other disciplines. Specialties that also may be at higher risk of infection include anesthesiologists, who are routinely exposed to aerosolized respiratory secretions, and otorhinolaryngologists involved in sinus and nasopharyngeal procedures.

During the ophthalmic examination, the face-to-face proximity of the slit-lamp biomicroscopic examination may place the ophthalmologist at a higher risk of aerosolized particles from respiratory droplets and contact.<sup>13</sup> Of the health care workers who died of COVID-19 in Wuhan, 3 were Chinese ophthalmologists who worked in the same unit that included Dr. Li Wenliang, who believed that he had been infected while treating an asymptomatic glaucoma patient.<sup>1</sup> The route of transmission in these cases is unknown, but the upper respiratory system and nasopharynx are a major site of viral infection, and likely present a higher risk to the ophthalmologist than exposure to tear film harboring SARS-CoV2. Recent studies have shown that viral RNA may be observed in association with the small minority of patients who demonstrate conjunctivitis (i.e., <1% of patients with COVID-19 demonstrated conjunctivitis at presentation). Viral RNA has not been identified in the tear film of COVID-19 patients without conjunctivitis to date, but data representing sampling performed early in the disease course when viral load is highest are lacking.<sup>14–16</sup>

The World Health Organization and United States Centers for Disease Control and Prevention have recommended the use of full PPE for the examination of persons under investigation and COVID-19 patients. The face masks can be divided into N95 respirators and surgical masks, and both have different uses. The N95 respirator is designed with filtration requirements to prevent inhalation of small airborne particles and to minimize leakage from the facial seal.<sup>17</sup> As such, it protects the wearer from the inhalation of viral particles. Surgical masks often are fitted loosely but can prevent respiratory droplet transmission and prevent hand-to-face contact. They are considered to be more effective in preventing spread from an infected person wearing the mask to another than in protecting the wearer from infection. In a randomized clinical trial, the use of N95 respirators and surgical masks were found to have comparable outcomes in protection from influenza virus in outpatient settings<sup>17</sup>; however, N95 respirators are the

preferred option when dealing with persons under investigation or COVID-19 patients.

### Global Variations in Risk Mitigation for Asymptomatic Patients

Countries around the world have responded in varying ways (Table 1) to managing the risk to ophthalmologists and patients in the absence of respiratory symptoms. Within countries, policies may vary regionally (e.g., Milan, Lombardy, may vary from Bologna, Emilia-Romagna). Most ophthalmic clinics have restricted their practices to urgent and emergent cases only, although some practices have suspended ophthalmic services completely.<sup>18</sup>

In most countries, ophthalmologists and patients are required to wear surgical face masks instead of N95 respirators. On-site temperature screening and regular hand hygiene are required broadly for both patients and doctors. Given the rapid surge of COVID-19 and mortality rates, some countries (e.g., China) have taken a “make no mistake” approach in which ophthalmologists are required to wear full PPE (including N95 masks) for all patients. Many practices (United States, United Kingdom, Europe, China, Korea, Singapore, and Australia) are adopting custom-designed or commercially available slit-lamp breath shields to minimize respiratory droplet transmission during the ophthalmic examination. However, custom-made barriers also could become a potential source of contamination,<sup>7</sup> and care must be taken to sterilize them properly between each patient encounter. Scientific evidence regarding the effectiveness of these shields is unavailable.

In the context of a disease in which person-to-person spread occurs through infected respiratory droplets, the appropriate use of facemasks is particularly contentious, especially when supply constraints must be factored into policy decisions. Within some hospitals in the United States, United Kingdom, and Australia, standard precautions (e.g., wearing surgical face masks for doctors and patients, routine hand hygiene and washing, temperature screening) are taken for asymptomatic patients. In addition, some hospitals actively prohibit the use of surgical masks by doctors and patients within hospital premises. In Singapore, one nuanced approach involves segregation of all doctors to work in 1 location exclusively. Health personnel are divided further into 2 teams to ensure proper isolation between team members.

### Future Directions: Establishing International Consensus

The variation in practice patterns worldwide points to the need for a network of international ophthalmology partners to develop evidence-based consensus on risk mitigation protocols that adequately protect the public, patients, staff, and ophthalmologists. Clear consensus statements with regard to operational issues such as clinic flow protocols, instrument cleaning protocols, and the appropriate use of PPE under different circumstances will help systems in the appropriate allocation of scarce resources. In addition, the mandate to gather evidence during this pandemic that will guide our approach to this, and future outbreaks is clear. After the tragic loss of life and health during the severe acute respiratory syndrome (SARS) epidemic of 2003, many countries have

Table 1. Protective Measures Adopted in Different Eye Hospitals Internationally to Mitigate the Risks of COVID-19 during the Examination of Asymptomatic Routine Eye Patients

Country	Ophthalmologist							Patient				
	Face Mask	Gloves	Goggles	Cap	Gown	Slit-Lamp Biomicroscope Shield	Temperature Screen	Face Mask	Temperature Screen	Single Accompanying Person per Patient	Reduction in Nonurgent Encounters	Screening Questions
Australia	—	—	—	—	—	—	X	—	X	X	X	X
China (Zhongshan Ophthalmic Center, Guangzhou)	X	—	X	X	X	X	X	X	X	X	X	X
Italy (Ospedali Privati Forlì, University of Ferrara)	X	X	—	—	—	X	X	X	X	X	X	X
Korea (Seoul National University)	X	—	—	—	—	X	X	X	X	X	X	X
Singapore (Singapore National Eye Center)	X	—	—	—	—	X	X	X*	X	X	X	X
United Kingdom (Moorfields Eye Hospital)	X	—	—	—	—	X	X	X*	X	X	X	X
United States												
Massachusetts Eye and Ear, Boston	X	—	—	—	—	X	X	X	X	X	X	X
Emory Eye Center, Atlanta	X	—	—	—	—	X	X	X	X	X	X	X
University of California, San Francisco	X	—	—	—	—	X	—	X	—	X <sup>†</sup>	X	X

X = yes; — = no.

The practice patterns are limited to only the specific hospital listed on the table and are not representative of all the eye hospitals in the respective country.

\*In patients with recent travel history in high-risk countries or recent respiratory illness.

<sup>†</sup>Zero visitors are allowed.

used lessons learned to inform their policies during the current COVID-19 pandemic. We must all do the same. As we face the unique, extraordinary challenges of this pandemic, rapid adaptations are required in the United States and around the world.

While in the throes of managing the acute pandemic, we also must not lose sight of the need to prepare our profession, and the medical profession in general, to emerge capable of fully meeting the needs of patients with ophthalmologic conditions that threaten their vision, their independence, and their quality of life. This will require not only a functioning general health infrastructure (people, organizations, facilities, and funding), but also assistance from governmental authorities to recover those elements of the system devastated by the medical and economic consequences of the pandemic. The world's population, for example, will still need cataract surgery, glaucoma care, corneal transplants, and management of vitreoretinal diseases.

Dr. Li Wenliang and other ophthalmology colleagues paid the ultimate price after alerting the world about this global public health crisis.<sup>1</sup> The challenges we face as a discipline are of profound public health impact. By taking action now, we can protect our patients, fellow front-line health care workers, and ophthalmology colleagues. Experience with the COVID-19 pandemic also will inform our ability to protect vision globally in the future as infection threats of varying scale inevitably recur.

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