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# SARS, avian flu, bioterror: infection control awareness for the optometrist

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The outbreak of severe acute respiratory syndrome (SARS) in 2003 alerted the world to the new face of pandemic disease: highly contagious and fatal infections for which no vaccines are available and current drugs are largely ineffective. As a practitioner providing primary care, the optometrist must be familiar with new and evolving infections present in today's society. Though they may be viewed as extreme events, scenarios such as the re-emergence of SARS, the affliction posed by the H5N1 strain of avian influenza and the threat of a bioterrorist attack have all been described. In the event that such events occur, there is the potential for the spread of some highly virulent, transmissible disease.

This paper highlights these public health threats and discusses several areas that the optometrist may want to consider regarding infection control in an era in which a highly transmissible disease is being spread from person to person.

Key words: avian influenza, biological terrorism, disease outbreaks, infection control, SARS virus

The threat of infectious harm to the population is well documented throughout recorded history. The development of germ theory in the late 19th Century by Louis Pasteur alerted us to the presence of microbial pathogens and led to the development of combative measures such as antibiotics, anti-virals, asepsis and vastly improved sanitation.[1] These advancements aside, the severe acute respiratory syndrome (SARS) epidemic of 2003 serves as a very recent reminder of the continual threat that opportunistic pathogens place on public health and society in general. At a clinical level, a practising optometrist must be informed on the epidemiology and aetiology of the various threats to prevent micro-epidemics, that is, the transmission of disease from patient to patient or between patient and practitioner in his or her practice. Given the ease with which highly transmissible diseases are spread, the considerations are far from trivial.

## SARS OUTBREAK OF 2003

The multi-national SARS outbreak of 2003 alerted the public to the new plague due to highly contagious and fatal viruses of animal origin, for which no vaccines are available and antiviral drugs are largely ineffective.[2] Believed to be a previously uncharacterised strain of the coronavirus, SARS-CoV was widespread and deadly, with the United Nations reporting about 8,000 probable cases in 29 countries, with a fatality rate of approximately 10 per cent.[3] Among the deceased worldwide were medical practitioners, nurses and health-care workers (HCWs), some of whom were frontline health-care personnel exposed to the pathogen through interaction with patients.[2]

The optometrist, as a primary-care health provider, interacts with a largely unscreened population and so is susceptible to the transmission of SARS during an epidemic. Though the exact route of transmission is unclear, the experience from 2003 showed that the vast majority of HCWs who acquired the disease had close contact with infected patients.[4] Given their routine diagnostic procedures, such as ophthalmoscopy and slitlamp biomicroscopy, optometrists will invariably be in close proximity to patients in the course of their examinations. Optometrists must

remain vigilant to reduce the risk of infection.

Patient-to-patient transmission of the disease is of concern to optometrists. One particularly significant finding from 2003 was the discovery of the coronavirus in tear samples taken from several patients testing positive for SARS.[5] This discovery, coupled with the fact that almost all of the disease transmissions in 2003 occurred through contact with bodily secretions of an infected individual,[4] highlights the particular risk tears can impose. Reusable equipment, such as applanation tonometers, trial contact lenses, trial frames, pinholes and handheld occluders potentially serve as vectors for transmission from patient to patient. The examiner's hands, often used to widen palpebral fissures or invert eyelids, are obvious vehicles for inadvertent patient inoculation.[5]

In hindsight, one benefit the world medical community derived from the acute but brisk SARS epidemic is the knowledge that the current infection control measures for such highly transmissible diseases were inadequate. The lessons learned from 2003 may prove invaluable for the inevitable future emergence of a highly contagious airborne pathogen that many experts fear will become the next flu pandemic.[6]

## AVIAN FLU AND THE NEXT INFLUENZA PANDEMIC

Despite the considerable death toll and societal disruption SARS precipitated during the epidemic of 2003, the effects of the next global flu pandemic may be equally or more profound. In the past century, worldwide influenza pandemics occurred in 1918, 1957, 1968 and 1977, with estimates of the 1918 pandemic alone suggesting upwards of 40 million casualties.[7] Most virologists concur that a future pandemic is a 'virtual certainty', whether it be from the current H5N1 strain of avian influenza that is devastating poultry stocks all over Asia and Eastern Europe or some other avian strain yet to be conceived.[8] Because of its zoological origin, humans lack antibodies to the animal-derived antigens present on the viral surface, thereby making the virus, which has now become endemic in certain countries, a leading threat to become a worldwide pandemic.[9]

Whether the new pandemic strain emerges this year or in 10 years, the optometrist in practice will have to remain particularly vigilant, as occurred during the SARS outbreak, to prevent patient-to-practitioner or patient-to-patient transmission. The evidence from 2003 showed that SARS was transmitted by airborne means as well as through direct contact with the secretions of an infected individual.[4] No-one can be sure of the form that the next influenza virus will take but if it too has airborne spread, it will have a similar very high risk of transmission.[7]

## THREAT OF BIOTERROR

In medical discourses of pandemic threats, the concern for bioterror is seldom discussed. In the days and weeks after September 11, the public got a glimpse of what may become a face of pandemic disease delivery in the 21st Century, that is, bioweaponry, as weapons-grade anthrax circulated through the US postal system.[10]

The rapid evolution of basic microbiotechnology and hence, affordability of bioweapons, makes them accessible to virtually any group intent on inflicting mass casualties. An oft quoted 1969 study by the United Nations estimated the cost per square kilometre of a large-scale military attack on civilians to be US$2,000 for conventional weapons, US$800 for nuclear weapons, US$600 for nerve gas weapons and US$1 with biological weapons (cited by Pringle[11]). Though inflation has occurred since 1969, there has been a precipitous fall in the price of the necessary biotechnologies. Many of the appropriate biological procedures can be performed using basic high-school scientific equipment, the techniques can be retrieved in 'cook-book' format from the internet[12] and materials can be acquired inexpensively from medical supply companies.[13] The reasons for bioterror being considered a significant public health concern are clear.

Worrisomely, the Atlanta-based Centers for Disease Control and Prevention (CDC) have identified a number of agents as being potential bioweapons.[14] Among them are six entities known as Category A agents (anthrax, botulinum toxin, plague, smallpox, tularaemia and viral haemorrhagic fevers, such as Ebola), scourges viewed as having the highest potential as bioweapons because of their high transmissibility and mortality rates.[15]

The presumption is that an optometric office would not be the target of a bioterror attack but such an attack could easily occur within our own city, province or country. Even if an attack occurred outside our country, we might not be immune, as many diseases have long incubation periods, in the case of smallpox up to 19 days.[10] If one considers the ubiquitous presence of intercontinental flight, a disease outbreak in even a remote part of the world followed by aeroplane travel by an asymptomatic person could conceivably land that person in our office. Given the numerous possible weapons of bioterror[14] and their various modes of transmission, the practising optometrist should have a basic protocol for the control of infection, in case an attack occurs and a disease is spread.

## INFECTION CONTROL DURING AN OUTBREAK OF A HIGHLY INFECTIOUS DISEASE

Optometrists may consider addressing some areas common to most private clinics in an era when a highly infectious disease is being transmitted from person to person. These areas are listed below and the sum of the ideas presented is intended to decrease the risk of acquiring an infection transmitted by respiratory droplets or direct contact. They do not constitute a set of directives *per se*, nor are they intended as a fully comprehensive algorithm of precautionary measures, as we cannot know in advance the exact nature of a future pandemic. The intent is to highlight areas the practising optometrist might consider with regards to personal and practice safety, in an era when a highly transmissible epidemic disease is present.

## Patient screening

The risk optometrists face in acquiring an infectious disease resides in the presenting patient population. A practising optometrist is safest if infectious persons can be excluded from the clinic. The first step is through proper screening of potential patients, typically by telephone, at a time when patients are called to confirm their appointments.

The exact screening questions will vary according to the nature of the disease. A basic framework is given below for a transmissible disease that presents with flu-like symptoms and is modelled after the CDC's guidelines for the screening of SARS.[16]

Screen all patients with fever or lower respiratory symptoms, with or without pneumonia, to determine if, within 10 days (that is, the incubation period of the disease) of the onset of symptoms, they had:

- close contact (defined as living with or being the care-giver of) with a person suspected of having the epidemic disease
- a history of foreign travel (or close contact with a person with a history of travel) to a location with documented or suspected cases of the epidemic disease
- exposure to a domestic or occupational location with documented or suspected cases of the epidemic disease (including a laboratory that contains live strains of the epidemic disease) or close contact with an ill person with such an exposure history.

Specific screening questions will vary according to the disease. For instance, questions relating to a smallpox outbreak may pertain to the presence of fever and the presence or absence of a rash.[17] If a new pandemic did occur, we could reasonably expect the CDC to release specific guidelines for the screening of patients, such as those issued for SARS.

The optometrist may consider implementing a second screening once patients arrive at the office, in the form of a questionnaire. This redundancy will give formal evidence of a screening, screen those who were uncontactable by telephone and detect any individuals whose exposure to infection has changed since the telephone call. A nurse or assistant may be assigned to this duty and to ensure compliance with infection controls.[18]

If a patient's infectious status is uncertain, the optometric appointment should be deferred indefinitely until the status is ascertained. Patients should be instructed on the telephone to avoid bringing others to the office, except where necessary, as in the case of small children or visually impaired individuals.[2]

## Personal protective equipment

As with the screening objectives, personal protective equipment (PPE) will vary with the nature of each pandemic. The protective measures described below will assist a wearer to reduce the likelihood of infection via either direct contact or respiratory droplets.[18]

### EYE PROTECTION

Face shields or visors should be used if sprays, such as those occurring with non-contact tonometry, are expected.[2] If splashes or direct coughing occurs, goggles should be worn.[19] Eyeglasses or contact lenses are not considered eye protection.[16]

### GOWNS AND GLOVES

To protect against splashes or droplets, water-repellent or water-resistant gowns and gloves (these need not be sterile) may be worn.[18] In the event that gowns are required, the apparel should fully cover the front torso and arms and should be tied at the back. Gloves should specifically cover the cuffs of the gown.[16]

### MASKS

Recommended respirators are National Institute for Occupational Safety and Health (NIOSH) certified N95 masks. Surgical masks are not considered a substitute for an N95 or higher-rated mask and should be used only if there is no alternative.[19]

Care must be taken with the removal of PPE. One may consider designating an area with adequate space within the office specifically for the task of PPE removal, so as not to contaminate the environment.[18] The appropriate sequence of PPE removal is not yet established as many national bodies offer contrasting recommendations.[20] If one is wearing all the apparel mentioned above, the recommendations are generally consistent in that the shields for the mucous membranes of the face, mainly the mask and eye protection, should be removed last, after the gloves have been removed and the hands sanitised.

As for handling and storage of fabric-based personal protective equipment such as gowns, it must be noted that textiles have not been implicated in the transmission of viruses such as SARS-CoV.[16] Nonetheless, fabrics and textiles should be handled carefully and not shaken in any manner that might cause infectious particles to become airborne. Ideally, these items should be stored in negative pressure environments[2] away from patient examination rooms. If soiled textiles are to be cleaned, they should be handled using gloves and transported using laundry bags. Washing and drying of textiles may be performed according to routine standards and procedures.[16]

If equipment, such as plastic goggles that cannot be soaked, does not come into direct contact with patients it should be washed daily with tap water. Masks and disposable gloves are to be discarded after every use.

## Equipment disinfection

Disinfection of equipment is mandatory, as microbes such as virus particles can remain stable on most surfaces for several days. Though the survival of pathogens varies, common disinfectants such as hypochlorite (bleach), alcohol and sodium peroxide have proved effective for the vast array of disinfection needs.[18] In the case of the SARS-CoV virus, the recommendation is that ophthalmic instruments in direct contact with patients' mucosal membranes be given an intermediate level of disinfection. For instance, the Goldmann applanation prism tip should be rinsed with tap water to remove any organic manner, soaked for 20 minutes at room temperature in six per cent sodium

peroxide,[2] thoroughly rinsed with saline solution and air dried before every use.

Other contact surfaces such as hand-held occluders and slitlamps should be disinfected between patients. For SARS-CoV, a cleansing agent such as that used to disinfect against epidemic keratoconjunctivitis (EKC) may be used:[21] 1000 ppm sodium hypochlorite solution made by a one in 50 dilution of 5.25 per cent household bleach. Surfaces that are more difficult to clean, such as computers, keyboards, telephones and other medical equipment may be wrapped with plastic sheeting such as cling wrap to facilitate cleaning.[18] These should be wiped down between patient encounters and changed at the end of each day.

Cleansing and disinfection of environmental surfaces, such as lavatories, doorknobs and other apparatus with high patient contact, should be done on a daily basis. PPE should be worn during cleansing regimens.[2]

### Hand sanitisation

Hand sanitisation is a critical element in the control of infection, particularly when disposable gloves are not worn. Hands are to be disinfected between patients. Practitioners should avoid touching their masks, eye protection and head and neck regions until they have completed a thorough hand cleansing procedure.[2] Though traditional hand-washing with soap and water is accepted in many guidelines for control of infection, the alcohol-based sanitisers have greater efficacy.[22] A bottle of alcohol-based sanitiser should be available for patients to use on entering and leaving the practice.

### Infection control measures for staff members

In addition to the optometrist, staff members must remain vigilant in the control of infection. Typical staff duties often result in high patient contact, through patient education and training (for example, in binocular vision, contact lenses and low vision), dispensing (for example, spectacle frames, non-prescription sunglasses et cetera) or auxiliary testing (for example, auto-refraction, automated visual fields et cetera). Staff must be conscious of the risks presented by transmissible disease, to protect not only themselves but also patients from the spread of infection.

Personal protective equipment for staff members is recommended. Wearing PPE, such as an N95 respirator and gown, may be viewed as cumbersome by some, particularly when there is no definite risk of highly transmissible disease, however, public and patient perceptions will be far more accepting of such measures in an era of SARS or avian flu.

For items such as spectacle frames and polarised spectacles that may come into contact with patients in the course of routine visits, steps must be taken to sanitise the contact surfaces after every use. Common disinfectants, such as alcohol, hypochlorite or heat (56 degrees centigrade for 15 minutes)[18] are appropriate in such cases. In addition, given the demonstrated efficacy of alcohol-based sanitising gels, one may consider implementing a policy of mandatory hand sanitisation for all patients, prior to contact with any objects or goods in the office.

### Other recommendations

Because of the very short working distance used in direct ophthalmoscopy and the risk imposed by airborne disease transmission, Hong Kong ophthalmologists ceased using direct ophthalmoscopy shortly after the SARS outbreak. In cases where the spread of pandemic disease is characterised by the spread of droplets and the infectious status of a patient is in doubt, fundus photography may serve as an alternative to traditional fundus examination.[2]

Though the traditional injection for influenza is not viewed as protective against SARS or a pandemic strain of avian flu, it is still in the optometrist's best interest to avoid the flu in an era in which a flu-like pandemic disease exists.[23]

During a disease outbreak, competent use of measures to control infection will reduce but not prevent or eliminate a person's exposure to pathogens. At the SARS epicentre of the Hong Kong outbreak during 2003, the HCWs who properly adhered to the control measures, specifically mask, gloves, gowns and hand washing, were overwhelmingly less likely to be infected. Conversely, the overwhelming majority of HCWs who were infected had omitted one or more of the preventative steps, signalling the efficacy of the measures.[2]

## CONCLUSION

A worldwide epidemic of an infectious disease, whether it is an H5N1-like flu, a re-emergence of SARS, a bio-terror attack or an as yet unidentified cause, has been described as a virtual certainty in the future. Learning from our experience in 2003, a critical factor in the rapid resolution of the SARS outbreak was adequate dissemination of screening and triage information to health-care workers.[24] As a front-line health-care provider, it remains the optometrists' responsibility to contribute to the resolution of any future pandemic by being informed of the nature of the current threats and by understanding the areas that must be addressed to protect themselves, their employees and their patients from the risk of infection in their practice.

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