

A Guide to being a green prescriber: Inhalers

Evidence-based document for
the respiratory multidisciplinary
team

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Being a Green Prescriber



The healthy patient-healthy planet complete care plan

The Greener Choice

<u>Section 1</u>	Check the diagnosis	Only prescribe inhalers where indicated to patients with a correct diagnosis.
<u>Section 2</u>	Reduce environmental exposures	Prescribe nicotine replacement and prioritise a reduction of environmental exposures like air pollution
<u>Section 3</u>	Wellbeing (nutrition, weight loss, exercise)	Prescribe exercise, diet and weight loss at every opportunity
<u>Section 4</u>	Inhaler choice: The greenest device is the device the patient can use, does use and will use.	Prescribe a DPI or SMI over MDI when commencing an inhaler.
	<u>Optimising drug delivery</u>	Always prescribe a spacer with an MDI Inhaler
<u>Section 5</u>	Checking inhaler technique	Check inhaler technique at every visit
	Compliance	Review compliance regularly
<u>Section 6</u>	Self-management	Provide information on self-management tools.
<u>Section 7</u>	Disposal plan	Advice on correct disposal and minimisation of waste when prescribing an inhaler



This communication tool will provide clinicians with concise, evidence-based information on the lifecycles of inhalers and the associated carbon footprint. The purpose of this tool is to empower clinicians and their patients to reduce the carbon footprint of inhalers while improving patient care.

This tool is not a replacement for the guidelines on the management of respiratory conditions for which inhaler therapy is used. Inhalers are, by their very nature, a preventative therapy, reducing unscheduled care use during exacerbations. Unscheduled care is associated with significant carbon emissions. This tool aims to provide information that will assist clinicians in identifying when a patient could be at least equally, if not better, controlled on an inhaler that has a lower global warming potential. This tool does not support inappropriate switching of a patient's inhaler from a high global warming potential inhaler to a low global warming potential, firstly because this could be associated with worsening patient outcomes and, secondly, because such decisions could be associated with increased net emissions through unscheduled care use.

This tool is a demonstration of clinicians' ability to change the trajectory of the greater global, national and local health crisis of climate change through changes within their own practice and prescribing. It also provides a lens for how we can relook other areas of healthcare that contribute disproportionately to the climate crisis. Most importantly, this tool serves to highlight the fundamental role of clinicians in communicating the health impacts of climate change and ensuring that the measures taken to address climate change yield the maximum health benefits possible.



This tool aims to aid clinicians to:

- Provide care that benefits both patient and planet.
- Provide information that can help to reduce symptoms, exacerbations and unscheduled care use through improved education on inhaler technique, compliance and reduced short-acting beta agonist (SABA) use.
- Identify where it is appropriate to initiate a dry-powdered inhaler (DPI) or soft mist inhaler (SMI) over a metered dose inhaler (MDI) when commencing an inhaler
- Improve inhaler efficacy through reducing waste, improved technique and compliance
- Consider carbon footprint when prescribing an inhaler



The Climate crisis is a health crisis



Covid-19 has impacted on many aspects of our society, yet climate change continues to be the greatest global health threat of our time.

The Lancet recognises the essential role of healthcare workers to communicate this threat and drive the necessary changes to safeguard human health.(1)

The International Organisation for Migration and the World Bank estimate that there will be over 200 million persons displaced worldwide by 2050.(2, 3) Our actions today to mitigate carbon emissions can change this course.

Healthcares climate footprint is

4.4% of global emissions

If the health sector were a country, it would be the fifth-largest emitter on the planet.(4)

Healthcare must respond to the growing climate emergency not only by treating those made ill, injured or dying from the climate crisis and its causes, but also by practicing primary prevention and radically reducing its own emissions

Healthcare emissions consist of:

- 17%** emissions arising from healthcare facilities
- 12%** in-direct emissions from purchased electricity
- 71%** emissions arising healthcare supply chain such as pharmaceuticals, medical devices and equipment (4)

Therefore, 83% of healthcare's emissions is attributable to clinical decisions and models of care. Ireland is a major emitter (0.5-1t per capita) of healthcare emissions. In the UK, another major emitter, inhaled medications account for 3% of emissions.

The National Health Service in the UK has committed to zero-emissions health care by 2050.





Inhalers & Carbon Footprint

There are three main classes of inhaled therapy devices for the treatment of chronic obstructive pulmonary disease (COPD) and asthma:

- metered-dose inhalers (MDI),
- dry-powdered inhalers (DPI) and
- soft mist inhalers (SMI).

MDIs contain a propellant (hydrofluroalkanes) which have a disproportionate global warming potential (GWP). The carbon footprint of MDIs can be 10-30 times greater than that of DPIs and SMIs. (5, 6)

MDI use varies throughout countries and increased use does not correlate with improved mortality. In 2017, 70% of all inhalers sold in England were MDIs, while in Sweden only 13% of inhalers were MDIs. (6) The mortality rate in the UK was found to be higher than Sweden and in fact is one of the highest in Europe. (7) In 2019, market research data showed that 58.9% of inhalers prescribed in Ireland were MDI. (8)

While the majority of inhalers sold in Europe are MDIs (9), an international study of real-world data, demonstrated preference for DPI amongst respiratory physicians. (10) Many patients who are currently prescribed MDIs could be adequately managed on DPIs. Therefore, on initiation of the first inhaled therapy for a patient, it is paramount that physicians are adequately informed to correctly identify patients suitable for a DPI or SMI.





Section 1: Check the diagnosis



An incorrect diagnosis of asthma or COPD can lead to unwarranted treatment and treatment escalation. To reduce emissions from unnecessary inhaler prescribing, always check the diagnosis before prescribing a new or repeat inhaler.

In children:

Up to the age of 6 years the diagnosis of asthma is a clinical one depending on symptoms, family history, identification of biomarkers and response to treatment. After the age of 6, pulmonary function testing can be performed and reversibility demonstrated which assists with diagnosis of asthma. Children under 6 years may have a viral induced wheeze that responds to bronchodilators and inhaled corticosteroids.

Section 2: Reduction of environmental exposures

Smoking Cessation

Best for the patient

After 72 hours	Your breathing will improve and your energy levels will increase
After 2-3 months	Your lung capacity could increase by up to 30%.
After 1 year	Your chance of having a heart attack drops by half.
After 5 years	The risk of smoking-related cancers is greatly reduced.
After 10 years	The risk of lung cancer is reduced by half.
https://www2.hse.ie/wellbeing/quit-smoking/reasons-to-quit-smoking/health-benefits-of-stopping-smoking.html	https://www2.hse.ie/quit-smoking/get-help-when-you-quit-smoking/



Best for the planet

The cultivation and production of tobacco worldwide in 2014, were shown to contribute almost 84 Mt CO2 equivalent emissions to climate change – approximately 0.2% of the global total. (11)

In Practice

ASK: assess current and past smoking behaviour
ADVISE: provide information on consequences of smoking and smoking cessation
PROVIDE: options for later/additional support
PRESCRIBE: smoking cessation medications and therapies
https://www.ncsct.co.uk/publication_very-brief-advice.php

Improve air quality



Best for the patient

In Europe, air pollution contributes to 400,000 deaths annually. (12) The European commission estimate that 1,300 people in Ireland die prematurely due to air pollution and air pollution costs the Irish State €2 billion annually. Children are especially vulnerable to the impacts of air pollution. Exposure to air pollution in early childhood, when the lungs are still developing, can lead to reduced lung capacity that persists through adulthood. In the UK, 1 in 5 new childhood asthma diagnosis are attributable to traffic-related air pollution.(13)

Outdoor air pollution is associated with increased burden of COPD and, in the short term, increased hospitalisation and mortality. (14, 15) In April 2020, Covid-19 restrictions resulted in a reduction in NO2 at urban locations by up to 50%. (16)



Best for the planet

The main causes of outdoor air pollution in Ireland are solid fuel burning in our homes and traffic-related pollution.(12) 12-16% of homes in Ireland rely on solid fuels for heating. (17) In 2019, solid fuels accounted for 17.6% of residential energy space heating in Ireland. Ireland ranks second highest in Europe for proportion of solid fuel use in our homes. (18)

In practice

- Advise patients to monitor national air pollution levels and choose to exercise outdoors only at times of good air quality <https://airquality.ie>
- Advise patients to avoid burning solid fuels in their homes.
- Provide patients with information on grants for retrofitting <https://www.seai.ie/grants/home-energy-grants/>
- Those with chronic respiratory illness may be eligible to take part in the [Warmth and Wellbeing Pilot Scheme](#)
- Encourage active transport as the healthiest mode of transport. Each one kilometre by car costs society €0.15, whereas society earns €0.16 on every kilometre cycled.(19)





Section 3: Wellbeing



Diet

Poor diet is responsible for more deaths globally than tobacco, high blood pressure, or any other health risk.(20) Many chronic diseases, including respiratory, can be prevented, mitigated and treated outside of the consultation.

Evidence has proven:

- Increased asthma prevalence with decreased consumption of fruits, greens and vegetables (21)
- Increased asthma prevalence with increased consumption of salt and fat (21)
- Seven fold risk of exacerbation with low vitamin C intake (fruits and vegetables) (22)
- Tenfold reduction in rates of exacaerbations with low saturated fat intake (22)

Exercise

Pulmonary rehabilitation plays an integral role in the management of patients with COPD and other chronic respiratory conditions where symptoms of breathlessness impact negatively on exercise capacity and quality of life.(23) Inability to exercise should be viewed as a lack of symptom control and should prompt a review of management rather than a contraindication to exercise in general

Healthy Weight

Even modest weight loss in obese asthmatic patients has been shown in a randomised control trial to measurably improve asthma symptoms and quality of life.(24)





Best for the planet

Plant-based diets are associated with the longest living and healthiest populations around the world, and in perfect symmetry, they are also associated with the lowest levels of carbon emissions and pollution. (25, 26) Food systems are one of the leading causes of carbon emissions, so eating healthier is a triple win: for the pocket, the patient, and the planet. (27, 28) Pulmonary rehabilitation is one of the most cost effective methods of supporting patients to self-manage and improve outcomes. It has been associated with 70% reduction in hospital readmission for an exacerbation of COPD in one year and also with a significant shortening effect on the length of stay of people who are readmitted. (29, 30) This is one of the best carbon saving interventions we have.

In practice

1. Advise a diet high in colourful fruits, vegetables, beans and greens and low in processed food. This diet also prevents heart disease, diabetes and cancer.
2. Advise working towards a normal body weight.
3. Liaise with your local hospital to see when and where their pulmonary rehabilitation course is running and how to refer.
4. Also, see the HSE Living Well 6-week course for chronic disease.
<https://www.hse.ie/eng/health/hl/selfmanagement/living-well-programme/>





Section 4: Inhaler Choice

Best for the patient

The effectiveness of inhaled therapy is affected by the correct choice of the device and proper inhalation technique. The effectiveness of drug delivery may be influenced by patient's preference, which in turn may influence the adherence to treatment and long-term disease control so it is best to include the patient in any decisions.

All types of inhaler devices have similar efficacy, and each has its advantages and limitations. The selection of the inhaler device should be primarily based on the specific needs of the individual patient, the right inhaler for the right patient.

Best for the planet

MDIs contain a propellant with a high global warming potential. MDIs have a disproportionately high carbon footprint, 20 – 30 times greater than DPI or SMI. (5, 6) Clinicians can reduce the carbon emissions of inhalers by appropriately identifying patients who can be at least equally and, more often, better managed with a DPI or SMI over MDI.

Choose the right inhaler for the right patient, with the lowest carbon footprint possible, disposed of correctly.

In practice

Choose the class of medication Check the Asthma guidelines Check the COPD guidelines	Assess the patient's disease severity and use the guidelines to select the right medication.
Select the delivery method – DPI, MDI or SMI	Check the patient's inspiratory flow rate. Consider the patient's ability to perform the technique required. If available, use a placebo device or an inspiratory flow measure. Choose a DPI or SMI over an MDI where appropriate.
Select the specific device	Choose the right inhaler for the right patient to optimise effectiveness and reduce waste. See Table
Check the Technique	On initiating or continuing an inhaler never miss an opportunity to check technique. If available, use a placebo device or the patient's own inhaler. Suboptimal technique should prompt the clinician to explore other options of MDI, DPI or SMI for the same class of drug.
Review	Regularly enquire about inhaler compliance, technique and SABA use to ensure this is the right inhaler for the right patient



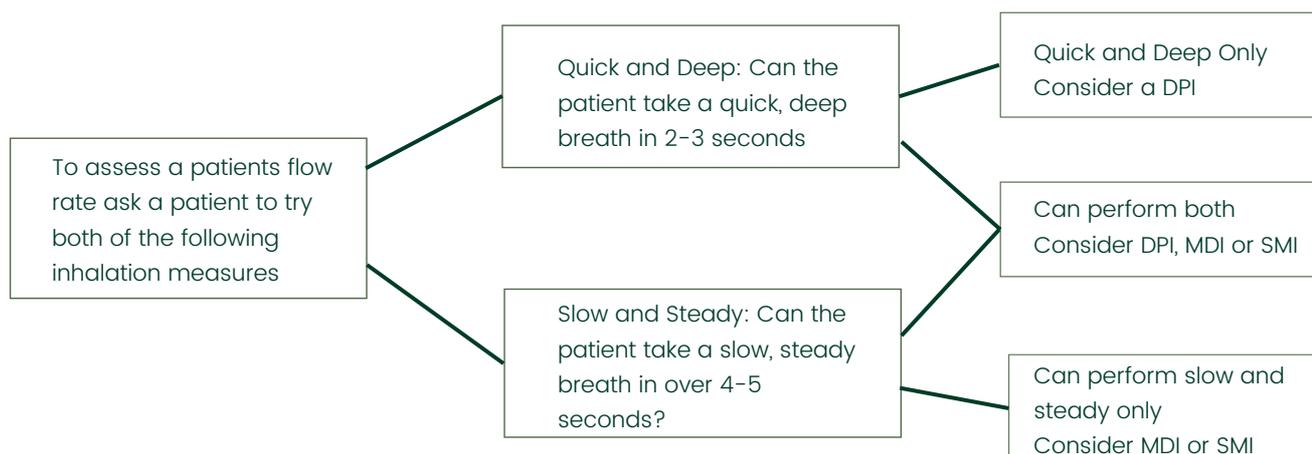
Choosing the right delivery method – MDI, DPI and SMI

Ideally prescribe one type of device or at least all MDI, DPI or SMI with the same inhalation technique.



Inspiratory flow

In order to safely use a DPI the patient must have sufficient inspiratory flow to break up the inhaled medication. Patients who you suspect have a low inspiratory flow rate may not get optimal benefit using a DPI. For these patients, consider using a SMI or MDI via a spacer device. The majority of patients have sufficient inspiratory flow rate to use DPI.



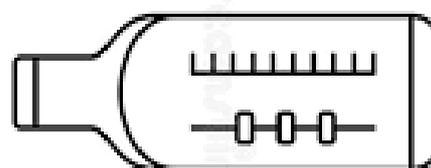
Tools to assess inspiratory flow rate

A patient's inspiratory flow rate can be checked using an inspiratory flow meter which is able to simulate the resistance characteristics of different inhalers. One such tool is the Clement Clarke In-check Dial.

Other useful tools to check inspiratory flow are inspiratory flow whistles/placebo inhalers which are freely available on request from GP and hospital pharmaceutical representatives.

Suspect low inspiratory flow rate

- Young
- Elderly
- Patients with cognitive impairment
- Patients with musculoskeletal conditions
- Patients with severe airflow obstruction





In practice with children

- Up to 4 years: A spacer with mask
- At 4 years: Transition to spacer with mouthpiece
- When the child is old enough, consider a change to DPI, come to a decision with the parent and child.



When transitioning from MDI to DPI

1. Check the medication that the child is using is available in a DPI at the right dose.
2. Be sure the child has the cognitive and inspiratory ability to use a DPI. Match the child's inspiratory flow rate with that required for a DPI.
3. Ensure the child can breathe, hold and rinse mouth or gargle after taking the medication.
4. Prescribe a MDI and spacer for use in the presence of asthma symptoms, if risk identified.
5. Instruct the parent and child on the correct use of a DPI including the preparation of device, the technique, storage, features and replacement.
6. Be aware of licensing and guidelines when prescribing a DPI for a child

Identifying an appropriate switch from an MDI to a DPI or SMI

It is safe in the majority of cases to switch patients from an MDI to a DPI or SMI and should be considered if any of the following are present:

- The patient's technique is poor
- The patient's compliance is poor
- The patient is using SABA frequently
- The patient's control is poor
- The patient wishes to change inhaler device class
- The patient is currently using more than one device type

Careful consideration must be given to changing an inhaler when a patient is stable and familiar with that inhaler, with a good technique. (31, 32) While switching to an equivalent inhaler type has been demonstrated to be safe, (33) switching inhaler device may be associated with poorer technique and subsequent reduced disease control. (32) Inhaler technique education is essential in any change in device. Any decision to change inhaler should be taken in consultation with the patient to ensure patient's best interest are being met.



What inhaler should we choose??

Metered Dose Inhaler

Dry Powdered Inhaler



What are the positives of this option?

- No drug preparation required
- Offers consistent dosing and rapid delivery
- Some include a dose counter
- Can be used in very low inspiratory flow

When a spacer is used

- The requirement of coordinate breath and actuation is overcome
- Improved airway deposition
- The patient can be assisted to use the inhaler e.g. where there is dexterity issues



- Breath-actuated
- Fewer rates of technique errors (50%)
- Easier to determine the number of doses
 - Dose counters in most newer designs
 - Capsules remaining
- Better airway deposition
- Most patients can use a high-resistance DPI effectively, even during exacerbations
- No propellants (which are potent greenhouse gasses)

What are the negatives of this option?

- Patients are required to coordinate breath with actuation
- Higher rates of technique errors (up to 90%)
- High pharyngeal deposition
- Patients with poor dexterity or weak grip strength, such as the elderly may find it difficult to actuate.
- With a spacer, compliance may be reduced as a spacer is bulky to carry.



- Require medium low to high inspiratory flow to break up medication
- May not be appropriate for emergency situations e.g. acute asthma attack
- Some require drug preparation (i.e. loading)
- Patients must operate independently

What is the carbon footprint?

10-35kg/CO₂ per inhaler



1kg CO₂ per inhaler

What is the required inspiratory flow?

No minimum required inspiratory flow
Suitable for Very Low inspiratory flow

Medium low to high depending on the device type.
See table

You might choose this option for;

- Elderly, Children
- Patients who require assistance in taking their inhaler
- Cognitive and psychomotor deficits (which may restrict the correct use of the DPIs)
- Those without the ability to generate sufficiently high inspiratory flows for DPI

- A DPI or SMI should be the first choice for most adult patients
- Choose an MDI if there is a clear indication that DPI or SMI are not suitable

If you choose this option for;

- Ensure correct technique
- Prescribe a spacer
- Advise a disposal plan with a recycling scheme or their local pharmacy

- Ensure correct technique
- Most DPIs are moisture sensitive so provide advice on storage
- Advise a disposal plan with a recycling scheme or their local pharmacy

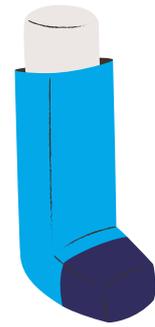


Reducing reliance on SABA therapy

Best for the patient

Regular or frequent use of SABA is associated with adverse effects

- Rebound hyper-responsiveness,
- Decreased bronchodilator response,
- Increased allergic response and
- Increased eosinophilic airway inflammation.



The Global Initiative for Asthma (GINA) no longer recommends treating adults/adolescents with asthma with short-acting bronchodilators alone. Instead they should receive a daily corticosteroid - containing inhaler (or a symptom-driven corticosteroid - containing inhaler in the case of mild asthma), to reduce risk of severe exacerbations.

Higher use of SABA is associated with adverse clinical outcomes:

- Dispensing of ≥ 3 canisters per year (average 1.7 puffs/day) is associated with higher risk of emergency department presentations (36, 37)
- Dispensing of ≥ 12 canisters per year is associated with higher risk of death (36)

In March 2020, when the World Health Organisation, declared the COVID-19 pandemic, salbutamol prescribing increased by 63% in the UK. (38)

Analysis of primary care reimbursement service dispensing data in Ireland to those with full General Medical Services Eligibility in 2016 (1.53 million patients), found 20% of the population was dispensed at least one respiratory medication.(39) 78% received at least one SABA. 25% were dispensed SABA with no other inhaler. 37% of this population received more than one SABA.

Best for the planet

The most commonly prescribed SABA inhaler is Ventolin (MDI) which has one of the highest global warming potential of all inhalers.(40) Within the UK, addressing SABA overuse has the potential to reduce the UK carbon footprint by an equivalent of 900million diesel cars each year.(41)

In practice

1. Do not prescribe SABA-only therapy.
 2. SABA overuse should prompt a review of treatment, technique and compliance.
 3. When prescribing SABA for emergency use, prescribe a smaller volume canister which has a smaller global warming potential.
 4. Perform an audit of prescribing practices in your facility.
-



Optimising MDI efficacy: Use a spacer

Best for the patient

With correct technique, inhalers deliver an effective dose of medication directly to the airways. Unfortunately, many patients do not use their inhalers correctly. (42)

Errors in technique are more common with MDIs because the patient must coordinate breath with actuation. For those with handling errors, drug deposition can be improved by using a spacer. Every patient treated with MDIs should own and regularly use a spacer and know how to use it properly, both for routine and emergency use.

Best for the planet

While MDIs have a significantly higher global warming potential, not all patients can be appropriately managed on a DPI or SMI. By using a spacer, medication waste is reduced, there is less chance of unnecessary treatment escalation and better control can be achieved which reduces exacerbations and unscheduled care use.

In practice

- **Prescribe a spacer** for patients who require an MDI, especially those with poor technique and explain the importance of using one.
- **Wash spacers** weekly and change them after 6 months. The electrostatic charge on plastic spacers attracts medication molecules and reduces drug delivery. (43) Manufacturers recommend replacing plastic spacer devices every 6 months to a year. Washing plastic spacers once a week in a dilute solution of water and washing up liquid and letting it dry without rinsing reduces static.





Section 5: Inhaler technique & compliance



Inhaler technique and compliance should be regularly assessed at each clinic visit. All members of the multidisciplinary team has a role to play in improving technique.

Best for the patient

Poor technique and compliance leads to poor control with increased exacerbations, increased use of inhalers, and unscheduled care,(44-47) all of which are associated with greater carbon emissions. Repeated instruction has been shown to improve adherence. (46, 48)

It has been shown that only between 7-15% of healthcare professionals can demonstrate all the correct steps for using an inhaler.(49, 50) Estimates of inhaler errors are reported to include up to 90% of patients using metered dose inhalers (MDIs) and up to 54% of patients using dry powder inhalers (DPIs).(42, 51, 52)

Best for the planet

Inadequate inhaler technique lowers drug deposition to the lungs and wastes medication. Unrecognised poor technique or compliance may lead to changes in inhaler device and therapy which may be associated with a greater global warming potential.

In practice

- Modifiable factors which practitioners can influence include training for correct inhaler use on initiation and follow-up at subsequent visits, choice of training method and device selection. (53)
 - Compliance in COPD and asthma is likely to remain poor unless the reasons are identified, assessed and addressed. GOLD advise using the Review, Assess and Adjust cycle to continually monitor and improve patient's management. (54)
 - On repeat prescribing the underuse of preventer medications and overuse of reliever medication should trigger a review of compliance and technique.
 - Check Technique at every visit by observing the patient using their inhaler. Look out for common errors.
-



Section 6: Self-Management

Discussing triggers, designing an action plan and keeping a diary can help prevent or reduce flare frequency and severity and improve patient autonomy. Self-management plans have been designed to include improving the inhalation technique and understanding the importance of maintaining inhaled medication over time.(55)

There is also the potential to use technology to improve compliance, to pair prescribing with inhaler technique resources, diet advice, and vaccine reminders etc.

In practice

The Asthma Action Plan recommends that every patient has an asthma action plan.

On prescribing emergency care SABA, consider using small volume Salamol with a spacer over Ventolin. This inhaler has half the volume of propellant than a regular Ventolin inhaler and therefore half the carbon footprint.

The COPD Communication Card includes a self-management advice plan.

The ICGP COPD Management Plan Includes a Self-Management Plan in Appendix 3

Links to video clips or other simple instructions for inhaler use should be routinely provided at consultations and when repeat prescribing (available at asthma.ie, COPD.ie and beyond).

Smart inhalers, which may be connected to smartphones, can provide real-time objective information about adherence and inhaler technique.(56) The use of dose counters may inform patients about their inhaler adherence.





Disposal of Inhalers



In 2014, 4.4 million inhalers were dispensed to patients in Ireland. The disposal of inhalers generates carbon emissions through incineration. On lifecycle analysis, the majority of emissions from MDIs occur during the use phase and disposal. By contrast, majority of emissions for DPIs occur during production phase. (5) This difference is mainly due to unused propellant being released from MDI on disposal.

A study in 2016 of disposed inhalers showed that on average MDIs had 48% unused doses while DPIs had 27%. (58) Dose counters may prevent under dosing of medication as well as reducing the overall environmental footprint by reducing waste.

Inhaler recycling scheme

the TEVA Inhaler Recycling Scheme is being piloted in pharmacies across the country.. A participating pharmacy will accept any inhaler prescribed in any pharmacy. The inhalers are then collected by Teva and the plastic and metal in each inhaler is recycled.

Best for the planet

Incinerating unused propellant released from MDIs degrades the HFAs to a less potent greenhouse gas. Recycling the metal and plastic in inhalers re-enters these materials into the supply chain.

In practice

- Counsel patients on avoiding medication hoarding and using up existing medication
- Encourage use of a dose counter – particularly if using an MDI
- Advise patients that inhalers should not be disposed of in the domestic bin, but returned to their local pharmacy
- Encourage patients to participate in the recycling initiative www.teva.ie/inhalerrecycling/
- Contact your local pharmacy to set up a collection point or contact TEVA to set up a collection point in your hospital. Consider performing an audit on the number of devices collected at your site.





Section 8: Changing prescribing choices in practice

Consider performing an audit of prescribing practices in your practice, pharmacy or clinic.

Case Study: General Practice

The carbon footprint of inhalers prescribed in a mixed rural urban GP practice was determined retrospectively January – June 2020. An educational team intervention was performed aiming to switch MDIs to DPIs where appropriate. Inhaler prescribing was re-audited July -December 2020 and the carbon equivalent difference estimated.

Results: At baseline the practice prescribed 84% MDIs to 16% DPIs. After the intervention this was reduced to 70% MDIs to 30% DPIs. The carbon equivalent difference was 3,575 kgCO₂ per month. Over the duration of the audit this equated to saving approximately 21, 448 kgCO₂. (57)

Conclusion: Targeting inhaler prescribing offers the potential to significantly improve the carbon footprint of Irish healthcare. The carbon saved in this audit was the equivalent to charging almost 3 million smart phones. DPIs may also improve compliance and drug delivery, while reducing unscheduled tertiary care.

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