American College of Emergency Physicians (ACEP) Covid Field Guide. https://www.acep.org/corona/covid-19-field-guide/work-safety/aerosolization/

Aerosolization

Work Safety

Transmission

COVID-19 is thought to spread mainly through close contact from person to person, including between people who are physically near each other (<6 ft). Asymptomatic carriers can also spread the virus to others.

COVID-19 spreads very easily from person to person

- The virus that causes COVID-19 appears to spread more efficiently than influenza but not as efficiently as measles, which is among the most contagious viruses known to affect people.

COVID-19 most commonly spreads during close contact

- People who are physically near (<6 feet) a person with COVID-19 or have direct contact with that person are at greatest risk of infection.
- Infections occur mainly through exposure to respiratory droplets when a person is in close contact with someone who has COVID-19. Respiratory droplets cause infection when they are inhaled or deposited on mucous membranes, such as those that line the inside of the nose and mouth.

COVID-19 can sometimes be spread by airborne transmission

- Some infections can be spread by exposure to the virus in small droplets and particles that can linger in the air for min to hrs. These viruses may be able to infect people who are >6 ft away from the person who is infected or after that person has left the space.
- There is evidence that under certain conditions, people with COVID-19 seem to have infected others who were >6 ft away. These transmissions occurred within enclosed spaces that had inadequate ventilation.
- Under these circumstances, scientists believe that the amount of infectious smaller droplets and particles produced by the people with COVID-19 became concentrated enough to spread the virus to other people. The people who were infected were in the same space during the same time or shortly after the person with COVID-19 had left.

COVID-19 spreads less commonly through contact with contaminated surfaces

- Contamination of surfaces with droplets of the COVID-19 virus is possible and may persist for hours, and potentially days (see the field guide section entitled "COVID-19 Aerosol and Surface Stability")

COVID-19 rarely spreads between people and animals

- It appears that the virus that causes COVID-19 can spread from people to animals in some situations. CDC is aware of a small number of pets worldwide, including cats and dogs, reported to be infected with the virus that causes COVID-19, mostly after close contact with people with COVID-19.
- At this time, the risk of COVID-19 spreading from animals to people is considered to be low.

More information can be found in the CDC Guidance on How Coronavirus Spreads.

Metered-dose inhalers versus nebulization

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Given the risk of aerosolization of the virus, increasing the exposure risk to health care workers or other patients, nebulized medications should be avoided. Respiratory medications should be administered as metered-dose inhalers (MDIs).

BiPAP and CPAP

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Both BiPAP and CPAP are controversial in patients with COVID-19. The concern is that noninvasive positive-pressure ventilation (NIPPV) could theoretically increase aerosolization of the virus, increasing the exposure risk to health care workers or other patients. Additionally, experience with prior viral pneumonias has demonstrated a high failure rate of approximately 60% to 80%. Lastly, there are concerns that patients with acute respiratory distress syndrome (ARDS) may have large, unchecked tidal volumes on NIPPV, resulting in lung-injurious ventilation. The potential benefits of avoiding intubation are obvious for the individual patient. When also considering ventilators as a scarce resource, a prevented intubation can result in better resource allocation. While many institutions are not promoting NIPPV at this time, its use has been supported by the Society of Critical Care Medicine, with caveats. If NIPPV is used, patients must be monitored carefully,

and intubation should not be delayed if there are any signs of worsening. However, there is insufficient evidence to recommend CPAP or BiPAP.

High-flow nasal oxygen

Article summary: respiratory support for adult patients with COVID-19

Whittle JS, Pavlov I, Sacchetti AD, Atwood C, Rosenberg MS. Respiratory support for adult patients with COVID-19. *JACEP Open*. Published 2020 Apr 2. doi:10.1002/emp2.12071

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High-flow nasal oxygen (HFNO) includes high-flow nasal cannula (HFNC) and high-velocity nasal insufflation. The use of HFNO has been associated with lower mortality in hypoxemic respiratory failure.[1] Compared to conventional oxygen therapy, HFNO is associated with decreased risk of subsequent intubation (RR 0.85, 95% CI 0.74-0.99)[2] and need for ICU admission.[3,4] Initial concern existed on the risk of aerosolization with HFNO, leading some to recommend avoiding use of this modality. However, the degree of aerosolization has been shown to be minimal with these devices, and it is now recommended as the oxygenation therapy of choice in patients with respiratory distress (**Figure 3.3**). Guidelines from the WHO,[5] the Italian Thoracic Society,[6] the Respiratory Care Committee of the Chinese Thoracic Society,[7] and The Australian and New Zealand Intensive Care Society;[8] a joint statement from the German intensive care, anesthesia, and emergency medicine societies;[9] and the joint guidelines produced by the European Society of Intensive Care Medicine and The Society of Critical Care Medicine[10] all recommend HFNO as a therapy for COVID-19 respiratory failure. Recent publications suggest that newer HFNO and NIPPV systems with good interface fitting do not create widespread dispersion of exhaled air and therefore may be associated with low risk of airborne transmissions.[5,8]

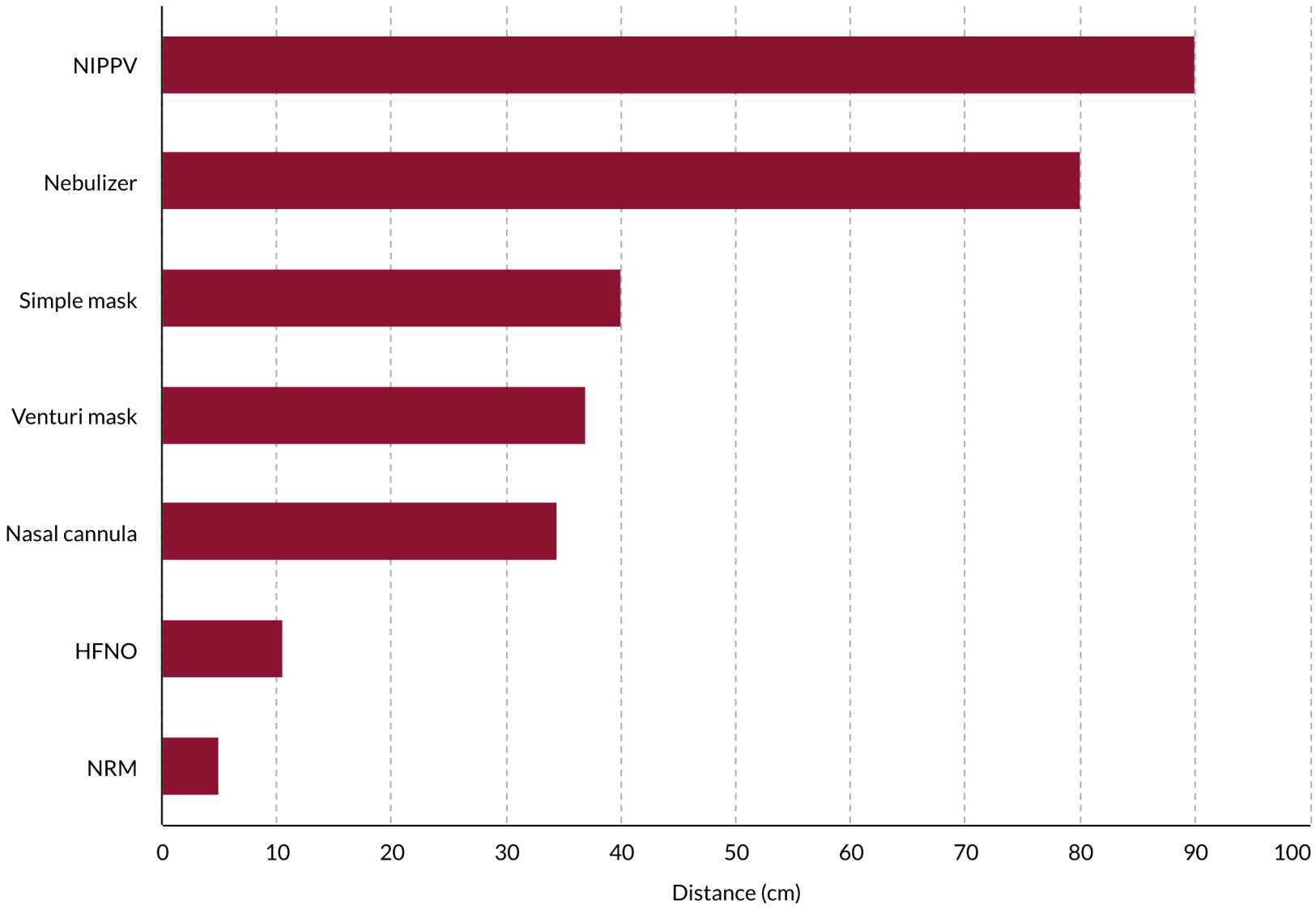
A high-fidelity mannequin study demonstrated that even at the highest setting of 60 L/ min, exhaled air dispersion was 17 cm in a healthy lung scenario and 4.8 cm in a severely diseased lung scenario.[11] Some guidelines recommend placement of a surgical mask over patients being treated with high-flow therapies as a secondary safety measure.[9] High-fidelity human mannequin simulation studies show surgical masks do, in fact, reduce exhaled air dispersion.[12] If HFNO oxygen therapy is used, medical staff should use airborne protection, and the patient should be treated in a negative-pressure room, if available.[5,8]

Newer data also support the safety of high-flow oxygen therapies. A recent study was published evaluating computational fluid dynamic simulation and a different model of high-flow oxygen therapy.[13] It demonstrated that a patient treated with high-flow oxygen therapy at maximal settings with a surgical mask placed over the face generated an aerosol dispersion cloud similar to a patient with tidal breathing.[13]

There is no currently published evidence that HFNO is a risk factor for nosocomial transmission of respiratory pathogens.[14,17] During the 2003 Toronto SARS-CoV outbreak, HFNO was not found to be a risk factor for transmission to health care workers.[17] This is in contrast to endotracheal intubation, which was strongly associated with transmission to health care workers during the SARS epidemic.[18]

There are currently no defined criteria for HFNO failure, but patients who require vasopressor support[17] and whose respiratory rate and thoracoabdominal asynchrony are not rapidly relieved with HFNO[19] are potentially at high risk of HFNO failure. Recently, the "ROX Index" was developed to aid in the prediction of clinical outcomes of patients treated with HFNO. It is calculated by the ratio of oxygen saturation, as measured by pulse oximetry/FiO_2 to respiratory rate. A ROX Index >4.88 is predictive of success, meaning the patient is unlikely to progress to needing mechanical ventilation.[20] Patients with established ARDS should move rapidly to mechanical ventilation and treated per published recommendations.[21,22]

Figure 3.3 Comparison of aerosol dispersion differences, using various treatment modalities.


NIPPV
Nebulizer
Simple mask
Venturi mask
Nasal cannula
HFNO
NRM
0
10
20
30
40
50
60
70
80
90
100
Distance (cm)

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Article Summary: DoD COVID-19 practice management guide regarding high-flow nasal cannula in the clinical management of severe COVID-19

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To consolidate resources and optimize the management of patients requiring clinical care during the global COVID-19 pandemic, selected information from the practice management guide regarding HFNC is listed here. Refer to the full document cited above for a detailed rationale and complete list of references.