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The Air We Share: Guiding Inhaler Selection Today for a Sustainable Tomorrow

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Introduction

Climate change is currently the greatest global health threat.[1] As the planet experiences rising temperatures due to global warming, widespread health impacts are emerging, including extreme weather events, food insecurity due to droughts, and forced relocation of populations.[2] From a respiratory health perspective, patients with lung disease experience negative health consequences due to high temperatures, risks from heat-related illnesses, exposure to wildfire smoke that causes poor air quality, and increased severity and duration of pollen seasons.[2] The resulting health consequences contribute to increased use of healthcare services, which in turn generate their own contributions to healthcare pollution, thus further worsening the climate crisis.

In fact, the health sector contributes more than 5.2% of net global greenhouse gas emissions.[2] In Canada, healthcare activities are responsible for 4.6% of the country's total greenhouse gas emissions,[3] placing Canada's healthcare system among the top four emitters per capita by country.[4] In terms of the contributions of various healthcare sectors to greenhouse gas emissions, England's National Health Service (NHS) demonstrated that anesthetic gases and metered dose inhalers (MDIs) play a significant role;[5] MDIs alone contribute to 3.1% of the NHS's total healthcare emissions.[6] MDIs rely on hydrofluorocarbon (HFC) propellants to deliver medication, which act as potent greenhouse gases when released into the atmosphere. Depending on the formulation, one aerosol inhaler can have a carbon footprint equivalent to driving a gasoline-powered car up to 170 km.[7] In Canada, short-acting beta-agonist (SABA) inhalers constitute 71% of total inhaler use,[8] the majority of which are delivered via MDI devices. For these reasons, strategies that reduce the use of MDIs have the potential to reduce negative environmental consequences of respiratory care.

However, it is important to recognize that healthcare delivery itself contributes to greenhouse gas emissions, with significant contributions related to the healthcare supply chain and the infrastructure required to deliver care, such as energy use in buildings, waste generation, and water consumption.[5] The carbon footprint of healthcare increases with the intensity of services delivered; for example, a single admission to a critical care bed is estimated to produce approximately 90 times more greenhouse gas emissions compared with a routine physician office visit.[5,9] Thus, there are opportunities to reduce the impact of climate change on the environment through reducing overall healthcare needs.

While much attention has been given to preferentially selecting inhalers that have the potential to reduce greenhouse gas emissions, it is equally important to consider how optimal inhaler selection can improve respiratory disease control. By reducing SABA use, minimizing exacerbations, and decreasing healthcare encounters, appropriate inhaler choices can maximize patient outcomes while also delivering environmental co-benefits. With this in mind, the Canadian Thoracic Society (CTS) proposed several opportunities to reduce inhaler-related greenhouse gas emissions in its Position Statement on Climate Change and Choice of Inhalers for Patients with Respiratory Disease.[10] This article summarizes these considerations and outlines the Climate Conscious Inhaler Prescribing Sustainability Pathway provided by CASCADES and adapted by Green et al. (**Figure 1**), to support respirologists in prescribing practices that are both sustainable and optimize patient outcomes.[11]

Ensure the Correct Diagnosis

Studies have demonstrated that 30–60% of patients with physician-diagnosed chronic obstructive pulmonary disease (COPD) do not have the disease.[12] Similarly, 33% of patients with physician-diagnosed asthma lack objective evidence of asthma, yet 79% of these patients continued to use asthma medications.[13] For these reasons the CTS's Choosing Wisely statements encourage conscientious medication prescribing. This includes avoiding the continuation of asthma medications in individuals who have not demonstrated clear clinical benefit or confirmation of reversible airflow limitation, and by refraining from initiating long-term maintenance inhalers in stable patients with suspected COPD unless post-bronchodilator airflow obstruction has been confirmed with spirometry.[14] As respirologists, it is our duty to advocate for objective confirmation of respiratory disease to guide appropriate inhaler prescribing and use, and to consider discontinuing inhaled therapies when objective testing does not confirm disease and the patient has not derived clinical benefit.

Optimize Disease Control

Uncontrolled asthma is associated with increased healthcare resource utilization,[15] while overuse of SABA in patients with asthma is associated with increased rates of exacerbations and mortality.[16] It is therefore not surprising that patients with poorly controlled asthma are estimated to have a carbon footprint nearly three times higher than those whose asthma is well-controlled.[17] Thus, adherence to guideline recommendations that optimize disease management is key to reducing the carbon footprint of care. Notably, the Global Initiative for Asthma no longer recommends SABA-only treatment for adults and adolescents with asthma, citing evidence that SABA monotherapy increases the risk of severe exacerbations and asthma-related death.[18] Instead, it supports the use of symptom-driven or daily inhaled corticosteroid-containing controller treatment.[18] Meanwhile, an evaluation of budesonide/formoterol dry powder inhaler (DPI) showed a 95.8% reduction in carbon emissions compared to as-needed salbutamol delivered through MDI and a 93.6% reduction compared to a regimen of budesonide DPI plus as-needed salbutamol MDI.[19] These findings reinforce that adhering to guideline-recommended care not only improves patient outcomes but also has a positive environmental impact.

Similarly, patients with COPD who experienced two or more severe exacerbations contribute greenhouse gas emissions up to 7-fold higher than those without exacerbations.[20] The 2023 CTS Guideline on Pharmacotherapy in Patients with Stable COPD and the 2025 Global Initiative for Chronic Obstructive Lung Disease (GOLD) Report both provide management recommendations to reduce exacerbations through escalation of inhaled therapies in accordance with symptoms and exacerbation risk.[21,22] Inhaled triple therapy combinations have been shown to reduce all-cause mortality, and both guidelines recommended delivering combination therapy using a single inhaler

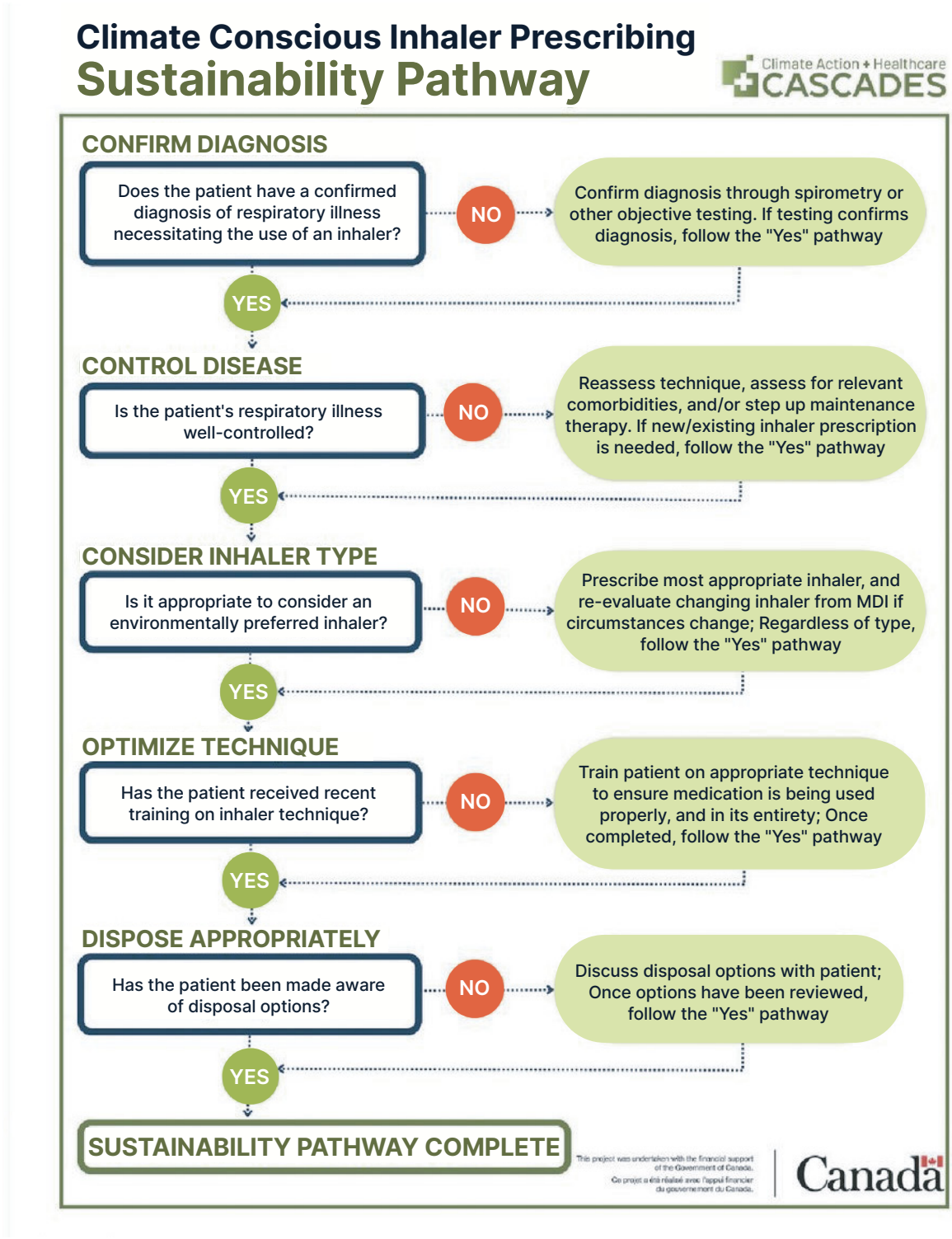

Figure 1. Strategies for Respirologists to Reduce Carbon Emissions Associated with Inhalers; *adapted from CASCADES' Concious Inhaler Prescribing in Outpatient Care, version 3.0;* https://cascadescanada.ca/resources/sustainable-inhaler-prescribing-in-primary-care-playbook *(CC BY-NC-SA 4.0).*

instead of multiple inhalers when possible.[21,22] This approach simplifies treatment and also reduces the overall number of dispensed inhalers, offering an added environmental co-benefit. As such, adhering to guideline-recommended therapy improves patient care outcomes while also reducing the environmental footprint related to the disease. Respirologists play an important role in optimizing disease control and educating both patients and referring providers on guideline-based care.

Choose Inhalers Wisely

As outlined in the CTS Position Statement and the accompanying Choosing Wisely statement, once a respiratory diagnosis is confirmed and inhaler therapy is indicated, providers can decrease the environmental footprint of care by prioritizing inhalers that generate lower greenhouse gas emissions when initiating new controller or rescue therapy.[10] DPIs and soft mist inhalers have a carbon footprint approximately ten times lower than that of MDIs.[23] Many medications available in MDIs are also offered in alternative inhaler forms within the same drug class and are often preferred by patients.[24,25] Recognizing that MDIs remain necessary and important for specific patient populations, including children, older adults, and those with concerns about adequate medication delivery using non-MDI devices, providers can select MDIs that use lower-impact greenhouse gas propellants (HFC-134a rather than HFC-227ea) or those with smaller metered valves that deliver a lower volume of HFCs (e.g., Teva-Salbutamol or Airomir) to reduce emissions.[10,26]

What the CTS Position Statement emphasizes, but is not always considered in practice, is that the decision to preferentially select inhalers that have a lower carbon footprint is contingent on shared decision-making with the patient. This includes consideration of key factors impacting adherence, including patient preference, cost, ease of use, and inhaler technique.[10] As such, automatic switching from MDIs to alternative inhalers is not recommended without careful consideration of the potential impact on the patient's ability to use the medication and timely reassessment of disease control. Respirologists should advocate for prescribing the inhaler that best controls the patient's underlying disease regardless of device type, while also considering opportunities to preferentially select lower-emission inhalers when all other factors are equal.

Optimize Inhaler Technique

It is well-known that inhalers are frequently used incorrectly, and that inhaler misuse is associated with poor disease control.[27,28] For MDIs, errors often occur in the context of poor synchronization of actuation with inhalation.[26] Ensuring proper inhaler technique, through frequent education and encouraging the use of spacers with MDIs, can improve drug delivery, ensure better disease control, reduce overuse of SABAs, lower exacerbation rates, and decrease greenhouse gas emissions.[10,28,29] Respirologists should routinely verify inhaler technique with their patients and engage allied health professionals in providing continuous patient education.

Dispose Appropriately

There is ongoing recognition that disposing of inhalers in landfills is problematic. The plastic components degrade poorly, and the HFC propellants used in MDIs are potent greenhouse gases. Unfortunately, MDI devices are often disposed before they are fully used, either because they are expired, no longer needed, or if patients are unable to determine if the inhaler is empty, particularly when embedded dose counters are absent. A study from the UK found that 75% of MDIs without dose counters were discarded before they were empty, with one-third containing >50% of their original doses.[30] Surveys conducted in both British Columbia and the United Kingdom have revealed that only a minority of respondents return empty inhalers to local pharmacies for disposal, with the majority disposing them in household waste.[30,31] Meanwhile, many hospitals send inhalers for incineration with other medical waste. These practices identify a need for more accessible and sustainable approaches to inhaler recycling. Companies such as 'Go Zero' facilitate sustainable recycling through the provision of recycling boxes for inhalers and their associated materials.[32] Once collected, recycled MDIs are disassembled into

various components, such that plastics and metals are recycled and any remaining propellants or medications are extracted and neutralized. Respirologists play an important role in this effort by educating patients regarding proper inhaler disposal and recycling practices, and advocating for improved inhaler recycling methods at their workplaces.

Future pMDIs

Looking to the near future, the development of MDIs containing next-generation propellants with near-zero global warming potential is highly anticipated. For example, one such propellant, HFO-1234ze(E), has a global warming potential 99.9% lower than current propellants, enabling MDIs using this propellant to achieve a carbon footprint similar to that of a DPI.[33] These next-generation propellants will be critical to providing maximal inhaler choice while reducing the carbon footprint of MDI use. Respirologists should advocate for access to these novel inhalers and stay informed about their clinical applications.

Conclusion

In summary, as climate change increasingly threatens global health, with a disproportionate impact on patients with respiratory disease, respirologists play an important role in advocating for sustainable inhaler prescribing. This multifaceted approach includes confirming the diagnosis, optimizing disease control, considering the carbon footprint of various inhaler types, ensuring proper technique, and supporting appropriate disposal of inhalers. Guideline adherence helps ensure that respiratory diseases are optimally treated to reduce the risk of exacerbations, reduce SABA overuse, and lower healthcare utilization, all of which are associated with environmental co-benefits. Importantly, switching patients to lower-emission inhalers should not be automatic; rather, it should involve shared decision-making with patients, which considers that the selected inhaler is affordable, available, and usable. Ultimately, the inhaler that best optimizes the patient's respiratory disease is likely to have the most positive impact on climate sustainability.

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