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ONE MINUTE CONSULT

BRIEF ANSWERS TO SPECIFIC CLINICAL QUESTIONS

# Q: What mask should I wear to protect against transmissible acute respiratory infections?

**A:** Clinical trials have not shown any direct advantage to using an N95 respirator compared with a surgical mask for many acute respiratory infections. Until further evidence is available, current guidelines recommend wearing a surgical mask when caring for patients who have respiratory infections with droplet transmission and a respirator for those with airborne transmission, except for the emerging infection of COVID-19 in which guidelines regarding mask use are still evolving.

*See COVID-19 Curbside Consults: www.ccjm.org*

**Guidelines on personal protective equipment and COVID-19 are still evolving**

Healthcare workers are routinely exposed to respiratory infections that can be transmitted to other patients and develop into a cluster or outbreak of healthcare-acquired respiratory infections.[1] Healthcare personnel are both a vulnerable population and a potential vector for transmission, which was evident during the epidemics of severe acute respiratory syndrome (SARS) and influenza H1N1 ("swine flu").[2] The subject is even more timely with worldwide concern about protection against the recent pandemic of coronavirus disease 2019 (COVID-19).[3,4]

## ROUTES OF TRANSMISSION

Different classes of pathogens, including viruses, bacteria, fungi, parasites, and prions, can be transmitted by one or more routes, depending on the type of organism. There are 3 principal routes of transmission: contact, droplet, and airborne.

**Contact transmission** is further classified as either *direct contact*, in which infection spreads from an infected person to another without an intermediary object or person, and *indirect contact*, in which the agent is transmitted through an intermediate object or person on which pathogens have been deposited.[5,6]

**Droplet transmission** occurs when pathogens hitch a ride in droplets, usually traveling directly from the respiratory tract of the infectious person by coughs or sneezes over short distances (≤ 3 feet around the patient) to the mucous membranes of other individuals, or landing on surfaces of objects and then being transferred to the mucous membranes of other individuals by contaminated hands. This route of transmission is seen with infections such as *Bordetella pertussis*, influenza, and SARS-associated coronavirus.[7]

**Airborne transmission** involves smaller pathogen-bearing particles (or naked pathogens themselves), which can remain suspended in air longer and travel farther. The World Health Organization uses a 5-µm cutoff for infectious particle size to differentiate between airborne (≤ 5 µm) and droplet transmission (> 5 µm).[8,9] This type of transmission can be further classified:

*Obligate airborne transmission* means that disease occurs only though inhalation of small particles, such as with pulmonary tuberculosis.

*Preferential airborne transmission* means the disease has multiple routes of transmission but is predominantly transmitted by inhalation of aerosolized particles, such as in measles and varicella.

*Opportunistic airborne transmission* occurs when the agent usually causes infection by other routes, but under special circumstances can be

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transmitted by the airborne route, as highlighted in the Amoy Gardens experience in Hong Kong during the 2003 SARS epidemic.[5,6,10]

As for COVID-19, the US Centers for Disease Control and Prevention (CDC) states that transmission results from close contact with an infected person (within about 6 feet) through respiratory droplets produced when the infected person coughs or sneezes. It is also possible that infection happens by touching a contaminated surface or an object and then touching the mucous membranes of the nose, mouth, or eyes.[3]

## PERSONAL PROTECTIVE EQUIPMENT

Nonpharmacologic interventions, including personal protective equipment, are urged to decrease transmission of disease, especially if the disease has no vaccine or treatment. These include wearing surgical masks, respirators, gloves, and gowns. The CDC recommends that patients presenting with signs and symptoms of respiratory infections adhere to handwashing and cough etiquette, including covering the mouth when coughing and using disposable tissues. These measures have been shown in several clinical trials to be specifically effective and crucial in respiratory infection control, particularly when used with face masks.[5,11]

However, the evidence is still limited on the effectiveness of personal protective equipment in healthcare settings for preventing the spread of infections, as studies of their efficacy are inherently challenging to do, in part because of the need to recruit enough patients to have statistical power to evaluate efficacy for low-incidence outcomes. Another difficulty is that people don't always use their personal protective equipment; for example, rates of adherence to using eye protection in the setting of direct droplet transmission range between 10% and 84%.[12–14] This highlights the need for clinical trials assessing the overall efficacy of personal protective equipment and the best equipment to limit the exposure of healthcare workers to acute respiratory infection.[15]

N95 respirators are so named because they are certified to filter out 95% of airborne particles larger than 0.3 µm, but not oil. They have been found to be better than surgical masks in laboratory studies,[5] but this has not been translated into a clinical advantage, and clinical trials conclude that evidence remains insufficient to determine whether N95 respirators are superior to surgical masks in protecting healthcare personnel against transmissible acute respiratory infections in clinical settings.[13,16–21] In addition, N95 respirators have the disadvantages of being uncomfortable and possibly impractical for regular use, especially in low-resource settings, as they require fit-testing, regulation, and certification.[22]

These factors led to conflicting recommendations regarding the best mask to use to prevent the different respiratory infections. Therefore, guidelines for personal protective equipment and the type of masks recommended to be used to prevent exposure to respiratory viruses in healthcare settings were published by the CDC in 2007 for standard practice among physicians.[5]

## EVOLVING GUIDELINES ON COVID-19

Guidelines on the use of personal protective equipment in caring for patients with confirmed or suspected COVID-19 are still evolving.

The CDC[23] currently recommends placing all patients with confirmed or suspected COVID-19 in single rooms with doors closed. Healthcare workers who enter rooms of patients with suspected or confirmed COVID-19 should adhere to standard precautions, which include hand hygiene and wearing gloves, gowns, and eye protection.

**For COVID-19, an N95 is preferred, but a surgical mask is acceptable for routine care**

Both the N95 mask (or higher respirators) and surgical masks are acceptable for routine care of these patients; however, respirators are preferred. Respirators must be used when performing an aerosol-generating procedure.

Recommendations regarding donning and doffing of personal protective equipment have also been established to decrease spreading of the virus. It is preferred to discard the respiratory mask after exiting the patient's room with performing hand hygiene after discarding the mask. However, due to the current shortage of respiratory masks, it is now acceptable to reuse the same respiratory mask to assess different patients or for more than one encounter.

Further, updated guidelines were recently published regarding isolation precautions in the setting of diagnosed or suspected COVID-19,

including the aforementioned standard precautions, placing patients in a single-patient room with negative pressure, and using personal protective equipment that includes gloves, gowns, eye protection, and masks.[23] The CDC currently recommends using respirators that are at least as protective as a fit-tested N95.[3,5]

## EXISTING EVIDENCE

In 2009, after the emergence of the first influenza epidemic in years, recommendations stated that respirators are needed when caring for any patient infected with H1N1 pandemic strain. These recommendations came as a part of drastic measures taken to limit exposure to the infection until it was clear whether the H1N1 strain was transmitted by the usual routes, the same as seasonal influenza. Later, medical masks were recommended in most settings for all types of influenza, as it appeared they had the same routes of transmission.[24]

Guidelines for infection control from the CDC and World Health Organization include measures for reducing respiratory infection transmission in healthcare settings, with hand hygiene and cough etiquette as part of standard precautions being the key components. Personal protective equipment, including surgical masks, is recommended for routine care in patients infected with influenza, while an N95 respirator or a higher-level protection is recommended when performing aerosol-generating procedures (eg, intubation, bronchoscopy, suctioning) in those patients.[24,25]

Furthermore, the CDC recommended N95 respirators as a part of personal protective equipment for severe infections such as smallpox and SARS, despite lack of data on the efficacy of these masks in real-world settings. Contact precautions including personal protective equipment (such as gowns and gloves), protection of equipment, environmental control, and patient placement and transport were also recommended by the CDC in certain infections and in immunocompromised patients and others at high risk.[5,24]

Many clinical trials since then have compared the efficacy of surgical masks with that of N95 respirators in preventing transmission of influenza in healthcare settings.[16,18]

Loeb and colleagues[16] reported that surgical masks were noninferior to N95 respirators in protecting against laboratory-confirmed influenza.[16] McIntyre et al[18] found no difference between surgical masks and N95 respirators against influenza during the 2008–2009 influenza season.

Radonovich et al[15] reported the results of the Respiratory Protection Effectiveness Clinical Trial, a randomized, multicenter pragmatic clinical trial comparing surgical masks vs respirators in the outpatient setting, that showed no significant difference between the effectiveness of N95 respirators and surgical masks in preventing laboratory-confirmed influenza among participants who are routinely exposed to respiratory illnesses in the workplace. In addition, there were no significant differences between N95 respirators and surgical masks in the rates of acute respiratory illness, laboratory-detected respiratory infections, laboratory-confirmed respiratory illness, and influenza-like illness among participants.[15]

Smith et al[14] conducted a meta-analysis reviewing clinical trials that compared N95 respirators and surgical masks for preventing transmissible acute respiratory infections. Their analysis included 6 clinical studies (3 randomized controlled trials, 1 cohort study, and 2 case-control trials) and 23 surrogate exposure studies. This study reported no significant difference in risk of respiratory infection transmission to patients from healthcare workers using N95 respirators vs surgical masks. The surrogate exposure studies showed N95 respirators to be superior to surgical masks under laboratory testing.[14,16,19]

**Research has not shown a direct advantage to using an N95 respirator compared with a surgical mask for many acute respiratory infections**

## THE MESSAGE

Clinical trials have not shown a direct advantage to using an N95 respirator compared with a surgical mask for many acute respiratory infections. Thus, healthcare workers should adhere to the current CDC recommendations on standard precautions, including handwashing, cough etiquette, and wearing a surgical mask to prevent respiratory infections with droplet transmission—and an N95 for agents or scenarios where airborne transmission may occur. Healthcare providers are also encouraged to follow updated CDC recommendations regarding protection against emerging infections such as COVID-19.

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