Environmentally Responsible Inhaler Disposal in Hospitals: Is There Such a Thing?

Brandon Tong and Aaron M Tejani

To cite: Tong B, Tejani AM. Environmentally responsible inhaler disposal in hospitals: is there such a thing?*Can J Hosp Pharm.* 2025;78(1):e3662. doi: 10.4212/cjhp.3662

INTRODUCTION

Globally, more than 800 million pressurized metered-dose inhalers (pMDIs) are manufactured annually. Each device uses a hydrofluoroalkane (HFA) as the propellant, with 2 compounds accounting for nearly all inhalers: HFA-134a (92%) and HFA-227ea (8%). These propellants can contribute a significant carbon footprint, with the most common propellant, HFA-134a, being 1300 times more potent than carbon dioxide as a greenhouse gas.[1] HFA-free inhalers, such as dry powder inhalers and soft mist inhalers, represent viable alternatives with substantially lower carbon footprints.[1] CASCADES, a collaborative nation-wide initiative encouraging sustainable health care practices and policies, has created a useful reference for patients and clinicians outlining the relative differences among inhalers in terms of carbon footprint.[2] CASCADES has made similar information available for individual provinces.[3]

In the community of residents covered by the Fraser Health Authority (in British Columbia), an average of 394 094 pMDIs and 199 536 dry powder inhalers or soft mist inhalers are prescribed yearly.[4] These quantities equate to an average annual carbon footprint of 8478 tonnes of CO_2 equivalent (also expressed as tCO2e), or approximately one-fifth of the annual reported emissions from the Fraser Health Authority.[4] This is approximately the same volume of emissions as would be generated by 1800 gas-powered vehicles each driven 18 000 km in 1 year.[5]

One way to minimize the negative environmental impacts of inhalers would be to minimize their use as much as possible, specifically by using inhalers only when necessary, for the shortest duration possible, at the lowest effective dose, and minimizing wasted doses. Even with such reductions, inhalers will still be needed, and their disposal will remain an important consideration. When a pMDI is disposed of improperly and sent to the landfill, the unused propellant remaining in the canister will eventually be released into the atmosphere.[6] Consequently, proper recycling and disposal of inhalers continues to be an important sustainability consideration.

DESCRIPTION OF CURRENT PRACTICE

Fraser Health hospitals send used and expired inhalers to a hospital waste management company for incineration (Daniels Health; https://www.danielshealth.ca/). A similar approach is used for inhalers collected by the British Columbia Medications Return Program (BCMRP), which is administered by the Health Products Stewardship Association. The BCMRP is responsible for disposing of consumer pharmaceuticals returned by the public to community pharmacies, of which 70% are incinerated at Suez Canada Waste Services in Alberta and 30% locally at Metro Vancouver's Waste-to-Energy Facility.[7]

DESCRIPTION OF AVAILABLE OPTIONS FOR INHALER DISPOSAL

We sought to identify the most environmentally responsible method of managing inhaler waste from Fraser Health hospital sites.

We conducted a literature search in the PubMed database to identify any descriptions of inhaler disposal methods. Our search used a combination of MeSH terms and keywords: "Metered Dose Inhalers" [MAJR] OR (metered dose inhalers) AND (disposal OR waste OR incineration OR recycling OR reuse OR carbon footprint OR greenhouse gas). English-language articles published between January 2013 and August 2023 were included for screening of titles and abstracts, and 46 unique articles were identified. In addition to our PubMed search, we conducted supplementary online searches (www.google.com) based on information from the identified literature. We also consulted local medication waste disposal contractors and local pharmacy colleagues with an interest in environmentally friendly pharmacy practice.

Although we found that detailed guidance on inhaler disposal is lacking, inhaler recycling programs are not a novel concept, and there have been previous inhaler recycling initiatives as an alternative to incineration. Our literature search identified 3 large-scale inhaler recycling programs, which we summarize below.

GSK's "Complete the Cycle" was a national inhaler recycling program that operated in the United Kingdom from 2011 to 2020 and was trialled in the United States as well.[8-10] Plastic and aluminum parts of the inhalers were recycled or upcycled into new products (e.g., plastic bottles), and the nonrecyclable parts were incinerated to generate energy in a waste-to-energy facility.[8-10] GSK reported that over the span of the program, 2 million inhalers were recovered and recycled, saving an amount of CO_2 emissions similar to that produced by 8665 cars in 1 year.[8-10] Teva Ireland started a similar recycling service in 2020, which involved the disassembly of inhalers for recycling and upcycling of materials.[11] Unfortunately, both of these inhaler recycling programs have since been discontinued, with limited details available publicly regarding the reasons for termination.[12]

In 2021, a 12-month UK pilot program, "Take AIR", recovered pMDIs through a mail-in program and dismantled them for recycling of the separate components.[13] The aluminum canisters were crushed and reclaimed for smelting, and the single-polymer plastics from dust caps and actuators were pelletized to be recycled. Remaining propellant gas was extracted for reuse in the refrigeration and air conditioning industries.[13] Due to their complexity, pMDI inhalers with a dose counter not easily separated from the canister, dry powder inhalers, and soft mist inhalers were incinerated in a waste-to-energy process to generate electricity.[13] According to the authors' estimates, this program prevented a minimum of 119.3 tonnes of carbon emissions from entering the atmosphere and did not account for savings from residual propellant due to incomplete use of inhalers.[13]

The description of the "Take AIR" program referenced waste hierarchy principles for waste reduction, which prompted our team to investigate whether British Columbia has its own waste hierarchy.[14] Waste management in British Columbia is guided by the "5 R" pollution hierarchy (ordered as reduce, reuse, recycle, recover, and residuals management) to reduce solid waste.[15] This pollution prevention hierarchy states that waste management at one level should only be undertaken when all feasible opportunities for pollution prevention at higher levels have been undertaken. Waste incineration is classified as part of the fifth "R", for residuals management, unless incineration at a waste-to-energy facility generates energy at an efficiency of over 60%, in which case it is classified as part of the fourth "R", for recovery.[16] Fraser Health's current waste management practices align with the fourth and fifth levels of the pollution hierarchy and emphasize the potential for more sustainable inhaler recycling practices within the organization.

Despite the limited scope of our findings, previous initiatives have demonstrated the feasibility of recycling and reusing the separate components of inhalers. While incineration of inhalers is preferable to sending them to landfill, there is evidently significant opportunity to improve on existing practices by reducing the need for incineration and prioritizing sustainable options at higher levels within the hierarchy, including reduction, reuse, and recycling. The recycling of plastics and metals from inhalers, especially aluminum from the canisters, allows for energy conservation that exceeds the energy generated from waste-to-energy incineration.[17] In addition, the propellants in pressured inhalers can be recaptured and reused in other industries.[13]

IMPLICATIONS AND SIGNIFICANCE FOR PRACTICE

Our team reached out to Fraser Health's existing waste management company to explore the feasibility of implementing a local inhaler recycling initiative, but the company does not have the necessary capabilities. We are now contacting other medical waste companies to see if there is an alternative local provider who can offer this recycling service.

Our discussions with a local pharmacist helped us to identify Go Zero Recycling as an alternative recycling provider; this organization offers recycling boxes for inhaler returns similar to Teva Ireland's recycling program.[11,18] The Go Zero recycling process involves separating inhaler metals and plastics for recycling, extracting and recycling propellant gas when possible, and incinerating only the medicine/powder.[18] However, Go Zero has only a single facility, located in Quebec; therefore, all inhalers would need to be transported by courier or truck from British Columbia to Quebec, and this vehicular transport might negate any environmental benefits from proper disposal and recycling of the inhalers.

In British Columbia, there is another option involving a process like that of Go Zero,[18] as described above. Secure is a waste management company that operates in western Canada, including the Metro Vancouver area (https://www.secure-energy.com/). Hospitals can arrange for Secure to supply 20-L black pails (with lids), which can be used for collection of empty or partially used inhalers, for pickup by Secure. When sufficient volumes have been collected, the pails are transported by truck to a contractor in Nysku, Alberta, where the company separates and recycles the inhaler components. For hospitals facing challenges in recycling inhalers through their existing waste services providers, Secure (in western Canada) or Go Zero Recycling (in central or eastern Canada) may be a reasonable option.

The next steps within Fraser Health will be to assess the practicality of a program to collect and recycle inhalers, through a pilot study at a large urban tertiary care hospital. We calculated the total annual number of inhalers dispensed at this hospital site. Based on previous inhaler wastage studies at Fraser Health, we estimate that approximately 70% of these inhalers will be disposed of as waste and calculated a predicted volume of inhaler waste, which can be used to estimate recycling costs (12 244 inhalers × 0.7 = 8571 inhalers would need to be properly disposed each year). Through the pilot project, we plan to make available special 20-L collection buckets where hospital staff can place empty or partially used inhalers. Secure will transport the collected inhalers to their facility in Alberta for processing, as described above. The approximate cost of services provided by Secure for 8571 inhalers per year will be $8550 (about 150 inhalers can be collected in each bucket, at a cost of $150 per bucket for pickup, transport, and proper disposal). We plan to assess the net financial impacts (amount of money spent on proper disposal services and human resource costs of collecting inhalers) and environmental impacts (number of inhalers collected and disposed, reduction in carbon emissions, volumes of plastic and metals recycled); if the net impacts are positive, we will consider expanding the program to other areas within Fraser Health.

Proper disposal costs, such as $8550 for 8571 inhalers at 1 hospital, might seem high, but these costs are likely less than the societal costs of long-term environmental damage from improper disposal. The cost of approximately $1 per inhaler for proper disposal equates to a range of less than 1% to as much as 30% of the acquisition cost for each of the different inhalers used in hospitals (based on hospital pricing). Hospital systems can fund proper disposal programs by collaborating with each other to negotiate volume discounts with disposal contractors and incorporating disposal costs into price negotiations with inhaler manufacturers.

CONCLUSION

A health authority–wide inhaler recycling program can be a key step in reducing the environmental footprint of inhalers and contribute to a more effective waste management system, aligning with British Columbia's pollution prevention hierarchy and Fraser Health's organizational goals for planetary health. We recommend that other jurisdictions explore plans to implement and evaluate the impact of proper inhaler disposal in their hospitals.

References

1. Wilkinson AJK, Anderson G. Sustainability in inhaled drug delivery. *Pharmaceut Med*. 2020;34(3):191-9.
2. Detailed inhaler comparison chart [spreadsheet]. CASCADES; 2023 [cited 2025 Jan 3]. Available from: https://cascadescanada.ca/wp-content/uploads/2023/02/Detailed-Inhaler-Comparison-Chart-English_2023.xlsx
3. *A clinical guide to inhalers in Canada* [website]. CASCADES; [cited 2025 Jan 3]. Available from: https://www.inhalerguide.ca/
4. Liang KE, Yao JA, Hui P, Quantz D. Climate impact of inhaler therapy in the Fraser Health region, 2016–2021. *B C Med J*. 2023;65(4):122-7.
5. Learn the facts: fuel consumption and CO_2 [fact sheet]. Minister of Natural Resources Canada; 2014 [cited 2025 Jan 3]. Available from: https://natural-resources.canada.ca/sites/www.nrcan.gc.ca/files/oee/pdf/transportation/fuel-efficient-technologies/autosmart_factsheet_6_e.pdf
6. Jeswani HK, Azapagic A. Life cycle environmental impacts of inhalers. *J Clean Prod*. 2019;237:117733.
7. Drover T. *Annual report: British Columbia Medications Return Program* [for 2022]. Health Products Stewardship Association; 2023 [cited 2023 Aug 28]. Available from: https://healthsteward.ca/wp-content/uploads/2023/06/HPSA-2022-AnnualReport-BC-FINAL.pdf
8. *Complete the cycle: protecting our environment and safeguarding our future, one inhaler at a time* [website]. GSK Group of Companies [UK]; [cited 2023 Sep 3]. Available from: https://web.archive.org/web/20200922211032/https://uk.gsk.com/en-gb/responsibility/our-planet/complete-the-cycle
9. *Complete the Cycle™ recycle program for GSK respiratory inhalers* [website]. GlaxoSmithKline; updated 2012 Sep 5 [cited 2023 Sep 3]. Available from: https://web.archive.org/web/20121027045458/http://us.gsk.com/html/responsibility/complete-the-cycle.html
10. *Complete the cycle: breathe new life into your old inhalers* [information leaflet]. GlaxoSmithKline; [cited 2023 Sep 3]. Available from: https://www.kentcht.nhs.uk/wp-content/uploads/2019/08/Complete-the-cycle-leaflet.pdf
11. Teva inhaler recycling service. Teva UK; 2020 [cited 2023 Sep 3]. Available from: https://web.archive.org/web/20201014165345/https://tevascheme.tevauk.com/pharmacy/support/inhaler-recycling
12. Clews G. Inhaler recycling scheme that cut carbon emissions equivalent to more than 8,500 cars is scrapped. *Pharm J*. 2020 [cited 2023 Aug 31];305(7939). doi: 10.1211/PJ.2020.20208144. Available from: https://pharmaceutical-journal.com/article/news/inhaler-recycling-scheme-that-cut-carbon-emissions-equivalent-to-more-than-8500-cars-is-scrapped
13. Murphy A, Howlett D, Gowson A, Lewis H. Understanding the feasibility and environmental effectiveness of a pilot postal inhaler recovery and recycling scheme. *Prim Care Respir Med*. 2023;33(1):1-7.
14. Patient care and environmental sustainability. Chiesi Medical; 2023 [cited 2025 Jan 3]. Available from: https://www.chiesi.uk.com/patient-care-and-environmental-sustainability
15. *A guide to solid waste management planning*. Ministry of Environment (BC); 2016 [cited 2023 Sep 2]. Available from: https://www2.gov.bc.ca/assets/gov/environment/waste-management/garbage/swmp.pdf
16. Considerations for the inclusion of waste-to-energy facilities (WTE) in solid waste management plans. Version 1.1. Ministry of Environment and Climate Change Strategy (BC); 2018 [cited 2023 Sep 2]. Available from: https://www2.gov.bc.ca/assets/gov/environment/waste-management/garbage/wtefactsheet.pdf
17. Morris J. Recycling versus incineration: an energy conservation analysis. *J Hazard Mater*. 1996;47(1):277-93.
18. *Inhalers* [website]. Go Zero Recycle; 2024 [cited 2023 Sep 6]. Available from: https://gozerorecycle.com/products/inhalers

Brandon Tong, PharmD, ACPR, is a Clinical Pharmacist with the Royal Columbian Hospital (Fraser Health), New Westminster, British Columbia.

Aaron M Tejani, BSc(Pharm), PharmD, is a Medication Use Evaluation Pharmacist with Lower Mainland Pharmacy Services (Fraser Health); a researcher and educator with the Therapeutics Initiative, The University of British Columbia; and a Clinical Assistant Professor with the Faculty of Pharmaceutical Sciences, The University of British Columbia, Vancouver, British Columbia.

Competing interests: For activities unrelated to the study reported here, Aaron Tejani has received speaker's honoraria from various divisions of family practice in British Columbia and the University of British Columbia Faculty of Pharmaceutical Sciences; served as a member of the data safety monitoring board for the ActionADE study (University of British Columbia Department of Emergency Medicine); and provided a report concerning medication-related adverse events (for litigation purposes). No other competing interests were declared.

Address correspondence to:
Dr Aaron M Tejani
Lower Mainland Pharmacy Services
Langley Fulfillment Centre
8521 198A Street
Langley BC V2Y 0A1

email: aaron.tejani@fraserhealth.ca

Funding: None received.

Submitted: June 11, 2024
Accepted: August 20, 2024
Published: February 12, 2025