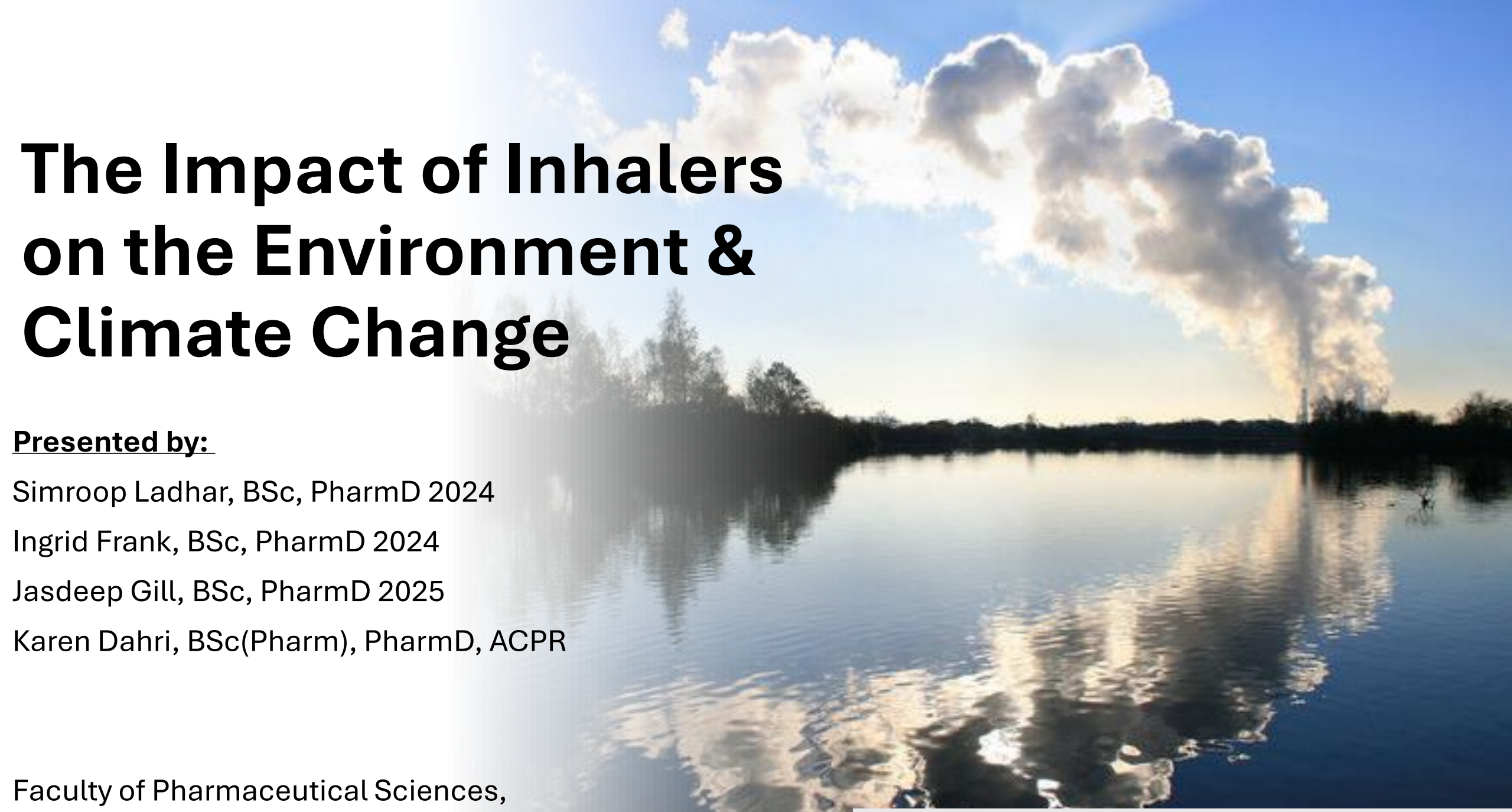
The Impact of Inhalers on the Environment & Climate Change



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B.R.E.A.T.H.E Team Members: Dr. Karen Dahri, Simroop Ladhar, Ingrid Frank and Jasdeep Gill

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Land Acknowledgment

We would like to begin by acknowledging that the land on which we gather, *University of British Columbia, Point Grey Campus (Vancouver),* is the traditional, ancestral, and unceded territory of the xwməθkwəy̓əm (Musqueam) People.

Learning Objectives

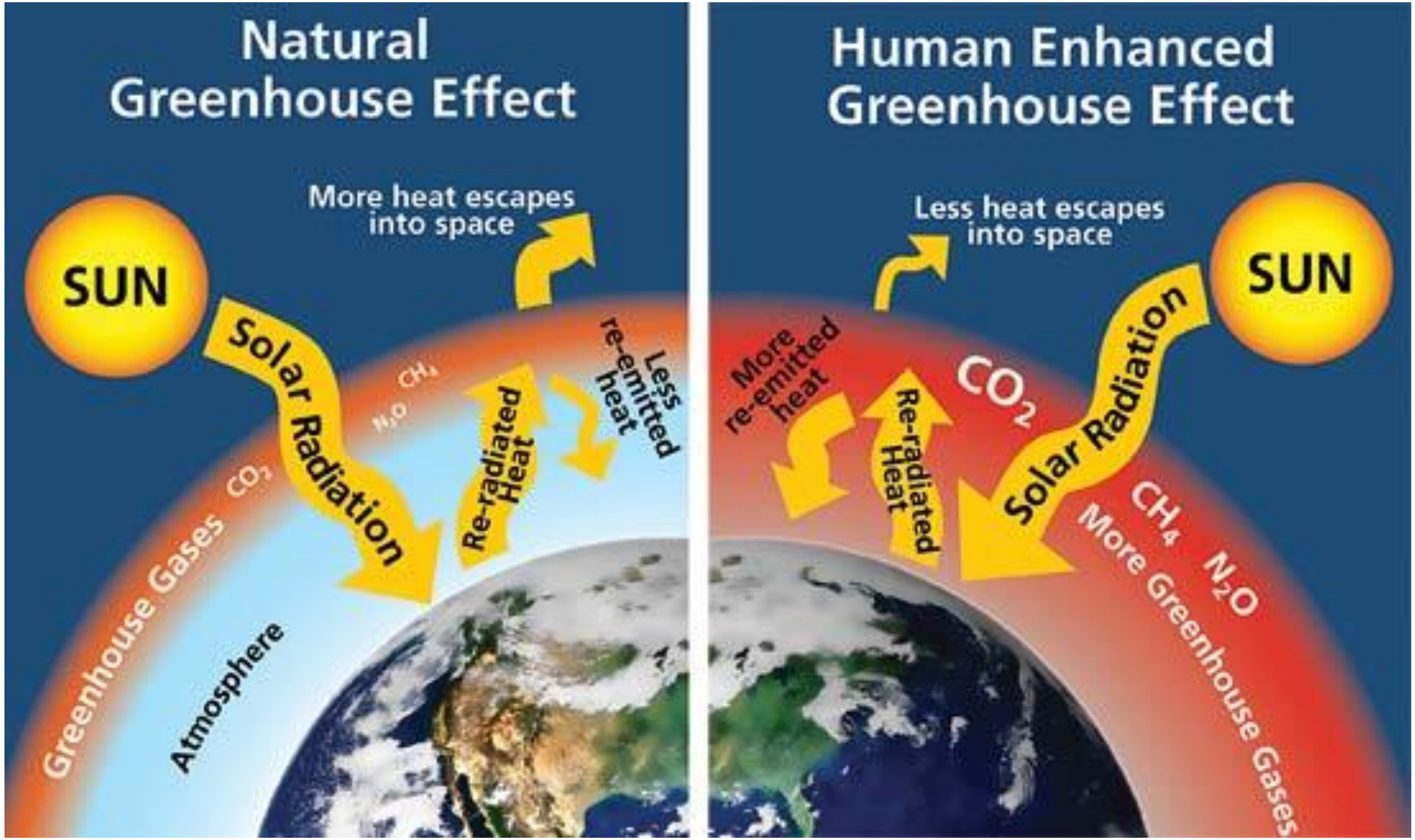
- Understand the overall impact of metered-dosed inhalers (MDIs) on climate change
- Learn the key considerations for selecting an inhaler
- Understand why MDIs have a negative impact on the environment and climate change
- Identify ways that pharmacists can help reduce the impact of inhalers on the environment and climate change

Image: Meyer 2021. Link: https://www.statnews.com/2021/08/11/doctors-health-care-sector-battling-climate-change/

Environmental Impact of the HealthCare System

- The Canadian healthcare system contributes **4.6%** of the total annual national greenhouse gas (GHG) emissions (Eckelman et al., 2018)
- **25%** of the healthcare system's emissions are from **pharmaceuticals** (Eckelman et al., 2018)
    - For example, MDIs can release potent GHG emissions

The Greenhouse Effect



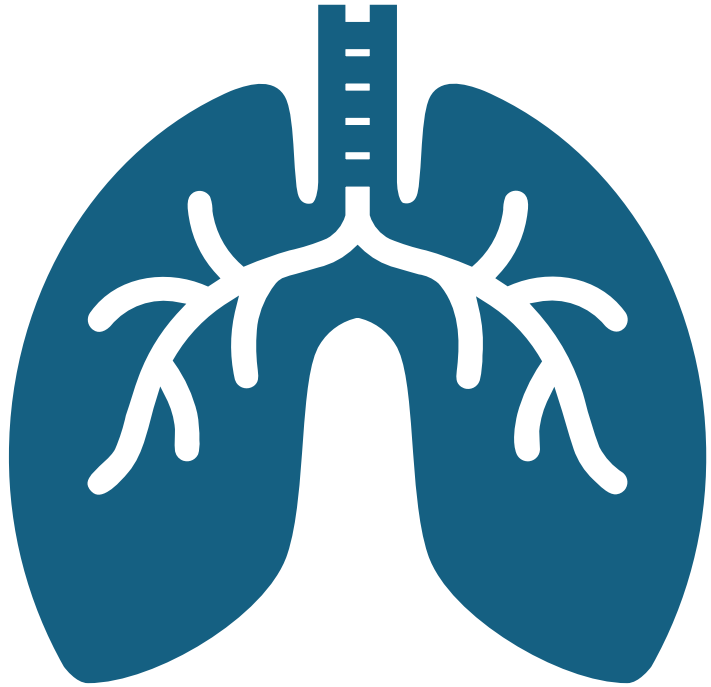
Background on Inhaler Devices

- Inhaler devices are specifically designed to deliver medication to the lungs.
- Three main types of inhalers:
  - **Metered-Dose Inhalers (MDI)**
    - **e.g., salbutamol**
  - Dry-Powder Inhalers (DPI)
    - e.g., budesonide/formoterol
  - Soft-Mist Inhalers (SMI)
    - e.g., tiotropium

Things to Consider When Selecting an Inhaler

From the Canadian Thoracic Society (Gupta et al. 2023)

- Patient preference
- Impact of inhaler device on adherence
- Inhalation technique (patient ability)
- Inspiratory flow rate/pressure required for adequate medication delivery (patient ability)
- Patient age
- Cost for patient and/or public healthcare system
- Side effect profile
- Environmental footprint



Other considerations:

- Indication (asthma, COPD etc.)
- Contra-indications (e.g., allergies)

Things to Consider When Selecting an Inhaler: Environmental Impact

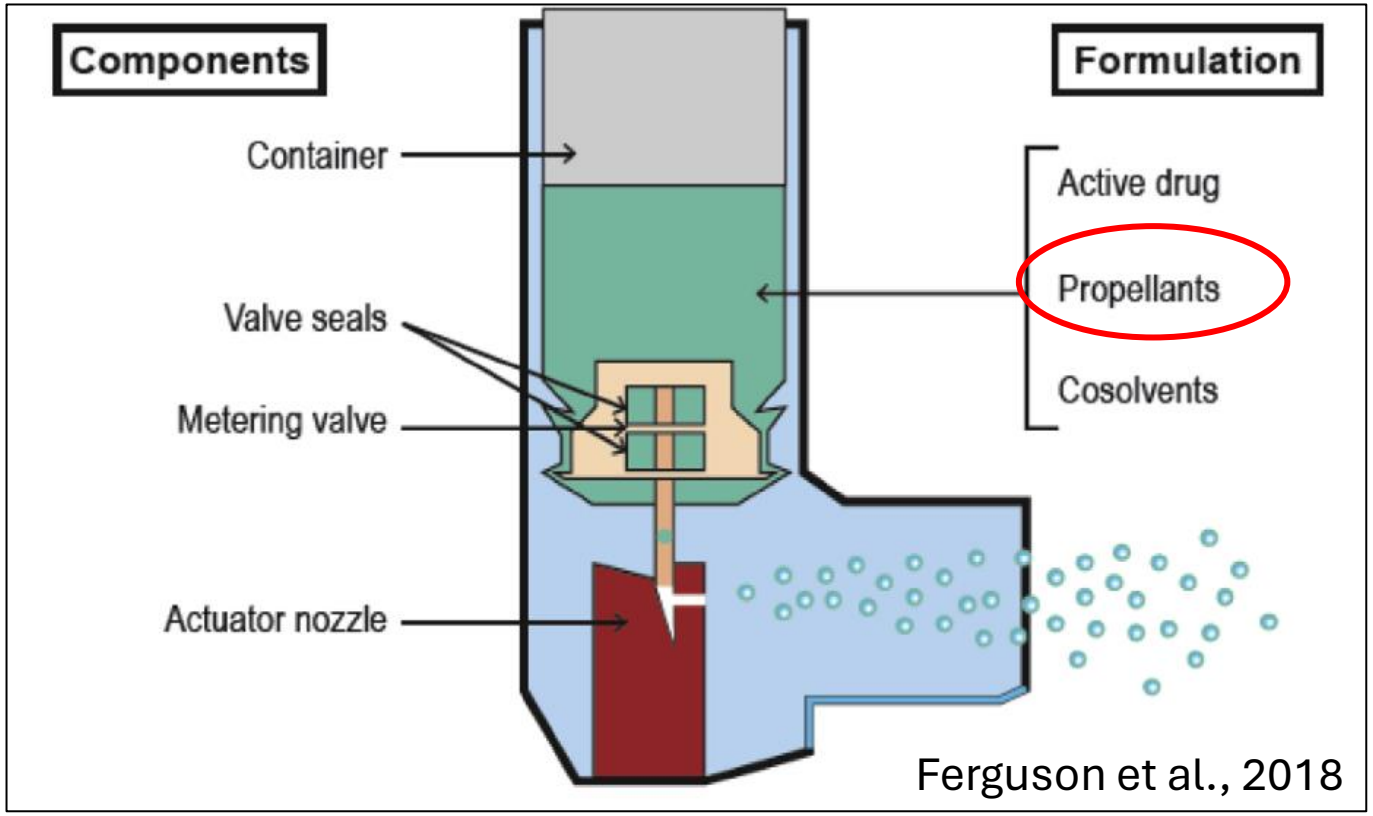
Woodcock et al., 2022

"Cradle-to-Grave" Impact

- Inhalers impact the environment throughout their life cycle
- MDIs: use/utilization phase contributes most to total carbon footprint [3,4,5]
- DPIs: manufacturing phase contributes most to total carbon footprint [3,4,5]

Click **here** for more information about the impact of inhalers at the different life cycle stages

How MDIs work



MDIs have different components:

- Canister: contains the medication
- Plastic casing + Actuator: delivery of the medication

Propellants:

- Provide the pressure needed to force medication out of the cannister

Propellants are potent greenhouse gases!

TABLE 1 Global warming potential (how powerful greenhouse gas is relative to CO_2) of propellants used in current and possible future MDIs[4]

Name	Global warming potential
CO_2 (carbon dioxide)	1
HFO 1234ze (potential new propellant in future MDIs)	<1
HFA152a (potential new propellant in future MDIs)	138
HFA-134a (used in most current MDIs)	1300
HFA-227ea (used in some current MDIs)	3350
CFC-11 (previously used in MDIs)	4660
CFC-12 (previously used in MDIs)	10 200

Wilkinson & Woodcock, 2021

Timeline:[7]

1960s: MDIs contained chlorofluorocarbons (CFC)

1980s: Discovery that CFCs breakdown the ozone layer and are greenhouse gases, phase out begins

2016: Worldwide phase out of CFCs completed

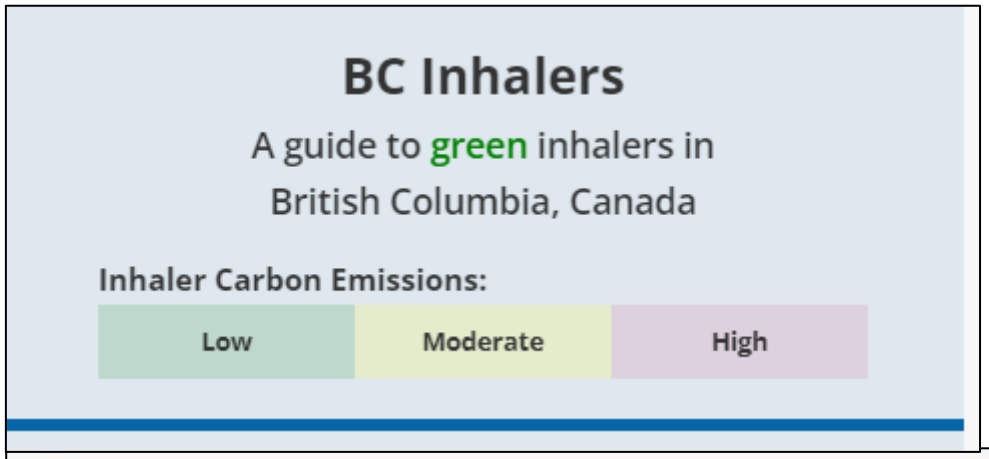
Current: Most MDIs contain hydrofluorocarbons (HFA)

- Do not deplete ozone BUT are still POTENT greenhouse gases
- HFA-134a used in salbutamol (Ventolin® MDI devices)

MDIs are not all bad!

- MDIs are very effective drug delivery devices
- They are generally inexpensive
- Useful for those with limited lung capacity and pediatrics
  - Can also utilize with a spacer to reduce handling/technique errors
- Not all MDIs are made the same
  - "Low-flow MDIs" have a lower carbon foot-print
- Patient preference
  - Some patients prefer MDIs and switching to another inhaler device (e.g., DPI) may result in inadequate technique/exacerbation of condition

Alternatives to High-Flow MDIs



- DPIs and SMIs have lower carbon emissions than MDIs
- Low-flow MDIs have lower carbon emissions than high-flow MDIs due to presence of HFA sparing agents (Stoynova & Culley, 2023)

[9]*Resource Link: https://www.bcinhalers.ca/*

Alternatives to High-Flow MDIs: Terbutaline

Low Emissions

Bricanyl Turbuhaler (DPI)

terbutaline 0.5 mg/dose

How to use a Turbuhaler.pdf

Age Indication: adults and children ≥ 6 years

Duration: 4-6h

Adult Instructions: one inhalation every 4 hours as needed; if dose is ineffective may repeat after 5 minutes

Cost: $23.88 for 120 doses

Covered

Teva-Salbutamol MDI- $18.45 for 200 doses
Bricanyl Turbuhaler DPI - $23.88 for 120 doses
Ventolin MDI - $20.29 for 200 doses
Ventolin Diskus DPI - $25.24 for 60 doses
*Costs as of March 2024

[9]*Resource Link: https://www.bcinhalers.ca/*

Rx

Date: February 28, 2024
Patient: Jill Smith
DOB: October 14, 2001

Terbutaline 0.5mg/dose
Dry Powder Inhaler
SIG: Inhale 0.5mg Q4H PRN; if ineffective may repeat after 5 mins (max 6 doses/day)

QTY: 1 inhaler
Refill: 2

Dr. J Doe — Prescriber
0001 — Provider No.

Pharmacist's Role: Assess & Counsel

Assess adequate treatment of underlying condition

- Ensure underlying disease is adequately treated per guideline recommendations
- Ensure inhaler choice is appropriate based on patient-specific and disease specific factors
- Ensure no over-reliance on reliever therapy (e.g., refilling reliever therapy often may be a red flag)

Patient counselling on proper technique

- Demonstrate technique, assess for understanding, follow up
- Refer to resources (e.g., videos, infographics)
- Recommend use of spacer with MDI—handling/technique errors with MDI alone are greater compared to DPIs

Example: CASCADES Canada Patient Resources

[10]*Resources Link: https://cascadescanada.ca/action-areas/pharmacy-and-prescribing/your-inhaler/*

Pharmacist's Role: Promote Appropriate Disposal

Patient counselling on proper disposal

- Remind patients EACH time they pick up an inhaler to bring it back for disposal
- Encourage patients to keep track of doses so they will be able to better assess when inhaler is truly empty
- Find a balance between emphasizing the environmental impact of improper disposal, but also importance of using MDIs for their condition

[10]*Resources Link: https://cascadescanada.ca/action-areas/pharmacy-and-prescribing/your-inhaler/*

Pharmacist's Role: Recommend, Advocate & Educate

Shared decision making on inhaler choice

- Assess if recommending an alternative to MDIs is appropriate to discuss with patients
- Remember choice of inhaler needs to be a patient informed decision and patient preference should **always** be respected

Advocate and Educate

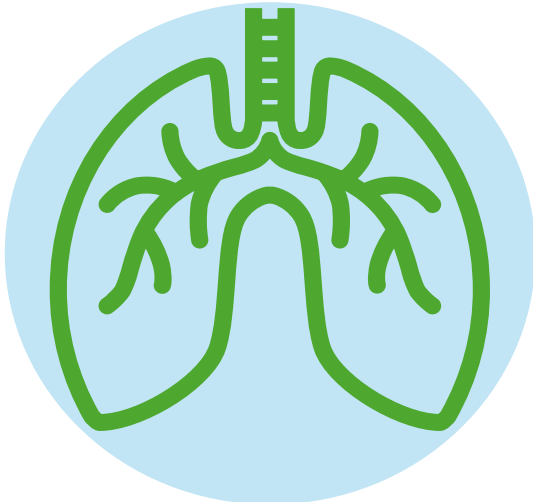
- Promote the use of environmentally sustainable pharmaceuticals
- Advocate for the incorporation of environmental impact in the assessment of funding, approval, and use of medication
- Disseminate knowledge regarding the impact of pharmaceuticals on the environment and interventions we can make

Initiatives

- **CASCADES**
  - Playbooks
  - Educational courses
- **Canadian Society of Hospital Pharmacy**
  - Sustainability Task Force
- **Canadian Association of Pharmacy for the Environment**
  - Developed in 2022
  - Mission "promote and improve planetary health among the Canadian pharmacy profession"
- **International Federation of Pharmacy**
  - Environmental Sustainability policy 2023

Summary

- The environmental impact of MDIs on the environment is substantial
- Alternatives to high-flow MDIs exist and can be considered when appropriate
- Pharmacists' have a vital role to play in addressing and reducing the impact of inhalers on the environment
- Patient preference should always be respected when recommending inhaler therapy



Questions/Comments/Feedback

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