How to Reduce the Carbon Footprint of Inhaler Prescribing

A Guide for Healthcare Professionals in the UK

Reviewed and endorsed by the NHS England and NHS Improvement Inhaler Working Group and Asthma UK and the British Lung Foundation

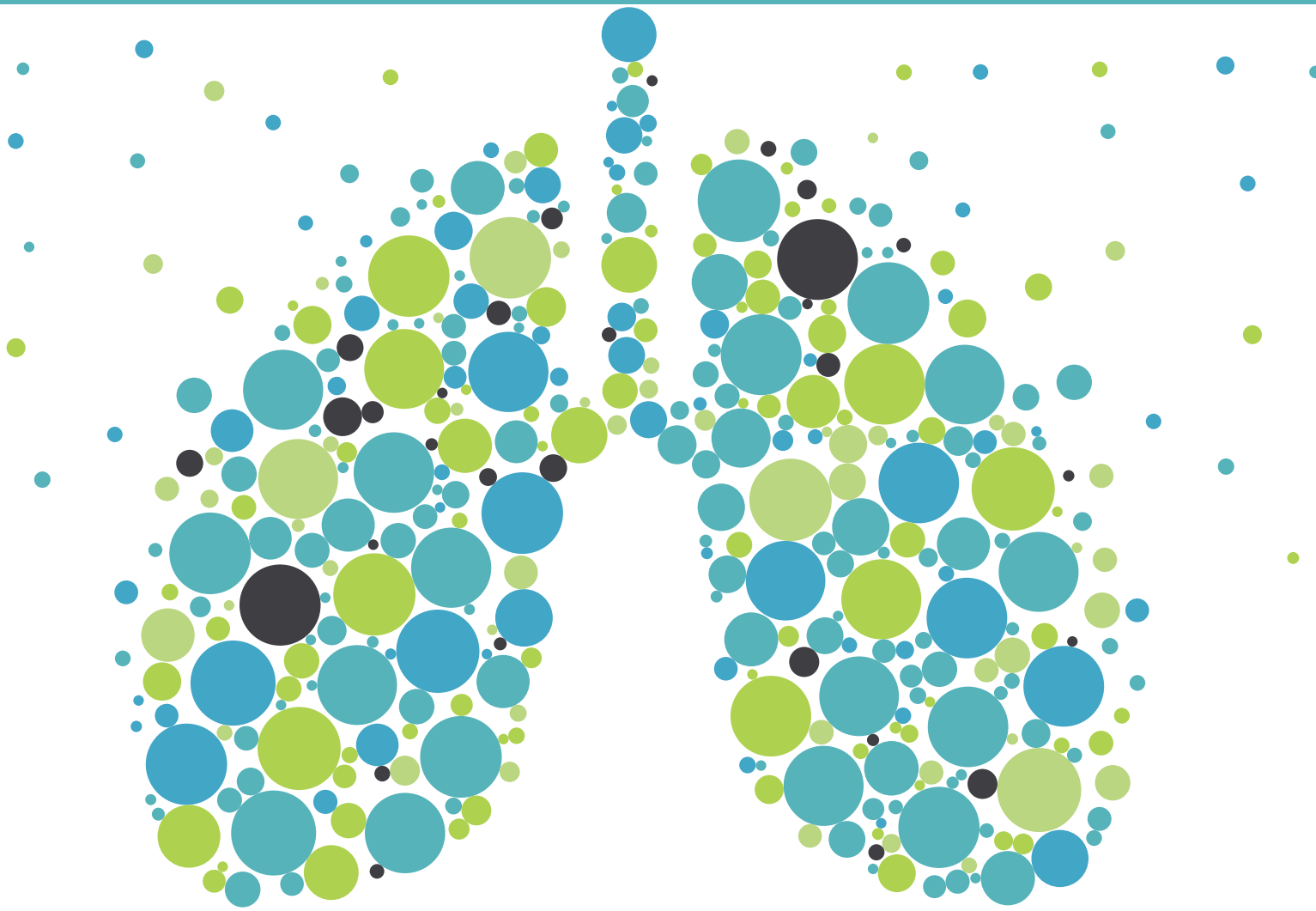
asthma UK

British Lung Foundation

This guide is written for healthcare professionals. If you are a user of inhalers, please discuss with your doctor, nurse, pharmacist, or pharmacy technician, before making any changes to your treatment. This guide is focused on adult respiratory care but may be useful in children over 12 years old.

THE GUIDE CONSISTS OF FIVE SECTIONS

1. Introduction and recommendations
2. Explanation of recommendations
3. Frequently asked questions
4. Tables of inhalers by carbon footprint
5. Reference



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Version 3.3.2 published Oct 2021

SECTION 1

INTRODUCTION AND RECOMMENDATIONS

The use of inhaled therapies has substantially improved the health of people with respiratory disease. However pressurised metered dose inhalers (pMDIs) contain hydrofluoroalkanes (HFA) propellants which are potent greenhouse gases, 1300 – 3350 times more potent than carbon dioxide.[1] The NHS has set the target of reaching net zero by 2040 for the greenhouse gas emissions which it can control ('NHS Carbon Footprint'). Inhalers are included in this scope and account for approximately 13% of the carbon footprint related to delivery of care.[2]

In England approximately 70% of inhalers prescribed are pMDIs, in contrast to Sweden which prescribes 13% as pMDIs.[3] In England most pMDI inhalers prescribed are short acting beta-agonist inhalers (SABA) such as salbutamol. In patients with asthma, using more than 3 SABA inhalers per year suggests over-use and poor control.[4] Therefore, optimising care following national guidance, can significantly reduce the carbon impact of inhaler prescribing.[5]

Alternatives to pMDIs, such as dry powdered inhalers (DPIs) and soft-mist inhalers (SMIs), have a much lower carbon footprint and can be safely and effectively used by many patients. DPIs do not require spacer devices and often have dose counters to aid use.

To reduce the carbon footprint of inhaler prescribing:

1. Optimise asthma and COPD care following national guidelines.
2. Offer dry powder inhalers or soft mist inhalers as first choice when clinically appropriate.
3. If pMDIs are needed for an individual then chose brand and regime with care to minimise carbon footprint.
4. Ask patients to return all used or unwanted inhalers to community pharmacies or dispensaries for disposal by incineration or re-cycling.

To safely and effectively change inhalers:

1. Focus on finding the right medication and device for each individual in consultation with them and their carers, through shared decision making.
2. Assess and optimise inhaler technique at every opportunity.
3. Follow patients up to ensure suitability of device and disease control.
4. Do not undertake blanket switching if changing the device type or medication.

SECTION 2

EXPLANATION OF RECOMMENDATIONS

1. Optimise Asthma and COPD care.

Our first priority must be to identify and review those with poorly controlled disease and optimise their care, their adherence and their inhaler technique. The clinical and environmental harms of poor disease control will likely outweigh any benefits from use of different inhalers. Regular inhaled preventer treatment in asthma should be with inhaled corticosteroids and regular inhaled treatment in COPD should normally be with long acting bronchodilators.[6,7] Opportunities to identify poor control and optimise care include exacerbations, repeat prescription requests suggesting SABA over-use, annual reviews, and practice quality improvement activities.

a) Identifying and reducing SABA overuse with effective preventer therapy

Overreliance on short-acting bronchodilators (SABA) can indicate poor disease control. 3 or more days a week with any need for SABA is a pragmatic threshold for uncontrolled asthma.[8] Well controlled asthma for most patients will mean using 1-2 SABA inhalers a year. However, many patients in England are prescribed more than 6 SABA inhalers a year which suggests over-reliance on SABA.[3] The PCRS asthma slide rule tool can help work out number of inhalers used. Increasing the prescribing interval of SABA from 28 days to 90 or 180 days can alert prescribers to SABA over-reliance.[9] To reduce SABA overuse in asthma, effective preventer therapy via a suitable device is required. Maintenance and reliever therapy regimens provide a good treatment approach for some adults with asthma.[6]

b) Reviewing inhaler technique and altering treatment

Alterations to inhaler devices and treatment regimes are an opportunity to improve disease control in discussion with individual patients. Sufficient time should be given to allow this to occur. Patients should be reassured that the aim is to improve disease control whilst also reducing environmental impact, but if disease control worsens due to changing inhalers then they can switch back again. Inhalers should be prescribed by brand name as devices are not interchangeable.[10] Spacer use should be encouraged with patients using pMDIs to reduce errors of technique and increase effectiveness of treatment. They are essential for young children.[6] When it is safe and possible to do so, face to face assessment should be prioritised to allow assessment of inhaler technique. Where this is not possible, video consultation can be used. Placebos can be useful to practice device use and handling. Some placebo devices (e.g. Turbohaler patient trainer whistle, Ellipta Inhalation Trainer, MDI Trainhaler) whistle if the patient uses the correct inspiratory flow. For patients using multiple inhalers try to use the same type of device where possible. Written care plans should be given to patients.

c) Other aspects of care

Aspects to consider include reviewing diagnosis, smoking cessation, allergen avoidance, avoiding the use of inhaled steroids in COPD unless specifically indicated, and collaborative working with respiratory teams.[11] These areas are beyond the scope of this guide and we recommend using national and international guidance for this.[4,5,6]

2. Offer dry powder inhalers (DPIs) or soft mist inhalers (SMIs) as first choice when clinically appropriate.

a) Would a DPI or SMI be clinically appropriate?

For the many patients, the answer will be yes. However, pMDI with spacer or breath actuated inhaler (BAI) should be used:

- where a patient is unlikely to be able to take a fast deep inhalation with sufficient inspiratory flow required for use of a DPI (e.g. in younger children or the very elderly),
- if following a personalised review of inhaler options, a patient cannot or would prefer not to use a DPI or SMI,
- where a patient is already using a pMDI/BAI with effective technique, has good disease control, and the risks of changing inhalers are thought to outweigh the benefits,
- for reliever inhalers where there is concern that a patient may be unable to use a DPI during exacerbations. In this situation a Salbutamol pMDI with spacer should be given for use in these situations.

b) Which DPI or SMI inhaler to prescribe?

It is important that any decision to prescribe or change a patient's asthma inhaler is the outcome of an individualised, shared decision-making conversation with patients and their carers. It is recommended that the tables below are used to identify options and then a selection is made informed by local guidance. Cost comparisons between inhalers are difficult, but changing inhalers to reduce carbon footprint is not necessarily more expensive and may be cheaper.[1] Cost savings from reducing the number of inhalers and better care should also be taken into account.

3. If pMDI is needed or preferred then chose brand and dosing regime with care to minimise carbon footprint by:

a) Avoiding use of branded Ventolin Evohaler

Ventolin 100mcg Evohaler has more than double the carbon footprint of other Salbutamol pMDIs.[1] This does not affect Ventolin Accuhaler which is a DPI with 200mcg per dose.

b) Prescribing inhaled corticosteroids to minimise the number of doses required for the same strength

For example, prescribe 1 dose of 200mcg Clenil or Soprobec twice a day rather than 2 doses of 100mcg Clenil or Soprobec twice a day. This effectively halves the carbon footprint of treatment and may be easier and cheaper for the patient. Any dosing changes need careful discussion with patient and good awareness across all involved health professionals to ensure dosing is correct.

c) Avoiding use of Flutiform or Symbicort pMDIs

These contain HFA227ea which has a much higher carbon footprint than the HFA134a used in other pMDIs.[1] These inhalers should only be used for patients where all alternative inhalers have been tried and they are recommended by respiratory specialists OR they are already in use and it is thought clinically inappropriate to switch, for example in a patient with known severe or hard to control asthma. This does not apply to Symbicort Turbohaler which is a DPI.

4. Ask patients to return all used or unwanted inhalers to community pharmacies or dispensaries for disposal.

The pharmacy or dispensary can then send for recycling or incineration. Inhalers should not be put into household waste as this allows release of remaining HFAs into the atmosphere. Incineration thermally degrades HFAs into far less potent greenhouse gases. Used and unwanted inhalers returned to community pharmacies can be sent for incineration or in some cases, pharmacies or dispensaries may have access to inhaler recycling which allows the plastics and gases to be recycled.(e.g. [12])

SECTION 3

FREQUENTLY ASKED QUESTIONS

1. **How can I effectively advise on appropriate technique for use of so many different devices which I am not familiar with?**
   Asthma UK videos on inhaler technique can help with this.[13] You will probably find there are relatively few types of device which you prescribe regularly informed by what is recommended in your area.

2. **How do I know which doses of inhalers are likely to be similar in clinical effectiveness?**
   The attached table is based on the BTS/SIGN Asthma Guidance. Remember that clinical effectiveness also depends on other factors including patient use so finding the right device for a patient is very important.

3. **Do I need to check inspiratory flow in all patients when starting a DPI? And how do I do this?**
   No. For many patients there is no need to check their inspiratory flow. Adults and older children with mild to moderate asthma are likely to have sufficient flow. It may be useful having an inspiratory flow device (which is a similar size to a peak flow meter) so that you can check this in those with more severe disease or older patients.

4. **Is there any benefit to prescribing inhaled corticosteroid pMDIs as 2 doses twice a day rather than 1 dose twice a day of a higher strength?**
   Clinically there may be an advantage in terms of flexibility of dosing. However once a patient is clinically stable, most should be able to use a one dose twice a day regimen. In inhalers with the same number of doses at a higher strength, patients may prefer a one dose twice a day regime for convenience and cost as each inhaler will last twice as long.

5. **Is there any way to ensure Ventolin Evohaler is not dispensed when prescribing a generic Salbutamol pMDI?**
   No. There remains debate about whether to prescribe Salbutamol pMDI generically or by brand. To ensure Ventolin Evohaler is not given you need to prescribe a specific alternative Salbutamol pMDI by brand such as Salamol or Airomir. However, prescribing generically allows pharmacies greater flexibility and so reduces the risk of stock shortages.

6. **My local Clinical Commissioning Group/Health Board recommends pMDIs first line. What should I do?**
   Many local NHS organisations have amended their prescribing guidance in recent years and others are looking at this. If possible, engage with the CCG and support them in this process. As a prescriber the responsibility for what you prescribe ultimately sits with you so you should only prescribe what you think is appropriate as a professional.

7. **Aren't there many different aspects of inhaler choice, not just environmental, which I should consider?**
   Yes. Foremost among these is which is the best inhaler clinically for the patient in question. Carbon footprint is another important but often overlooked impact which is why it is the focus of this guide. Patient preference and financial costs are also important considerations. Supply issues may be important in some areas at some times. Other environmental and social impacts of inhalers are currently poorly described and therefore are difficult to take into account.

8. **What about addressing smoking, air pollution, and other causes of lung disease?**
   Preventing respiratory disease is very important but beyond this guide's scope.

9. **Is Maintenance and Reliever Therapy (MART) a good option for some patients with asthma?**
   Yes. This can improve clinical outcomes and lower environmental footprint for some patients. Some combination inhalers, containing corticosteroid and the long- acting beta agonist formoterol, can be used as both preventer and reliever inhaler – so-called Maintenance and Reliever Therapy (MART). Most of the licensed options for MART in the UK are DPIs and as this regime reduces the use of salbutamol pMDI it can significantly lower the carbon footprint of treatment. More information for patients about MART is available from Asthma UK.[14]

10. **Should emergency packs containing a Salbutamol pMDI and spacer be offered to patients with asthma or COPD whose normal treatment is DPI/SMI?**
    This is one proposed solution to concerns that in an acute asthma attack a patient may not be able to use a dry powder reliever inhaler. This may be particularly useful for those with a history of acute attacks or who are thought to be at high risk of an attack.

11. **Will new propellant gases for pMDIs with lower carbon footprint make the changes suggested in this guide unnecessary?**
    Metered dose inhalers using the propellant HFA152a are being developed and are expected to have a significantly lower carbon footprint than currently available pMDIs. They are likely to be a valuable option for patients requiring pMDIs in the future but it is not clear when these will be available for patients and it is not expected that their carbon footprint will be as low as currently available dry powder inhalers. It is therefore not recommended that treatment changes are delayed in anticipation of this development.

SECTION 4

TABLES OF INHALERS BY CARBON FOOTPRINT CATEGORY

Inhaled Corticosteroid (ICS) Inhalers by Adult Dose and Carbon Footprint				
	ICS	Low Dose	Medium Dose	High Dose #
Low Carbon Footprint **(<2kg CO2e per inhaler)** Use where clinically appropriate	**Beclometasone**			
	Beclomethasone Easyhaler	200mcg one dose twice a day	200mcg two dose twice a day	n/a
	Budesonide			
	Budesonide Easyhaler	200mcg one dose twice a day	400mcg one dose twice a day*	400mcg two doses twice a day
	Pulmicort Turbohaler	200mcg one dose twice a day*	400mcg one dose twice a day*	400mcg two doses twice a day
	Budelin Novolizer	200mcg one dose twice a day	400mcg one dose twice a day	400mcg two doses twice a day
	Fluticasone proprionate			
	Flixotide Accuhaler	100mcg one dose twice a day	250mcg one dose twice a day	500mcg one dose twice a day
	Mometasone			
	Asmanex Twisthaler	200mcg one dose twice a day	400mcg one dose twice a day	n/a
High Carbon Footprint **(6-20kgCO2e per inhaler)** Use if low carbon footprint alternative not appropriate	**Beclometasone**			
	Clenil Modulite pMDI	200mcg one dose twice a day*	200mcg two doses twice a day	250mcg two-to four doses twice a day
	Kelhale pMDI (extrafine)	100mcg one dose twice a day*	100mcg two doses twice a day	100mcg four doses twice a day
	Qvar pMDI / Autohaler / Easi-Breathe (all extrafine)	100mcg one dose twice a day*	100mcg two doses twice a day	100mcg four doses twice a day
	Soprobec pMDI	200mcg one dose twice a day*	200mcg two doses twice a day	250mcg two or four doses twice a day
	Ciclesonide			
	Alvesco pMDI	160mcg one dose once a day*	160mcg two doses once a day	160mcg two doses twice a day
	Fluticasone proprionate			
	Flixotide Evohaler pMDI	50mcg two doses twice a day	250mcg one dose twice a day*	250mcg two doses twice a day

Only use after referring the patient to specialist care.
* Alternative regimes exist consisting of more doses of lower strength per day.
All doses listed are licensed for adult asthma.
For COPD and paediatric asthma please check licensing and dosing in the British National Formulary.

ICS/LABA Combination Inhalers by Adult Dose and Carbon Footprint

	ICS/LABA	Low Dose	Medium Dose	High Dose #
Low Carbon Footprint (<2kg CO2e per inhaler) Use where clinically appropriate	**Beclometasone diproprionate (extrafine) with formoterol**			
	Fostair Nexthaler	100/6 one dose twice a day	100/6 two doses twice a day	200/6 two doses twice a day
	Budesonide with formoterol			
	Duoresp Spiromax Fobumix Easyhaler	160/4.5 one dose twice a day	320/9 one dose twice a day*	320/9 two doses twice a day
	Symbicort Turbohaler	200/6 one dose twice a day	400/12 one dose twice a day*	400/12 two doses twice a day
	Fluticasone proprionate with salmeterol			
	Seretide Accuhaler	100/50 one dose twice a day	250/50 one dose twice a day	500/50 one dose twice a day
	Fusacomb Easyhaler	n/a	250/50 one dose twice a day	500/50 one dose twice a day
	AirFluSal Forspiro Stalpex DPI	n/a	n/a	500/50 one dose twice a day
	Fluticasone furoate with vilanterol			
	Relvar Ellipta	n/a	92/22 one dose once a day	184/22 one dose once a day
High Carbon Footprint (10-20kgCO2e per inhaler) Use if low carbon footprint alternative not appropriate	**Beclometasone diproprionate (extrafine) with formoterol**			
	Fostair pMDI	100/6 one dose twice a day	100/6 two doses twice a day	200/6 two doses twice a day
	Fluticasone proprionate with salmeterol			
	Combisal pMDI Seretide Evohaler (Other brands exist)	50/25 two doses twice a day	125/50 two doses twice a day	250/25 two doses twice a day
Highest Carbon Footprint (>34kgCO2e per inhaler) Avoid unless no appropriate alternative or switching is inappropriate clinically	**Fluticasone proprionate with formoterol**			
	Flutiform pMDI	50/5 two doses twice a day	125/5 two doses twice a day	250/10 two doses twice a day
	Flutiform K-haler (discontinued 2021)	50/5 two doses twice a day	125/5 two doses twice a day	250/10 two doses twice a day
	Budesonide with formoterol			
	Symbicort pMDI	100/3 two doses twice a day	200/6 two doses twice a day	n/a

Only use after referring the patient to specialist care. * Alternative regimes exist consisting of more doses of lower strength per day. All doses listed are licensed for adult asthma.
For COPD and paediatric asthma please check licensing and dosing in the British National Formulary.

Other Inhalers by Carbon Footprint

	Short Acting Beta Agonists (SABA)	Long Acting Beta Agonists (LABA)	Triple combination (ICS/ LABA/LAMA)
Low Carbon Footprint **(<2kg CO2e per inhaler)** Use where clinically appropriate	**Salbutamol:** Salbutamol Easyhaler Salbulin Novolizer Ventolin Accuhaler (DPI) **Terbutaline:** Bricanyl Turbohaler (DPI)	**Formoterol:** Foradil (DPI) Formoterol Easyhaler (DPI) Oxis Turbohaler (DPI) **Indacaterol:** Onbrez Breezhaler (DPI) **Olodaterol:** Striverdi Respimat (SMI) **Salmeterol:** Serevent Accuhaler (DPI)	**Fluticasone Furoate / Umeclidinium / Vilanterol:** Trelegy Ellipta (DPI)
High Carbon Footprint **(9-20kgCO2e per inhaler)** Use if low carbon footprint alternative not appropriate	**Salbutamol:** Airomir Salamol (pMDI) Airomir 100 Autohaler (BAI) Salamol 100 Easi-breathe (BAI)	**Formoterol:** Atimos Modulite (pMDI) **Salmeterol:** Serevent Evohaler (pMDI) Multiple other manufacturers (pMDI)	**Beclometasone / Glycopyrronium / Formoterol:** Trimbow (pMDI)
Higher Carbon Footprint (28KgC02e)	**Salbutamol:** Ventolin 100 Evohaler (pMDI)		

All Long Acting Muscarinic Antagonists (LAMA) have low carbon footprint (DPI or SMI).
All LAMA/LABA inhalers have low carbon footprint (DPI or SMI).
Short Acting Muscarinic Antagonist (SAMA) is only available as Ipratropium which has a high carbon footprint (Atrovent pMDI)
Cromoglicate and Nedocromil inhalers are only available as inhalers with high carbon footprints. (Intal pMDI and Tilade pMDI).
For indications, dosing and licensing please check the British National Formulary.

Note on construction of tables: The above tables have been constructed based on propellant included in the inhalers rather than detailed consideration of the specific carbon footprint of individual inhalers as this usually dominates the carbon footprint. Ventolin Evohaler was considered specifically as an exception in its class. The indicative footprints have been based on Wilkinson et al (2019) and the Ventolin Evohaler footprint has been taken from Janson et al (2020).[1,15] The indicative ranges were widened slightly in response to emerging work by PrescQIPP CIC (2021).

SECTION 5

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Authorship:

Version 3 of this guide was prepared by Dr James Smith, Dr Aarti Bansal, Dr Joe Barron-Snowdon, Dr Duncan Keeley, and Dr Alex Wilkinson for Greener Practice. We would like to acknowledge the members of the RCGP Climate Emergency Advisory Group and the NHS England and NHS Improvement Inhalers Working Group who provided feedback on earlier versions of this guide. We would welcome suggested improvements to this guide.

Conflicts of Interests Statement:

JS: Married to GP partner at dispensing practice.
AB: No conflicts of interest to declare
J B-S: No conflicts of interest to declare
DK: No conflicts of interest to declare
AW: Has made unpaid contributions to research on the carbon footprint of inhalers which was funded by AstraZeneca and GlaxoSmithKline.

Not for Marketing Use:

Specific branded inhalers are referred to in this guide in order to help health professionals identify which devices are likely to have higher or lower carbon footprint so they can consider this when making treatment decisions with patients. We are not endorsing any specific products or suggesting clinical superiority of any particular products relative to others. We ask that this guide is not to be used by the pharmaceutical industry in marketing their products.