



Protecting the air we breathe: Reducing the impact of inhalers on our planet

CLINICAL QUESTION

What is the environmental impact of metered-dose inhalers (MDI's), and how can clinicians reduce these harms?

BOTTOM LINE

Metered-dose inhalers contain hydrofluorocarbon propellants that have a large greenhouse gas footprint on our planet. Clinicians can reduce these harms by:

- Encouraging a switch to dry powder inhalers (DPIs) - a switch that reduces certain measures of environmental impact
- Improving patient inhaler technique to reduce excess inhaler usage
- Encouraging recycling of inhaler devices
- Ensuring proper COPD and asthma diagnoses

EVIDENCE

- Dry-Powdered Inhalers (DPIs) have a lower carbon footprint, and over a year of daily use can prevent 234kg of CO₂ emissions. (Jeswani & Azapagic, 2019)
- In a British study performed in 2011, 66 COPD patients on MDI's were switched to DPI's, and 34/52 of contacted participants stated they had no preference for the MDI over DPI. (Tack et al., 2011)
- A 2022 post-hoc analysis (n=2236) found that asthma patients switched to a DPI-based maintenance therapy (n=1081) had greater asthma control while lowering their inhaler carbon footprint from 240kg to 108 kg CO₂e when compared to the control group (n=1155) that stayed on MDI-based maintenance therapy. (Woodcock et al., 2022).
- A 2019 study of 300 subjects with COPD found that in 48.2% of inhaler use demonstrations, at least one step was incorrectly performed, with a 29.9% critical error rate of significant patient mistakes. (Duarte-de-Araujo et al., 2019).
- An observational study of 1664 adult subjects with asthma or COPD diagnoses found that critical mistakes were widely distributed among users of all the inhaler types (Melani et al., 2011).
- A 2008 Canadian study of 10,428 patients diagnosed with asthma found that 44% have never had spirometry testing performed and 32% have never demonstrated their inhaler use to a health care professional. (Chapman et al., 2008)
- A British study of 261 patients in 2020 found that only 35% of patients recycled their inhalers and 57% were not aware of this option. (De Vos et al., 2020)
- A Canadian study found that in 1,403 randomly selected participants, 5.1% were overdiagnosed with COPD and 3.7% were correctly diagnosed, suggesting that up to 58% of Canadian patients with COPD diagnoses are overdiagnosed according to diagnostic criteria. Only 1/3 patients were found to receive spirometry to confirm diagnosis. (Gershon et al., 2018).

- A prospective, multicentre Canadian study of 701 participants with physician-diagnosed asthma found that after 12 months, 29.5% of participants exhibited no clinical or laboratory evidence of asthma (Aaron et al., 2017).
- A British study of 50 patients already using inhalers found that only 14% of patients ranked carbon footprint as “not important” in their consideration of changing inhalers (Liew & Wilkinson, 2017).

CONTEXT

- Pressurized metered-dose inhalers (pMDIs) are the largest single contributors to pharmaceutical-related GHG emissions (Jeswani & Azapagic, 2019)
- MDI's contain hydrofluorocarbon propellants that are 1300-3350 times more potent greenhouse gases than carbon dioxide (Jeswani & Azapagic, 2019).
- DPI's are propellant-free, so the raw materials are the biggest contributors to greenhouse warming, followed by the production process. They are much lower in terms of greenhouse gas emissions, but still pose significant environmental harms (Jeswani & Azapagic, 2019)
- DPI's are a reasonable and effective alternative to MDI's, and in Sweden, approximately 90% of inhaled corticosteroids devices used are DPI's. (Janson et al., 2019)
- Proper MDI usage, including a spacer device, improves drug delivery and can reduce the amount of doses needed (Wilkinson & Anderson, 2020)

REFERENCES

- Jeswani HK, Azapagic A. Life cycle environmental impacts of inhalers. *Journal of Cleaner Production*. 2019;237:117733. doi:10.1016/j.jclepro.2019.117733
- Tack G, Tjia-Leong E, Davies L, Warburton CJ. P229 Factors affecting inhaler choice and adherence in urban Liverpool. *Thorax*. 2011;66(Suppl 4):A161-A161. doi:10.1136/thoraxjnl-2011-201054c.229
- Duarte-de-Araújo A, Teixeira P, Hespanhol V, Correia-de-Sousa J. COPD: misuse of inhaler devices in clinical practice. *Int J Chron Obstruct Pulmon Dis*. 2019;14:1209-1217. doi:10.2147/COPD.S178040
- Chapman, K. R., Boulet, L. P., Rea, R. M., & Franssen, E. (2008). Suboptimal asthma control: Prevalence, detection and consequences in general practice. *European Respiratory Journal*, 31(2), 320–325. doi.org/10.1183/09031936.00039707
- Melani A, Bonavia M, Cilenti V, et al. Inhaler mishandling remains common in real life and is associated with reduced disease control. *Respir Med*. 2011;105:930–938. doi:10.1016/j.rmed.2011.01.005
- De Vos R, Rupani H, Longstaff J, Hicks A, Fox L, Wiffen L, Brown T, Chauhan A. Inhaler recycling prevalence in a secondary care clinic in England. *European Respiratory Journal*. 2020, 56 (suppl 64) 1886; doi: 10.1183/13993003.congress-2020.1886
- Diab, N., Gershon, A. S., Sin, D. D., Tan, W. C., Bourbeau, J., Boulet, L.-P., & Aaron, S.
- D. (2018). Underdiagnosis and Overdiagnosis of Chronic Obstructive Pulmonary Disease. *American Journal of Respiratory and Critical Care Medicine*, 198(9), 1130–1139. doi:10.1164/rccm.201804-0621CI
- Aaron SD, Vandemheen KL, FitzGerald JM, et al. Reevaluation of Diagnosis in Adults With Physician- Diagnosed Asthma. *JAMA*. 2017;317(3):269-279. doi:10.1001/jama.2016.19627

CO-AUTHORS

Sophie Thornton, BSc Environmental Science
 Hannah Yua, BSc Pharm, BCGP
 Veronica Tomcej, MD, CCFP

In partnership with:

