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## Home Use Guidance for Aerosol-Generating Procedures During the Coronavirus Disease 2019 Pandemic

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## A B S T R A C T

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From the early days of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic, there were concerns that nebulizers used for the treatment of respiratory diseases as aerosol-generating devices could enhance the transmission of SARS-CoV-2. However, given the absence of any compelling data showing that nebulized treatments increase the risk of SARS-CoV-2 infection, it is unnecessary for community-dwelling patients with respiratory diseases to alter their current therapies, including nebulized treatments, to prevent symptom exacerbations. Maintaining current inhaled therapies also minimizes the risk of hospitalization and hospital-acquired infection of SARS-CoV-2.

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The first human case of coronavirus disease 2019 (COVID-19) emerged in December 2019 and was found to be caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Although we have learned much about the transmission of SARS-CoV-2 since the start of this pandemic, there are still widespread misconceptions regarding how the virus is spread. SARS-CoV-2 is transmitted primarily by airborne respiratory droplets. From the early days of the pandemic, there were concerns that nebulizers, such as aerosol-generating devices, could enhance the transmission of SARS-CoV-2.<sup>1</sup>

A limited number of studies have investigated the risk of coronavirus spread by aerosol-generating treatments. After the 2002 and 2003 SARS-CoV outbreaks, a 2004 study of a patient with SARS-CoV who was being administered treatment with a large-volume nebulizer found no evidence of coronavirus-specific nucleic acids in air samples taken from the area near the patient.<sup>2</sup> A 2012 report of 3 cohort studies investigating coronavirus transmission to health care workers did not find elevated risk of SARS-CoV transmission to personnel involved in the care of patients undergoing nebulizer treatment.<sup>3</sup> A recent systematic review assessing the risk of SARS-CoV-2, SARS, Middle East respiratory syndrome, and influenza transmission after the administration of medications via nebulizer failed to find conclusive evidence that nebulized treatments increase the transmission of coronaviruses.<sup>4</sup> Although data are still being gathered on the transmission and pathogenesis of SARS-CoV-2, there are no compelling data at present that suggest alteration of treatments for patients at home using nebulized treatments.

Apprehension regarding the use of nebulized treatments likely stems from concerns that nebulizer use by people with COVID-19

may enhance the aerosolization and dispersion of virus particles, thereby endangering caregivers or other bystanders in the vicinity by increasing SARS-CoV-2 exposure.<sup>1,5</sup> However, people with chronic respiratory diseases, such as asthma and chronic obstructive pulmonary disease (COPD), are advised to keep their symptoms under control with maintenance therapies, which may include regular or intermittent use of nebulized therapy.<sup>6</sup> This is sound advice, given that nonadherence to prescribed respiratory medications results in disease instability and poor clinical control.<sup>7</sup> Loss of respiratory disease control can lead to exacerbations and subsequent hospitalization, which substantially raises the risk of exposure to health care-associated infections of SARS-CoV-2.

Nebulizers and handheld devices such as metered dose inhalers (MDIs) and dry powder inhalers (DPIs) are commonly used in treating patients with respiratory disease at home and in school settings. Patients may be concerned about the perceived risk of SARS-CoV-2 transmission via aerosol-generating therapies, such as nebulization, and may feel the need to switch from nebulized treatments to handheld devices for the delivery of their medications. A sudden change from nebulized treatments to handheld devices can result in poor adherence to medication, which occurs when patients have insufficient knowledge about the correct administration technique required for their new device or when they need to use multiple devices (MDI and DPI) that require different inhalation techniques.<sup>7</sup> In other cases, they may be unable to derive all the benefits of inhaler therapy because of poor hand-mouth coordination or other hindrances that prevent the correct use of handheld devices. Additionally, the inpatient use of MDIs has risen steeply as an alternative to nebulized treatment. Initially, this resulted in critical shortages of MDIs for outpatient disease

management.<sup>8,9</sup> Thus, there are many cases in which nebulized treatments may remain the only option in preventing severe respiratory exacerbations.

The use of nebulized treatments does not conflict with guidance from independent professional organizations and governmental infection prevention recommendations. For instance, the Global Initiative for Chronic Obstructive Lung Disease 2022 Report advises that patients with COPD maintain their regular therapy and recommends nebulizers for those who need them and MDIs for patients who are suited for them.<sup>10</sup> Similar guidance is provided by agencies within the United States, such as the Minnesota Department of Health<sup>11</sup> and in a report prepared for the US Department of Veterans Affairs.<sup>4</sup> In the United Kingdom, guidance from the National Institute for Health and Care Excellence<sup>6</sup> recommends the continued use of nebulizers, because the administration of medication via nebulization is not considered a significant risk for SARS-CoV-2 infection.

UK Government guidance from the New and Emerging Respiratory Virus Threats Advisory Group (NERVTAG)<sup>12</sup> also notes that aerosol generated during the use of a nebulizer is not disseminated from the patient but generated from medication within the nebulizer chamber and, therefore, does not carry patient-derived viral particles. If a virus particle in the aerosol comes into contact with a patient's contaminated mucous membrane, it will not be airborne and will not be part of an aerosol.<sup>12</sup>

To mitigate the spread of infection, it is essential that nebulizers are designated for single-person use only and that medication is dispensed from sealed single-dose vials. Handling of the nebulizer and medication should be done aseptically, and the nebulizer must be cleaned, disinfected, or sterilized after each use.<sup>13</sup> Nebulization with a mouthpiece rather than a facemask reduces aerosol emissions. Placing a filter on the exhalation port of the nebulizer could further reduce dispersion of exhaled bioaerosols.<sup>13</sup> Additional measures to avoid exposure to other people in the vicinity are to use the nebulizer near open windows or in areas of increased air circulation.<sup>10</sup>

Given the current health care guidance and absence of any known data showing that nebulized treatments increase the risk of SARS-CoV-2 infection, community-dwelling patients should adhere to their current therapies, including nebulized treatments, to prevent symptom exacerbations and to minimize their risk of hospitalization and hospital-acquired infection of SARS-CoV-2.

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## References

1. Reyhler G, Vecellio L, Dubus JC. 'group Aerosoltherapy GAT' of the French Language Respiratory Society-Société de Pneumologie de Langue Française SPLF. Nebulization: a potential source of SARS-CoV-2 transmission. *Respir Med Res.* 2020;78:100778. <https://doi.org/10.1016/j.resmer.2020.100778>
2. Wan GH, Tsai YH, Wu YK, Tsao KC. A large-volume nebulizer would not be an infectious source for severe acute respiratory syndrome. *Infect Control Hosp Epidemiol.* 2004;25(12):1113-1115.
3. Tran K, Cimon K, Severn M, Pessoa-Silva CL, Conly J. Aerosol generating procedures and risk of transmission of acute respiratory infections to healthcare workers: a systematic review. *PLoS One.* 2012;7:e35797.
4. Goldstein KM, Ghadimi K, Mystakelis H, et al. Risk of transmitting coronavirus disease 2019 during nebulizer treatment: a systematic review. *J Aerosol Med Pulm Drug Deliv.* 2021;34(3):155-170.
5. Tang JW, Kalliomaki P, Varila TM, et al. Nebulisers as a potential source of airborne virus. *J Infect.* 2020;81:647-679.
6. National Institute for Health and Care Excellence. COVID-19 rapid guideline: community-based care of patients with chronic obstructive pulmonary disease (COPD). Published April 9, 2020. Accessed December 14, 2021. <https://www.nice.org.uk/guidance/ng168/resources/covid19-rapid-guideline-community-based-care-of-patients-with-chronic-obstructive-pulmonary-disease-copd-pdf-66141907467973>
7. George M, Bender B. New insights to improve treatment adherence in asthma and COPD. *Patient Prefer Adherence.* 2019;13:1325-1334. <https://doi.org/10.2147/PPA.S209532>
8. American College of Allergy, Asthma and Immunology. A message to asthma sufferers about a shortage of albuterol metered dose inhalers. April 9, 2020. Accessed December 14, 2021. <https://acaai.org/news/message-asthma-sufferers-about-shortage-albuterol-metered-dose-inhalers>
9. Cambridgeshire and Peterborough CCG Medicines Optimisation Team. Local supply issues—inhalers; salbutamol, ICS and ICS/LABA combinations. Accessed December 14, 2021. <https://www.cambridgeshireandpeterboroughccg.nhs.uk/EasySiteWeb/GatewayLink.aspx?allId=20589>
10. Global Initiative for Chronic Obstructive Lung Disease. 2022 GOLD report. Updated July 10, 2020. Accessed December 14, 2021. [https://goldcopd.org/wp-content/uploads/2021/11/GOLD-REPORT-2022-v1.0-12Nov2021\\_WMV.pdf](https://goldcopd.org/wp-content/uploads/2021/11/GOLD-REPORT-2022-v1.0-12Nov2021_WMV.pdf)
11. Minnesota Department of Health. Guidance for providing nebulization treatments. July 9, 2021. Accessed December 14, 2021. <https://www.health.state.mn.us/diseases/coronavirus/schools/nebulization.pdf>
12. Brighton and Sussex University Hospitals NHS Trust. Aerosol generating procedures. May 2, 2021. Accessed December 14, 2021. <https://www.bsuh.nhs.uk/library/documents/aerosol-generating-procedures-based-on-updated-phen-guidance-08-02-2021-v/>
13. Fink JB, Ehrmann S, Li J, et al. Reducing aerosol-related risk of transmission in the era of COVID-19: an interim guidance endorsed by the International Society of Aerosols in Medicine. *J Aerosol Med Pulm Drug Deliv.* 2020;33(6):300-304.

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