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Protecting against Infectious Disease Transmission during Equipment Maintenance: Lessons from the 2003 SARS Outbreak

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EXECUTIVE SUMMARY



In response to the COVID-19 coronavirus outbreak (first detected in late 2019), ECRI Institute is reissuing guidance it published following the 2003 epidemic of severe acute respiratory syndrome (SARS). We believe much of the information can also be applied to other infectious disease events.

This article, originally published in February 2004, provides guidance for clinical engineering, respiratory therapy, and other personnel involved in maintaining potentially SARS-exposed equipment. Adhering to appropriate infection control practices can help minimize the risks during such activities.

Introduction

Concerns about the COVID-19 coronavirus outbreak—first detected in China, in late 2019—have prompted ECRI Institute to reissue some of its past guidance related to infectious disease outbreaks. In the current moment, we believe healthcare professionals will find it instructive to revisit issues associated with the 2003 outbreak of severe acute respiratory syndrome (SARS).

Background

In 2003, more than 8,000 people worldwide contracted SARS—a respiratory illness that usually begins with a fever, progresses to include other symptoms, and can lead to the development of pneumonia. During the initial outbreak, 774 deaths were attributed to the disease. In less than two months at the start of 2020, the impact of the novel coronavirus (2019-nCoV) that causes COVID-19 has far surpassed those totals. COVID-19 is spreading faster than SARS did, and has already infected tens of thousands of patients. COVID-19 appears to progress with relatively mild symptoms at first, then develops to pneumonia and potentially to acute respiratory distress syndrome (ARDS), which is hard to treat and often requires the patient to be put on a ventilator (advanced life support).

The mechanism of SARS-CoV transmission was understood to be associated with close contact with a SARS-infected person or exposure to large-droplet secretions from an infected person's cough or sneeze. As [reported in *The Lancet*](#) (subscription or fee required for access) in mid-February 2020, "presently COVID-19 seems to spread from person to person by the same mechanism as other common cold or influenza viruses—ie, face to face contact with a sneeze or cough, or from contact with secretions of people who are infected."

In the case of SARS, transmission of the disease was quickly controlled, and the outbreak was declared over by July 2003. Nevertheless, concern existed that SARS could in fact be a seasonal disease and that another outbreak

could occur in later years. The threat of another outbreak underscored the importance of facilities having a response plan in place to safeguard the health of their communities and staff members. ECRI Institute produced a series of articles in 2003 and 2004 discussing the risks associated with SARS, reviewing recommendations from the U.S. Centers for Disease Control and Prevention (CDC), discussing the role of hospital facilities staff and clinical engineers in SARS preparations, and updating ECRI's recommendations for infection control procedures during equipment servicing.

Considerable attention has been given to the risks faced by healthcare workers who treat SARS patients. However, there may also be some level of risk exposure for the clinical engineering, respiratory therapy, and other personnel involved in maintaining equipment that has been potentially exposed to SARS.

What follows is an excerpt of that content produced during the SARS outbreak. While the information was produced with that specific instance in mind, much of the information would likewise apply to other outbreaks of infectious diseases. Note that in some places, we have updated links or references to other material that has been published since this article was issued.

Source: ECRI Institute. SARS preparedness: revisiting the procedures to protect staff and help prevent or contain an outbreak. *Health Devices* 2004 Feb;33(2):44-53.

Considerations during Equipment Maintenance

Risks of Infection

The risks of SARS infection during equipment servicing are likely to be very low, except when maintenance must be performed *inside* a SARS patient's room. We are not aware of any cases of infection associated with handling of equipment or supplies outside patient rooms.

ECRI has established the following levels of concern related to the risks of infection associated with the circumstances described:

- **No infection concern.** There is no concern about infection from external surfaces that have been cleaned and disinfected.
- **Minimal infection concern.** If the interior of a device is exposed to SARS-CoV from room air—most likely air drawn into the device by a cooling fan—there *may* be some concern about contamination. Until more is known about the transmission of SARS, we suggest that hospitals err on the side of caution and use simple protective measures for even such minimal-risk situations. These measures are readily implemented (see Specific Protective Steps, below). Note, however, that the warm air that is generally circulating inside a device with a cooling fan promotes drying and dilution of contaminants, which may reduce the viability of some viruses.
- **Higher infection concern.** Surfaces that have been in contact with the patient's oral secretions or other excretions and cannot be readily disinfected pose a bigger concern. This is because, although the infection risk is still likely to be extremely low on these surfaces, there is a greater probability that the virus has remained viable. Such surfaces include the following:
 - Breathing circuits (including ventilator accessories and any portions of the breathing circuit inside ventilators), suction devices and systems, or any other devices that are exposed to the patient's oral secretions (including contaminated condensate), urine, feces, and other excretions
 - HEPA filtration systems, which are installed systems or portable systems (i.e., mobile high-efficiency-filter air cleaners [MHEFACs]) used to control room air contamination levels and ensure negative pressure in isolation rooms
 - Any handheld items or other items that can be found in beds, including nurse call buttons, remote controls

for televisions, pillow speakers, blood pressure cuffs, and telemetry transmitters

- **Highest infection concern.** The highest level of concern is posed by entering the room of a SARS patient without appropriate personal protective equipment (PPE). This is because of the close proximity to the patient, the potential risk of exposure to droplet secretions from coughs and sneezes, exposure to contaminated surfaces, and possible exposure associated with aerosol-generating procedures.

Keep in mind that even the highest level of risk is not an insurmountable concern as long as servicing personnel take the protective steps listed in the next section.

Specific Protective Steps

The following practices should be implemented to protect personnel while they are maintaining and repairing equipment that has been used on—or that has been in the same room as—patients who have or who are suspected of having SARS. For the most part, these represent good infection control practices that should be followed when servicing any device, independent of SARS concerns.

1. Do not enter the room of a SARS patient

Access to such rooms should be restricted to essential personnel only. This is to ensure the safety of personnel and to minimize disease transmission. However, if you must enter the room, follow relevant hospital procedures to minimize the exposure risks.

2. Minimize exposure of medical equipment to SARS

Before a patient with SARS is brought into a room, remove any unessential equipment. Use breathing-circuit filters to protect exhalation valves and other ventilation components from contamination (for more on this topic, see the Guidance Article [Mechanical Ventilation of SARS Patients: Lessons from the 2003 SARS Outbreak](#)). Use disposable devices or accessories for SARS patients whenever possible.

3. Observe proper hand hygiene

Frequent and thorough handwashing with soap and water is essential. Alcohol-based handrubs can be used when hands are not visibly soiled and handwashing facilities are not immediately available. Personnel should not rub their eyes or touch their mouth, nose, or other mucous membranes while working on exposed equipment. While wearing gloves, personnel should also avoid touching other surfaces in the room that are not involved in the equipment repair (e.g., doorknobs, telephones, test equipment, computer terminals, keyboards, manuals). In addition, personnel should not eat, drink, chew gum, smoke, or apply cosmetics until they have removed all protective wear and washed their hands.

4. Use proper decontamination and transport procedures

Equipment should not be transported until it has been cleaned and disinfected and disposables have been removed by housekeeping, central processing, or other appropriate personnel. (Note that commonly used disinfectants are effective against the SARS virus.) If equipment from the room of a SARS patient must be removed before the exterior can be cleaned and disinfected, follow any hospital policies on transporting contaminated devices.

5. Choose an appropriate work area

Equipment that poses particular infection concerns should be worked on in designated areas where servicing can be performed without the risk of infecting patients or other employees. These areas should not be near any patient care areas, food preparation or storage areas, medication areas, or other clean areas.

6. Wear protective equipment when appropriate

For personnel working on minimal-risk surfaces, we recommend using the following PPE:

- Gloves

- Clean, nonsterile gown, apron, or laboratory coat
- Eye protection (e.g., goggles)

A face shield is an alternative form of eye protection. Although a face shield should provide adequate protection against an occasional minor splatter that may occur during servicing, the U.S. Occupational Safety and Health Administration (OSHA) requires the use of goggles (or special protective eyeglasses) when eye protection is used. CDC, on the other hand, recommends goggles *or* a face shield for protection against a splash or spray of body fluids.

- Respiratory protection

Update: *As of February 3, 2020, CDC recommends, in the case of the COVID-19 outbreak, that staff "use respiratory protection (i.e., a respirator) that is at least as protective as a fit-tested NIOSH-certified disposable N95 filtering facepiece respirator before entry into the patient room or care area." That recommendation matches the guidance ECRI Institute initially issued (in June 2003) in the case of the 2003 SARS outbreak.*

Note, however, that respiratory protection recommendations can evolve over time. For example, as new information about airborne transmission of SARS became available and as concern lessened, we updated our recommendations for that circumstance: In February 2004, we specified that it would be prudent for personnel working with the equipment to wear a surgical mask, but that there was no significant benefit to using an N95 respirator for that application, particularly in light of the considerable time and effort that respirator use entails. (For additional information about respirator types and implementation challenges, see [Selecting Respiratory Protection for Equipment Servicers and Other Hospital Personnel: Lessons from the 2003 SARS Outbreak](#).) It is unknown at this time if similar changes will develop in the case of the COVID-19 outbreak.

7. Before starting work . . .

If there is any question about whether the exterior surfaces of the equipment were adequately disinfected, including the bottom and back, disinfect those surfaces immediately. Also, if disposable components have not already been discarded, do that right away as well. If the equipment is not needed immediately, ECRI suggests allowing time—several hours to overnight—for viruses to die before servicing is carried out. (Note, however, that this waiting period should not be seen as a substitute for other infection control procedures.)

8. If the interior of the equipment is dusty . . .

Use a vacuum cleaner with a HEPA filter to remove dust as soon as adequate access is gained during disassembly and before working on the interior. Never blow on the equipment or use compressed air to remove dust or other particulates.

9. Clean up when done.

Clean and disinfect the work area after servicing is complete.

10. If an exposure occurs . . .

If you believe you have been exposed to SARS-CoV while unprotected, consult with the hospital's infection control practitioner, epidemiologist, or employee health staff for the procedures to follow.

RELATED RESOURCES

[Outbreak Preparedness and Response: The Essentials](#)

[Mechanical Ventilation of SARS Patients: Lessons from the 2003 SARS Outbreak](#)

[Preparation Is the Best Protection: Lessons from the 2003 SARS Outbreak](#)

Selecting Respiratory Protection for Equipment Servicers and Other Hospital Personnel: Lessons from the 2003 SARS Outbreak

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CITATION

ECRI Institute. Protecting against infectious disease transmission during equipment maintenance: lessons from the 2003 SARS outbreak. *Health Devices* 2020 Feb 18.