

## 1 **2024 Guideline to Prevent Transmission of Pathogens in Healthcare Settings**

### 2 **Section A: Overview of Transmission of Pathogens in Healthcare Settings**

#### 3 **Overview**

4 Section A updates the conceptual framework for pathogen transmission, providing the rationale for  
5 recommended infection prevention and control interventions. This framework focuses on elements of  
6 transmission that are relevant in healthcare settings.

7 This guideline replaces the corresponding content in the "[2007 Guideline for Isolation Precautions: Preventing](#)  
8 [Transmission of Infectious Agents in Healthcare Settings](#)," hereafter referred to as the '2007 Guideline.'<sup>1</sup>

9 Elements of the 2007 Guideline that are not directly affected by this update, including the 2007 Guideline's

10 Appendix A (hereafter referred to as "[Appendix A \[2007\]](#)"), will remain active until updated specifically.<sup>2</sup>

11 Pathogen-specific guidance that is currently in [Appendix A \(2007\)](#) will be updated over time and added as Part 2  
12 of this guidance in the future.

#### 13 **Background**

#### 14 **Factors Affecting Transmissibility**

15 Transmission occurs when an at-risk person acquires a pathogen from an infectious person. Transmission is  
16 determined by pathogen, environmental, and person factors at the time of event. While pathogen factors are  
17 often biologically intrinsic (e.g., the ability of a pathogen to remain viable during transit), environmental and  
18 person-specific factors may vary by location and over time. Environmental variables include air (e.g.,  
19 temperature, humidity, ventilation) and surface (e.g., material, porosity) conditions. Factors that vary among  
20 infectious persons include pathogen load and shedding rate. Factors that vary among at-risk persons include  
21 host defense mechanisms that are non-immune-based (e.g., intact skin) and immune-based (e.g., pathogen-  
22 specific immunity from prior infection or vaccination).

#### 23 **Significance of Transmission**

24 Transmission can result in colonization or infection. Based on the health impact that a pathogen is expected to  
25 have on an individual or the community, some pathogens are recognized as requiring intensive efforts to  
26 prevent transmission, while others may not rise to that level. Less intensive effort might be indicated when  
27 outcomes are not usually severe, the population has a high degree of immunity, and effective therapeutics and  
28 vaccines are available. The boundaries describing those categories require risk assessment and can vary by  
29 setting and population at risk.

#### 30 **Transmission Pathways**

31 In the healthcare setting, pathogen transmission pathways can be grouped into two broad categories:  
32 pathogens that spread via the air, and pathogens that spread via touch. Pathogens generally spread via a major  
33 pathway, though multiple pathways might contribute to spread. Pathogen transmission epidemiology is  
34 informed by observing patterns of infection spread.

#### 35 **Transmission via air**

36 Pathogens can transmit via air over short distances through direct splash or spray of the pathogen onto a part of  
37 the body (e.g., spray from a sneeze landing on a person's eyes or mouth) or variably across ranges of distance

38 and time via suspended infectious particles. Pathogens suspended in the air cause infection via inhalation and  
39 deposition along the respiratory tract, anywhere from the nasal or oral passages to the lungs.

40 Historically, the infection prevention community has categorized transmission of respiratory pathogens as  
41 'droplet' or 'airborne.' While these epidemiologic terms reflect observed patterns of short versus long distance  
42 transmission respectively, the terms do not explicitly describe the continuum of respiratory pathogen  
43 transmission through in the air.

44 Pathogens that spread via the air preferentially transmit over short distances, due to greater concentrations of  
45 infectious particles in the air near an infectious person. However, each pathogen has a signature pattern of  
46 observed transmission that extends variably across short-to-long distances and over time, reflecting unique  
47 characteristics such as pathogen viability while suspended in the air and the required dose for causing an  
48 infection in a susceptible person. Pathogens that remain infectious for a long time while suspended in the air  
49 (e.g., *M. tuberculosis*, measles virus, and varicella virus) are capable of causing infections over long distances,  
50 such as across a large part of a building or healthcare facility.

## 51 **Transmission via touch**

52 Transmission via touch occurs through physical contact with the pathogen. Transmission in healthcare settings  
53 can occur via contact with intact skin, non-intact skin (including percutaneous routes such as needlestick injury),  
54 or mucous membranes of the face and gastrointestinal tract.

55 Intact skin is inherently protective and resists infection by most pathogens. Some pathogens encountered in  
56 healthcare settings can infect intact skin, including exoparasites, herpesviruses, and poxviruses. Potentially  
57 pathogenic bacteria and fungi can cause short- or long-term colonization of intact skin, which can be a reservoir  
58 for infection of the colonized person or for transmission to other individuals.

59 Percutaneous exposures, through non-intact skin or via skin trauma (e.g., by a needlestick), can deliver potential  
60 pathogens to susceptible tissues normally protected by skin. Pathogens that are present in the blood and body  
61 fluids of infected individuals (e.g., hepatitis B and C viruses, HIV, Ebola virus) can be transmitted by  
62 percutaneous delivery of those fluids.

63 Pathogens that spread by contact with mucous membranes include organisms that target the gastrointestinal  
64 tract and those that can infect any mucosal surface. Bloodborne pathogens that transmit percutaneously can  
65 also transmit via mucous membrane contact.

66 Transmission by touch can involve intermediary reservoirs such as people, surfaces, or equipment that facilitate  
67 spread. Potential reservoirs include healthcare personnel (e.g., transient hand carriage with pathogenic  
68 bacteria), shared medical equipment (e.g., stethoscopes, blood pressure cuffs), environmental surfaces (e.g.,  
69 bedrails and sink counter tops), and water systems (e.g., water supply or wastewater drainage).

## 70 **Approach to Transmission-Based Precaution Recommendations**

71 Recommendations for Transmission-Based Precautions are based on evaluation of clinical epidemiologic studies  
72 in healthcare settings. Evidence reviews in this guideline focus on clinical studies with infection outcomes  
73 because such studies compare prevention strategies in the context of feasibility, user adherence, and  
74 implementation within a hierarchy of controls (e.g., engineering, administrative, and personal protective  
75 equipment controls) available in the healthcare setting to reduce risk of infection. The methodology and  
76 evidence reviews informing recommendations in this guideline are available in this guideline's Appendix.

- 77 Recommendations in this guideline largely address infection prevention strategies available to frontline  
78 healthcare personnel (HCP) at the point of care.
- 79

DRAFT

80 **Section B: Fundamental Elements Needed to Prevent Transmission of Pathogens in Healthcare  
81 Settings**

82 **Overview**

83 Section B describes the fundamental elements of infection prevention available to frontline healthcare  
84 personnel (HCP) in healthcare settings, with a focus on personal protective equipment (PPE). Other important  
85 elements such as hand hygiene and environmental controls are highlighted, with details referred to other  
86 existing guidelines.

87 The use of PPE falls within a [hierarchy of controls](#) designed to reduce risk of illness or injury for both infectious  
88 and non-infectious exposures in the workplace.<sup>3</sup> In healthcare, multiple controls are used to lower the risk of  
89 transmission of pathogens that may result in infection. The hierarchy of controls, in preferred order of action  
90 based on general effectiveness, has five components:

- 91 • **Elimination** (remove or prevent entry of the pathogen into a facility, e.g., using virtual instead of in-  
92 person visits to manage some potentially infectious patients)
- 93 • **Substitution** (although generally not applied to infectious pathogens, refers to substituting a more  
94 hazardous agent with a less hazardous form, e.g., substituting toxigenic *C. difficile* with non-toxigenic *C.*  
95 *difficile*)
- 96 • **Engineering Controls** (isolate, capture, and reduce levels of pathogen in the environment, e.g.,  
97 improving ventilation)
- 98 • **Administrative Controls** (work policies and procedures that prevent pathogen exposure and disease,  
99 e.g., vaccination of HCP)
- 100 • **Personal Protective Equipment** (PPE used to prevent pathogen exposure and spread)

101 PPE is last in the hierarchy because it relies on the user to determine appropriate use (e.g., time, situation) and  
102 to use PPE correctly, depends on availability at the point of care, and depends on PPE to function properly.

103 Other components may be more reliable in reducing risk when applied and maintained at the facility level (e.g.,  
104 ventilation).

105 **Hand Hygiene**

106 Hand hygiene is a foundational component of infection prevention and control. Routine use of alcohol-based  
107 hand sanitizer — and handwashing with soap and water when hands are visibly soiled or when otherwise  
108 indicated — prevents transmission of potential pathogens to patients, personnel, and environmental surfaces  
109 from hands that are soiled or transiently colonized. Detailed recommendations for hand hygiene are addressed  
110 in the [CDC Guideline for Hand Hygiene in Health-Care Settings](#).<sup>4</sup>

111 **Personal Protective Equipment (PPE) for Healthcare Personnel**

112 **General considerations**

113 Recommendations:

- 114 1. HCP must be trained and demonstrate competency in the selection, putting on, use, removal, and  
115 disposal of PPE.<sup>5,6</sup> (*Standard Practice*)
- 116 2. Employers in healthcare settings are required to provide readily available PPE to healthcare personnel  
117 (HCP), ideally at or near likely points of use.<sup>5,6</sup> (*Standard Practice*)

118        3. Sizing and models should be chosen to accommodate the needs of the local workforce.<sup>5,6</sup> (*Standard*  
119        *Practice*)

120      Narrative:

121      PPE refers to various barriers (e.g., gowns, gloves), masks, and respirators used alone or in combination to  
122      interrupt transmission of pathogens by touch or air.

123      'Reuse' refers to the use of the same PPE item for multiple encounters with different patients, with removal of  
124      the PPE item between encounters. PPE can consist of products that are labeled for single use or as reusable.  
125      Single use PPE is not intended to be reused. Reusable items are reprocessed between uses according to  
126      manufacturer's instructions for use.

127      'Extended use' refers to use of the same PPE item for encounters with different patients, without removing the  
128      PPE item between patient encounters. Extended use is not considered standard practice and should be avoided  
129      unless otherwise specified in recommendations (e.g., extended use of masks for source control).

130      Sterile gloves, gowns and other PPE used for surgery and aseptic procedures are addressed in the [CDC Surgical](#)  
131      [Site Infection guidelines](#).<sup>7</sup>

132      The [CDC PPE sequence document](#) demonstrates one approach to appropriate technique for putting on and  
133      removing each type of PPE.<sup>8</sup>

## 134      **Gloves**

135      Recommendations:

136      *Indications*

137      1. Non-sterile gloves are indicated in any of the following situations: (1) any anticipated contact with body  
138      fluids or infectious material, (2) touching mucous membranes or non-intact skin, (3) handling soiled  
139      items such as used wound dressings, and (4) as indicated by Transmission-Based Precautions.<sup>5</sup> Activities  
140      that do not meet these criteria do not require gloves. (*Standard Practice*)

141      *Use*

142      2. HCP should perform hand hygiene prior to reaching into a box of non-sterile exam gloves and putting on  
143      gloves, to reduce the risk of contaminating both the remaining gloves in the box and the gloves being  
144      put on.<sup>9-11</sup> (*Expert Opinion*)

145      3. During care of a single patient, gloves should be changed after a task or procedure if contact occurs with  
146      potentially infectious material (e.g., if moving from a dirty task to a clean task).<sup>5</sup> (*Standard Practice*)

147      4. Remove gloves if torn or soiled, and before caring for another patient.<sup>5</sup> (*Standard Practice*)

148      5. Hand hygiene should be performed immediately after removing gloves, because pathogens on used  
149      gloves can contaminate hands during glove removal.<sup>5</sup> (*Standard Practice*)

150      6. HCP should not practice extended glove use in place of hand hygiene.<sup>5</sup> (*Standard Practice*)

151      *Selection*

152      7. Non-sterile gloves should be available in a range of sizes so that all users will be able to select a glove  
153      that fits comfortably without excess material that could impair function.<sup>12</sup> (*Standard Practice*)

154

155      Narrative:

156      Non-sterile exam gloves are worn to provide a protective barrier between hands and soiled material or surfaces,  
157      and to allow efficient removal of infectious material from hands by removing and discarding soiled gloves. Glove  
158      use is not a substitute for hand hygiene. Non-latex gloves are available for personnel with latex allergies.

159      Medical gloves, including non-sterile examination gloves that are used as part of Standard and Transmission-  
160      based Precautions, are regulated by the United States Food and Drug Administration (FDA) to ensure that  
161      performance criteria, such as leak resistance, certain physical properties, and biocompatibility, are met.<sup>13,14</sup> FDA-  
162      approved medical gloves are also used by HCP for routine disinfection of surfaces or medical equipment  
163      contaminated with blood or body fluids. Gloves that are used for routine janitorial functions in medical facilities  
164      are not regulated by FDA and might have specific requirements for chemical compatibility, thickness, and  
165      durability beyond that of medical gloves.

166      **Gowns**

167      Recommendations:

168      *Indications*

169      1. Non-sterile gowns are indicated in any of the following situations: (1) when an activity is anticipated to  
170      contaminate HCP clothing through direct touch or splash, and (2) as indicated by Transmission-Based  
171      Precautions.<sup>5</sup> (*Standard Practice*)

172      *Use*

173      2. Gowns should be worn to cover the individual's clothing with all fasteners secured. (*Standard Practice*)

174      Narrative:

175      Gowns used in healthcare are intended to protect HCP and patients from transfer of infectious material.  
176      Infectious material can transfer from one patient or environment to another on the clothing of HCP.<sup>15-17</sup> Gowns  
177      also provide an easily removable layer in the event of recognized soiling (e.g., splash or spray) that would  
178      otherwise require the HCP to change clothes. Gowns can be single use or reusable; reusable gowns are  
179      reprocessed between uses.

180      The National Institute for Occupational Safety and Health (NIOSH) provides a detailed discussion of factors for  
181      consideration when choosing gowns in [Considerations for Selecting Protective Clothing used in Healthcare for](#)  
182      [Protection against Microorganisms in Blood and Body Fluids](#).<sup>18</sup> Some factors that influence these decisions  
183      include intended use, fabric strength, liquid barrier resistance, and the extent of coverage. In addition, the ease  
184      of putting on and taking off gowns is an important consideration in product selection, to decrease the risk of  
185      self-contamination while removing.

186      **Masks**

187      Recommendations:

188      *Indications*

189      1. Masks are indicated in any of the following situations: (1) when an activity is anticipated to create  
190      splashes or spray to the face, (2) as source control, and (3) as indicated by Transmission-Based  
191      Precautions.<sup>5</sup> (*Standard Practice*)

192    *Use*

- 193    2. Masks should not be reused<sup>5</sup> as they can serve as a reservoir of infectious material if they become soiled  
194    during use.<sup>19-23</sup> (*Standard Practice*)
- 195    3. Masks should be changed when soiled, damaged, or harder to breathe through (*Standard Practice*)
- 196    4. Extended use is not practiced with masks except when used for source control, and then disposed of  
197    when removed or after use when caring for a patient on Transmission-Based Precautions.<sup>24,25</sup> (*Standard*  
198    *Practice*)

199    *Selection*

- 200    5. A fluid resistant mask should be used in situations when splashes and sprays are anticipated.<sup>12</sup>  
201    (*Standard Practice*)

202    *Narrative:*

203    Masks are devices worn over the nose and mouth that perform three primary functions: (1) block direct splashes  
204    to the mucous membranes of the nose and mouth, (2) contain exhaled respiratory secretions (source control),  
205    and (3) provide filtration of inhaled air. Masks include surgical masks, face masks (sometimes referred to as  
206    procedure masks), and [enhanced barrier face coverings](#).<sup>26</sup>

207    Among mask types, efficacy can vary depending on fit. Well-fitting masks refer to masks that fit closely against  
208    the face with minimal gaps, especially along the edges of the mask. A loose-fitting mask may block splashes from  
209    reaching the nose or mouth, but may not fully contain secretions of the wearer or efficiently filter inhaled air.  
210    Well-fitting masks may include: any mask approved for use in healthcare that fits well without adjustment;  
211    masks with adjustments or modifications, such as knotted ear loops or mask fitters<sup>27,28</sup>; and enhanced barrier  
212    face coverings.<sup>26</sup>

213    **Respirators**

214    *Recommendations:*

215    *Indications*

- 216    1. Respirators are used as indicated by Transmission-Based Precautions. (*Standard Practice*)

217    *Use*

- 218    2. A seal check should be performed each time an HCP puts on a fit-tested respirator to ensure that the  
219    respirator is properly seated on the face.<sup>29</sup> (*Standard Practice*)
- 220    3. Single use disposable respirators should not be reused<sup>5</sup> as they can serve as reservoir of infectious  
221    material if they become soiled during use. (*Standard Practice*)
- 222    4. Reusable respirators must be cleaned, disinfected, and dried between uses according to the  
223    manufacturer's instructions for use. (*Standard Practice*)
- 224    5. Optimally, extended use is not practiced with single use respirators except when used for source control  
225    and then disposed of when removed or after use when caring for a patient on Transmission-Based  
226    Precautions.<sup>24</sup> (*Standard Practice*)
- 227    6. Respirators should be changed when soiled, damaged, or harder to breathe through (*Standard Practice*)

228    *Selection*

7. A fluid resistant respirator should be used in situations when splashes and sprays are anticipated.<sup>12</sup>  
*(Standard Practice)*

231 Narrative:

Respirators are devices worn over the nose and mouth that provide filtration of inhaled air. Respirators work by passing air delivered to the wearer through a filter with defined filtration efficacy. Respirators may perform two additional functions similar to masks: (1) block direct splashes to the mucous membranes of the nose and mouth (if fluid-resistant), and (2) contain exhaled respiratory secretions (source control), if the respirator is the type that filters exhaled air. In most situations, respirators can be worn in place of a mask, whenever a mask is indicated (See **Masks Recommendations: Indications**).

Respirators may be either disposable or reusable. Disposable filtering facepieces, such as NIOSH-approved® N95 respirators, are most common in healthcare settings. Reusable powered air purifying respirators (PAPRs) are often used when HCP cannot pass fit testing (e.g., due to the presence of facial hair). Reusable elastomeric respirators are used in some circumstances (e.g., during shortages of disposable respirators).

242 It is important to limit the amount of inhaled air that comes from leaks around the respirator, because leaked air  
243 is not filtered. Filtration efficacy for fit-tested respirators is expected to be greater than that for masks. Factors  
244 that influence the decision to use a respirator instead of a mask include pathogen-associated morbidity and  
245 mortality from infection, the level of aerosols of infectious particles anticipated to be present, lack of effective  
246 treatment or vaccine, transmissibility of the pathogen, and situations in which the major mode of transmission  
247 has yet to be determined.

248 A respirator's effectiveness is reduced if it is not worn correctly for the entire duration of exposure. Respirators  
249 that are uncomfortable or those that are expected to be used for extended periods of time may provide  
250 challenges with HCP tolerability and compliance.

Fit-testing requirements are specific to the model of respirator and can affect logistics and ability to use alternative models when supplies are limited. When respirators are required to be worn as PPE, they are used in the context of a Respiratory Protection Program that complies with the [standards](#) established by the Occupational Safety and Health Administration (OSHA) and include medical clearance, training, and fit testing.<sup>29</sup> Additional implementation support may be found in the [Hospital Respiratory Protection Program toolkit](#).<sup>30</sup>

256 Eye/Face Protection

257 Recommendations:

258 *Indications*

- 259       1. Eye/face protection is indicated in either of the following situations: (1) when an activity is anticipated  
260           to create splashes or spray of potentially infectious material to the face, and (2) as indicated by  
261           Transmission-Based Precautions.<sup>5</sup> (*Standard Practice*)

262 Use

- 263       2. If reusable devices are used for eye and face protection, protocols must be in place for cleaning,  
264           disinfection, and drying between uses, per manufacturers' instructions for use. (*Standard Practice*)

265 *Selection*

266        3. The selection of eye and face protective equipment should consider the nature of the activity for which  
267        it will be used.<sup>5</sup> (*Standard Practice*)

268        Narrative:

269        Eye and face PPE are used singly or in combination with other PPE to protect the mucous membranes of the  
270        eyes, nose and mouth from exposure to infectious material from patients or the environment. Splashes or  
271        sprays to the face may occur during some medical procedures, as part of environmental cleaning activities such  
272        as pouring out liquid waste, and during the care of patients who might not be able to effectively contain their  
273        coughs using source control (e.g., children). Eye and face PPE may also be used to reduce the risk of inadvertent  
274        self-inoculation (e.g., providing a barrier to prevent the wearer from rubbing their face with a soiled hand).

275        Available devices for eye and face protection include disposable face or eye shields, disposable fluid-resistant  
276        masks with integral eye shields, reusable full-face shields, and reusable goggles combined with a fluid-resistant  
277        mask or respirator that covers the nose and mouth. Certain combinations, such as goggles combined with a  
278        fluid-resistant mask or respirator, or a reusable full-face shield, offer better protection when splashes from the  
279        side are possible. General prescription eyeglasses do not provide full eye protection.

280        **Environmental Controls**

281        **Environmental Cleaning and Disinfection**

282        Environmental surfaces serve as reservoirs for some pathogens that transmit by touch. Routine and targeted  
283        cleaning of environmental surfaces, as indicated by the level of patient or HCP contact and degree of soiling,  
284        reduces the burden of environmental pathogens. EPA-registered disinfectants that have microbiocidal activity  
285        against likely pathogens on surfaces are used according to manufacturers' instructions. Refer to "[CDC Guidelines  
for Environmental Infection Control in Health-Care Facilities](#)" and "[CDC Guideline for Disinfection and  
Sterilization in Healthcare Facilities](#)" for details.<sup>31,32</sup>

288        **Specialized Air Handling**

289        Airborne infection isolation rooms for containment of air in a designated space (AIIRs) are engineered to prevent  
290        flow of air from the room to other parts of the facility (e.g., into the hallway) through use of both negative  
291        pressure and 100% outside exhaust (or HEPA-filtered exhaust). In addition, these rooms often have a higher  
292        number of air changes per hour compared to standard patient rooms, which may provide a higher level of  
293        protection to others entering the room. Additional features of AIIRs are described in the [CDC Guidelines for  
Environmental Infection Control in Healthcare Facilities](#). When such rooms are used for patients, the patient bed

294        is placed as near as possible to the air exhaust location (i.e., where the air leaves the room), and the functional  
295        status of air handling for the room is monitored and verified.

297        Other environmental controls can be useful components of the layered approach to preventing transmission of  
298        infection through air. Although full discussion would be out of scope for the current document, it is important to  
299        recognize the importance of interventions such as [general ventilation](#) with sufficient delivery rates of clean air to  
300        dilute pathogens in air, local exhaust ventilation to capture pathogens at their source, and removal of infective  
301        pathogens from air such as by filtration through portable HEPA filters or by inactivation via ultraviolet germicidal  
302        irradiation.<sup>33</sup> An advantage of these interventions is that they do not require individual compliance to be  
303        effective.

304

305 **Section C: Precautions to Prevent Transmission of Pathogens in Healthcare Settings**

306 **Overview**

307 There are two tiers of precautions to prevent transmission of infectious agents, Standard Precautions and  
308 Transmission-Based Precautions. Standard Precautions apply to the care of all patients in all healthcare settings,  
309 regardless of the suspected or confirmed presence of an infectious pathogen. **Implementation of Standard**  
310 **Precautions is the primary strategy to prevent transmission of pathogens in healthcare settings.**

311 Transmission-Based Precautions apply to the care of patients with known or suspected infectious pathogens,  
312 which require additional control measures to effectively prevent transmission. Since a patient's infectious status  
313 often is not known at the time of initial encounter with healthcare personnel (HCP), Transmission-Based  
314 Precautions are used empirically, according to the clinical syndrome and the likely etiologic agents at the time,  
315 and then modified as needed when the pathogen is identified or a transmissible infectious etiology is ruled out.

316 The specific elements of infection prevention, including personal protective equipment (PPE), are discussed in  
317 Section B. Section C defines and updates the applications of Standard Precautions and Transmission-Based  
318 Precautions. [Appendix A \(2007\)](#) outlines the application of Transmission-Based Precautions to specific  
319 pathogens.

320 **Standard Precautions**

321 Recommendation:

- 322 1. Standard Precautions apply to the care of all patients, regardless of suspected or confirmed infection  
323 status, in any setting in which healthcare is delivered, and at all times.<sup>5</sup> (*Standard Practice*)

324 Narrative:

325 Standard Precautions are a group of infection prevention and control practices that are based on the principle  
326 that all blood, body fluids, secretions, excretions (except sweat in most circumstances), nonintact skin, and  
327 mucous membranes may contain transmissible infectious agents.

328 Components of Standard Precautions are defined in the [CDC's Core Infection Prevention and Control Practices](#)  
329 [for Safe Healthcare Delivery in All Settings](#)<sup>5</sup> and include:

- 330 • Hand hygiene  
331 • Environmental cleaning and disinfection  
332 • Injection and medication safety  
333 • Risk assessment with use of appropriate personal protective equipment (e.g., gloves, gowns, masks)  
334 based on activities being performed  
335 • Minimizing Potential Exposures (e.g., having patients and visitors wear a mask when respiratory  
336 symptoms are present)  
337 • Reprocessing of reusable medical equipment between each patient or when soiled

338 Standard Precautions have multi-directional benefits, protecting HCP and preventing HCP or the environment  
339 from transmitting pathogens to patients. Standard Precautions apply to the care of patients at all times,  
340 including when Transmission-Based Precautions are implemented or discontinued.

341 Performing a risk assessment is central to Standard Precautions; this includes assessment by HCP of their risk of  
342 exposure to potentially infectious materials for each activity being performed. Based on that assessment, HCP

343 implement practices and use PPE to prevent possible exposure. For example, when planning to irrigate a wound  
344 and perform a dressing change, HCP would anticipate the potential for splashes and sprays during irrigation and  
345 the potential for contact with the wound or contaminated dressing materials. To prevent such exposures, they  
346 would put on gloves, a gown, eye protection and a mask prior to performing the activity.

347 Performing a risk assessment can be challenging, and HCP might not anticipate all potential opportunities for  
348 exposure. To reduce this risk, facilities might choose to systematically apply elements of Standard Precautions to  
349 situations recognized as likely to present a risk of pathogen transmission. For example, because it can be difficult  
350 to anticipate if a patient with a respiratory infection will cough or sneeze during an encounter, facilities may  
351 choose to implement universal use of eye protection by HCP (in addition to the already indicated mask or  
352 respirator) for the care of patients with respiratory virus infections.

### 353 **Transmission-Based Precautions**

354 Recommendation:

- 355 1. HCP should be trained on how and when to apply Transmission-Based Precautions, including how to put  
356 on, correctly use, and remove PPE.<sup>5</sup> (*Standard Practice*)

357 Narrative:

358 Transmission-Based Precautions are used when transmission is not completely interrupted using Standard  
359 Precautions alone. For pathogens that have multiple routes of transmission (e.g., disseminated herpes zoster  
360 virus infection), more than one Transmission-Based Precautions category will be used. Whether applied singly or  
361 in combination, Transmission-Based Precautions are used in addition to Standard Precautions. See [Appendix A](#)  
362 ([2007](#)) for recommended precautions for specific pathogens and infections.

363 When Transmission-Based Precautions are indicated, acceptance by patients and adherence by HCP may be  
364 improved by addressing potential adverse effects on patients (e.g., anxiety, depression and other mood  
365 disturbances, perceptions of stigma, and reduced contact with clinical staff).

### 366 **Syndromic and Empiric Applications of Transmission-Based Precautions**

367 Recommendation:

- 368 1. Use appropriate Transmission-Based Precautions at the time a patient develops symptoms or signs  
369 consistent with a transmissible infection, to reduce transmission risk.<sup>5</sup> (*Standard Practice*)

370 Narrative

371 While it is not possible to identify prospectively all patients needing Transmission-Based Precautions, certain  
372 clinical syndromes and conditions carry a sufficiently high risk to warrant their use empirically while  
373 confirmatory tests are pending (e.g., initiation of Contact Precautions for a patient with vomiting and diarrhea).  
374 Once a diagnosis has been confirmed or ruled out, the need for Transmission-Based Precautions is reassessed.

### 375 **Use of Transmission-Based Precautions to Prevent Transmission by Touch**

376 Recommendations:

- 377 1. **Contact Precautions** (applies to all healthcare facilities):
  - 378 a. Patients are cared for in a dedicated space, preferably a single patient room.<sup>5</sup> See Patient  
379 Placement and Patient Transport sections below for more details. (*Standard Practice*)

- 380        b. A gown and gloves are used for all interactions that may involve contact with the patient or the  
381           patient's environment. Gown and gloves should be put on upon entry into a patient's  
382           designated space (generally defined the patient's bedspace or room) and properly removed and  
383           disposed before exiting the designated space. (*Standard Practice*)  
384        c. Patient-care equipment (e.g., blood pressure cuffs, stethoscopes) is ideally dedicated to the  
385           patient and the patient's designated space. Disposable equipment may be used to minimize  
386           cross-transmission. If shared patient-care items are used, they should be cleaned and  
387           disinfected prior to use with other patients in accordance with the manufacturer's instructions  
388           for use.<sup>5</sup> (*Standard Practice*)  
389        d. In general, clean, unopened patient care supplies should not be stored in the room but should  
390           be available near the room to allow easy access while ensuring that large amounts of supplies  
391           do not become contaminated. Any disposable supplies that are brought into the room should  
392           not be returned to the general supply; they may be sent home with the patient upon discharge  
393           if needed (e.g., for dressing changes) or discarded. For clinical areas where supplies are stored  
394           routinely within rooms (e.g., outpatient clinic rooms), supplies should be stored in covered or  
395           closed clean storage areas. (*Standard Practice*)  
396        e. Frequent cleaning and disinfection of room surfaces (e.g., at least daily, or prior to use by  
397           another patient in ambulatory settings) is used to reduce environmental reservoirs of infectious  
398           material, focusing on frequently touched surfaces and areas in the immediate vicinity of the  
399           patient. See [Environmental Infection Control Guidelines](#) for additional details.<sup>31</sup> (*Standard  
400           Practice*)

401        2. **Enhanced Barrier Precautions** (applies to Skilled Nursing Facilities):

- 402        a. Enhanced Barrier Precautions are indicated, when Contact Precautions do not otherwise apply,  
403           for nursing home residents with multidrug-resistant organism (MDRO) infection or  
404           colonization.<sup>34</sup> (*Expert Opinion*)  
405        b. Enhanced Barrier Precautions may be considered for residents at high risk for MDRO  
406           colonization, regardless of known MDRO status (e.g., residents with wounds and/or indwelling  
407           medical devices).<sup>34-37</sup> (*Expert Opinion*)  
408        c. Use a gown and gloves for high-contact resident care activities including dressing,  
409           bathing/showering, transferring, providing hygiene, changing linens, changing briefs or assisting  
410           with toileting, device care or use (e.g., central venous catheter, urinary catheter, feeding tube,  
411           tracheostomy/ventilator management), and wound care.<sup>15,17,38,39</sup> In general, gown and gloves  
412           would not be required for resident care activities other than those listed above, unless indicated  
413           per Standard Precautions. (*Expert Opinion*)  
414        d. Residents are not restricted to their rooms or limited from participation in group activities.  
415           Because Enhanced Barrier Precautions do not impose the same activity and room placement  
416           restrictions as Contact Precautions, they are intended to be in place for the duration of a  
417           resident's stay in the facility or until the indication for Enhanced Barrier Precaution is resolved  
418           (e.g., resolution of wound or discontinuation of the indwelling medical device). (*Expert Opinion*)

419        Narrative:

420        Contact Precautions and Enhanced Barrier Precautions are used to interrupt the route of transmission for  
421           pathogens transmitted by touch. Application of these precautions to patients/residents with suspected or

422 confirmed MDRO infection or colonization vary by facility type (for healthcare facilities except skilled nursing  
 423 facilities, see **Table 1**; for skilled nursing facilities, see **Table 2**).

424 Enhanced Barrier Precautions are intended for the prevention of MDRO transmission in skilled nursing  
 425 facilities.<sup>34-37</sup> They refer to the use of gown and gloves during high contact resident care activities that risk  
 426 potential transfer of MDROs to HCP hands and clothing.<sup>15,17,38,39</sup> Preventing this transfer can then help prevent  
 427 MDRO transmission when HCP perform high contact care activities on other residents.<sup>34,35</sup> They also take into  
 428 account the special circumstances of care in a skilled nursing facility (e.g., home-like environment) and barriers  
 429 to implementing Contact Precautions for residents infected or colonized with an MDRO.<sup>40</sup> For example, MDRO  
 430 colonization may persist for long periods (e.g., months to years<sup>41,42</sup>); restriction of a resident to their room on  
 431 the basis of their MDRO status, as recommended for residents on Contact Precautions, would result in  
 432 prolonged isolation of the resident to the detriment of their overall health and wellbeing. The target MDROs for  
 433 Enhanced Barrier Precautions may be prioritized by public health and through local risk assessment. Enhanced  
 434 Barrier Precautions may be considered for other congregate settings in healthcare facilities other than skilled  
 435 nursing facilities (e.g., congregate behavioral health units in acute care hospitals).

436 **Table 1: Transmission-Based Precautions to Prevent Transmission by Touch for Healthcare Facilities (Except**  
 437 **Skilled Nursing Facilities)**

Category	PPE	Situation	Dedicated Medical Equipment	Single occupancy
Contact Precautions	Gown/glove for all activities	Any entry into designated patient space	Yes	Preferred; if not available, then cohort

438

439 **Table 2. Transmission-Based Precautions to Prevent Transmission by Touch for Skilled Nursing Facilities**

Category	PPE	Situation	Dedicated Medical Equipment	Single occupancy
Contact Precautions	Gown/glove for all activities	Any entry into designated patient space	Yes	Preferred; if not available, then cohort
Enhanced Barrier Precautions	Gown/glove during high contact resident care activities	When Contact Precautions do not otherwise apply: <b>Indicated for</b> residents with infection or colonization with an MDRO <b>Consider for</b> residents at high risk for MDRO colonization, regardless of known MDRO status (e.g., residents with	Not required. Clean and disinfect equipment between residents (per Standard Precautions)	Not required

		wounds or indwelling medical devices)		
--	--	---------------------------------------	--	--

440

441 **Use of Transmission-Based Precautions to Prevent Transmission through the Air**

442 Recommendations:

443 **1. Routine Air Precautions:**

- 444 a. A mask is worn by HCP on room entry, and eye protection is used based on Standard  
445 Precautions. (*Standard Practice*)
- 446 b. Private rooms are preferred<sup>5</sup>; if not available, then cohort. (*Standard Practice*)
- 447 c. Rooms should be appropriately ventilated<sup>33</sup>, but an AIIR is not routinely needed. (*Standard  
448 Practice*)
- 449 d. Source control masking should be used by the patient when they leave their room (e.g., for  
450 transport to a procedure).<sup>5</sup> (*Standard Practice*)

451 **2. Special Air Precautions:**

- 452 a. A NIOSH-approved® fit-tested N95 (or higher-level) respirator and eye protection are worn by  
453 HCP on room entry. (*Expert Opinion*)
- 454 b. A private room is indicated.<sup>5</sup> (*Expert Opinion*)
- 455 c. Rooms should be appropriately ventilated<sup>33</sup>, but an AIIR is not routinely needed. (*Expert  
456 Opinion*)
- 457 d. Source control masking is indicated for the patient when they leave their room (e.g., for  
458 transport to a procedure).<sup>5</sup> (*Expert Opinion*)

459 **3. Extended Air Precautions:**

- 460 a. A NIOSH-approved® fit-tested N95 (or higher-level) respirator is worn by HCP on room entry,  
461 and eye protection is used based on Standard Precautions. (*Standard Practice*)
- 462 b. A private room is indicated.<sup>5</sup> (*Standard Practice*)
- 463 c. An AIIR is required. (*Standard Practice*)
- 464 d. Source control masking is indicated for the patient when they leave their room.<sup>5</sup> (*Standard  
465 Practice*)
- 466 e. Travel outside the room should be limited (e.g., for necessary procedures and treatments).  
467 (*Standard Practice*)

468 Narrative:

469 The previous categories of Droplet Precautions and Airborne Precautions have now been divided into three  
470 categories to better reflect the continuum of transmission for reasons described in Section A. Pathogen-specific  
471 recommendations may be found in [Appendix A \(2007\)](#), which will be updated with interim suggestions for how  
472 facilities may map existing categories to new categories of Transmission-Based Precautions, until  
473 recommendations for all pathogens have been updated. **Table 3** summarizes baseline recommended  
474 requirements for care of patients in each precaution category for preventing transmission by air.

475 **Table 3. Transmission-Based Precautions to Prevent Transmission by Air**

Category	Mask or Respiratory Protection	Eye Protection	AIIR <sup>a</sup>
Routine Air Precautions	Mask	Per Standard Precautions	Not routinely recommended
Special Air Precautions	NIOSH-approved® N95 (or higher-level) respirator	Yes	Not routinely recommended
Extended Air Precautions	NIOSH-approved® N95 (or higher-level) respirator	Per Standard Precautions	Yes

476 a. AIIR = Airborne Infection Isolation Room for containment of air in a designated space

477 Routine Air Precautions are focused on reducing transmission of common, often endemic, respiratory pathogens  
478 that spread predominantly over short distances based on observed patterns of transmission, and for which  
479 individuals and their communities are likely to have some degree of immunity.480 Special Air Precautions are applied to patients with a respiratory pathogen, typically new or emerging, that is not  
481 observed or anticipated to spread efficiently over long distances (such as through ventilation systems), for which  
482 infection generally leads to more than mild illness, and where immunity (or vaccine) and effective treatment are  
483 not available.484 Extended Air Precautions are used when providing care to patients with pathogens that are observed to spread  
485 efficiently across long distances and over extended times, such that room air needs to be contained (e.g.,  
486 prevented from moving into the hallway where individuals are not appropriately protected).487 While not required for Routine Air Precautions, HCP may choose voluntarily to wear a NIOSH-approved® N95 (or  
488 higher-level) respirator, per existing federal regulations.<sup>29,43</sup> For Routine and Extended Air Precautions, eye  
489 protection may be added as required PPE based on infection control risk assessment performed by the facility  
490 for specific pathogens (e.g., implementing eye protection for care of all patients with respiratory viral infections  
491 during periods of high incidence in the community or facility). For Special Air Precautions, although an AIIR is not  
492 routinely recommended, an AIIR may be suggested for certain pathogens listed in [Appendix A \(2007\)](#), and for  
493 pathogens with uncertain transmission characteristics.494 **Special Situations**495 Some procedures performed on patients may be more likely to generate higher concentrations of aerosols of  
496 respiratory particles than others. There is neither expert consensus, nor sufficient supporting data, to create a  
497 definitive and comprehensive list of these procedures (sometimes called “aerosol-generating procedures”) for  
498 healthcare settings. Certain procedures that involve manipulation of the patient’s airway and close proximity  
499 between the patient and the HCP may increase risk of pathogen transmission by air. Facilities may perform an  
500 infection control risk assessment to implement Special Air or Extended Air precautions for patients with certain  
501 target pathogens, or for all patients regardless of symptoms or confirmed infection, during certain higher risk  
502 procedures.

503   **Source control**

504   Recommendations:

- 505   1. During periods of higher levels of community respiratory virus transmission, facilities should consider  
506   implementing one of the tiers of source control:  
507      a. Having HCP mask when interacting with patients (e.g., on entry to the patient's room or  
508         bedspace). (*Expert Opinion*)  
509      b. Having all individuals (e.g., patients, visitors, and HCP) mask upon entry to the facility or a  
510         clinical area.<sup>5</sup> (*Standard Practice*)  
511   2. Source control measures can be implemented facility-wide or targeted toward higher risk areas (e.g.,  
512         emergency departments, urgent care, bone marrow transplant units, or units experiencing an outbreak)  
513         based on a facility risk assessment.<sup>5</sup> (*Standard Practice*)

514   Narrative:

515   Individuals breathing, speaking, coughing, or sneezing generate aerosols of respiratory secretions that can  
516   contain infectious organisms. The use of a mask or respirator by an infectious individual can reduce the amount  
517   of secretions released into the environment (source control) and thus reduce exposure of people in a shared  
518   space to respiratory pathogens.<sup>27,44,45</sup>

519   Source control, included as part of respiratory hygiene and cough etiquette in [CDC's Core Infection Prevention](#)  
520   [and Control Practices for Safe Healthcare Delivery in All Settings](#), historically focused on use of masks by  
521   symptomatic patients (e.g., in waiting areas).<sup>5</sup> Source control is now recognized to be applicable to  
522   asymptomatic individuals as well, since a proportion of such individuals may be asymptotically or pre-  
523   symptomatically infected with pathogens such as respiratory viruses.<sup>46</sup>

524   **Patient Placement**

525   Recommendations:

- 526   1. Single patient rooms are the preferred option for patients requiring Transmission-Based Precautions,  
527   whether to prevent transmission by touch or through the air.<sup>5</sup> (*Standard Practice*)  
528   2. In long-term and other residential settings, room placement decisions should balance risks to the  
529   infectious individual and to other patients.<sup>5</sup> (*Standard Practice*) Residents in Enhanced Barrier  
530   Precautions do not require placement in a single person room. (*Expert Opinion*)  
531   3. In ambulatory settings, patients requiring Transmission-Based Precautions should be placed in an exam  
532   room or cubicle as soon as possible rather than waiting in common areas.<sup>5</sup> (*Standard Practice*)  
533   4. If single patient rooms are not available, patients housed (cohorting) in the same room should have the  
534   same pathogen infection or colonization status to the greatest extent possible. (*Standard Practice*)  
535   5. Any time room sharing occurs, practices need to be in place to limit potential for cross-contamination,  
536   including ready access to hand hygiene supplies, changing PPE between roommates, and dedicating  
537   patient care items or cleaning and disinfecting shared equipment after each use. (*Standard Practice*)

538   **Transport of Patients**

539   Recommendations:

540   *Patient considerations*

- 541     1. Patients under Transmission-Based Precautions (with the exception of Enhanced Barrier Precautions  
542       alone) should leave their room only when medically necessary for their evaluation or care. (*Standard*  
543       *Practice*)
- 544     2. If the patient is being isolated for a pathogen transmitted through the air, they should use source  
545       control, (i.e., wear a mask), any time they are outside of their room, unless a mask is medically  
546       contraindicated or the individual is not capable of wearing a mask safely.<sup>5</sup> (*Standard Practice*)
- 547     3. If the patient is cared for using Contact Precautions for a pathogen transmitted by touch, appropriate  
548       barriers (e.g., clean patient gown, wrapping sheet, or impervious dressing) should be used to cover  
549       affected areas of the patient's body during transport when infectious skin lesions or drainage are  
550       present. (*Standard Practice*)
- 551     4. Before transport, direct communication with the HCP receiving the patient is required to ensure  
552       notification regarding the nature of the infection, the type of Transmission-Based Precautions required,  
553       and when the patient will arrive.<sup>5</sup> (*Standard Practice*)
  - 554       a. Communication at time of transport applies to within-facility transfers and between-facility  
555       transfers. (*Standard Practice*)

556 ***Transporter considerations***

- 557     1. HCP transporting patients should follow Standard Precautions for pathogens to avoid spreading  
558       infectious material during transport.<sup>5</sup> (*Standard Practice*)
  - 559       a. This includes performing hand hygiene before beginning transport, ensuring that wheelchairs  
560           and gurneys used for transport have been cleaned and disinfected prior to use, putting on all  
561           appropriate PPE prior to contact with the patient when assisting with patient movement at the  
562           destination location, and removing and discarding soiled PPE. (*Standard Practice*)
- 563     2. PPE might be recommended during transport in certain circumstances:
  - 564       a. When transporting a patient with a pathogen that presents a high risk for morbidity and  
565           mortality for HCP (e.g., Ebola virus), all pathogen-recommended PPE should be used. (*Expert*  
566           *opinion*)
  - 567       b. When transporting a patient with a pathogen transmitted through the air, the transporter  
568           should carry a mask or respirator with them based on the recommended Transmission-Based  
569           Precaution category. If the patient is unable to wear a mask for source control or if the patient  
570           will require medical care during transport (e.g., suctioning), the transporter should put on a  
571           mask or respirator prior to assisting the patient. (*Expert opinion*)
  - 572       c. When transporting a patient with a pathogen transmitted by touch, gloves might be used if  
573           there is a need to touch the patient during transport (e.g., a clean pair of non-sterile gloves can  
574           be carried, put on prior to assisting the patient and discarded immediately afterward and  
575           followed with hand hygiene). (*Expert opinion*)
- 576     3. If a patient on Special Air Precautions is unable to wear source control, or if a patient is on Extended Air  
577       Precautions for a highly contagious infection (e.g., varicella or measles), the transport route and process  
578       should include a selection of the time and route of travel within a facility to minimize exposure of others  
579       during transport (*Expert Opinion*), and use of appropriate PPE by staff during transport and at the  
580       destination location (*Standard Practice*).

581 ***Use of Personal Protective Equipment by Visitors***

582 The use of PPE (e.g., gowns, gloves, or masks) by visitors in healthcare settings may be considered, particularly in  
583 settings where they are providing hands-on care and having very close patient contact (e.g., feeding, dressing).  
584 In these situations, visitors may have contact with other patients or the environment and could contribute to  
585 transmission if PPE is not used. Specific recommendations may vary by facility or by unit and are determined by  
586 the level of interaction and the suspected or proven infection for which Transmission-Based Precautions might  
587 be recommended.

588 **Visitors as Sources of Infection**

589 Visitors, including patient family members, have been identified as the source of several types of healthcare-  
590 associated infections (e.g., pertussis, *M. tuberculosis*, and respiratory viruses).<sup>47,48</sup> Visitor symptom screening can  
591 reduce risk of healthcare-associated infections, and may be especially important for high-risk patient care areas  
592 such as oncology and neonatal intensive care units.

593 Visitor symptom screening may be *passive* (e.g., using signs that alert visitors with symptoms of infection not to  
594 enter clinical areas) or *active* (e.g., asking each visitor to report current symptoms and recent exposures to  
595 persons with infection or relevant travel, with subsequent review by facility staff to determine whether the  
596 visitor can proceed with visitation).

597 **Discontinuation of Transmission-Based Precautions**

598 In general, Transmission-Based Precautions are intended to remain in effect for limited periods of time (i.e.,  
599 while the risk for transmission of the infectious agent persists or for the duration of the illness). For most  
600 infectious diseases, this duration reflects known patterns of persistence and shedding of infectious agents  
601 associated with the natural history of the infectious process and its treatment. Colonization with MDROs can  
602 persist for months to years.<sup>41,42</sup> In acute care hospitals, Contact Precautions are often left in place throughout  
603 the entire admission or may have a set duration based on repeat testing or symptom resolution. In nursing  
604 homes, Enhanced Barrier Precautions are used to better accommodate the communal and residential  
605 environment of the setting, and are left in place for the duration of the resident's stay or until their risk factors  
606 have resolved (e.g., indwelling medical device is removed or wound is healed). Refer to [Appendix A \(2007\)](#) for  
607 pathogen/disease specific recommendations.

608

609 **Appendix**

610 **Federal Advisory Committee Guideline Update Process**

611 This document is the first in a two-part update to the 2007 Guideline for Isolation Precautions: Preventing  
612 Transmission of Infectious Agents in Healthcare Settings (hereafter referred to as the *2007 Guideline*). At an  
613 August 2021 public meeting of the Healthcare Infection Control Practices Advisory Committee (HICPAC), the  
614 Division of Healthcare Quality Promotion (DHQP) requested input from HICPAC on an update to the 2007  
615 Guideline. HICPAC responded by forming a workgroup to review and update the 2007 Guideline, and this  
616 workgroup was announced at a public meeting of the committee in October 2021. This workgroup was  
617 comprised of subject matter experts in infectious disease, infection prevention, occupational health, nursing,  
618 healthcare epidemiology, and healthcare management. Federal technical experts from DHQP and National  
619 Institute of Occupational Safety and Health (NIOSH) were present during workgroup meetings in order to  
620 answer workgroup questions as they arose.

621 The workgroup reviewed the 2007 Guideline and weighed peer-reviewed literature, existing regulations and  
622 guidance, and expert opinion when updating the 2007 recommendations. The workgroup provided updates on  
623 the guideline update process, draft Transmission-Based Precautions categories, their supporting  
624 recommendations, and contextual systematic literature reviews at HICPAC Public Meetings in June, August, and  
625 November of 2022, and in June, August, and November of 2023. (Meeting Minutes are found [here](#)).<sup>49</sup>

626 **Recommendation Formulation and Categorization**

627 The authors conducted a thorough review of the recommendations contained in the 2007 Guideline. This review  
628 identified recommendations from the 2007 Guideline that remained relevant in 2023; these recommendations  
629 were carried forward as Standard Practice and are noted as such in the 2024 update. The authors additionally  
630 identified gaps in the 2007 Guideline that required the development of new recommendations.

631 New recommendations also were categorized as Standard Practice if they met any of the following criteria:

- 632 1. Are consistent with recommendations in current CDC guidelines or guidance (e.g., the [Core Infection](#)  
633 [Prevention and Control Practices for Safe Healthcare Delivery in All Settings](#)<sup>5</sup>)
- 634 2. Are consistent with current federal regulations. Regulations include, but are not limited to:
  - 635 a. Occupational Safety and Health Administration (OSHA) Bloodborne Pathogen Standard 29 CFR  
636 1910.1030(g) (2),
  - 637 b. OSHA Respiratory Protection Standard 29 CFR 1910.134, and
  - 638 c. OSHA Personal Protective Equipment Standard 29 CFR 1910.132.
- 639 3. Are consistent with manufacturer instructions for use (e.g., recommendations to follow instructions for  
640 proper use or reprocessing)

641 New recommendations not categorized as Standard Practice were categorized as Expert Opinion, with  
642 supporting peer-reviewed literature where available.

643 In order to provide context to the update of the 2007 Guideline's Transmission-Based Precaution categories, the  
644 authors requested three systematic reviews from DHQP that answered questions on the performance of several  
645 PPE items. These systematic reviews, which were not conducted to support the development of specific  
646 recommendations, answered the following key questions:

- 647     1. For healthcare personnel caring for patients with respiratory infections, what is the effectiveness of N95  
648       respirators compared to medical/surgical masks in preventing symptomatic illness or laboratory-  
649       confirmed infection? [cite webpage]  
650     2. For healthcare personnel caring for patients with respiratory infections, what is the effectiveness of  
651       adding eye protection to routine personal protective equipment (PPE), compared to routine PPE alone,  
652       in preventing symptomatic illness or laboratory-confirmed infection? [cite webpage]  
653     3. For healthcare personnel, what is the effectiveness of risk-based use of gowns and gloves, or gloves  
654       alone, to prevent transmission of pathogens? [cite webpage]
- 655     The detailed methods of each systematic literature review are available online in the respective documents.
- 656

657 **References**

- 658 1. Siegel JD, Rhinehart E, Jackson M, L. C, and the Healthcare Infection Control Practices Advisory  
659 Committee. Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in  
660 Healthcare Settings (2007). Updated July, 2023. Accessed October 11, 2023.  
<https://www.cdc.gov/infectioncontrol/pdf/guidelines/isolation-guidelines-H.pdf>
- 661 2. Centers for Disease Control and Prevention; National Center for Emerging and Zoonotic Infectious  
662 Diseases; Division of Healthcare Quality Promotion. Type and Duration of Precautions Recommended for  
663 Selected Infections and Conditions: Guideline for Isolation Precautions: Preventing Transmission of  
664 Infectious Agents in Healthcare Settings (2007). Updated July 22, 2019. Accessed October 11, 2023.  
<https://www.cdc.gov/infectioncontrol/guidelines/isolation/appendix/type-duration-precautions.html>
- 665 3. Centers for Disease Control and Prevention; The National Institute for Occupational Safety and Health.  
666 Workplace Safety & Health Topics: Hierarchy of Controls. Updated January 17, 2023. Accessed October  
667 11, 2023. <https://www.cdc.gov/niosh/topics/hierarchy/default.html>
- 668 4. Centers for Disease Control and Prevention; National Center for Emerging and Zoonotic Infectious  
669 Diseases; Division of Healthcare Quality Promotion. Hand Hygiene in Healthcare Settings: Hand Hygiene  
670 Guidance. Updated January 30, 2020. Accessed October 11, 2023.  
<https://www.cdc.gov/handhygiene/providers/guideline.html>
- 671 5. Centers for Disease Control and Prevention; National Center for Emerging and Zoonotic Infectious  
672 Diseases; Division of Healthcare Quality Promotion. CDC's Core Infection Prevention and Control  
673 Practices for Safe Healthcare Delivery in All Settings. Updated November 29, 2022. Accessed October 11,  
674 2023. <https://www.cdc.gov/infectioncontrol/guidelines/core-practices/index.html>
- 675 6. U.S. Department of Labor; Occupational Safety and Health Administration. Occupational Safety and  
676 Health Standard 1910.132: General Requirements: Personal Protective Equipment. Accessed October  
677 11, 2023. <https://www.osha.gov/laws-regulations/standardnumber/1910/1910.132>
- 678 7. Centers for Disease Control and Prevention; National Center for Emerging and Zoonotic Infectious  
679 Diseases; Division of Healthcare Quality Promotion. Guideline for Prevention of Surgical Site Infection.  
680 Updated November 5, 2015. Accessed October 12, 2023.  
<https://www.cdc.gov/infectioncontrol/guidelines/ssi/index.html>
- 681 8. Centers for Disease Control and Prevention. Sequence For Putting On Personal Protective Equipment  
682 (PPE). Accessed October 12, 2023. <https://www.cdc.gov/hai/pdfs/ppe/ppe-sequence.pdf>
- 683 9. Berthelot P, Dietemann J, Fascia P, et al. Bacterial contamination of nonsterile disposable gloves before  
684 use. *Am J Infect Control*. Apr 2006;34(3):128-30. doi:10.1016/j.ajic.2005.08.017
- 685 10. Hughes KA, Cornwall J, Theis JC, Brooks HJ. Bacterial contamination of unused, disposable non-sterile  
686 gloves on a hospital orthopaedic ward. *Australas Med J*. 2013;6(6):331-8. doi:10.4066/amj.2013.1675
- 687 11. Rossoff LJ, Lam S, Hilton E, Borenstein M, Isenberg HD. Is the use of boxed gloves in an intensive care  
688 unit safe? *Am J Med*. Jun 1993;94(6):602-7. doi:10.1016/0002-9343(93)90211-7
- 689 12. U.S. Department of Labor; Occupational Safety and Health Administration. Occupational Safety and  
690 Health Standard 1910.1030: Bloodborne pathogens. Accessed October 12, 2023.  
<https://www.osha.gov/laws-regulations/standardnumber/1910/1910.1030>
- 691 13. U.S. Food and Drug Administration. Guidance for Industry and FDA Staff: Medical Glove Guidance  
692 Manual. Accessed October 12, 2023. <https://www.fda.gov/media/90612/download?attachment>
- 693 14. U.S. Food and Drug Administration. Personal Protective Equipment for Infection Control: Medical  
694 Gloves. Updated December 12, 2022. Accessed October 12, 2023. <https://www.fda.gov/medical-devices/personal-protective-equipment-infection-control/medical-gloves>
- 695 15. Blanco N, Johnson JK, Sorkin JD, Lydecker AD, Levy L, Mody L, Roghmann MC. Transmission of resistant  
696 Gram-negative bacteria to healthcare personnel gowns and gloves during care of residents in  
697 community-based nursing facilities. *Infect Control Hosp Epidemiol*. Dec 2018;39(12):1425-1430.  
698 doi:10.1017/ice.2018.247

- 705 16. O'Hara LM, Nguyen MH, Calfee DP, et al. Risk factors for transmission of carbapenem-resistant  
706 Enterobacterales to healthcare personnel gloves and gowns in the USA. *J Hosp Infect*. Mar 2021;109:58-  
707 64. doi:10.1016/j.jhin.2020.12.012
- 708 17. Roghmann MC, Johnson JK, Sorkin JD, et al. Transmission of Methicillin-Resistant Staphylococcus aureus  
709 (MRSA) to Healthcare Worker Gowns and Gloves During Care of Nursing Home Residents. *Infect Control*  
710 *Hosp Epidemiol*. Sep 2015;36(9):1050-7. doi:10.1017/ice.2015.119
- 711 18. Centers for Disease Control and Prevention; The National Institute for Occupational Safety and Health;  
712 The National Personal Protective Technology Laboratory. Considerations for Selecting Protective  
713 Clothing used in Healthcare for Protection against Microorganisms in Blood and Body Fluids. Updated  
714 April 9, 2020. Accessed October 12, 2023.  
<https://www.cdc.gov/niosh/npptl/topics/protectiveclothing/default.html>
- 715 19. Chughtai AA, Stelzer-Braids S, Rawlinson W, et al. Contamination by respiratory viruses on outer surface  
716 of medical masks used by hospital healthcare workers. *BMC Infect Dis*. Jun 3 2019;19(1):491.  
717 doi:10.1186/s12879-019-4109-x
- 718 20. Luksamijarulkul P, Aiempradit N, Vatanasomboon P. Microbial Contamination on Used Surgical Masks  
719 among Hospital Personnel and Microbial Air Quality in their Working Wards: A Hospital in Bangkok.  
720 *Oman Med J*. Sep 2014;29(5):346-50. doi:10.5001/omj.2014.92
- 721 21. Nightingale M, Mody M, Rickard AH, Cassone M. Bacterial contamination on used face masks among  
722 nursing home healthcare personnel. *Antimicrob Steward Healthc Epidemiol*. 2023;3(1):e54.  
723 doi:10.1017/ash.2023.130
- 724 22. Ostrowski P, Masiuk H, Kulig P, et al. Medical Face Masks Do Not Affect Acid-Base Balance Yet Might  
725 Facilitate the Transmission of Staphylococcus aureus in Hospital Settings during the COVID-19 Pandemic.  
726 *Int J Environ Res Public Health*. Jan 30 2023;20(3)doi:10.3390/ijerph20032474
- 727 23. Sachdev R, Garg K, Singh G, Mehrotra V. Is safeguard compromised? Surgical mouth mask harboring  
728 hazardous microorganisms in dental practice. *J Family Med Prim Care*. Feb 2020;9(2):759-763.  
729 doi:10.4103/jfmpc.jfmpc\_1039\_19
- 730 24. Centers for Disease Control and Prevention; The National Institute for Occupational Safety and Health.  
731 Strategies for Conserving the Supply of Medical Masks. Updated May 9, 2023. Accessed October 12,  
732 2023. <https://www.cdc.gov/niosh/topics/pandemic/strategies-masks.html>
- 733 25. Yousefimashouf M, Yousefimashouf R, Alikhani MS, Hashemi H, Karami P, Rahimi Z, Hosseini SM.  
734 Evaluation of the bacterial contamination of face masks worn by personnel in a center of COVID 19  
735 hospitalized patients: A cross-sectional study. *New Microbes New Infect*. Mar 2023;52:101090.  
736 doi:10.1016/j.nmni.2023.101090
- 737 26. Centers for Disease Control and Prevention; The National Institute for Occupational Safety and Health.  
738 Making Enhanced Performance Barrier Face Coverings: Guidance for Manufacturers on Enhanced  
739 Barrier Face Coverings Which Build Upon the ASTM International (ASTM) Standard. Updated May 16,  
740 2023. Accessed October 12, 2023. <https://www.cdc.gov/niosh/topics/publicppe/barrier-face-coverings.html>
- 741 27. Brooks JT, Beezhold DH, Noti JD, Coyle JP, Derk RC, Blachere FM, Lindsley WG. Maximizing Fit for Cloth  
742 and Medical Procedure Masks to Improve Performance and Reduce SARS-CoV-2 Transmission and  
743 Exposure, 2021. *MMWR Morb Mortal Wkly Rep*. Feb 19 2021;70(7):254-257.  
744 doi:10.15585/mmwr.mm7007e1
- 745 28. Clapp PW, Sickbert-Bennett EE, Samet JM, et al. Evaluation of Cloth Masks and Modified Procedure  
746 Masks as Personal Protective Equipment for the Public During the COVID-19 Pandemic. *JAMA Intern*  
747 *Med*. Apr 1 2021;181(4):463-469. doi:10.1001/jamainternmed.2020.8168
- 748 29. U.S. Department of Labor; Occupational Safety and Health Administration. Occupational Safety and  
749 Health Standard 1910.134: Respiratory Protection: Personal Protective Equipment. Accessed October  
750 12, 2023. <https://www.osha.gov/laws-regulations/regulations/standardnumber/1910/1910.134>

- 753 30. U.S. Department of Labor; Occupational Safety and Health Administration, Centers for Disease Control  
754 and Prevention; The National Institute for Occupational Safety and Health. Hospital Respiratory  
755 Protection Program Toolkit. Accessed October 13, 2023.  
<https://www.osha.gov/sites/default/files/publications/OSHA3767.pdf>
- 756 31. Centers for Disease Control and Prevention; National Center for Emerging and Zoonotic Infectious  
758 Diseases; Division of Healthcare Quality Promotion. Guidelines for Environmental Infection Control in  
759 Health-Care Facilities. Updated July 23, 2019. Accessed October 13, 2023.  
<https://www.cdc.gov/infectioncontrol/guidelines/environmental/index.html>
- 760 32. Centers for Disease Control and Prevention; National Center for Emerging and Zoonotic Infectious  
762 Diseases; Division of Healthcare Quality Promotion. Guideline for Disinfection and Sterilization in  
763 Healthcare Facilities. Updated May 24, 2019. Accessed October 13, 2023.  
<https://www.cdc.gov/infectioncontrol/guidelines/disinfection/index.html>
- 764 33. ASHRAE. Standards and Guidelines. Accessed October 13, 2023. <https://www.ashrae.org/technical-resources/standards-and-guidelines>
- 765 34. Healthcare Infection Control Practices Advisory Committee. Consideration for Use of Enhanced Barrier  
766 Precautions in Skilled Nursing Facilities. Updated July 28, 2021. Accessed October 13, 2023.  
<https://www.cdc.gov/hicpac/workgroup/EnhancedBarrierPrecautions.html>
- 767 35. Lydecker AD, Osei PA, Pineles L, et al. Targeted gown and glove use to prevent *Staphylococcus aureus*  
768 acquisition in community-based nursing homes: A pilot study. *Infect Control Hosp Epidemiol.* Apr  
769 2021;42(4):448-454. doi:10.1017/ice.2020.1219
- 770 36. Mody L, Gontjes KJ, Cassone M, et al. Effectiveness of a Multicomponent Intervention to Reduce  
771 Multidrug-Resistant Organisms in Nursing Homes: A Cluster Randomized Clinical Trial. *JAMA Netw Open.*  
772 Jul 1 2021;4(7):e2116555. doi:10.1001/jamanetworkopen.2021.16555
- 773 37. Mody L, Krein SL, Saint S, et al. A targeted infection prevention intervention in nursing home residents  
774 with indwelling devices: a randomized clinical trial. *JAMA Intern Med.* May 2015;175(5):714-23.  
775 doi:10.1001/jamainternmed.2015.132
- 776 38. Blanco N, Pineles L, Lydecker AD, Johnson JK, Sorkin JD, Morgan DJ, Roghmann MC. Transmission of  
777 Resistant Gram-Negative Bacteria to Health Care Worker Gowns and Gloves during Care of Nursing  
778 Home Residents in Veterans Affairs Community Living Centers. *Antimicrob Agents Chemother.* Oct  
779 2017;61(10)doi:10.1128/aac.00790-17
- 780 39. Pineles L, Morgan DJ, Lydecker A, et al. Transmission of methicillin-resistant *Staphylococcus aureus* to  
781 health care worker gowns and gloves during care of residents in Veterans Affairs nursing homes. *Am J*  
782 *Infect Control.* Sep 1 2017;45(9):947-953. doi:10.1016/j.ajic.2017.03.004
- 783 40. Furuno JP, Krein S, Lansing B, Mody L. Health care worker opinions on use of isolation precautions in  
784 long-term care facilities. *Am J Infect Control.* Apr 2012;40(3):263-6. doi:10.1016/j.ajic.2011.03.019
- 785 41. Bar-Yoseph H, Hussein K, Braun E, Paul M. Natural history and decolonization strategies for  
786 ESBL/carbapenem-resistant Enterobacteriaceae carriage: systematic review and meta-analysis. *Journal*  
787 *of Antimicrobial Chemotherapy.* 2016;71(10):2729-2739. doi:10.1093/jac/dkw221
- 788 42. Chiew CJ, Ho HJ, Win MK, Tan A, Lim JW, Ang B, Chow A. Persistence of methicillin-resistant  
789 *Staphylococcus aureus* carriage in re-admitted patients. *Journal of Hospital Infection.* 2018/11/01/  
790 2018;100(3):350-354. doi:<https://doi.org/10.1016/j.jhin.2018.04.001>
- 791 43. U.S. Department of Labor; Occupational Safety and Health Administration. Occupational Safety and  
792 Health Standard 1910.504: Mini Respiratory Protection Program. Updated June 21, 2021. Accessed  
793 October 23, 2023. <https://www.osha.gov/laws-regulations/regulations/standardnumber/1910/1910.504>
- 794 44. Lindsley WG, Blachere FM, Law BF, Beezhold DH, Noti JD. Efficacy of face masks, neck gaiters and face  
795 shields for reducing the expulsion of simulated cough-generated aerosols. *Aerosol Sci Technol.* Jan 7  
796 2021;55(4):449-457. doi:10.1080/02786826.2020.1862409

- 800 45. Wang Y, Tian H, Zhang L, et al. Reduction of secondary transmission of SARS-CoV-2 in households by face  
801 mask use, disinfection and social distancing: a cohort study in Beijing, China. *BMJ Glob Health*. May  
802 2020;5(5)doi:10.1136/bmjh-2020-002794  
803 46. Carrat F, Vergu E, Ferguson NM, Lemaitre M, Cauchemez S, Leach S, Valleron AJ. Time lines of infection  
804 and disease in human influenza: a review of volunteer challenge studies. *Am J Epidemiol*. Apr 1  
805 2008;167(7):775-85. doi:10.1093/aje/kwm375  
806 47. Gopalakrishna G, Choo P, Leo YS, Tay BK, Lim YT, Khan AS, Tan CC. SARS transmission and hospital  
807 containment. *Emerg Infect Dis*. Mar 2004;10(3):395-400. doi:10.3201/eid1003.030650  
808 48. Muñoz FM, Ong LT, Seavy D, Medina D, Correa A, Starke JR. Tuberculosis among adult visitors of children  
809 with suspected tuberculosis and employees at a children's hospital. *Infect Control Hosp Epidemiol*. Oct  
810 2002;23(10):568-72. doi:10.1086/501972  
811 49. Healthcare Infection Control Practices Advisory Committee. Meeting Minutes. Updated September 8,  
812 2023. Accessed October 13, 2023. <https://www.cdc.gov/hicpac/minutes.html>
- 813