

How to Reduce the Carbon Footprint of Inhaler Prescribing for Children and Young People with asthma

A Guide for Healthcare Professionals in the UK



Greener Practice

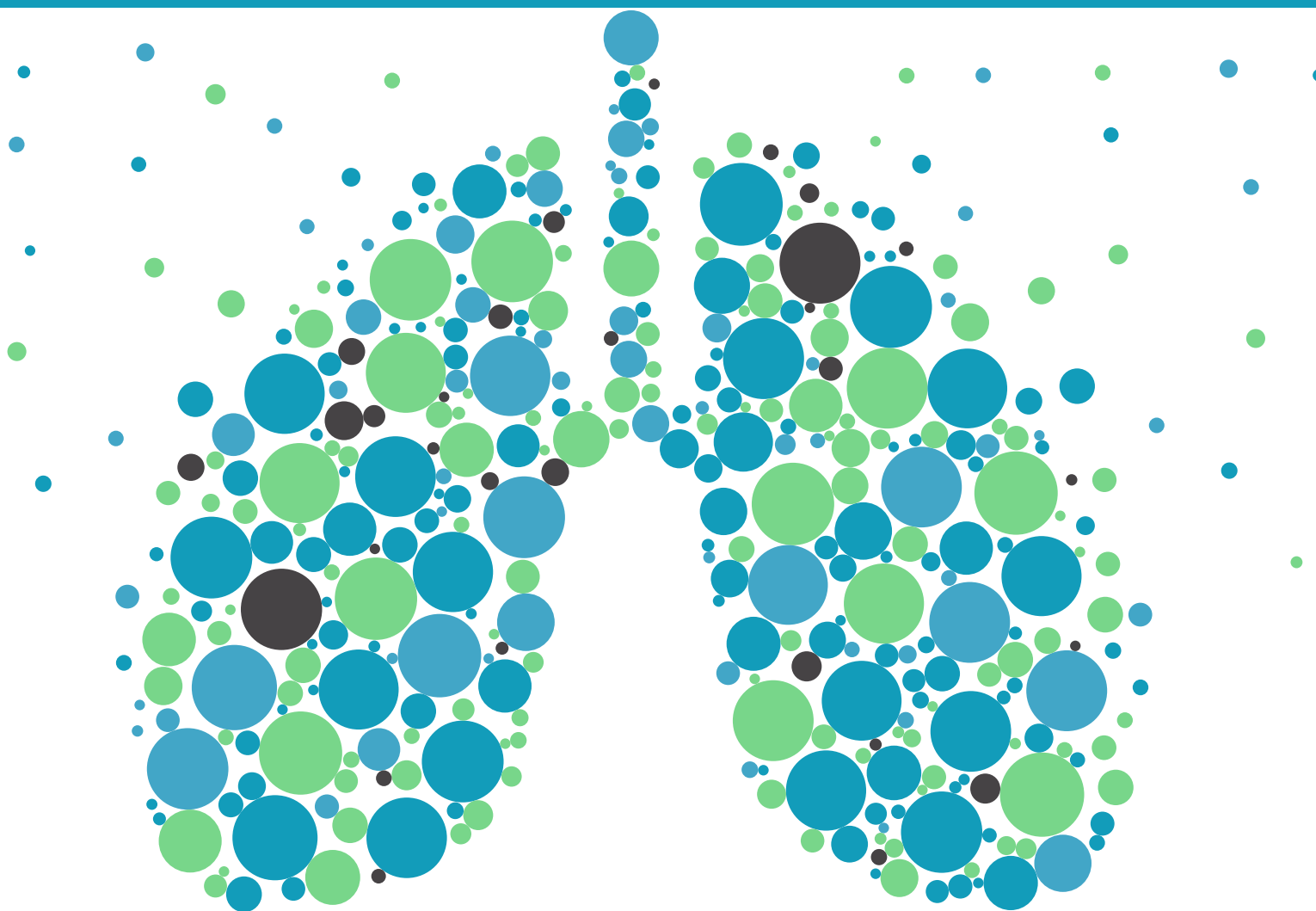


This guide is written for healthcare professionals. If you or your child use inhalers, please discuss with your doctor, nurse, pharmacist, or pharmacy technician, before making any changes to your treatment. This guide is focused on the care of children and young people (CYP) with asthma.

You can find the guidance for adult inhaler prescribing [here](#)

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 References



Choose the greenest inhaler that the child or young person will use and will use correctly.

KEY RECOMMENDATIONS AND PRINCIPLES

To reduce the carbon footprint of inhaler prescribing:

- 1 Optimise asthma care following national guidelines.
- 2 Discuss and consider changing to a DPI when clinically appropriate, usually around 12 years of age.
- 3 If pMDIs are needed for a CYP then choose a brand and regime with care to minimise the carbon footprint.
- 4 Ask CYP to return all used or unwanted inhalers to community pharmacies or dispensaries for disposal.

To safely and effectively change inhalers:

- 1 Focus on finding the right medication and device for each individual CYP in consultation with them and their carers, through shared decision making.
- 2 Educate, assess and optimise inhaler technique at every opportunity for both CYP and parents/carers.
- 3 Follow CYP up to ensure suitability of device and disease control.
- 4 Inform school regarding any inhaler changes that may affect the CYPs asthma action plan.

SECTION 1

INTRODUCTION AND RECOMMENDATIONS

The use of inhaled therapies has substantially improved the health of CYP with respiratory disease. There are two broad categories of inhaler devices: pressurised metered dose inhalers (pMDIs) and dry powder inhalers (DPIs). In England approximately 70% of inhalers prescribed are pMDIs, in contrast to Sweden which prescribes 13% as pMDIs.⁽¹⁾ However, pMDIs contain hydrofluoroalkanes (HFA) propellants which are potent greenhouse gases, 1526 – 3350 times more potent than carbon dioxide.^(2,3) The NHS has set itself ambitious targets for reducing greenhouse gas emissions, including from inhalers. ('NHS Carbon Footprint').⁽⁴⁾

In CYP with asthma, adherence to regular preventer therapy is the key to good asthma control. Poor control tends to drive high use of short-acting beta agonist (SABA) inhaler such as Salbutamol. In CYP with asthma, using three or more SABA inhalers per year suggests over-reliance and poor control.⁽⁵⁾ Therefore, optimising care following [national guidance](#), can significantly reduce the carbon impact of inhaler prescribing.⁽⁶⁾

Alternatives to pMDIs, such as dry powdered inhalers (DPIs), have a much lower carbon footprint and can be safely and effectively used by some young people. However, for children under five years and some between 5 and 12 years inhaled treatment should be with pMDI with spacer. Currently, DPIs are not routinely recommended for children in England <12 years of age due to the relative lack of data to confirm that children are able to use these devices safely and effectively.

SECTION 2

EXPLANATION OF RECOMMENDATIONS

1. Optimise Asthma care

The clinical and environmental harms of poor disease control will very likely outweigh any benefits from use of different inhaler types. Therefore, the priority for healthcare professionals must be to identify and review CYP with poorly controlled asthma and ensure that they have access to preventative treatments that they can and will use can use effectively. Where appropriate a lower carbon inhaler should be first choice. Regular preventative treatment in asthma should be with inhaled corticosteroids.⁽⁷⁾

Opportunities to identify poor control and optimise care include exacerbations, repeat prescription requests suggesting SABA over-use, annual reviews, and quality improvement activities.

a) Identifying and reducing SABA overuse with effective preventer therapy

Overreliance on short-acting bronchodilators (SABA) is a marker of poor disease control. A pragmatic threshold for uncontrolled asthma in CYP is the use of a SABA inhaler three or more days most weeks.⁽⁸⁾ **Well controlled asthma for most CYP will mean using 1-2 SABA inhalers or fewer a year.** The [PCRS asthma slide rule](#) tool can help work out the 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. For some young people aged 12 years or over, maintenance and reliever therapy (MART) regimens provide a good treatment approach.⁽⁷⁾ This means a combination of a preventer medication and reliever medication in one inhaler device. In those young people aged 12 years and over, this combination treatment / inhaler can be useful to support better management of their asthma.

b) Reviewing inhaler technique and altering treatment

Alterations to inhaler devices and treatment regimens are an opportunity to improve disease control in discussion with CYP and their families or carers. Sufficient time should be given to allow this to occur. Any change of device must be followed up with a review 6-12 weeks later to ensure there has been no loss of control on the new device and to reinforce correct delivery technique. CYP should be reassured that if asthma control worsens due to changing inhalers then they can switch back again. Refer the CYP and parents / carers to a community pharmacy for a New Medicine Service when a new inhaler is prescribed so they can show them how to use the device.

Inhalers and spacer devices should be prescribed by brand name as devices are not interchangeable.^(10,11) The appropriately sized spacer or spacer with a mask should always be used for CYP using MDIs, to reduce errors of technique and increase effectiveness of treatment.⁽⁷⁾

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 CYP uses the correct inspiratory flow. For CYP using multiple inhalers, try to use the same type of device where possible. Personalised asthma action plans should be given to all CYP.

c) Other aspects of care

These include reviewing the diagnosis, treating comorbidities, and patient education including trigger avoidance. This should include a discussion about social and environmental modifiable risk factors for asthma. For example, parental/CYP smoking, difficult housing circumstances, air pollution and indoor air quality.⁽¹²⁾ These areas are beyond the scope of this guide and we recommend using national and international guidance for this.^(5,6,7)



2. Choosing the lowest carbon inhaler

Offer dry powder inhalers (DPIs) as a choice when clinically appropriate for CYP around 12 years.

a) Would a DPI be clinically appropriate?

For many CYP aged 11-12 years and above, the answer will be yes.

However, pMDI with spacer or breath actuated pMDI (BAI) should be used:

- where a CYP is unlikely to be able to consistently take a fast, deep inhalation with sufficient inspiratory flow required for use of a DPI (e.g. in younger children). It may be necessary to measure the peak inspiratory flow at a given resistance, for instance using an In-Check DIAL device (Clement Clarke International Ltd., Harlow, UK), to determine the likely best inspiratory flow achievable with a particular inhaler type⁽¹²⁾. However, this is not a substitute for checking ability to use the actual inhaler being proposed,
- if following a personalised review of inhaler options, a CYP cannot or would prefer not to use a DPI,
- where a CYP 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.

Using DPI during periods of poorer control

- CYP may have sufficient inspiratory flow when well but be unable to use a DPI during exacerbations. This is because peak inspiratory flow may fall during periods of poor control due to exposure to viruses, cigarette smoke, environmental pollution or allergens⁽¹³⁾. This is more likely to affect CYP whose maximum inspiratory flow is closer to that required to effectively use a dry powder device. Although many CYP attending hospital with an asthma attack can generate sufficient peak inspiratory flow to use DPI⁽¹³⁾, evidence is lacking for CYP experiencing a severe or life-threatening attack. See section 3, frequently asked questions for advice about how these situations can be safely managed.

b) Which inhaler to prescribe?

It is important that any decision to prescribe or change a CYP's asthma inhaler is the outcome of an individualised, shared decision-making conversation with CYP and their families/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.⁽²⁾ Cost savings from reducing the number of inhalers and better care should also be taken into account.

If pMDI is needed or preferred, then choose brand and dosing regimen with care to minimise carbon footprint by:

c) Avoiding use of branded Ventolin Evohaler

Ventolin 100mcg Evohaler has more than double the carbon footprint of other salbutamol pMDIs.⁽²⁾ This does not affect Ventolin Accuhaler which is a DPI with 200mcg per dose.

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

For example, prescribe 1 dose of 200mcg Clenil or Soprobeq twice a day rather than 2 doses of 100mcg Clenil or Soprobeq twice a day⁽¹⁴⁾. This effectively halves the carbon footprint of treatment and may be easier and cheaper for the CYP.

Any dosing changes need careful discussion with CYP and good awareness across all involved health professionals to ensure that dosing is correct.

e) Avoiding use of Flutiform or Symbicort pMDIs

These contain HFA227ea which has a much higher carbon footprint than the HFA137a used in other pMDIs.⁽¹⁾ These inhalers should only be used for CYPs 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 CYP with known severe or difficult to treat asthma. This does not apply to Symbicort Turbohaler which is a DPI.

3. Ask CYPs to return all used or unwanted inhalers to community pharmacies or dispensaries for disposal.

The pharmacy or dispensary can then send used or unwanted inhalers for recycling or incineration. Inhalers should not be put into household waste as this allows the release of remaining HFAs into the atmosphere. In some cases, pharmacies or dispensaries may have access to inhaler recycling which allows the plastics and gases to be recycled. (e.g.⁽¹⁵⁾) Incineration thermally degrades HFAs into far less potent greenhouse gases.



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?

[BeatAsthma videos](#) on inhaler technique can help with this.⁽¹⁶⁾ There will likely be 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 tables (in Section 4) are based on the BTS/SIGN Asthma Guidance. Remember that clinical effectiveness also depends on other factors including CYP usage habits, so finding the right device for an individual CYP is very important.

3. 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. Therefore, the strategy suggested above may be less suitable in CYP where frequent dosing adjustments are required or anticipated i.e. when doses are being titrated. However, once a CYP 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, CYPs may prefer a one dose twice a day regime for convenience as each inhaler will last twice as long and dose administration is quicker.

4. Is there any way to ensure Ventolin Evohaler is not dispensed when prescribing a generic Salbutamol pMDI?

No. To ensure Ventolin Evohaler is not given you need to prescribe a specific alternative Salbutamol pMDI by brand such as Salamol or Airomir.

However, it is important to make this change in coordination and agreement with local pharmacies to avoid stock shortages.

5. My local Integrated Care Board/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 ICB 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.

6. Aren't there many different aspects of inhaler choice, not just environmental, which I should consider?

Yes. Foremost among these is: what is the best inhaler clinically for this child or young person and their family? The best inhaler for any CYP is the one that they can and will use.

Carbon footprint is another important but often overlooked impact which is why it is the focus of this guide. CYP 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.

7. What about addressing smoking, air pollution, and other causes of lung disease?

Preventing respiratory disease is very important but beyond this guide's scope.

8. Is Maintenance and Reliever Therapy (MART) a good option for some CYPs (aged 11 – 12 and over) with asthma?

Yes. This can improve clinical outcomes and lower the environmental footprint for some CYPs. 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 pMDIs so it can significantly lower the carbon footprint of treatment. More information for CYPs about MART is available from [Asthma UK](#).⁽¹⁷⁾

9. Should emergency packs containing a Salbutamol pMDI and spacer be offered to CYP with asthma whose normal treatment is DPI?

This is one proposed solution to concerns that in an acute asthma attack a CYP 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. If an emergency pack is supplied, CYP and their families should be reminded to check the expiry dates of the medication and return unused medication to pharmacies for safe disposal.

10. Will new propellant gases for pMDIs with a lower carbon footprint make the changes suggested in this guide unnecessary?

New, low carbon propellant, inhalers 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 CYPs requiring pMDIs in the future but are unlikely to be available until 2025 and their actual carbon footprint is not yet known. It is therefore not recommended that treatment changes are delayed in anticipation of this development.

11. What advice should I give to parents and children who want to reduce the carbon impact of asthma?

The biggest carbon saving will be achieved by ensuring good asthma control. Other simple steps will also help and are summarised in the box overleaf.

Nine ways to reduce the carbon impact of your (or your child's) asthma care*

- 1 Take preventer inhalers regularly to stay well.
- 2 Recognise that reliever (rescue) inhaler use is a sign that something is not right and not an inevitable consequence of having asthma.
- 3 Use a spacer device when using a pressurised metered dose inhaler (pMDI).
- 4 Check in with the asthma nurse or doctor regularly to keep healthy (at least once a year and after every attack).
- 5 Check in on inhaler technique videos every few months. Ask your asthma nurse, pharmacist, doctor to review your inhaler technique.
- 6 Discuss with your doctor or nurse about changing to a dry powder preventer inhaler would be appropriate for you.
- 7 Know how many doses are in your inhaler to help understand when an inhaler is empty (or full).
- 8 Return empty inhalers, those that have past their expiry date, or no longer needed to a community pharmacy for environmentally friendly disposal.
- 9 Don't smoke, avoid pollution and other asthma triggers.

*(adapted from 14)

The following tables have been compiled using multiple prescribing guidelines that are currently available. Highlighted doses should only be prescribed by a specialist respiratory paediatrician and are not suitable for initiation in Primary Care.

SECTION 4

TABLES OF INHALERS BY CARBON FOOTPRINT CATEGORY

Inhaled Corticosteroid (ICS) Inhalers by CYP Dose and Carbon Footprint [†]				
	ICS	Very low dose	Low Dose	Medium Dose # only to be initiated by specialist paediatrician after referral
Low Carbon Footprint (<2kg CO ₂ e per inhaler) Use where clinically appropriate	Beclometasone			
	Beclomethasone Easyhaler (DPI) (unlicensed in CYP)	N/A	200mcg one dose twice a day	200mcg two doses twice a day
	Budesonide			
	Budesonide Easyhaler (DPI) (Budesonide 100 & 200 licensed in ages 6+; Budesonide 400 licensed in ages 12+)	100mcg one dose twice a day	200mcg one dose twice a day	400mcg one dose twice a day
	Pulmicort Turbohaler (DPI) (licensed for ages 6+)	100mcg one dose twice a day	200mcg one dose twice a day	400mcg one dose twice a day
	Budelin Novolizer (DPI) (licensed for ages 6+)		200mcg one dose twice a day	200mcg two doses twice a day
	Fluticasone propionate			
	Flixotide Accuhaler (DPI) (Flixotide 50 & 100 licensed in ages 5+; Flixotide 250 licensed in ages 17+)	50mcg one dose twice a day	100mcg one dose twice a day	250mcg one dose twice a day
	Mometasone			
	Asmanex Twisthaler (DPI) (licensed in ages 12+)	N/A	200mcg one dose once a day (maintenance)	400mcg one dose (in the evening) OR 200mcg one dose twice a day
High Carbon Footprint (6-20kgCO ₂ e per inhaler) Use if low carbon footprint alternative not appropriate	Beclometasone			
	Clenil Modulite (pMDI) (Clenil 50 & 100 licensed for ages 2+; Clenil 200 & 250 (off label use in children; BNF gives doses for ages 2 – 11 and 12+)	100mcg one dose twice daily	200mcg one dose twice a day	400mcg one dose twice a day

High Carbon Footprint (6-20kgCO₂e per inhaler) Use if low carbon footprint alternative not appropriate	Beclometasone (continued)			
	Qvar (pMDI) (licensed ages 5+)/ Autohaler (licensed ages 5+)/ Easi-Breathe (licensed ages 12+) (all extrafine)	N/A	50mcg two doses twice daily OR 100mcg one dose twice daily	100mcg two doses twice daily
	Soprobeq (pMDI) (no lower age limit for licensing given)	100mcg one dose twice daily	200mcg one dose twice a day	200mcg two doses twice a day
	Ciclesonide			
	Alvesco (pMDI) (licensed ages 12+)	N/A	160mcg one dose once a day	160mcg two doses once a day
	Fluticasone proprionate			
	Flixotide Evohaler pMDI (Flixotide 50 & 125 licensed in ages 5+; Flixotide 250 licensed in ages 17+)	50mcg one dose twice a day	125mcg one dose twice a day	250mcg one dose twice a day

† In all instances where possible, one inhalation is recommended as this reduces the climate impact of inhaler usage (14)

medium doses should only be prescribed by a specialist respiratory paediatrician and are not suitable for initiation in Primary Care.

All doses listed are licensed for paediatric asthma, unless specified. For indications, dosing and licensing please check the British National Formulary for children.

ICS/LABA Combination Inhalers by CYP ICS Dose and Carbon Footprint†

	ICS/LABA	Very Low Dose	Low Dose	Medium Dose # only to be used after referral to specialist care
Low Carbon Footprint (<2kg CO ₂ e per inhaler) Use where clinically appropriate	Budesonide with formoterol			
	Symbicort Turbohaler(DPI) (Symbicort 100/6 licensed in ages 6+; Symbicort 200/6 licensed in ages 12+)	100/6mcg one dose twice a day	200/6mcg one dose twice a day	400/12mcg one dose twice a day
	Fluticasone propionate with salmeterol			
	Seretide Accuhaler (DPI) (Seretide 100 licensed in ages 4+; Seretide 250 licensed in ages 12+)	N/A	100/50mcg one dose twice a day	250/50mcg one dose twice a day
	Fusacomb Easyhaler (pMDI) (licensed in ages 12+)	N/A	N/A	250/50mcg one dose twice a day
	Fluticasone furoate with vilanterol			
Relvar Ellipta (DPI) (licensed in ages 12+)	N/A	N/A	92/22mcg one dose once a day	
High Carbon Footprint (10-20kgCO ₂ e per inhaler) Use if low carbon footprint alternative not appropriate	Fluticasone propionate with salmeterol			
	Combisal (pMDI) (Combisal 25/50 licensed in ages 4+; Combisal 25/125 licensed in ages 12+)	N/A	50/25mcg two doses twice a day	125/25mcg two doses twice a day
	Seretide Evohaler (pMDI)(Seretide 50 licensed in ages 4+; Seretide 125 & 250 licensed in ages 12+)	N/A	50/25mcg two doses twice a day	125/25mcg two doses twice a day
Highest Carbon Footprint (>34kgCO ₂ e per inhaler) Avoid unless no appropriate alternative or switching is inappropriate clinically	Budesonide with formoterol			
	Symbicort (pMDI) (Symbicort 100/3 licensed in ages 12+)	N/A	100/3mcg two doses twice a day	N/A
	Fluticasone propionate with formoterol			
Flutiform (pMDI) (Flutiform 50 licensed for ages 5+; Flutiform 125 licensed for ages 12+)	N/A	50/5mcg two doses twice a day	125/5mcg two doses twice a day	

† In all instances where possible, one inhalation is recommended as this reduces the climate impact of inhaler usage (14)
medium doses should only be prescribed by a specialist respiratory paediatrician and are not suitable for initiation in Primary Care.

All doses listed are licensed for paediatric asthma, unless specified. For indications, dosing and licensing please check the British National Formulary for children.

Other Inhalers by Carbon Footprint		
	Short Acting Beta Agonists (SABA)	Long Acting Beta Agonists (LABA)
Low Carbon Footprint (<2kg CO₂e per inhaler) Use where clinically appropriate	Salbutamol: Salbutamol Easyhaler (DPI) (Salbutamol 100 & 200 licensed in ages 4+) Salbulin Novolizer (DPI) (Salbulin 100 licensed in ages 6+) Ventolin Accuhaler (DPI) (Ventolin 200 licensed in ages 4+) Terbutaline: Bricanyl Turbohaler (DPI) (no lower age limit for licensing given; BNF doses given in ages 5+)	Formoterol: Foradil (DPI) (licensed in ages 6+) Formoterol Easyhaler (DPI) (licensed in ages 6+) Oxis Turbohaler (DPI) (licensed in ages 6+) Salmeterol: Serevent Accuhaler (DPI) (licensed in ages 4+)
High Carbon Footprint (9-20kgCO₂e per inhaler) Use if low carbon footprint alternative not appropriate	Salbutamol: Airomir (pMDI) (licensed in ages 4+) Salamol (pMDI) (licensed in ages 4+) Airomir 100 Autohaler (BAI) (licensed in ages 4+) Salamol 100 Easi-breathe (BAI) (licensed in ages 4+)	
Higher Carbon Footprint (28KgCO₂e)	Salbutamol: Ventolin 100 Evohaler (pMDI) (licensed in ages 4+)	
All Long Acting Muscarinic Antagonists (LAMA) have low carbon footprint (DPI). All LAMA/LABA inhalers have low carbon footprint (DPI). Short Acting Muscarinic Antagonist (SAMA) is only available as Ipratropium which has a high carbon footprint (Atrovent pMDI) For indications, dosing and licensing please check the British National Formulary for Children.		

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).^(2,18) PrescQIPP information included carbon footprint data submitted by manufacturers using a standardised questionnaire.⁽¹⁹⁾

SECTION 5

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Conflicts of Interests Statement:

WJDC: Has received research funding to conduct studies in CYP with asthma from GlaxoSmithKline and Trudell Medical International. He has received consulting fees and honoraria from AstraZeneca, GlaxoSmithKline, Orion and Novartis.

JKD: No conflicts of interest to declare

JS: Married to GP partner at dispensing practice.

RS: No conflicts of interest to declare

DK: No conflicts of interest to declare

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 CYPs. 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.



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