Information regarding SARS-CoV-2 and hospital air quality.

Introduction

SARS-CoV-2, also known as COVID-19, is a novel coronavirus which originated in China in late 2019. Since that time, is has grown into a global pandemic, causing pneumonia and respiratory failure in certain patient populations. The virus can be spread via direct contact, respiratory droplet, feces, and bioaerosol.

Can SARS-CoV-2 be transmitted via an airborne route?

Yes. SARS-CoV-2 has been shown to be transmitted through the air in several studies. This can result from respiratory droplets from patient sneezing and coughing and as smaller bioaerosols.

What is the difference between respiratory droplets and bioaerosols?

Respiratory droplets are larger than bioaerosols. Respiratory droplets tend to be greater than 5-10 microns in diameter, and result from coughing or sneezing by an infected patient. Standard N95 masks are able capture most of these large droplets. Respiratory droplets, because of their relatively large size and mass, tend to fall to the ground within a few minutes. In contrast, bioaerosols are smaller than 5 microns in diameter, and result from normal talking or breathing by an infected patient. Bioaerosols can linger in the air for prolonged periods- hours or even days. Bioaerosols are potentially more dangerous than larger droplets because they can be inhaled more deeply into the lungs with normal respiration.

Can SARS-CoV-2 be transmitted by bioaerosols?

A growing body of research demonstrates that SARS-CoV-2 does exist in bioaerosols and can persist in the air for up to three hours in care settings. Recent studies from the University of Nebraska conclude that disease spread through indirect contact with bioaerosols have occurred.[1] The National Academy of Sciences concludes: “the results of available studies are consistent with aerosolization of virus from normal breathing.[2]”

Are hospital care areas potentially contaminated with airborne SARS-CoV-2 bioaerosols?

Care areas containing SARS-CoV-2 patients are likely to have airborne contamination with bioaerosols. Studies from the US and China have detected the presence of persistent airborne virus in patient rooms, bathrooms, hallways medical service areas and caregiver changing areas.[3] There is additional concern in areas where bioaerosol generating procedures, such as bag-valve ventilation, intubation, administration of nebulized medicines and bronchoscopy are performed.

What can be done to increase environmental safety in the presence of airborne SARS-CoV-2?

The best way to increase safety is to treat SARS-CoV-2 as a bioaerosolized pathogen and use airborne isolation precautions. This includes the use of negative pressure rooms, respirators, maintaining high levels of air exchange, maximizing fresh air where possible and using HEPA filtration.

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What is the role of portable air disinfection units during the SARS-CoV-2 response?

We recommend following the published CDC "Guidelines for Environmental Infection Control in Health Care Facilities," updated July 2019.[4] For patients with SARS-CoV-2 infection, the gold standard is a total negative pressure isolation. However, in a pandemic situation, negative pressure rooms may not be available or practical. In such cases, portable units, containing HEPA filtration can be utilized to:

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- Provide increased air exchange where fresh air recirculation is limited
- Augment areas with low air exchange rates
- Create anterooms or transition areas to infection isolation rooms
- Provide regional air disinfection following aerosol-generating procedures

A new technical report from the European Centre for Disease Prevention and Control (ECDC) indicates that in rooms where aerosol-generating procedures (AGP) have been performed (bag-valve ventilation, intubation, administration of nebulized medicines, bronchoscopy, etc.), high-efficiency particulate air (HEPA) filtration should be used for the recycled air, including "using a portable HEPA air filtration system placed in close proximity to where the patient was located.[5]"

What options are available for facilities which want to adopt portable air disinfection units?

High efficiency particle arrestance (HEPA) filtration has been the gold-standard for biological air filtration for decades. Various commercial-grade HEPA filtration systems are available. Facilities should ensure that devices provide adequate filtration capacity (minimum 99.95%) and air exchange rate. Systems should include adequate prefiltration in addition to HEPA filtration in order to reduce the risk of internal contamination. Prefilters should be easily accessible and changed often. Residential-grade systems should never be used, since they have poor quality assurance and performance. Certain systems include internal ultraviolet germicidal irradiation to provide additional deactivation of viruses and prevent device contamination.

Which air disinfection systems have been shown to effectively eliminate viral bioaerosols?

HEPA-ultraviolet air recirculation units manufactured by Aerobiotix units are wheeled, free-standing air decontamination devices which provide HEPA filtration and ultraviolet germicidal irradiation to the airstream. These devices have undergone independent testing demonstrating 100% inactivation efficiency in viral single-pass testing, using MS2 virus at 450 cubic feet of air per minute. This testing was performed by the Research Triangle Institute and reviewed by the FDA in 2018.[6] Coronaviruses are larger and more radiosensitive than MS2, making them potentially more vulnerable to ultraviolet and mechanical filtration than the MS2 test organism.

References

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