

Isolation Precautions: Airborne (Ambulatory) - CE

ALERT

Avoid physical contact with the patient with suspected or confirmed tuberculosis (TB) or other airborne pathogen before donning appropriate personal protective equipment (PPE).

Patients in airborne isolation need to be placed in a negative-pressure airborne infection isolation room (AIIR). If an AIIR is not available, place a surgical mask on the patient.⁵

Airborne precautions are the highest level of isolation. Until an airborne-transmitted illness is diagnosed, airborne precautions represent the safest precautions.

Perform hand hygiene with soap and water or use an alcohol-based hand sanitizer immediately after removing all PPE.

OVERVIEW

Infection prevention and control measures help to ensure the protection of patients in a range of settings who may be vulnerable to acquiring an infection both in the general community and when receiving care because of health problems.

Infection-control practices that reduce and eliminate sources of infection transmission help to protect patients and health care team members from disease. The health care team member is responsible for educating a patient about infection control. Knowledge of the infectious process, disease transmission, and critical-thinking skills associated with use of aseptic techniques and barrier protection is essential for both health care team members and patients.

One of the most common airborne pathogens is TB. Current guidelines for preventing and controlling TB focus on detecting the infection early, preventing close contact with a patient who has active TB, and applying effective infection-control measures in the health care setting.² Other airborne pathogens include chicken pox and Rubeola (i.e., measles). Shingles, also a varicella infection, does not require airborne isolation precautions.

TB should be suspected in any patient who has a persistent cough lasting longer than 3 weeks accompanied by chest pain, bloody sputum, unexplained weight loss or loss of appetite, fever, chills, night sweats, malaise, or fatigue.² Isolation for a patient with suspected or confirmed TB includes being placed on airborne precautions in a negative-pressure airborne isolation infection room (AIIR) with special air-handling and ventilation capacity.¹

The advantages of the QuantiFERON®-TB Gold (QFT-G) blood test in place of the traditional tuberculin skin test (TST) are that it does not boost responses measured by subsequent tests and that the results are not subject to reader bias. QFT-G can be used in place of, but not in addition to, the TST. A patient who has a positive QFT-G result, regardless of signs or symptoms, should be evaluated for TB disease before latent TB infection is diagnosed. At minimum, a chest radiograph should be examined for abnormalities consistent with TB.

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Health care team members who care for patients with suspected or confirmed TB should wear nonpowered air-purifying respirators (i.e., N95).¹ These respirators are high-efficiency particulate masks that have the ability to filter particles at a 95% or better efficiency.¹

N95 respirators must be fit-tested in a reliable way to determine which size mask is appropriate and to ensure that the wearer knows when a good seal is achieved. Fit-testing must be performed before health care team members are required to wear the respirator in the workplace and must be repeated at least annually.⁴ Fit-testing must also be conducted whenever respirator design or facial changes that may affect a proper fit take place.⁴ A respirator that has not been fitted properly may leave unprotected gaps between it and the face, impairing its effectiveness.

If facial hair or unusual facial features make fitting a mask-type respirator properly difficult, a powered air-purifying respirator (PAPR) may be used. A PAPR has the same filtering properties as the mask-type respirator and is approved by national organization guidelines.² This type of respirator covers the head and uses a blower to move air through the filter and into the face piece, helmet, or hood. A PAPR does not require fit-testing before use.

Respirators are disposable, but the same individual may use them more than once. Respirators should be stored between uses in a clean, breathable container (e.g. paper bag), in a dry place, and out of direct sunlight.³ The respirator should be discarded if it becomes wet or damaged.

Using a respirator does not, on its own, fully protect health care team members from acquiring an infection. Other infection-control practices, such as performing hand hygiene, isolating an infected patient, and using appropriate coughing etiquette are also important to minimize the risk of infection.

All organizations should have a procedure for removing their particular N95 or PAPR and preparing equipment for reprocessing (e.g., bagging for temporary storage before reprocessing, immediate reprocessing in the doffing area).

EDUCATION

- Provide developmentally and culturally appropriate education based on the desire for knowledge, readiness to learn, and overall neurologic and psychosocial state.
- Teach the patient about the need for health care team members to wear extensive PPE.
- Encourage questions and answer them as they arise.

PROCEDURE

1. Perform hand hygiene.
2. Verify the correct patient using two identifiers.
3. Evaluate the patient's potential for infectious pulmonary or laryngeal TB.
 - a. Positive QFT-G test
 - b. Positive acid-fast bacilli (AFB) smear or culture
 - c. Signs or symptoms of TB

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- d. Cavitation on chest x-ray study
 - e. History of recent exposure
 - f. Clinical team leader's progress notes, indicating a plan to rule out TB
 - g. Positive TB screen
4. Assess for signs or symptoms of other airborne infections (e.g., Rubeola, chicken pox).
 5. Label the door of the room.
 6. Prevent extra trips in and out of the room; gather all needed equipment and supplies before re-entering the room.
 7. Dedicate medical equipment (e.g., stethoscope, blood pressure cuff, thermometer) to be used only with the patient.⁵

PAPR Option **Donning PPE**

1. Perform hand hygiene.
2. Obtain PPE appropriate for the recommendations and type of isolation used for a patient who has or is suspected of having an airborne-transmitted infectious illness, per the organization's practice.
3. Inspect PPE before donning. Ensure that the PPE is intact, that all required PPE and supplies are available, and that the correct size has been selected.
4. Enter the designated area for donning PPE and prepare for entry into the isolation room as applicable.
5. Perform hand hygiene.
6. If a PAPR with a self-contained filter and blower unit integrated inside the helmet will be used, put on the belt and battery before donning the impermeable gown so that the belt and battery unit are under the gown.
7. Don a fluid-resistant or impermeable gown if the patient is also in contact isolation.
8. If a PAPR with an external belt-mounted blower will be used, attach the tubing and don a belted blower unit. Ensure that the blower and tubing are outside the gown to ensure proper airflow.
9. Don gloves, pulling the cuffs over the sleeves of the gown.
10. Don a PAPR with a full-face shield, helmet, or headpiece.
 - a. For a PAPR with a self-contained filter and blower unit inside the helmet, use a single-use (disposable) hood that extends to the shoulders and fully covers the neck. Ensure that the hood covers all of the hair and the ears and that it extends past the neck to the shoulders.¹
 - b. For a PAPR with an external belt-mounted blower unit and attached reusable headpiece, use a single-use (disposable) hood that extends to the shoulders and fully covers the neck. Ensure that the hood covers all of the hair and the ears and that it extends past the neck to the shoulders.
11. Verify the integrity of the PPE. Extend the arms, bend at the waist, and go through a range of motion that is sufficient for delivering patient care.
12. Perform hand hygiene and don gloves. Don a gown if the patient is also in contact isolation. Don both a gown and eye protection if there is a risk of being splashed by blood, body fluids, secretions, or excretions.

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13. Enter the patient's isolation room, close the door, and arrange the supplies and equipment.
14. Introduce yourself to the patient.
15. Verify the correct patient using two identifiers.
16. Explain the procedure to the patient and ensure that he or she agrees to treatment.
17. Ensure that evaluation findings are communicated to the clinical team leader per the organization's practice.
18. Provide designated care to the patient while maintaining precautions.

- a. Keep hands away from own face.
- b. Limit touching surfaces in the room.
- c. Remove gloves when torn or heavily contaminated, perform hand hygiene, and don clean gloves.

19. Administer medications as ordered while maintaining precautions.

- a. Provide oral medication in a wrapper or cup and then discard the wrapper or cup in the proper trash receptacle.

Rationale: Single-use medication containers minimize the transfer of microorganisms.

- b. Wear gloves when administering injections.

Rationale: Gloves act as a barrier to reduce the risk of exposure to blood.

- c. Discard disposable syringes and uncapped or sheathed needles in the proper sharps receptacle.

Rationale: Properly disposing of sharps reduces the risk of a needlestick injury.

- d. Place the reusable plastic syringe holder, if used, on a towel for eventual removal and disinfection.

20. Collect any ordered specimens.

- a. In the presence of the patient, label the specimen per the organization's practice.⁵
- b. Place the labeled specimen in a biohazard bag.

21. Remind the patient to cover his or her mouth with a tissue when coughing and to wear a disposable surgical mask when leaving the room.

Rationale: Covering the mouth with a tissue when coughing helps prevent the spread of infection to other patients and to health care team members. The mask prevents particles from the patient's respiratory tract from being released into shared air. Patients should

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not wear a respirator because it does not prevent expulsion of droplet nuclei into shared air.

22. After providing patient care, leave the isolation room.
23. Ensure that equipment is disinfected with an organization-approved disinfectant when it is removed from the room, before use on another patient.

Doffing PPE

1. Inspect PPE for visible contamination, cuts, or tears before starting the doffing process.
 - a. If PPE is potentially contaminated, disinfect it using an Environmental Protection Agency (EPA)-registered disinfectant wipe and allow it to dry.
 - b. If the organization's conditions permit and appropriate regulations are followed, use an EPA-registered disinfectant spray, particularly on contaminated areas. Allow it to dry.

Rationale: Potentially contaminated PPE is disinfected before doffing to minimize the risk of contamination.

2. Remove and discard gloves, taking care not to contaminate bare hands during the removal process.
3. Remove and discard the gown.
 - a. Depending on the gown design and the location of the fasteners, untie or gently break them.
 - b. Avoid contact of the scrubs or disposable garments with the outer surface of the gown during removal.
 - c. Pull the gown away from body, rolling it inside-out and touching only the inside of the gown.
4. Remove the PAPR with an external belt-mounted blower.
 - a. Remove the headpiece while still connected to the belt-mounted blower and filter unit.

If a PAPR with a self-contained filter and blower unit inside the helmet is used, remove the hood and wait until later in the procedure to remove the integrated components.

- b. Remove the belt-mounted blower unit and place all reusable PAPR components in an area or container designated for the collection of PAPR components for disinfection.
5. Perform a final inspection for any indication of contamination, and immediately change into clean surgical scrubs or disposable garments if contamination is identified.

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Rationale: The final inspection is a key step to ensuring health care team members' safety.

Completing the Procedure

1. Transport the specimen to the laboratory per the organization's practice.
2. Perform hand hygiene.
3. Document the procedure in the patient's record.

N95 Respirator Option

Donning PPE

1. Perform hand hygiene.
2. Choose a barrier protection appropriate for the recommendations and type of isolation used for a patient who has or is suspected of having an airborne-transmitted infectious illness, per the organization's practice.
3. Inspect PPE before donning. Ensure that the PPE ensemble is in serviceable condition, that all required PPE and supplies are available, and that the correct size has been selected.
4. Enter the designated area for donning PPE and prepare for entry into the isolation room, as applicable.
5. Perform hand hygiene.
6. Don a fluid-resistant or impermeable gown if the patient is also in contact isolation. Don both a gown and eye protection if there is a risk of being splashed by blood, bodily fluids, secretions, or excretions.
7. Don the N95 respirator and complete a user seal check.
 - a. Check the respirator before donning it to ensure that there is no damage or tears and that the straps are in good condition.
 - b. Place the mask over the nose, mouth, and chin. Ensure that the bottom flap is pulled out completely, if applicable.
 - c. Secure the lower elastic strap at the top of the neck and the upper elastic strap above the ears at the back or top of the head.
 - d. Adjust the mask for a comfortable fit.
 - e. Place the fingertips on each side of the metal nosepiece. Beginning at the bridge of the nose, move down the cheeks and mold the flexible nosepiece to create a snug fit.

Avoid pinching the nosepiece, which may result in an improper fit.

- f. Perform a fit-check.
 - i. Inhale rapidly and ensure that the mask collapses slightly.
 - ii. Exhale and use the hands to check for leaks around the face.
- A. Adjust the nosepiece if there are air leaks around the nose.
- B. Adjust the straps along the sides of the head if there are air leaks at the mask edges.
- g. Repeat the fit-check.

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8. Don gloves, pulling the cuffs over the sleeves of the gown.
9. Verify the integrity of the ensemble. Extend the arms, bend at the waist, and go through a range of motion that is sufficient for delivering patient care.
10. Enter the patient's room and arrange the supplies and equipment.
11. Introduce yourself to the patient.
12. Verify the correct patient using two identifiers.
13. Explain the procedure to the patient and ensure that he or she agrees to treatment.
14. Ensure that evaluation findings are communicated to the clinical team leader per the organization's practice.
15. Provide designated care to the patient while maintaining precautions.
 - a. Keep hands away from own face.
 - b. Limit touching surfaces in the room.
 - c. Remove gloves when torn or heavily contaminated, perform hand hygiene, and don clean gloves.

16. Administer medications as ordered while maintaining precautions.

- a. Provide oral medication in a wrapper or cup and then discard the wrapper or cup in the proper trash receptacle.

Rationale: Single-use medication containers minimize the transfer of microorganisms.

- b. Wear gloves when administering injections.

Rationale: Gloves act as a barrier to reduce the risk of exposure to blood.

- c. Discard disposable syringes and uncapped or sheathed needles in the proper sharps receptacle.

Rationale: Properly disposing of sharps reduces the risk of a needlestick injury.

- d. Place the reusable plastic syringe holder, if used, on a towel for eventual removal and disinfection.

17. Collect any ordered specimens.

- a. In the presence of the patient, label the specimen per the organization's practice.⁵
- b. Place the labeled specimen in a biohazard bag.

18. Remind the patient to cover his or her mouth with a tissue when coughing and to wear a disposable surgical mask when leaving the room.

Rationale: Covering the mouth with a tissue when coughing helps prevent the spread of infection to other patients and to health care

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team members. The mask prevents particles from the patient's respiratory tract from being released into shared air. Patients should not wear a respirator because it does not prevent expulsion of droplet nuclei into shared air.

19. After providing patient care, leave the isolation room.
20. Ensure that equipment is disinfected with an organization-approved disinfectant when it is removed from the room, before use on another patient.

Doffing PPE

1. Inspect the PPE for visible contamination, cuts, or tears before starting the doffing process.
 - a. If PPE is potentially contaminated, disinfect it using an EPA-registered disinfectant wipe and allow it to dry.
 - b. If the organization's conditions permit and appropriate regulations are followed, use an EPA-registered disinfectant spray, particularly on contaminated areas. Allow it to dry.

Rationale: Potentially contaminated PPE is disinfected before doffing to minimize the risk of contamination.

2. Remove and discard gloves, taking care not to contaminate the bare hands during the removal process.
3. Remove and discard the gown.
 - a. Depending on the gown design and the location of the fasteners, untie or gently break them.
 - b. Avoid contact of the scrubs or disposable garments with the outer surface of the gown during removal.
 - c. Pull the gown away from body, rolling it inside-out and touching only the inside of the gown.
4. Don clean gloves.
5. Remove the N95 respirator.

- a. Tilt the head slightly forward.

Rationale: Tilting the head forward aids the doffing process and minimizes the risk of contamination.

- b. Grasp the bottom elastic strap first and then the top elastic strap.
- c. Remove them without touching the front of the N95 respirator.

Rationale: Avoiding touching the front of the N95 respirator aids the doffing process and minimizes the risk of contamination.

- d. If not reusing the respirator, discard the N95 respirator.

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e. If reusing the respirator, place the reusable respirator mask in a clean, breathable container (e.g., paper bag), labeled for reuse by the same person. N95 respirators can be reused when supplies are limited (e.g., influenza pandemics or widespread outbreaks of other respiratory illnesses).³

6. Remove and discard gloves, taking care not to contaminate the bare hands during the removal process.

7. Perform a final inspection for any indication of contamination, and immediately change into a clean pair of surgical scrubs or disposable garments if contamination is identified.

Rationale: The final inspection is a key step to ensuring health care team members' safety.

Completing the Procedure

1. Transport the specimen to the laboratory per the organization's practice.
2. Perform hand hygiene.
3. Document the procedure in the patient's record.

EXPECTED OUTCOMES

- Respirator mask fits correctly.
- No evidence of suspected breach of isolation precautions exists.
- Health care team members are free from airborne-transmitted infectious illnesses.
- Health care team members perform donning and doffing of PPE correctly.
- Patient can explain purpose of isolation and cooperates with precautions.

UNEXPECTED OUTCOMES

- Respirator mask does not fit correctly.
- Evidence of or suspected breach of isolation precautions.
- Health care team members contract an airborne-transmitted infectious illness.
- Health care team members do not perform donning and doffing of PPE correctly.
- Patient does not cooperate with precautions.

DOCUMENTATION

- Patient education
- Evidence of or suspected breach of isolation precautions
- Unexpected outcomes and related interventions

PEDIATRIC CONSIDERATIONS

- Isolation creates a sense of separation from family and the loss of control. A strange environment may add to any confusion the child feels during isolation. A preschool-age child is unable to understand the cause-and-effect relationship for isolation. Older children may be able to understand cause, but they still may be frightened.
- A child requires simple explanations; for example, "This is a special room that will help you get better." All barrier precautions should be shown to the child. The family should be actively involved in any explanations.

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- For preschool-age and school-age children, making a game out of wearing the mask (e.g., superheroes) can lessen the child's anxiety regarding PPE.

OLDER ADULT CONSIDERATIONS

- Older adults may become confused when they are confronted with a health care team member using barrier precautions or when left in a room with the door closed. The need for closing the door (negative-pressure AIIR), along with the patient's safety and additional safety measures, should be evaluated.

REFERENCES

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*In these skills, a "classic" reference is a widely cited, standard work of established excellence that significantly affects current practice and may also represent the foundational research for practice.

Elsevier Skills Levels of Evidence

- Level I - Systematic review of all relevant randomized controlled trials
- Level II - At least one well-designed randomized controlled trial
- Level III - Well-designed controlled trials without randomization
- Level IV - Well-designed case-controlled or cohort studies
- Level V - Descriptive or qualitative studies
- Level VI - Single descriptive or qualitative study
- Level VII - Authority opinion or expert committee reports

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Supplies

- Single-use gloves
- Single-use fluid-resistant impermeable mid-calf gown
- Single-use N95 respirator or PAPR and appropriate related equipment (e.g., hose, hood)
- Single-use full-face shield
- Surgical hood
- Surgical scrubs or disposable garments, as needed
- EPA-registered disinfectant wipes
- EPA-registered disinfectant spray

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