



SEVERE ACUTE RESPIRATORY SYNDROME

NOTICE

Since 2004, there have not been any known cases of SARS reported anywhere in the world. The content in this PDF was developed for the 2003 SARS epidemic. But, some guidelines are still being used. Any new SARS updates will be posted on this Web site.



Supplement I: Infection Control in Healthcare, Home, and Community Settings

III. Infection Control in Healthcare Facilities

A. Preparedness Planning

SARS preparedness planning for healthcare facilities is addressed in Supplement C. One component with particular relevance to this Supplement is the education and training of healthcare workers on infection control measures. Observations of healthcare workers caring for SARS patients during the 2003 epidemic identified numerous breaches in infection control, especially in the use of personal protective equipment (PPE). These can be corrected through complete and comprehensive training, provision of properly selected PPE, and monitoring of PPE use. Most important, all healthcare settings need to re-emphasize the importance of basic infection control measures, including hand hygiene, for the control of SARS-CoV and other respiratory pathogens.

Objective: Reinforce basic infection control practices in healthcare facilities and among healthcare personnel.

Activities

- Educate staff about the importance of strict adherence to and proper use of standard infection control measures, especially hand hygiene (i.e., hand washing or use of an alcohol-based hand rub). For complete recommendations on hand hygiene, refer to: www.cdc.gov/handhygiene/.
- Reinforce education on the recommended procedures for Standard, Contact, and Airborne Infection Isolation (AII) Precautions (see www.cdc.gov/ncidod/hip/ISOLAT/Isolat.htm).
- Ensure that personnel have access to appropriate PPE, instructions and training in PPE use, and respirator fit-testing.

B. Early Recognition and Prevention of Transmission in Outpatient Settings

Objective: Ensure early recognition and prevention of transmission of SARS-CoV and other respiratory viruses at the initial encounter with a healthcare setting.

The 2003 outbreaks identified weaknesses in the way infection control precautions are implemented at the time symptomatic patients first visit a healthcare facility for evaluation. To address this deficiency, CDC is *incorporating measures to prevent the transmission of all respiratory infections*, beginning at the first point of contact with a potentially infected person, as one component of Standard Precautions in healthcare settings (see Appendix I1 and www.cdc.gov/ncidod/hip/ISOLAT/Isolat.htm).

These simple preventive measures apply in the absence and presence of SARS-CoV transmission in the world. Once SARS-CoV transmission is detected, efforts to enhance the early detection of patients with SARS-CoV disease (described in Section III.C below) should be added to these new Standard Precautions measures.

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Activities

Visual alerts

- Post visual alerts (in appropriate languages) at the entrance to outpatient facilities (e.g., emergency departments, physicians' offices, outpatient clinics) instructing patient and the persons who accompany them to: 1) inform healthcare personnel of symptoms of a respiratory infection when they first register for care, and 2) practice respiratory hygiene/cough etiquette (www.cdc.gov/flu/professionals/infectioncontrol/resphgiene.htm). Sample visual alerts will be posted on CDC's SARS website: www.cdc.gov/ncidod/sars/.

Respiratory hygiene/cough etiquette

To contain respiratory secretions, all persons with signs and symptoms of a respiratory infection, regardless of presumed cause, should be instructed to:

- Cover the nose/mouth when coughing or sneezing.
- Use tissues to contain respiratory secretions.
- Dispose of tissues in the nearest waste receptacle after use.
- Perform hand hygiene after contact with respiratory secretions and contaminated objects/materials.

Healthcare facilities should ensure the availability of materials for adhering to respiratory hygiene/cough etiquette in waiting areas for patients and visitors:

- Provide tissues and no-touch receptacles (i.e., waste container with pedal-operated lid or uncovered waste container) for used tissue disposal
- Provide conveniently located dispensers of alcohol-based hand rub
- Provide soap and disposable towels for hand washing where sinks are available

Masking and separation of persons with symptoms of respiratory infection

- During periods of increased respiratory infection in the community, offer masks to persons who are coughing. Either procedure masks (i.e., with ear loops) or surgical masks (i.e., with ties) may be used to contain respiratory secretions; respirators are not necessary. Encourage coughing persons to sit at least 3 feet away from others in common waiting areas. Some facilities may wish to institute this recommendation year-round.

Droplet Precautions

- Healthcare workers should practice Droplet Precautions (i.e., wear a surgical or procedure mask for close contact), in addition to Standard Precautions, when examining a patient with symptoms of a respiratory infection. Droplet Precautions should be maintained until it is determined that they are no longer needed (see www.cdc.gov/ncidod/hip/ISOLAT/Isolat.htm).

C. Early Detection and Isolation of Patients Potentially at Risk for SARS-CoV Disease

Early detection and isolation of patients who may be infected with SARS-CoV are the most important interventions to prevent the introduction of SARS-CoV into a healthcare setting. However, because measures to control SARS-CoV can impose a considerable burden, especially if multiple patients with respiratory illnesses are being seen in an outpatient setting or admitted to a hospital for treatment of

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pneumonia, the intensity of early detection and control measures should be based on the level of SARS-CoV transmission in the world. See CDC's SARS website (www.cdc.gov/sars/) for current information on SARS-CoV transmission worldwide.

Objective 1: *In the absence of SARS-CoV transmission in the world*, implement screening to detect the re-emergence of SARS-CoV, and ensure appropriate triage and management of patients with possible SARS-CoV disease.

In the absence of person-to-person SARS-CoV transmission, the likelihood that a patient being evaluated for fever or lower respiratory illness, with or without pneumonia, has SARS-CoV disease will be exceedingly low unless there are both typical clinical findings and some accompanying epidemiologic evidence that raises the suspicion of exposure to SARS-CoV. Therefore, patients with respiratory infections should not be considered as possible cases of SARS-CoV disease unless they have severe pneumonia (or acute respiratory distress syndrome) of unknown etiology that requires hospitalization *and* an epidemiologic history that raises the suspicion of SARS-CoV exposure.

Activities

Screening and triage

- Only patients requiring hospitalization for radiographically confirmed pneumonia (or acute respiratory distress syndrome) of unknown etiology should be screened for SARS epidemiologic risk factors. The suspicion for SARS-CoV disease is raised if, within 10 days of symptom onset, the patient:
 - Has a history of travel to mainland China, Hong Kong, or Taiwan,¹ or close contact² with an ill person with a history of recent travel to one of these areas, *OR*
 - Is employed in an occupation associated with a risk for SARS-CoV exposure (e.g., healthcare worker with direct patient contact; worker in a laboratory that contains live SARS-CoV), or
 - Is part of a cluster of cases of atypical pneumonia without an alternative diagnosis

Evaluate persons with such a clinical and exposure history according to Figure 1 in *Clinical Guidance on the Identification and Evaluation of Possible SARS-CoV Disease among Persons Presenting with Community-Acquired Illness* (www.cdc.gov/ncidod/sars/clinicalguidanceframe1.htm).

¹ The 2003 SARS-CoV outbreak likely originated in mainland China, and neighboring areas such as Taiwan and Hong Kong are thought to be at higher risk due to the large volume of travelers from mainland China. Although less likely, SARS-CoV may also reappear from other previously affected areas. Therefore, clinicians should obtain a complete travel history. If clinicians have concerns about the possibility of SARS-CoV disease in a patient with a history of travel to other previously affected areas (e.g., while traveling abroad, had close contact with another person with pneumonia of unknown etiology or spent time in a hospital in which patients with acute respiratory disease were treated), they should contact the local or state health department.

² Close contact: A person who has cared for or lived with a person with SARS-CoV disease or had a high likelihood of direct contact with respiratory secretions and/or body fluids of a person with SARS-CoV disease. Examples of close contact include kissing or hugging, sharing eating or drinking utensils, talking within 3 feet, and direct touching. Close contact does not include activities such as walking by a person or briefly sitting across a waiting room or office.

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Outpatient infection control

- Follow the infection control recommendations for respiratory hygiene/cough etiquette and Droplet Precautions outlined in Section III.B above.

Disposition

- No special infection control measures are recommended following discharge from an outpatient setting.

Hospitalization

- Patients who require hospitalization for radiographically confirmed pneumonia (or acute respiratory distress syndrome) of unknown etiology and who have one of the potential SARS risk factors should be placed on Droplet Precautions until it is determined that the cause of the pneumonia is not contagious. If the health department and clinicians *strongly* suspect SARS-CoV disease, then the patient should be placed on Contact and Airborne Infection Isolation Precautions, in addition to Standard Precautions (See Section C below and *Clinical Guidance on the Identification and Evaluation of Possible SARS-CoV Disease among Persons Presenting with Community-Acquired Illness*, www.cdc.gov/ncidod/sars/clinicalguidance.htm).

Objective 2: *In the presence of person-to-person transmission of SARS-CoV in the world*, ensure the prompt identification and appropriate management of patients with possible and known SARS-CoV disease.

Activities

Screening and triage

Once person-to-person SARS-CoV transmission has been documented anywhere in the world, the probability that a patient presenting with early clinical symptoms of SARS actually has SARS-CoV disease increases if the patient has an epidemiologic link to a geographic location in which SARS-CoV transmission has been documented.

- Screen all patients with fever or lower respiratory symptoms, with or without pneumonia, to determine if, within 10 days of the onset of symptoms, they had:
 - o Close contact with a person suspected of having SARS-CoV disease, *or*
 - o A history of foreign travel (or close contact with an ill person with a history of travel) to a location with documented or suspected SARS-CoV transmission, *or*
 - o Exposure to a domestic or occupational location with documented or suspected SARS-CoV (including a laboratory that contains live SARS-CoV), or close contact with an ill person with such an exposure history
- For persons with a high risk of exposure to SARS-CoV (e.g., persons previously identified through contact tracing or self-identified as close contacts of a laboratory-confirmed case of SARS-CoV disease; persons who are epidemiologically linked to a laboratory-confirmed case of SARS-CoV disease), the clinical criteria should be expanded to include, in addition to fever or respiratory symptoms, the presence of any other early symptoms of SARS-CoV disease (subjective fever, chills, rigors, myalgia, headache, diarrhea, sore throat, rhinorrhea). The more common early symptoms include chills, rigors, myalgia, and headache. In some patients,

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myalgia and headache may precede the onset of fever by 12-24 hours. However, diarrhea, sore throat, and rhinorrhea may also be early symptoms of SARS-CoV disease.

Evaluate persons with an exposure history suggesting possible SARS-CoV disease according to Figure 2 in *Clinical Guidance on the Identification and Evaluation of Possible SARS-CoV Disease among Persons Presenting with Community-Acquired Illness*

(www.cdc.gov/ncidod/sars/clinicalguidanceframe2.htm).

- Patients who require hospitalization for pneumonia and who do not have a known epidemiologic link to a setting in which SARS-CoV has been documented should be screened for additional risk factors using the questions that apply when no SARS-CoV is documented in the world (i.e., employment in an occupation at particular risk for SARS-CoV exposure; part of a cluster of atypical pneumonias without an alternative diagnosis).
- Healthcare workers who are the first points of contact (e.g., triage and reception) should be trained to perform SARS-CoV screening. If screening personnel are not available, healthcare providers should screen symptomatic patients for SARS-CoV disease risk factors before initiating history-taking and physical examination. If SARS symptoms and risk factors are present, follow the clinical algorithm for patient management (www.cdc.gov/ncidod/sars/clinicalguidanceframe2.htm).

Outpatient infection control

- Patients with fever or lower respiratory symptoms, with or without pneumonia, who have been exposed to SARS-CoV or who have SARS risk factors should be suspected of having SARS-CoV disease and isolated as soon as possible. Such patients should be given a mask (surgical or procedure) to wear and immediately placed in a private examination room or cubicle. If available, an AII room (AIIR) should be used.
- Where limited space and examination room capacity preclude these measures, the patient should sit as far away as possible from other patients in the waiting area.
- Family members or friends who accompany the patient should be considered at risk for SARS-CoV disease and screened for fever and lower respiratory symptoms. If either is present, infection control measures to prevent SARS-CoV transmission should be applied.
- Healthcare workers should wear gown, gloves, respiratory protection, and eye protection (if needed) as described in Section III.D.5 below.

Disposition

- Hospital admission or discharge of a possible SARS patient should generally be based on the patient's clinical condition and healthcare needs. If diagnostic, therapeutic, or supportive regimens do not necessitate hospitalization, patients with possible SARS-CoV disease should not be hospitalized.
- Exceptions include persons for whom no other alternative for providing safe infection control is available. Such persons include travelers, homeless persons, and persons who would be returned to an environment where infection control measures are not feasible or practical (e.g., crowded dormitories, prisons and jails, detention centers, homeless shelters, other multi-person single-room dwellings). These persons should be hospitalized and isolated as recommended in Section D below. As soon as appropriate arrangements can be made for out-of-hospital care, the patient can be discharged. Alternatively, the patient may be admitted to a designated residential facility for isolation of convalescing SARS-CoV disease cases, if one exists.

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- During transport between locations, patients should wear a mask. Public transportation (e.g., bus, train) should be avoided. Recommendations for emergency medical transport are provided in Section IV below.

Hospitalization

- Follow recommended precautions for hospitalization of a patient with known or possible SARS-CoV disease as described in Section D below.

D. Infection Control Precautions for Hospitalized SARS Patients

The following recommendations apply to patients who have laboratory evidence of SARS-CoV disease or for whom the attending clinicians and health department strongly suspect SARS-CoV disease. The level of precautions described will rarely be needed in the absence of SARS-CoV transmission in the world but will be used increasingly once SARS-CoV transmission is detected.

Contact and All Precautions, in addition to Standard Precautions, should be applied when caring for patients with known or possible SARS-CoV disease. (Droplet Precautions also are required but are subsumed within All Precautions.) These precautions should be maintained for the duration of potential infectivity (see (www.cdc.gov/ncidod/sars/clinicalguidance.htm) or until a diagnosis of SARS-CoV disease has been ruled out. See Appendix I2.

The objective of all of the following activities is to prevent the transmission and acquisition of SARS-CoV in the hospital.

1. Patient placement

- Admit patients with SARS-CoV disease to an AIIR. An AIIR is a single-patient room in which environmental conditions are controlled to minimize the possibility of airborne transmission of infectious agents. These rooms have specific requirements for controlled ventilation, including: 1) a specified number of required air exchanges per hour (ACH) (i.e., 6 for old buildings; 12 for new construction or renovation), 2) monitored negative pressure relative to hallways, and 3) air exhausted directly to the outside preferably or passed through a high-efficiency purifying air (HEPA) filter if recirculated. These requirements are detailed in the *Guideline for Environmental Infection Control in Healthcare Facilities, 2003* (www.cdc.gov/ncidod/hip/enviro/guide.htm).
- If there is a lack of AIIRs and/or a need to concentrate infection control efforts and resources, patients may be cohorted on a floor or nursing unit designated for the care of SARS patients only, rather than placed in AIIRs throughout the hospital. This strategy physically isolates SARS patients and also makes it possible to dedicate resources and appropriately trained staff to their care. Experience in some settings in Taiwan and Toronto demonstrated that cohorting SARS patients, without use of AIIRs, effectively interrupted transmission. Thus, although single AIIRs are recommended for SARS isolation, other strategies may provide effective overall infection control, particularly if air-handling systems in existing rooms/units/floors can be modified to allow these areas to operate under negative pressure relative to surrounding areas.
- Even if a facility has chosen to cohort SARS patients, properly designed and operated AIIRs are preferred for 1) patients who are known to have transmitted SARS-CoV to other persons and 2) patients in whom the risk of SARS is being assessed.

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- Designate "clean" and "dirty" areas for isolation materials. Maintain a stock of clean patient care and PPE supplies outside the patient's room. Decide where contaminated linen and waste will be placed. Locate receptacles close to the point of use and separate from the clean supplies. Also designate the location where reusable PPE (e.g., goggles, face shields) will be placed for cleaning and disinfection before reuse.
- Limit the amount of patient-care equipment brought into the room to that which is medically necessary. Provide each patient with patient-dedicated equipment (e.g., thermometer, blood pressure cuff, stethoscope).
- Limit staff to the number sufficient to meet patient-care needs. Using staff who have been specially trained to care for patients with SARS may reduce opportunities for exposure, increase adherence to recommended infection control practices, and promote continuity of care.

2. Patient transport

- Limit patient movement and transport outside the AIIR to medically necessary purposes. Whenever possible, use portable equipment to perform x-rays and other procedures in the patient's room.
- If transport or movement is necessary, ensure that the patient wears a surgical mask, puts on a clean patient gown, and performs hand hygiene before leaving the room. If a mask cannot be tolerated (e.g., due to the patient's age or deteriorating respiratory status), apply the most practical measures to contain respiratory secretions.
- Limit contact between SARS patients and others by using less traveled hallways and elevators when possible.

3. Visitors

- Limit visits to patients with known or possible SARS-CoV disease to persons who are necessary for the patient's emotional well-being and care.
- Visitors who have been in contact with the patient before and during hospitalization are a possible source of SARS-CoV. Therefore, schedule and control visits to allow for appropriate screening for SARS-CoV disease before entering the hospital and appropriate instruction on use of PPE and other precautions (e.g., hand hygiene, limiting surfaces touched) while in the patient's room.

4. Hand hygiene

Hand hygiene (i.e., hand washing or use of an alcohol-based hand rub) should be performed after contact with a patient on precautions for SARS-CoV disease or their environment of care. Current guidelines for hand hygiene are provided at: www.cdc.gov/handhygiene/.

5. Personal protective equipment (PPE)

Gloves, gown, respiratory protection, and eye protection (as needed) should be donned before entering a SARS patient's room or designated SARS patient-care area. This level of protection is required for the majority of patient contacts. Additional guidance for performing an aerosol-generating procedure on patients with SARS Co-V disease is provided in Section III.D.11 below. Instructions on how to safely don, use, and remove PPE are being developed and will be provided at www.cdc.gov/ncidod/sars/ when available. Removal of PPE in a manner that prevents contamination of clothing and skin is a priority.

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- Gown and gloves – Wear a standard isolation gown and pair of nonsterile patient-care gloves for all patient contacts. The gown should fully cover the front torso and arms and should tie in the back. Gloves should cover the cuffs of the gown.
- Respiratory protection – Wear a NIOSH-certified N-95 filtering facepiece respirator for entering an AIIR or designated SARS patient-care area.³ If N-95 or higher level of respiratory protection is not available, then wear a snug-fitting surgical mask to prevent nose and mouth contact with large respiratory droplets. Discard respirators upon leaving the patient room or area.
- Eye and face protection -- It is not yet known whether routine eye protection is needed to prevent SARS-CoV transmission. Routinely wear eye protection when within 3 feet of a patient with SARS-CoV. If splash or spray of respiratory secretions or other body fluids is likely, protect the eyes with goggles or a face shield, as recommended for Standard Precautions. The face shield should fully cover the front and wrap around the side of the face. Corrective eyeglasses or contact lenses alone are not considered eye protection.
- Use safe work practices when wearing PPE:
 - Avoid touching the face with contaminated gloves
 - Avoid unnecessary touching of surfaces and objects with contaminated gloves

6. Medical waste

Medical waste has not been implicated in the transmission of SARS-CoV. Therefore, no special handling procedures are recommended for SARS-CoV-contaminated medical waste.

- Contain and dispose of SARS-CoV-contaminated medical waste in accordance with facility-specific procedures and/or local or state regulations for handling and disposal of medical waste, including used needles and other sharps.
- Discard as routine waste used patient-care supplies that are not likely to be contaminated (e.g., paper wrappers).
- Wear disposable gloves when handling waste. Perform hand hygiene after removal of gloves.

7. Textiles (linen and laundry)

Contact with textiles has not been implicated in the transmission of SARS-CoV. Therefore, no special handling procedures are recommended for linen and laundry that may be contaminated with SARS-CoV.

- Store clean linen outside patient rooms, taking into the room only linen needed for use during the shift.
- Place soiled linen directly into a laundry bag in the patient's room. Contain linen in a manner that prevents the linen bag from opening or bursting during transport and while in the soiled linen holding area.

³ Respirators should be used in the context of a complete respiratory protection program as required by the Occupational Safety and Health Administration (OSHA). This includes training, fit-testing, and fit-checking to ensure appropriate respirator selection and use. To be effective, respirators must provide a proper sealing surface on the wearer's face. Detailed information on a respiratory protection program is provided at: www.osha.gov/SLTC/etools/respiratory/.

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- Wear gloves and gown when directly handling soiled linen and laundry (e.g., bedding, towels, personal clothing) as per Standard and Contact Precautions. Do not shake or otherwise handle soiled linen and laundry in a manner that might aerosolize infectious particles.
- Wear gloves for transporting bagged linen and laundry.
- Perform hand hygiene after removing gloves that have been in contact with soiled linen and laundry.
- Wash and dry linen according to routine standards and procedures (www.cdc.gov/ncidod/hip/enviro/guide.htm).

8. Dishes and eating utensils

Dishes and eating utensils have not been implicated in SARS-CoV transmission. Therefore, no special precautions, beyond those for Standard Precautions, are recommended for dishes and eating utensils used by a patient with known or possible SARS-CoV disease.

- Wash reusable dishes and utensils in a dishwasher with recommended water temperature (www.cdc.gov/ncidod/hip/enviro/guide.htm).
- Wear gloves when handling patient trays, dishes, and utensils.

9. Patient-care equipment

- Follow standard practices for handling and reprocessing used patient-care equipment, including medical devices. Wear gloves when handling and transporting used patient-care equipment. Wipe heavily soiled equipment with an EPA-approved hospital disinfectant before removing it from the patient's room. Follow current recommendations for cleaning and disinfection or sterilization of reusable patient-care equipment.
- Wipe external surfaces of portable equipment for performing x-rays and other procedures in the patient's room with an EPA-approved hospital disinfectant upon removal from the patient's room.

10. Environmental cleaning and disinfection

Cleaning and disinfection of environmental surfaces are important components of routine infection control in healthcare facilities. Although little is known about the extent of environmental contamination in SARS patients' rooms, epidemiologic and laboratory evidence suggests that the environment could play a role in transmission. Therefore, cleaning and disinfection are critical to the control of SARS-CoV transmission. Environmental cleaning and disinfection for SARS-CoV follows the same principles generally used in healthcare settings.

Cleaning and disinfection of occupied patient rooms

- Consider designating specific, well-trained environmental services personnel for cleaning and disinfecting of SARS patient rooms/units. Fully define the scope of cleaning that will be done each day; identify who will be responsible for cleaning and disinfecting the surfaces of patient-care equipment (e.g., IV pumps, ventilators). Consider using a checklist to promote accountability for cleaning responsibilities.
- Environmental services personnel should wear PPE as described in Section III.D.5 above. These staff should be trained in proper procedures for PPE use, including removal of PPE, and the importance of hand hygiene.

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- Keep cleaning supplies outside the patient room (e.g., in an anteroom or storage area).
- Keep areas around the patient free of unnecessary supplies and equipment to facilitate daily cleaning.
- Use any EPA-registered hospital detergent-disinfectant. Follow manufacturer's recommendations for use-dilution (i.e., concentration), contact time, and care in handling.
- Clean and disinfect SARS patients' rooms at least daily and more often when visible soiling/contamination occurs. Give special attention to frequently touched surfaces (e.g., bedrails, bedside and over-bed tables, TV control, call button, telephone, lavatory surfaces including safety/pull-up bars, doorknobs, commodes, ventilator surfaces) in addition to floors and other horizontal surfaces.
- Because so little is known about environmental transmission of SARS-CoV, placement of patients in rooms that do not have carpeting is preferred because non-carpeted floors are easier to clean and disinfect. If use of carpeted rooms cannot be avoided, vacuuming should be done daily, and personnel should wear the recommended PPE. Follow current CDC environmental guidelines for vacuuming and shampooing carpeted floors in patient rooms (www.cdc.gov/ncidod/hip/enviro/guide.htm).
- After an aerosol-generating procedure (e.g., intubation), clean and disinfect horizontal surfaces around the patient. Clean and disinfect as soon as possible after the procedure.
- Clean and disinfect spills of blood and body fluids in accordance with current recommendations for Standard Precautions (www.cdc.gov/ncidod/hip/ISOLAT/Isolat.htm).

Cleaning and disinfection after patient discharge or transfer

Follow standard facility procedures for terminal cleaning of an isolation room.

- Clean and disinfect all surfaces that were in contact with the patient or may have become contaminated during patient care.
- Wipe down mattresses and headboards with an EPA-approved hospital disinfectant.
- Privacy curtains should be removed, placed in a bag in the room and then transported to be laundered.
- No special treatment is necessary for window curtains, ceilings, and walls unless there is evidence of visible soil.
- Do not spray (i.e., fog) occupied or unoccupied rooms with disinfectant. This is a potentially dangerous practice that has no proven disease control benefit.

11. Aerosol-generating procedures

Because aerosol-generating procedures may pose a greater risk of SARS-CoV transmission, additional precautions are recommended for healthcare workers who perform or assist with these procedures. Procedures that stimulate coughing and promote the generation of aerosols include aerosolized or nebulized medication administration, diagnostic sputum induction, bronchoscopy, airway suctioning, endotracheal intubation, positive pressure ventilation via face mask (e.g., BiPAP, CPAP), and high-frequency oscillatory ventilation.

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Healthcare facilities should review their strategies to protect healthcare workers during these procedures, including the use of PPE and safe work practices. Healthcare workers who perform these procedures should be alerted to the fact that there may be an increased risk for SARS-CoV transmission when these procedures are performed.

Infection control measures

- Limit performance of aerosol-generating procedures on SARS patients to those that are considered medically necessary. Clinically appropriate sedation during intubation and bronchoscopy may minimize resistance and coughing during the procedure.
- Limit the number of healthcare workers in the room during an aerosol-generating procedure to those essential for patient care and support.
- Perform aerosol-generating procedures in an AIIR. If an AIIR is not available, perform the procedure in a private room, away from other patients. If possible, increase air exchanges, create a negative pressure relative to the hallway, and avoid recirculation of the room air. If recirculation of air from such rooms is unavoidable, pass the air through a HEPA filter before recirculation, as recommended for *Mycobacterium tuberculosis* (www.cdc.gov/mmwr/preview/mmwrhtml/00035909.htm).
- Air-cleaning devices, such as portable HEPA filtration units, may be used to further reduce the concentration of contaminants in the air. Keep doors closed except when entering or leaving the room, and minimize entry and exit during the procedure.
- Submicron filters on exhalation valves of mechanical ventilators may prevent contaminated aerosols from entering the environment. Although the effectiveness of this measure in reducing the risk of SARS-CoV transmission is unknown, the use of such filters is prudent during high-frequency oscillatory ventilation of patients with SARS-CoV disease.

PPE for aerosol-generating procedures

The optimal combination of PPE for preventing SARS-CoV transmission during aerosol-generating procedures has not been determined. Wearing PPE during these procedures protects the respiratory tract from inhalation of droplet nuclei and the mucous membranes, skin, and clothing from contact with infectious respiratory secretions. PPE should cover the torso, arms, and hands as well as the eyes, nose, and mouth. PPE must be compatible with the needs of healthcare worker protection and patient care. The following PPE is recommended:

- Disposable isolation gown, preferably with fluid-resistant properties, to protect the body and exposed areas of the arms. A disposable full-body isolation suit is an option and may provide greater protection of the skin, especially around the neck. Surgical hoods, which fully cover the head, neck, and face, (with the addition of an N-95 or higher-level disposable particulate respirator), have been used in some settings. It is unknown whether covering exposed areas of skin or hair on the head will further reduce the risk of transmission.
- Pair of disposable gloves that fit snugly over the gown cuff.
- Eye protection (i.e., goggles) to protect the eyes from respiratory splash or spray. Goggles should fit snugly (but comfortably) around the eyes. A face shield may be worn over goggles to protect exposed areas of the face but should not be worn as a primary form of eye protection for these procedures.

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- Respiratory protection -- During aerosol-generating procedures, there must be minimal respirator face-seal leakage to fully protect the worker from exposure to aerosolized infectious droplets. The following respiratory protection options should be considered:
 - Disposable particulate respirators (e.g., N-95, N-99, or N-100) are sufficient for routine respiratory protection for Airborne Infection Isolation and are the minimum level of respiratory protection required for healthcare workers who are performing aerosol-generating procedures. To ensure adequate protection, healthcare workers must be fit-tested to the respirator model that they will wear (www.cdc.gov/niosh/99-143.html) and also know how to check the face-piece seal. A fit-check should be performed each time a respirator is put on, before entering the patient room. Workers who cannot wear a disposable particulate respirator because of facial hair or other fit limitations should wear a loose-fitting (i.e., helmeted or hooded) PAPR.
 - Healthcare facilities in some SARS-affected areas routinely used higher levels of respiratory protection for performing aerosol-generating procedures on patients with SARS-CoV disease. It is unknown whether these higher levels of protection will further reduce transmission. Factors that should be considered in choosing respirators in this setting include availability, impact on mobility, impact on patient care, potential for exposure to higher levels of aerosolized respiratory secretions, and potential for reusable respirators to serve as fomites for transmission. Higher levels of respiratory protection include:
 - PAPR with loose-fitting face piece that forms a partial seal with the face
 - PAPR with hood that completely covers the head and neck and may also cover portions of the shoulder and torso
 - PAPR with tight-fitting face piece (half and full face-piece)
 - Full face-piece elastomeric negative-pressure (non-powered) respirators with N, R, or P-100 filters.

For more information, visit www.cdc.gov/ncidod/sars or call the CDC public response hotline at (888) 246-2675 (English), (888) 246-2857 (Español), or (866) 874-2646 (TTY)