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PrescQIPP
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Inhaler carbon footprint

This bulletin updates the PrescQIPP inhaler carbon footprint data table and includes information on inhaler carbon emissions, national net zero targets, a review of the clinical evidence for lowering the inhaler carbon footprint and practical advice on reducing inhaler carbon emissions. It should be read alongside Bulletin 340. Sustainability in medicines optimisation, Bulletin 369: Asthma and Bulletin 283: COPD.

Recommendations

- NHS organisations should use the PrescQIPP inhaler carbon footprint data tool and visual data pack to determine how their inhaler carbon footprint prescribing data compares to the national or local average and identify priority areas for clinically appropriate inhaler carbon footprint reductions.
- Agree the organisational medicine optimisation strategies to support lowering inhaler carbon emissions with key stakeholders (e.g. ICBs, HBs, acute trusts, LMCs, LPCs). Examples may include:
  - Supporting patients to achieve and maintain good control of their asthma and COPD through regular reviews.
  - Supporting patients when their symptoms are not controlled, for example by providing treatment in line with national or locally agreed respiratory guidelines.
  - Information on, and incorporating, lower carbon footprint options within local respiratory treatment pathways and medicines formularies.
  - Supporting healthcare professionals with access to training materials on the impact of climate change on the health system, lowering the inhaler carbon footprint and improving respiratory care.
  - Providing patients with information on lower carbon footprint inhaler choices that are suitable for them, giving them the option to change their inhaler device, and fully explaining any changes to them.
  - Auditing to identify respiratory patients where review may improve clinical outcomes and reduce inhaler carbon footprint, e.g. identify and review patients overusing short-acting B_2 agonist (SABA) inhalers either from GP clinical system issues information or when discussing SABA use with patients.
  - Assessing inhaler technique in person regularly, and teaching the correct technique.
  - Providing patients with access to demonstration videos and instruction leaflets to support them to maintain optimal inhaler technique.
  - Optimising patients' therapy for those on multiple individual inhalers by discussing and offering a combination inhaler, where clinically appropriate.
  - Monitoring and sharing local inhaler carbon footprint prescribing data, noting where improvements can be made, produce action plans, and monitor progress.
  - Providing healthcare professionals with information on examples of locally preferred changes from high to low carbon footprint inhalers, when clinically appropriate and in agreement with the patient.
  - Ensuring stock availability, when making locally recommended choices, of all alternative lower carbon footprint inhalers through discussions with pharmacies, suppliers, and/or manufacturers.

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Recommendations

- ICBs/HBs/Trusts should undertake initiatives to reduce the environmental impact of inhaler waste. For example, public campaigns to inform people that they should:
  - » Return their used or unwanted inhalers to a pharmacy for recycling where available, or environmentally safe disposal.
  - » Look after their inhalers.
  - » Not over-order or stockpile inhalers.
  - » Know how to tell when their inhaler is empty.
  - » Talk to their pharmacy if the above options are not achievable.

Background

The World Health Organization (WHO) has identified climate change as a significant threat to human health, impacting the effectiveness of health systems. Reducing greenhouse gas emissions can greatly benefit health, particularly by decreasing air pollution.[1]

Pharmaceuticals produce greenhouse gases throughout their life cycle from activities such as active pharmaceutical ingredients (API) production, packaging, transport, usage and disposal.[2] A higher carbon footprint in pressurised metered dose inhalers (pMDIs) is associated with the propellant which is necessary for drug delivery, with the majority of carbon dioxide emissions (CO_2) arising from the use phase and disposal. The primary contributors to CO_2 emission in dry powder inhalers (DPI's) are represented by the device components packaging and production phase.[3]

In the UK, chlorofluorocarbon (CFC) propellants in pMDIs were phased out by 1996 due to their ozone-depleting properties.[4] They were replaced by 'CFC-free' inhalers containing hydrofluorocarbons (HFCs). Although HFCs do not deplete the ozone layer, they are greenhouse gases that contribute to global warming.[5] Inhalers and anaesthetic gases are responsible for 3% of the NHS carbon footprint.[6] The majority of emissions for inhalers arise from the propellant in pMDIs rather than the medicine itself.[7]

Two hydrofluoroalkane (HFA) propellants are currently used in pMDIs in the UK, HFA-134a and HFA-227ea. These propellants have a high global-warming potential (GWP) which are 1300 and 3350 times more potent than CO_2.[8] For example, each 200 dose small volume salbutamol pMDI (Salamol) or breath-actuated inhaler (Airomir) has a carbon footprint of about 10KgCO_2e per inhaler which is equivalent to a 33 mile petrol car journey.[9]

A new European Commission regulation (EU) 2024/573 came into force on 11 March 2024 requiring that pMDIs containing fluorinated greenhouse gases (F-gas) need to be labelled as 'contains fluorinated greenhouse gases' with information on the F-gas weight in kilograms or grams and the CO_2 equivalent expressed in tonnes using the GWP values for the propellant listed in Annex I of Regulation (EU) 2024/573.[10] To date, 65 of the 72 (90%) pMDIs available in the UK now contain these values in the patient information leaflet, refer to attachment 1 the inhaler data table available with this resource.

Some question the impact of HFA propellants in pMDIs, arguing that they are short-lived gases with a short lifetime in the atmosphere (14 years for HFA-134A and 36 years for HFA-227ea) compared to long-lived gases such as CO_2 that typically survive in the atmosphere for >100 years. They argue that removing pMDIs from medical practice will have no impact on the climate system and the trajectory of global warming.[11]

On the other hand, the European Commission regulation (EU) 2024/573 is encouraging transition to cleaner solutions for F-gas pMDIs such as using lower GWP F-gases as propellants.[10] Two lower GWP propellants, also known as next generation propellants (NGP), HFA-152a and HFO-1234ze, for use in pMDIs are in development.[11] One is currently available in the UK, in Trixeo a combination ICS/LABA/LAMA (inhaled corticosteroid/long-acting B_2-agonists/long-acting muscarinic antagonists) pMDI, which

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contains HFO-1234ze as the propellant.[12] The NGP in Trixeo has a 99.9% lower GWP than propellants used in currently available pMDIs.[13] Regulatory submissions for other inhalers with NGPs are expected towards the end of 2025, such as from the Chiesi Group for a carbon minimal ICS/LABA inhaler, which is expected to reduce greenhouse gas emissions by up to 90% compared to existing pMDIs.[13,14] GSK is developing a low carbon Ventolin pMDI using the NGP, HFA-152a. A regulatory decision is anticipated in 2026.[15]

In England, Wales, Northern Ireland, Scotland and the Isle of Man pMDIs account for 63.4% of all inhalers dispensed. Salbutamol is almost exclusively prescribed as a pMDI accounting for 91.7% of prescriptions. For non-salbutamol inhaler devices, pMDIs account for 48.8% of all devices.[16] pMDI devices will remain essential in some clinical situations, e.g. only device suitable for the patient, emergency situations. However, pMDI use in the UK is high compared to other countries such as Sweden where pMDIs are 13% of all devices used.[5] The highest per capita use of both SABAs and controller medication, such as ICS-containing inhalers, LABA, LAMA and LAMA/LABA combinations inhalers, (doses per 10,000 persons per year) was observed in the UK compared to 20 countries in Europe and Canada.[17]

PrescQIPP have updated the inhaler carbon footprint table originally published in October 2021 to include the carbon footprint impact of individual inhalers available in the UK amongst other useful clinical information. Attachment 1 provides:

- The inhaler carbon footprint values used in the visual data pack accompanying this resource and in the PrescQIPP Clinical Snapshot - Inhaler Carbon Footprint data tool.
- A change log, detailing all changes made since the last PrescQIPP publication.
- The full inhaler carbon footprint lifecycle (where manufacturers have provided this information).
- For pMDIs, the propellant carbon footprint information that is available in the patient information leaflet.
- The methodology for producing the inhaler carbon footprint values.

Attachment 2 also details the methodology for producing the data in **attachment 1.**

These data tools may be used by NHS organisations to view how their inhaler carbon footprint prescribing data compares to the national or local average and prescribing trends from 2019 to present. They can also assist in the identification of priority areas for inhaler carbon footprint reductions and support the development of strategies for lowering inhaler carbon emissions.

National guidance

The Climate Change Act 2008 (2050 Target Amendment) Order 2019 sets out the UK government's target for net zero emissions of greenhouse gases by 2050.[18] All four UK health services have committed to achieving this target.[6,7,18-21]

Lowering the inhaler carbon footprint has been identified as an objective in supporting ambitions towards achieving net zero carbon emissions in England, Wales and Scotland. Precise targets and timescales vary by country and these are outlined in table 1.[6,7,18-21]

Table 1. Net zero carbon emission targets and timescales by country

England • The 10 Year Health Plan for England states that it will prioritise the NHS' existing commitments set out in Delivering a Net Zero NHS. Two targets have been set:[7,22] 1. For directly controlled emissions (NHS Carbon Footprint), to reach net zero by 2040, with an ambition to reach an 80% reduction by 2028 to 2032. 2. For emissions which the NHS can influence (NHS Carbon Footprint Plus), to reach net zero by 2045, with an ambition to reach an 80% reduction by 2036 to 2039.

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England (cont.)

- Delivering a Net Zero NHS states that achieving the required reductions in emissions from inhalers will only be possible by:[7]
  - Significantly increasing the use of DPIs, which may be clinically equivalent for many patients, and come with significantly lower carbon emissions.
  - Increasing the frequency of the greener disposal of used inhalers.
  - Supporting the innovation in and use of lower carbon propellants and alternatives.
- Five years of a greener NHS: progress and forward look outlines the next steps for reducing inhaler carbon emissions including to:[6]
  - Continue to promote best practice in respiratory care.
  - Support the use of clinically appropriate low-carbon inhalers, when supported by individual patient choice.
  - Collaborating with inhaler manufacturers to foster innovation of the next generation propellants for pMDIs, ensuring availability for patients who need them, while ensuring supply resilience and best value for the taxpayer.
- All Trusts, Foundation Trusts and Integrated Care Boards (ICBs) have a duty to contribute to achieving net zero emissions under the Health and Care Act 2022 through the delivery of board-approved green plans.[23]
- The NHS England national medicines optimisation opportunities 2024/25 recommend 'Optimising inhaler use to improve respiratory outcomes and reduce carbon emissions' as one of the (at least) five options ICBs should choose from to meet their key objectives. The metric to support implementation and monitoring of this option is the mean inhaler emissions per 1,000 patients. The expected outcomes are:[24]
  - Reducing short-acting beta-agonists (SABAs) over-reliance and over-prescribing.
  - Increasing the use of preventer inhalers.
  - Prioritising lower carbon options (DPIs or lower carbon MDI) for inhalers, where appropriate and safe to do so, and via shared decision-making.
  - Prioritising lower carbon options (DPIs or lower carbon MDIs) for salbutamol inhalers.
  - Promoting appropriate inhaler disposal (returning used and expired inhalers to pharmacy for disposal).

Wales

- NHS Wales target is to be net zero by 2030 which includes 16% and 34% reductions from 2018/19 baseline by 2025 and 2030 respectively. A target of 80% of inhalers being low GWP alternatives by 2025 has been set, but only where it is clear patients' stabilisation will not be affected.[19] The NHS Wales Strategic Delivery Plan sets out 46 initiatives and targets for the decarbonisation of NHS Wales that will be assessed and reviewed in 2025 and 2030. Three of the 46 initiatives include inhalers:
  - Take a patient-centric approach to optimise inhaler use, focusing on a reduction in the over-reliance of reliever inhalers where possible and emphasising the importance of inhaler-specific disposal and recycling.
  - Transition the existing use and distribution of carbon-intensive and high global warming potential (GWP) inhalers to alternative lower GWP inhaler types where deemed suitable.
  - Engage with pharmacists and prescribers to build upon and support existing efforts to encourage responsible disposal of inhalers through discussions with patients, information leaflets, posters and media.

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Scotland

- NHS Scotland aims to become a net-zero organisation by 2040 or earlier. The NHS Scotland climate emergency sustainability strategy 2022-2026 aims to reduce emissions from inhaler propellant by 70% by 2028.[20] The 70% reduction is split into biennial targets of a:[25]
  - 25% reduction by the end of 2024
  - 50% reduction by 2026
  - 70% reduction by the end of 2028.
- The Quality Prescribing Strategy for Respiratory. A guide for improvement 2024-2027 includes a summary of recommendations for environmental considerations of respiratory prescribing.[8]

Northern Ireland

- Health and Social Care Northern Ireland will contribute to the target for Northern Ireland to be net zero by 2050, reducing emissions by 48% for 2030 and 100% by 2050. There are no specific targets for inhaler carbon footprint reductions.[21,26] The Northern Ireland Formulary includes recommendations on reducing the carbon footprint of inhaler prescribing.
- Valuing Medicines: A strategy for the sustainable use of medicines in Northern Ireland states that making lower-carbon prescribing choices can significantly reduce carbon emissions. For example, a 25% reduction in CO_2 emissions from inhaler use has already been achieved in NI by transitioning to lower-carbon alternatives where clinically appropriate. While these alternatives may initially be more expensive, they represent a long-term, environmentally responsible choice.

Isle of Man

- The Isle of Man government has committed to net zero carbon emissions by 2050 with interim targets of a 35% reduction by 2030 and 45% reduction by 2035. There are no specific targets for reducing carbon emissions from inhalers.[27]

Many national organisations and patient charities support strategies to reduce the inhaler carbon footprint by using lower carbon footprint inhalers where clinically appropriate for patients, gaining better respiratory control, promoting inhaler recycling or environmentally friendly inhaler disposal. These include the British Thoracic Society (BTS), National Institute for Health and Care Excellence (NICE), Scottish Intercollegiate Guidelines Network (SIGN),[28] Primary Care Respiratory Society,[29] Royal Pharmaceutical Society[30,31] and Asthma + Lung UK.[32]

The BTS, NICE, SIGN asthma guidelines [NG245] include choosing an inhaler with the lowest environmental impact among suitable devices as one of the four criteria to base the choice of inhalers for asthma on.[28] There is a patient decision aid on asthma inhalers and climate change which can be used to support implementation of this recommendation. The decision aid is used to explain to people with asthma, aged 12 years and over, the options if they would like to think about reducing the carbon footprint of their asthma treatment, in discussion with their healthcare professional. The decision aid explains how inhalers affect the environment, gives examples of how the carbon footprint of inhalers compared to car journeys, options to think about, making a decision and information about responsible inhaler disposal.[9] It emphasises the importance of making sure the person has the inhaler that best suits them, so it doesn't get wasted or is unused. This has the greatest impact on the environment.

The BTS, NICE, SIGN asthma guidelines [NG245] do not recommend using SABA-only treatment for any age group. For adults and children over 12 years old as-needed anti-inflammatory reliever (AIR) therapy or maintenance and reliever therapy (MART) which use combination inhalers of an inhaled corticosteroid (ICS) and formoterol are recommended. Using AIR therapy has been shown to reduce severe exacerbations of asthma and produce consistently better outcomes compared with SABA alone.[28] It is recommended that organisations take steps to implement the BTS, NICE, SIGN asthma guidelines to improve outcomes for patients, reduce severe exacerbations and associated use of salbutamol inhalers, including SABA overuse and so support reductions in the NHS inhaler

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carbon emissions. Patients transitioned to AIR therapy or MART should avoid using more than the recommended maximum daily doses for AIR therapy or MART. Inhaler issues can be monitored to check if this is happening.

The Royal College of Physicians also supports achieving better asthma control to reduce the inhaler carbon footprint due to high SABA use.[33]

Clinical evidence

Switching to lower carbon footprint inhalers

An economic and carbon footprint analysis of NHS prescription data in England found that switching pMDIs to DPIs would result in large carbon savings which can be achieved alongside reduced drug costs by using less expensive brands. Further substantial carbon savings can be made by using small volume HFA134a pMDIs, in preference to large volume HFA134a pMDIs, or switching those containing HFA227ea as a propellant.[34]

Vartiainen et al estimated that the pMDI carbon footprint for the UK is 1.3 million tons (Mt) CO_2e (1,300,000 $KgCO_2e$) and if equivalent treatment were delivered in DPIs this would be 0.1 $MtCO_2e$ (110,000 $KgCO_2e$). So, it is estimated that using DPIs in preference to pMDIs in the UK would decrease the inhaler carbon footprint by 85%. They also estimated the carbon emissions of different treatment regimens based on Global Initiative for Asthma (GINA) step 2, tracks 1 and 2. Patients on track 1 receive a fixed combination treatment of LABA, formoterol, with ICS in a single inhaler taken only as-needed (as-needed AIR therapy). In the alternative track 2 patients use a more traditional strategy of a low dose maintenance ICS therapy with a separate SABA rescue therapy. The inhaler carbon emissions were found to be fewer for track 1 (0.8$KgCO_2e$) compared to track 2 (by 2.9$KgCO_2e$ over 1 year). Track 1 conveyed similar exacerbation rates and lower ICS exposure, plus 72% fewer inhaler carbon emissions. Using as-needed AIR therapy instead of the traditional ICS/LABA plus SABA as needed could lower the inhaler carbon footprint and reduce ICS exposure with no change to exacerbation rates. The authors state that it is important that any changes in inhalers and treatment plan should be done carefully, in a measured manner, and in partnership with the patient.[35]

Analysis of a subset of patients from the Salford Lung Study in Asthma demonstrated that switching patients on pMDI-based therapy to DPI-based maintenance therapy more than halved their inhaler carbon footprint without any loss of asthma control in conditions representing everyday clinical practice. Most patients who switched from a pMDI-based treatment to fluticasone furoate/vilanterol DPI did not switch back during the 1-year treatment period, suggesting that they tolerated DPI therapy well and without any detriment to their asthma control.[36]

Switching asthma and COPD inhalers to less costly, clinically equivalent inhalers in a real-world study found that medication adherence significantly increased post-switch and was associated with reduced exacerbations. The authors concluded that switching to an equivalent inhaler in patients with asthma and COPD appeared safe and did not negatively affect patient's health or healthcare utilisation.[37]

Attar-Zadeh and colleagues presented three model scenarios of patients transitioning from pMDIs to DPIs with escalating levels of patient counselling to enable a transition to a DPI. Results demonstrated that resources, such as staff time, are needed to successfully manage targeted inhaler transitions alongside counselling and follow up reviews with an appropriately skilled clinician who can assess the patient's inhaler technique and disease control. Depending on the approach, resource requirements to switch the estimated 3,542 patients treated for asthma or COPD in a typical PCN of 50,000 patients ranged from £18,000 to £53,000. For the estimated 2.7 million patients treated for asthma or COPD in England, this would equate to an NHS expenditure between £21 and £60 million for the English NHS.[38]

A survey in England found that the use of low carbon footprint inhalers was low (26.3%) in 2020-2021 despite national recommendations supporting the use of low carbon footprint inhalers. SABA (6% low carbon inhalers) and ICS (35-45% low carbon inhalers) classes were less often dispensed as low carbon

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inhalers. The survey also found significant geographical variation in low carbon inhaler dispensing in each therapeutic class. Advice on climate change in CCG formularies or guidelines as of May 2021 was available in 72 out of 135 CCG formularies. The presence of advice on climate change in CCG formulary's or guidelines was associated with significant increases in low carbon inhaler percentage for SABA and ICS classes (26% and 28% respectively) compared to those CCG's that did not provide this information (SABA 5.7% to 7.2% and for ICS from 6.1% to 7.8%). (Refer to Supplementary materials Tables S3 and S5 for further information.) This suggested that local initiatives may be important in achieving increases in the use low carbon inhalers.[39]

A review of Integrated Care Boards (ICB) websites undertaken by the author of this bulletin in April 2025 found that 37 out of 42 ICBs now include carbon footprint information within their medicines formularies and/or guidelines. The following factors were found to be associated with reductions in the ICB % pMDIs (excluding salbutamol):

- Inhaler disposal advice included in ICB respiratory guidelines (Average % pMDI use was 52.8% when information was included vs. 56.6% pMDIs when not, a 3.8% difference)
- Publicly available medicines formulary (Average % pMDI use 53.9% when there was a publicly available medicines formulary vs. 57.6% when not available, a 3.7% average difference)
- Inhaler carbon footprint information within formulary/guidelines (Average % pMDI use was 53.6% when inhaler carbon footprint information was within formulary/guidelines vs. 56.6% when not available, a 3.0% difference)
- Patient information on carbon footprint of inhalers available on website, such as leaflets, videos (Average % pMDI use was 53.6% pMDIs when patient information was available on inhaler carbon footprint vs. 54.1% when not available, a difference of 0.45%)
- Patient information on recycling or disposal of inhalers on website, such as leaflets, videos (Average % pMDI use was 53.8% when patient information on inhaler recycling or disposal was available vs. 54.4% when not available, a difference of 0.6%)

It is recommended that all ICBs/HBs/Trusts include information on environmentally friendly inhaler disposal in their respiratory guidelines, have a publicly available medicines formulary and guidelines which include low carbon inhalers on their websites.

Usmani and Levy's opinions are that changing a patients prescribed inhaler when their condition is stable on their current device **risks loss of disease control** which would require additional healthcare resources, resulting in a negative impact on the environment. Any clinically warranted inhaler changes should be undertaken through face-to-face consultations to ensure good inhaler technique and have a comprehensive follow up to confirm disease control. Prescribers should be able to provide patients asking about the environmental impact of their treatment with a clear summary of the wider picture in terms of the overall lifecycle of the various inhalers available to them plus inhaler disposal and recycling available locally, rather than just the difference in the GWP of pMDIs versus DPI's.[40]

A survey undertaken across UK hospitals found that inhalers having a low carbon footprint was either important or very important to 65% patients. 69% patients would consider switching to a lower carbon alternative if one was available. Other important factors for patients when making decisions regarding switching inhalers were ease of use, transportability, and dose counters. Inhaler technique was assessed; only 34% patients demonstrated perfect technique for DPI use. 33% patients demonstrated perfect technique with MDI.[41]

Strategies which have reduced the inhaler carbon footprint

In Wales an increase from 30.8% to 41.1% in the use of low GWP inhalers was seen from 2018 to 2024. Over the same time frame there was a 13.11% reduction in the use of high GWP inhalers. (Refer to Supplementary Table 2.2 for further data). Factors attributed to the change included the introduction of:[42]

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- An integrated respiratory toolkit, comprising national asthma and chronic COPD guidelines with icons denoting the carbon footprint of inhalers, delivered in digital and print format to every practice in Wales.
- Applications (Apps) for asthma and COPD patients (uptake of 18,200 users).
- Delivery of educational and quality improvement webinars and video-based update modules to 13,000 healthcare professionals and 18,200 respiratory app users.
- Paediatric asthma guidelines suggesting switching to dry powder inhalers at the age of 6 for those who are able to use the device.

A rural primary care practice in England reduced the proportion of non-salbutamol pMDI prescriptions (compared to DPIs/SMIs) from 62.9% to 36.2% over a 4-year period. They achieved this through implementing a quality improvement initiative which provided:[43]

- **Staff education** on GOLD, GINA, NICE, inhaler carbon footprint, and active ingredients within the local medicines formulary was delivered through in-house clinical meetings and external educational events.
- **Restructured respiratory consultations** replacing the traditional annual recall systems with a risk-stratified approach. High-risk patients (such as those receiving four or more SABA inhalers per year; without a prescribed preventer inhaler or with a history of exacerbations or hospital admissions) were prioritised for consultation and structured reviews were conducted to address medication adherence, inhaler technique, and environmental considerations.
- **Patient education** on pMDI versus DPI techniques, accessible via face-to-face events and remotely. Training devices were used for demonstration: DPI trainers that emit a whistle when adequate inspiratory effort is achieved, and In-check dial G16® devices that signal excessive force, improving inhaler technique.

Post consultation, digital education materials were sent via the practice mobile messaging system, reinforcing key messages around inhaler technique, at home pulmonary rehabilitation programmes, and local support programmes available for smoking cessation and weight management.

Each patient received a personalised asthma or COPD care plan delivered digitally which outlined medication use and steps to be taken if symptoms worsened using a traffic light system. Reminders emphasised the importance of spacers for pMDIs, oral hygiene, and inhaler recycling.

The NHS England 2022/2023 investment and impact fund for primary care networks awarded points to practices that prescribed salbutamol pMDIs with a lower carbon footprint. The average carbon footprint for SABA inhalers prescribed in primary care declined by 33% between 2020 and 2024, from 24.2 kgCO_2e to 16.1 kgCO_2e. This was most likely due to a relatively simple shift from Ventolin Evohaler (28kgCO_2e per inhaler) to Salamol pMDI (12kgCO_2e per inhaler). Many areas undertook a straightforward bulk switch of inhalers due to the similarities between the two devices. The proportion of non-SABA inhalers prescribed in primary care that are pMDIs remained steady, at 56.2% in 2020 compared with 55.7% in 2024, suggesting switches to DPIs have not been widely introduced. Switching people over from pMDIs to DPIs requires a more intensive time commitment to allow clinical decision-making, person-centred discussions, and face-to-face appointment to ensure good inhaler technique. Consequently, this change is likely to happen much more slowly.[44]

The SABINA CARBON study (SABA use IN Asthma healthCARe-Based envirONmental cost of treatment) found that **poorly-controlled versus well-controlled asthma generated a larger overall and excess per capita carbon footprint, primarily contributed by SABA use**, with small contributions from ICS use, exacerbations, and healthcare resource utilisation (HCRU). Asthma care across the UK asthma population accounts for 750,540 tonnes CO_2e annually with poorly controlled asthma contributing to nearly 80% of these emissions. The findings suggest that addressing the high burden of poorly-

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controlled asthma, including curbing high SABA use, and its associated risk of exacerbations, may significantly alleviate asthma care-related carbon emissions. 47.3% of the SABINA CARBON study population had poorly-controlled asthma. Poorly-controlled asthma generated 3.1-fold higher overall carbon footprint and 8.1-fold higher excess per capita carbon footprint, largely SABA-induced, with small contributions from HCRU. Higher asthma care-related GHG emissions were observed among residents of the most socioeconomically deprived areas of the UK. Targeted interventions designed to increase healthcare access for patients living in socioeconomically disadvantaged areas could promote improved clinical outcomes and deplete the carbon footprint of the UK health system. Adopting GINA-guided treatment strategies could assist healthcare systems to decarbonise care pathways.[45]

Poor asthma control is associated with a high carbon footprint and so decreasing the use of SABAs is important when reducing asthma carbon footprints.[46] Instead of SABAs, asthma should be treated with ICS-formoterol combinations as a reliever to reduce severe exacerbations and hospitalisations. Severe exacerbations and hospitalisation cause significant greenhouse gas emissions through increased medical interventions; exacerbation and admission avoidance is likely to reduce the NHS carbon footprint.[47]

The SENTINEL project was a quality improvement initiative undertaken in Hull and East Yorkshire, supported through a Joint Working Agreement between Hull University Teaching Hospitals NHS Trust and AstraZeneca UK. SENTINEL implementation in the pilot PCN provided real-world evidence demonstrating that a guideline including a SABA-free, MART strategy offered a feasible approach for improving ICS uptake and reducing SABA overuse, leading to fewer asthma exacerbations.[48] SENTINEL Plus is based on the SENTINEL project and is a quality improvement package developed with the aim of improving outcomes for adult asthma patients while reducing the environmental impact of asthma treatments, by addressing SABA over-reliance, increasing appropriate anti-inflammatory treatment and implementing a MART focussed strategy for appropriate patients. The five core elements of SENTINEL Plus are:[49]

- Healthcare professional education.
- Implementation of SENTINEL Plus ‘Gold standard’ prescribing practice.
- Targeted asthma reviews.
- Patient support and education.
- Real-time data monitoring and reporting of asthma care metrics.

Actions pharmacists can implement to improve the health of the planet and patients were considered by Roy:[50]

- Use DPIs/Soft Mist Inhalers (SMIs) in place of pMDIs when clinically appropriate. Use a patient decision aid which explains the inhaler carbon footprint. Educate patients on proper inhaler technique to minimise wastage.
- Optimise medication.
- Educate patients and other healthcare professionals on sustainable healthcare.
- Advocate the prioritisation and development of an environmentally sustainable healthcare system to healthcare leaders, politicians and professional organisations .
- Join or develop a local environmental committee.
- Review personal practices to identify individual opportunities, such as cycling or walking to work, digital patient or team meetings, minimising paper usage, and opting for electronic journal subscriptions.

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Radcliffe suggests that staff need to be motivated to act to support reductions in the inhaler carbon footprint in line with behavioural change models (COM-B) which describe three components required to change behaviour:

3. Capability
4. Opportunity
5. Motivation

Including in the project scope, improving asthma outcomes by providing high quality and low carbon care is suggested as a motivation for staff.[51]

Inhaler recycling and disposal

A UK hospital audit of in-patient adults using inhaled therapies found that 58% respondents most frequently disposed of their inhalers in their household waste bin with only 13% returning inhalers to the pharmacy. Most of the respondents (78%) were unaware that inhalers could not be recycled in the local council recycling bin.[41]

The Take AIR project, a postal inhaler recovery and recycling scheme, sponsored by Chiesi, was estimated to have saved a minimum of 119.3 tonnes of carbon emissions from entering the atmosphere over the 12 month project period. Community pharmacies across Leicester, Leicestershire and Rutland and hospitals in Leicestershire discussed Take AIR with patients and provided them with prepaid pre-addressed envelopes. Patients filled the envelopes with up to 4 inhalers per envelope and posted them to the waste management company via a Royal Mail tracked service. The waste management company recovered recyclable materials such as aluminium from canisters, and plastics and the remaining propellant gas was extracted for use in refrigerators and air conditioning units. Non-recyclable components were incinerated at high temperatures to produce energy-from-waste. In total, 14,805 envelopes were delivered to pharmacies of which 5,686 envelopes were returned to the waste management company via Royal Mail. An online survey of patients taking part in Take AIR project highlighted that most patients (94%) wanted to take part in the recycling scheme because they were concerned about the environment. In addition feedback on the scheme itself appeared to be well received by patients with 90% either very satisfied or satisfied with the scheme. All patients thought the instructions around the scheme were very easy or easy to follow. All patients who responded to the question thought that the scheme should be available nationally across the UK.[52]

The Take AIR Study found that pMDIs with an integrated dose counter were more likely to be sent for recycling with the optimal number of doses remaining in the inhaler compared to only one quarter of pMDIs without a dose counter recycled at this stage. This was consistent with previous studies demonstrating the importance of dose counters for patients to track the number of actuations, allowing them to identify when the maximum labelled number of actuations had been reached and recognise when the inhaler should be replaced. Approximately one-third of pMDIs inhaler devices without a dose counter were returned underused. Disposing of an underused inhaler is particularly wasteful.[53]

The Re-Hale inhaler recycling project was a collaborative working project between Chiesi and NHS Kent and Medway ICB where used inhalers were returned to pharmacies and GP surgeries and collected by a wholesaler when they did their usual deliveries. A waste company collected the used inhalers from the wholesaler for recycling. At the end of the project 41,650 inhalers were recycled (Nov 2023-Oct 2024); a return rate of 5.5%. Overall, the project saved a total of 176 tonnes of CO_2.[54]

At the time of publication, a pilot inhaler recycling project was running in South East London encouraging patients to return their used or expired inhalers to participating community pharmacies or hospitals in South East London. Returned inhalers were sent on to specialist waste management facilities for recycling, to recover and repurpose pMDI propellant gases. The study will be used to support the assessment of the feasibility for a national inhaler recycling scheme in England.[55]

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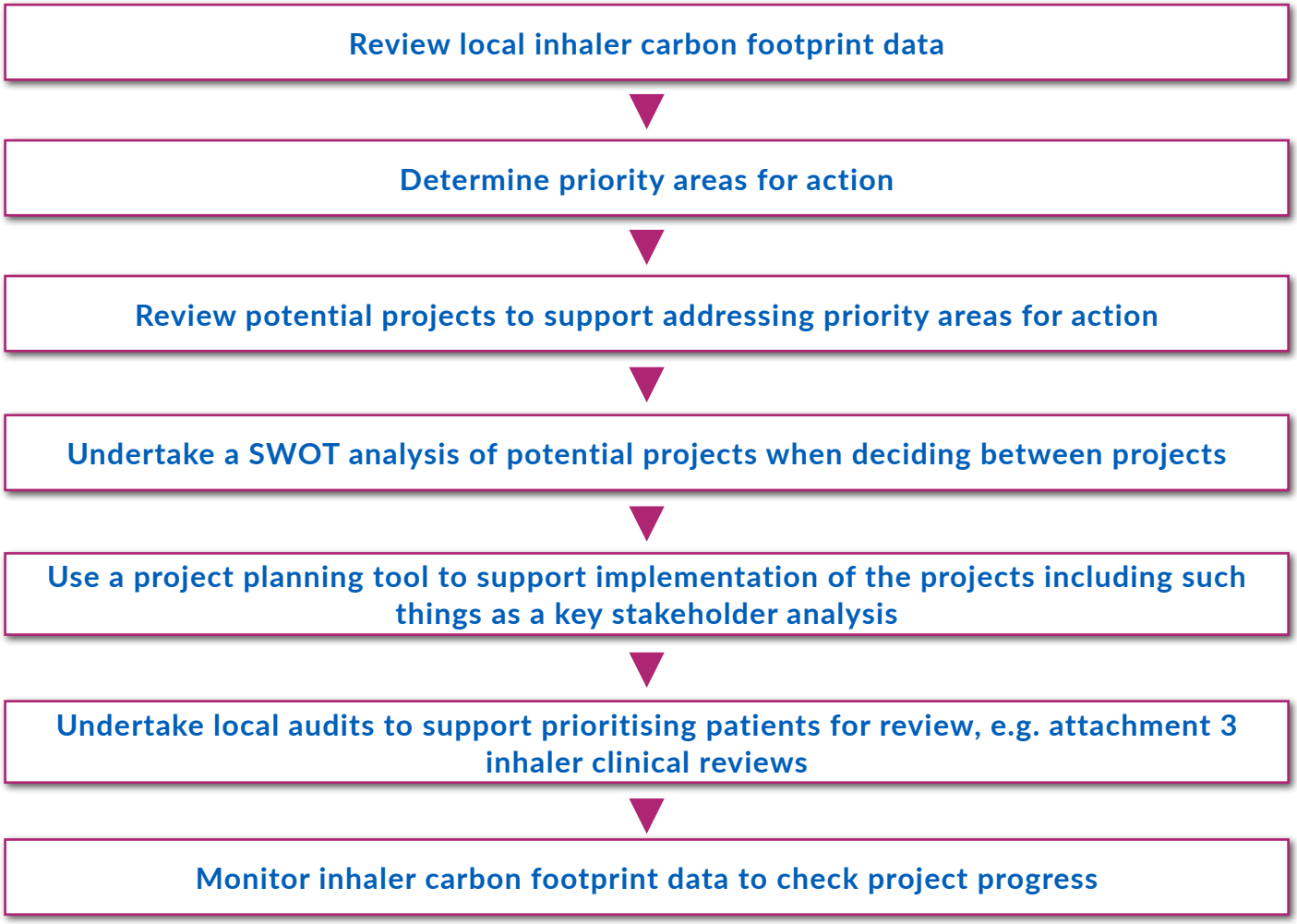
This review of the clinical evidence has revealed that several medicine optimisation strategies can be deployed to support a reduction in inhaler carbon emissions without detriment to patient care, and in some cases, can improve patient outcomes.

Practical advice on reducing inhaler carbon emissions

The suggested practical steps to take when developing a strategy to support lowering the inhaler carbon footprint:



It may be helpful to undertake a SWOT analysis for proposed projects to prioritise them, clarify the benefits of and difficulties associated with undertaking them. Attachment 4 provides an example SWOT analysis which may help organisations understand the **strengths** which will support the project, **weaknesses** to be addressed, **opportunities** to support implementation, and **threats** requiring management, all leading to a successful project outcome.

It is important to identify all key local stakeholders and gain agreement when developing an inhaler carbon emission reduction strategy. Attachment 5 provides an example key stakeholder analysis. An appropriate local group, such as the Hospital Drug and Therapeutics Committee, Area Prescribing Committee or equivalent, should be consulted to discuss and agree the strategy. This group may also be used to agree local respiratory pathways and medicines formulary choices that consider inhaler carbon footprints.

Should any new inhalers be added to the local formulary or respiratory pathways, organisations should ensure there is sufficient stock availability. A phased introduction, with manufacturer involvement, if necessary, should help to prevent stock shortages and adverse impacts on patients, pharmacies, and healthcare professionals. Communication of all changes to key stakeholders is essential to ensure a smooth transition to a new inhaler formulary or clinical pathway. A communication strategy should be outlined in any plans developed.

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Table 2 provides a summary of steps to take and a method for delivery when developing an inhaler carbon footprint reduction strategy. This can be used as a checklist and modified to suit local need.

Table 2: Developing an inhaler carbon footprint reduction strategy

What?	How?
Review local inhaler carbon footprint prescribing data Compare local data with neighbouring and other local organisations, regionally and/or nationally Identify priority target areas	• Use the PrescQIPP inhaler carbon footprint data tool, inhaler carbon footprint snapshot and visual data pack to compare neighbourhood, local, regional, and national inhaler prescribing data. • Identify areas where the organisation is an unintended outlier. • Look at potential inhaler changes and view the local carbon footprint and financial impact. • Create a list of potential changes for consideration by an appropriate prescribing group, such as the Area Prescribing Committee. • View data on SABA overuse and ICS underuse; consider if these need optimisation.
Educate healthcare professionals and patients about the impact of climate change on health and healthcare, and how they can support local initiatives	Use existing resources such as: • PrescQIPP EoE inhaler awareness campaign materials • Why choose a more environmentally friendly inhaler • Ventolin pMDI to Salamol pMDI change explained • PrescQIPP Asthma management and reducing the carbon inhaler footprint therapeutic workshop
Ensure that all key stakeholders are aware, and supportive, of any changes to the local inhaler formulary, the respiratory pathway, and inhaler carbon footprint reduction strategy	• Identify all key stakeholders and produce a stakeholder analysis (attachment 5). • Determine stakeholder power and level of interest in inhaler carbon footprint emission reduction strategies. • Involve key stakeholders with a high level of interest in inhaler carbon footprint emission reduction strategies, for example, through including them in Area Prescribing Committee or local equivalent discussions. • Once agreed, communicate the strategy and any changes to formulary choices or clinical pathways to key stakeholders.
Develop a local respiratory medicines formulary and clinical pathways which promote a reduction in inhaler carbon emissions Ensure any changes aim to improve patient outcomes	• Discuss whether any changes are required in the current local respiratory medicines formulary and clinical pathways to allow reductions in the inhaler carbon footprint at an appropriate group, such as the Area Prescribing Committee or local equivalent. • Incorporate the new asthma pathway from the BTS, NICE, SIGN chronic asthma management guidance[28] • Use the PrescQIPP inhaler carbon footprint data tool, inhaler carbon footprint snapshot and visual data pack to view the impact of changing formulary inhaler choices or clinical pathways. • Plan a phased introduction with manufacturer involvement, if necessary, to help prevent any stock shortages resulting in adverse outcomes for patients, pharmacies or healthcare professionals.

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What?	How?
Improve individual patients' asthma control and reduce the use of SABA reliever inhalers	• Encourage regular prevention treatment using a variety of suitable approaches. • Empower patients by ensuring they understand their condition and how their treatments work.[56] • Ensure that healthcare professionals understand the dose ranges and relative potencies of inhaled corticosteroids.[56] Use PrescQIPP bulletin 369. Asthma Attachment 5) – 'Inhaled corticosteroid doses for the BTS, NICE, SIGN asthma guideline'. • Undertake an audit to identify patients with risk factors identified in the National Review of Asthma Deaths (NRAD) report, e.g. high or very high SABA use.
Review patients prescribed lone SABA therapy and change to appropriate treatment, e.g., AIR therapy or MART Consider deprescribing if no confirmed asthma diagnosis	• Undertake an audit to identify anyone prescribed a SABA inhaler without a confirmed diagnosis of asthma or COPD. • Confirm diagnosis or seek further investigation if appropriate. • Discuss prescribing AIR therapy or MART as appropriate for people aged 12 years or older with a confirmed asthma diagnosis. Change the SABA to an appropriate combination inhaler. • For people who do not have a confirmed respiratory diagnosis, discuss deprescribing the SABA.
Transition patients on traditional asthma pathway to flexible regimen using low-dose or moderate-dose MART as appropriate, or step down to AIR therapy	• For patients presenting with uncontrolled asthma, discuss transitioning to a flexible asthma pathway following the BTS, NICE, SIGN asthma guidelines, if appropriate.[28] • During annual asthma reviews discuss transitioning to a flexible pathway with the patient, if appropriate. • Use the audit available with PrescQIPP bulletin 369. Asthma (Attachment 6) to prioritise patients for transitioning to a flexible asthma pathway. • If capacity is a barrier, consider prioritising patients for asthma review, (e.g., high-risk patients overusing SABAs).
Improve COPD control and reduce use of SABA reliever inhalers[56]	• Smoking cessation, exercise promotion and pulmonary rehabilitation, flu immunisation. • Use regular daily long acting bronchodilators.[56]
Use combination inhalers	• Identify patients on multiple single inhalers (ICS, LABA, LAMA) and consider changing to combination inhalers, if appropriate. • Follow BTS, NICE, SIGN asthma guidelines and use as-needed AIR therapy and MART in place of, for example, lone SABA, ICS, LABA, or ICS/LABA plus SABA, ICS-non-formoterol inhaler combinations.[28]
Promote effective self-management[56]	• Provide all patients with written personal action plans[56] e.g. Asthma + Lung UK Asthma Action Plan, COPD self-management plan • Consider promoting applications (Apps) for asthma and COPD patients e.g., NHS Wales COPD hub, Asthmahub, Asthmahub for parents, Asthmahub (England).

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What?	How?
Ensure all inhalers are used with correct technique for greater effectiveness[56]	• Know how to teach this and then teach it to patients and colleagues. • Encourage the use of online video tutorials[56] • PrescQIPP inhaler technique assessment videos and leaflets • PrescQIPP spacer device instruction videos and leaflets
Optimise the use of spacers to increase clinical effectiveness of pMDIs, where these are the most appropriate device for the patient[56]	• Consider using spacers for patients with pMDIs to aid inhalation: increases lung deposition and reduces oral deposition of drug.[56] • Ensure patients know how to clean and maintain their spacer device. • Provide sufficient access to replacement spacer devices at appropriate time intervals. • PrescQIPP spacer device instruction videos and leaflets
Ensure pMDIs are not discarded before they are empty[56]	• Teach patients how to recognise correctly when their inhaler is empty.[56] • Share the patient information leaflet 'PrescQIPP How to manage your inhaler stock at home, which contains advice on how long inhalers should last and when patients should reorder. • Use attachment 1 to identify which inhalers have dose counters. • Encourage patients to be aware of, and use, the dose counters on pMDIs.[56]
Promote inhaler recycling[56]	• Encourage local pharmacies to take part in local inhaler recycling schemes, or develop and promote the use of inhaler recycling schemes to reduce waste of plastic, metal, and propellants.[56] • Educate patients about inhaler recycling and disposal as part of their inhaler technique check. • Run patient education campaigns on reducing medicine waste for inhalers. • Use patient campaign resources on lowering the carbon inhaler footprint • Refer patients to the Government supported and funded Recycle Now website for more information on the safe recycling of inhalers.
Prevent over-ordering	• Organisations should encourage patients to reduce inhaler waste by not over-ordering their inhalers and also by looking after their inhalers. • Reinforce this message with the PrescQIPP prevent medicine waste campaigns - inhalers resources. • Utilise patient information materials, for example, 'How to manage your inhaler stock at home' and 'You don't have to order your inhalers every month' leaflets. A receptionist guide on 'How to manage inhaler supplies' is also available.
Optimise the use of re-usable inhalers	• Aim to prescribe refill cartridges with re-usable inhalers when prescribing Respimat inhalers. Refer to Attachment 2. Examples of reusable devices and how often to change them from Bulletin 340. Sustainability in medicines optimisation.

What?	How?
Transition to low GWP propellant pMDIs (e.g. HFA-152a) when they are licensed and available in the UK	• Regularly review inhaler choices within the medicines formulary to ensure that low GWP propellants are considered for inclusion in the formulary as and when they become available.
pMDI to DPI switches	• Use the potential switch tables to consider locally agreed pMDI to DPI changes. • Use the PrescQIPP inhaler switch tool to view the cost and carbon footprint impact of proposed switches. • Use inspiratory flow monitoring devices (e.g., InCheck Dial) to identify the most appropriate device for the patient's natural inspiratory technique. • Use a patient decision aid which explains the inhaler carbon footprint, e.g., asthma inhalers and climate change (NICE). • Use the PrescQIPP inhaler carbon footprint comparison tool to show patients their current inhaler carbon footprint and the carbon footprint of suitable alternative inhalers. • Educate patients on proper inhaler technique when changing inhaler device. PrescQIPP inhaler technique assessment videos and leaflets
Motivate staff to improve disease control and improve patient outcomes by providing high quality, low carbon care	• Use the Greener Practice High Quality and Low Carbon Asthma Care Toolkit

Useful resources

Collaborative Inhaler Returns Campaign SYICB /Sheffield Children's Hospital (2023) The project aim was to try and ensure patients returned their inhalers to either Sheffield Children's Hospital or a local community pharmacy for correct disposal. This reduced the carbon impact associated with incorrect disposal.

Reducing our carbon footprint per Salbutamol inhaler in Sheffield (2023) Switching to a lower carbon footprint salbutamol inhaler.

Sustainable Inhaler Prescribing CTMUHB (2023) Achieved a reduction in SABA overuse by identifying and reviewing patients with indicators of poor asthma control. Also switched to lower carbon equivalent salbutamol inhalers.

Decarbonisation of Inhalers and working towards Carbon Zero in a Community Pharmacy Setting (2022)

Community pharmacy calculated their carbon footprint and offset this by planting trees in Wales. Also undertook a project to explain to patients the advantages of changing to dry powder inhalers and environment consequences of using an MDI, and explain the benefits of converting to a DPI.

Reducing the Carbon Impact of Inhalers Suffolk and North East Essex ICB (2022) Utilised a multi-disciplinary approach to reduce the use of metered dose inhalers across the ICB. The project focused on respiratory and formulary guidelines, appropriate inhaler disposal, practical advice to review, switch and monitor inhalers.

Greener practice Introduction: High-quality and low-carbon asthma care education video 1. Video explaining about the Greener practice toolkit.

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Prescribing data, costs and savings

The inhaler carbon footprint values included in attachment 1 have been used in the visual data pack which accompanies this resource and in the PrescQIPP inhaler carbon footprint snapshot which is updated monthly. NHS organisations can use these resources to:

- Identify where they are outliers and view longer term trends (data from 2019 to present)
- Prioritise areas for change
- Support the development of strategies for lowering the inhaler carbon footprint impact across their organisation
- Review progress against objectives

Across England, Wales, Northern Ireland, Isle of Man and Scotland approximately 208 million inhaler items are prescribed annually with a total carbon footprint of 2.28 trillion $KgCO_2e$ (NHSBSA and Public Health Scotland April to June 2025).

Table 3 illustrates the % pMDI (excluding low GWP pMDIs) compared to all inhalers dispensed in primary care by country from 2019 to 2025. There is a 16.7% difference between the highest and lowest use of pMDI by country across the UK. The current UK pMDI average 64.3% is higher than the European average 48% pMDI use.[57]

Table 3. % pMDI (excluding low GPW pMDIs) by country 2019 to 2025 (NHSBSA and Public Health Scotland April 2019 to June 2025)

	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	Year to date 2025/26
England	71.26%	71.19%	72.20%	71.30%	69.53%	68.29%	65.92%
Wales	68.40%	68.68%	69.42%	67.52%	62.88%	57.61%	54.92%
Northern Ireland	66.04%	64.49%	66.02%	66.72%	66.61%	65.46%	62.21%
Isle of Man	72.30%	71.72%	72.54%	72.09%	73.01%	73.44%	71.62%
Scotland	67.41%	66.71%	68.17%	69.46%	69.10%	68.43%	66.97%
Average	69.08%	68.56%	69.67%	69.42%	68.23%	66.65%	64.33%

Table 4 illustrates the % pMDI for non-salbutamol pMDIs (excluding low GWP pMDIs) compared to all non-salbutamol inhaler devices.

Table 4. % pMDI (non-salbutamol grouping) by country 2019 to 2025

	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	Year to date 2025/26
England	52.77%	54.24%	55.52%	54.82%	53.26%	52.50%	50.86%
Wales	49.66%	51.38%	52.50%	51.04%	46.87%	42.23%	40.23%
Northern Ireland	44.63%	44.00%	45.70%	46.57%	46.59%	45.64%	43.17%
Isle of Man	54.47%	55.65%	56.61%	56.76%	58.00%	58.93%	57.75%
Scotland	46.91%	47.39%	48.90%	50.60%	51.19%	51.35%	50.22%
Average	49.69%	50.53%	51.84%	51.96%	51.18%	50.13%	48.45%

In England, Wales, Northern Ireland and the Isle of Man, the top 3 inhalers by total carbon emissions account for **55%** of the total inhaler carbon footprint. They are all salbutamol inhalers:

1. Salbutamol inhalers prescribed as generic salbutamol inhaler
2. Ventolin Evohaler
3. Salamol pMDI

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To reduce an organisations total inhaler carbon footprint the number of inhalers dispensed will need to reduce and/or the average carbon footprint per inhaler dispensed will need to reduce. These two parameters can therefore be used to monitor progress.

Chart 1 illustrates the number of salbutamol inhalers per 1,000 patients by country from 2019 to 2025. All countries have seen a downward trend over the last five years.

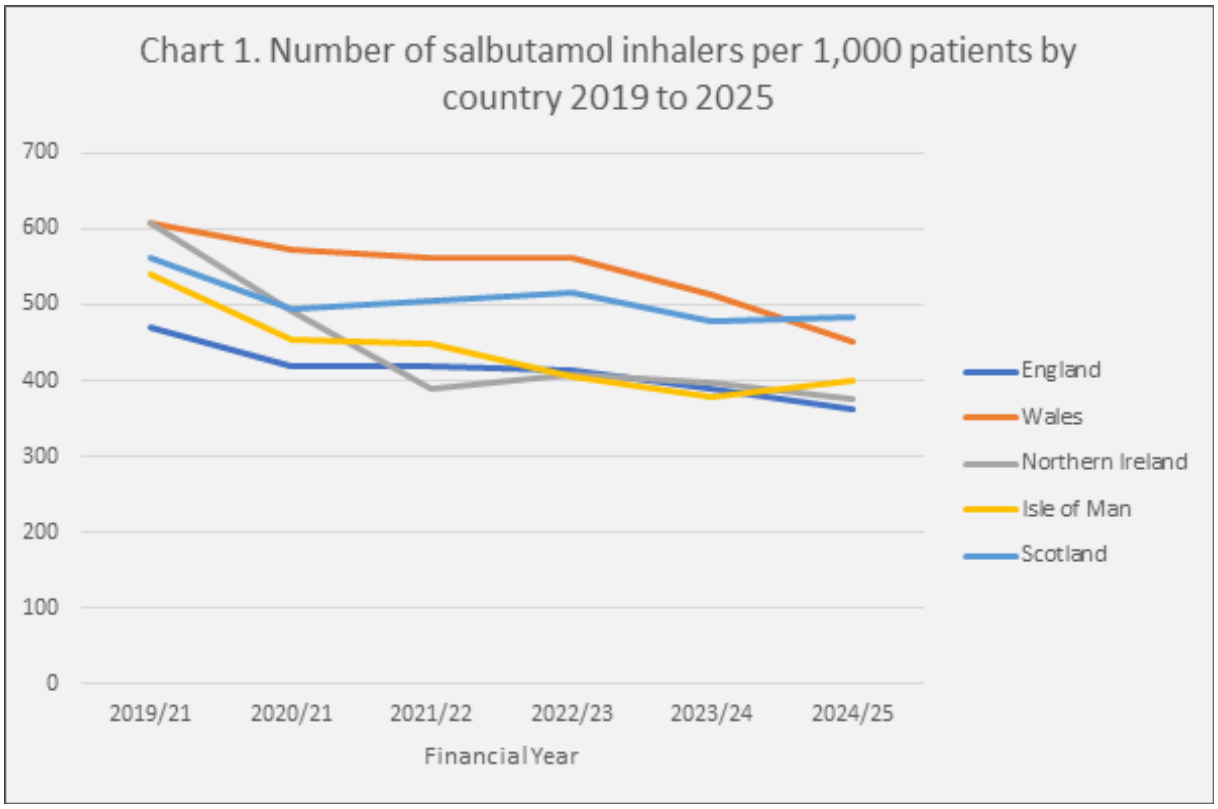
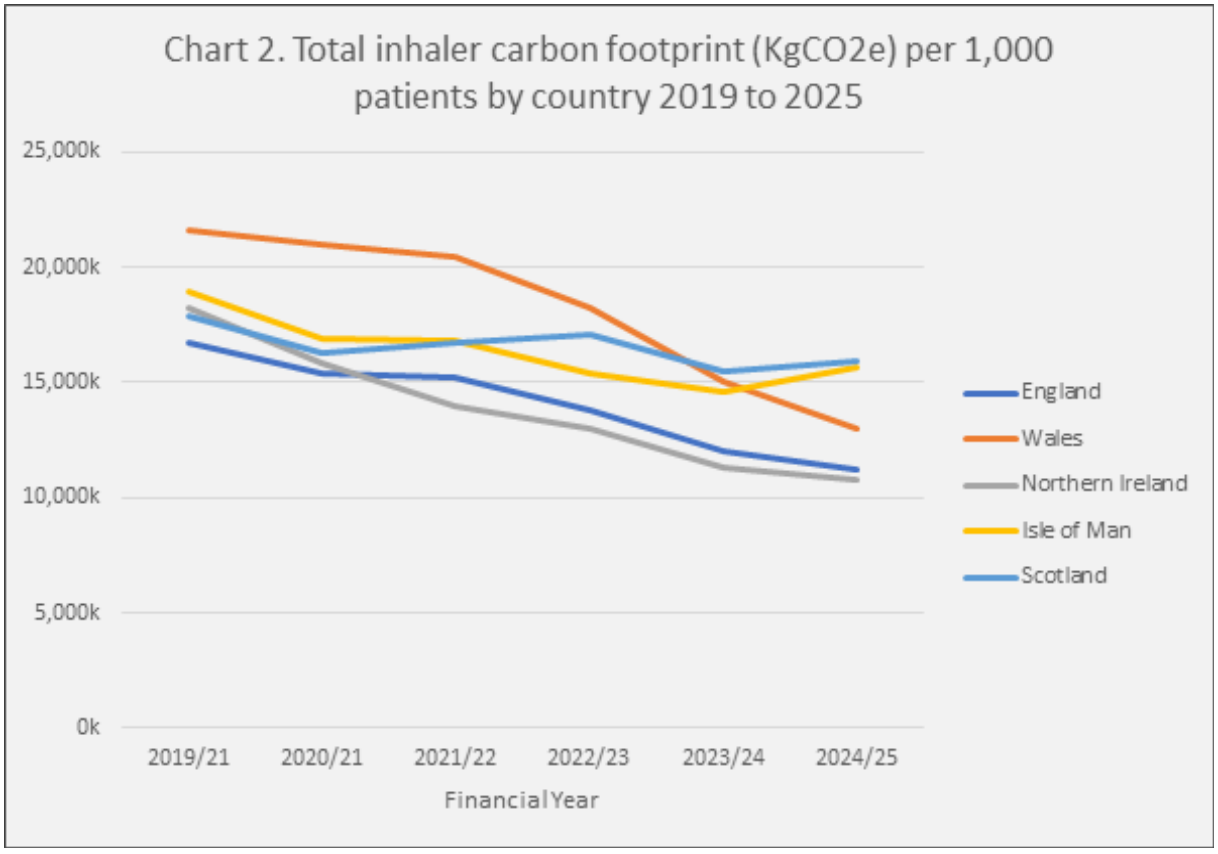


Chart 2 illustrates the total inhaler carbon footprint ($KgCO_2e$) per 1,000 patients by country 2019 to 2025. All countries have seen a downward trend over the last five years.



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The PrescQIPP 'lowering the inhaler carbon footprint data tool and visual data pack' allows users to view their local prescribing data and compares it to the national average. The impact of potential or actual switches to lower carbon footprint inhalers can be reviewed, in terms of indicative carbon footprint and cost impact. The tool and data pack have been designed to support decision-making on strategies to reduce inhaler carbon footprint.

The top 21 inhalers for inhaler carbon footprint gCO_2e/1000 patients were used to produce the example switches shown in tables 5 to 7.[16] Many examples include the impact on transition to the BTS, NICE, SIGN asthma guidelines.[28] The tables separately illustrate examples of inhaler switches which reduce the inhaler carbon footprint and are:

- Cost saving or cost saving plus avoidance of emergency attendance or hospital admission (notated as 'Hospital attendance avoidance' (table 5).
- Cost neutral (table 6).
- Cost pressures or convey cost pressures that may be offset by avoidance of emergency attendance or hospital admission (table 7).

In the examples used to switch to AIR therapy or MART, inhalers licensed for these indications have been provided. An advantage of using an inhaler which is licensed for use as AIR therapy and MART is that patients' treatment can be stepped up and stepped down using one licensed inhaler, without the need to explain unlicenced therapies to the patient. Refer to PrescQIPP bulletin 369 Asthma for further information on the off-label use of inhalers. The least costly (WockAIR 160 micrograms/4.5 micrograms/dose dry powder inhaler) and most costly licensed AIR therapy/MART inhalers (Symbicort 200/6 micrograms Turbohaler) have been used as examples to give an idea of the cost impact of the switch alongside the carbon footprint impact.

The NICE resource impact template is available to assess the potential capacity benefits from reduced emergency attendances and avoidance of hospital admissions that may be realised from the increased uptake of MART. This template includes examples switches that align with recommendations in the BTS, NICE, SIGN asthma guidelines,[28] for example:

- SABA-only therapy → as needed AIR therapy
- SABA plus low- or moderate-dose (ICS) → low- or moderate-dose MART
- LABA plus low- or moderate-dose ICS → low- or moderate-dose MART

The PrescQIPP inhaler switch data tool may be used to review the carbon footprint and cost impact of other options (from national to local level).

Tables 5 to 7 list whether the switch would involve a change in drug, device, licensed indication, or age range. The relevant impact of the switch per inhaler is also given. These are example switches and local switches may be used/preferred.

Before undertaking any switches it is important to determine whether the switch is appropriate for the patient and their condition (asthma or COPD). Any switches being considered should be discussed and agreed with patients using the principles of shared decision making. They should be tailored to the individual, particularly as alternatives may not be therapeutically equivalent. Inhaler device instructions should be provided and doses may need to be adjusted on follow-up, according to the patient's response. Local guidelines should be amended to support a drug switch in appropriate patients. These switches are likely to take place during annual reviews. The inhaler technique should be demonstrated and follow up links to videos and leaflets provided.

Further information on the BTS, NICE, SIGN asthma guidelines can be found in PrescQIPP Bulletin 369. Asthma.

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The PrescQIPP Asthma Pathway Costing Tool is available to subscribers in England, Wales, Northern Ireland, and Isle of Man. It provides an estimate of the 12-month carbon footprint impact and costs per patient of different asthma treatment pathways and formulary choices. There are two pathways; a flexible regimen using AIR therapy and MART based on the BTS, NICE, SIGN chronic asthma guidelines, and a traditional regimen based on the previous NICE asthma guidelines (NG80).[28] By selecting different inhaler choices, the results can be compared visually with available alternatives to view the impact of selecting different inhalers with ease. The tool can also be used to estimate the carbon footprint impact and cost of aligning to the updated BTS, NICE, SIGN guidelines.

The RightBreathe website contains inhaler images and may be used in conjunction with Tables 5 to 7 when developing local strategies or discussing inhaler options with patients. The Inhaler carbon footprint comparison tool is available for healthcare professionals to use in discussion with patients to illustrate the carbon footprint of their current inhalers and that of suitable alternatives.

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Table 5. Examples of inhaler switches to reduce the carbon footprint with cost savings, or cost-saving plus potential avoidance of emergency attendance or hospital admission (notated as 'Hospital attendance avoidance')[28,58-63]

Switch from higher carbon footprint pMDI	Switch to lower carbon footprint alternative	Therapeutic group	Different drug(s)?	Different device?	Cost impact per inhaler (£)	Indicative carbon footprint impact per inhaler (gCO_2e)	Difference in licensed indication or age range?	Cost saving/cost neutral or pressure
Fostair 100/6 pMDI + Ventolin Evohaler	WockAIR 160/4.5 DPI	Low-dose ICS/LABA plus SABA to low-dose MART/AIR license	YES	YES	-£11.82	-35,905	YES	Cost saving Hospital attendance avoidance
Flutiform 125/5 pMDI + Ventolin Evohaler	WockAIR 160/4.5 DPI	Moderate-dose ICS/LABA plus SABA to moderate-dose licensed MART	YES	YES	-£10.50	-60,319	YES	Cost saving Hospital attendance avoidance
Atimos Modulite pMDI	Formoterol Easyhaler DPI	LABA (COPD only)	NO	YES	-£6.31	-12,534	YES	Cost saving
Seretide Evohaler 25/125 pMDI + Ventolin Evohaler	WockAIR 160/4.5 DPI	Moderate-dose ICS/LABA plus SABA to moderate-dose licensed MART	YES	YES	-£5.95	-41,415	YES	Cost saving Hospital attendance avoidance
Sirdupla 25/125 + Ventolin Evohaler	WockAIR 160/4.5 DPI	Moderate-dose ICS/LABA plus SABA to moderate-dose licensed MART	YES	YES	-£4.95	-41,771	YES	Cost saving Hospital attendance avoidance
Flutiform 125/5 pMDI + Ventolin Evohaler	Symbicort 200/6 Turbohaler	Moderate-dose ICS/LABA plus SABA to moderate-dose licensed MART	YES	YES	-£1.50	-61,004	YES	Cost saving Hospital attendance avoidance
Fostair 100/6 pMDI + Ventolin Evohaler	Symbicort 200/6 Turbohaler	Low-dose ICS/LABA to low-dose MART/AIR license	YES	YES	-£2.82	-36,590	YES	Cost saving Hospital attendance avoidance
Ventolin Evohaler	Salamol pMDI	SABA (COPD only)	NO	NO	-£0.04	-15,015	NO	Cost saving

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Table 6. Examples of inhaler switches which reduce carbon footprint and are cost neutral[58-63]

Switch from higher carbon footprint pMDI	Switch to lower carbon footprint alternative	Therapeutic group	Different drug(s)?	Different device?	Cost impact per inhaler (£)	Indicative carbon footprint impact per inhaler (gCO_2e)	Difference in licensed indication or age range?	Cost saving/cost neutral or pressure
Symbicort 200/6 pMDI	Symbicort 200/6 Turbohaler	ICS/LABA	NO	YES	£0.00	-33,332	YES	Cost neutral
Seretide Evohaler 25/250	Seretide Accuhaler 50/500	ICS/LABA	NO	YES	£0.00	-16,262	NO	Cost neutral
Trimbow 87/5/9 pMDI	Trimbow NEXThaler 88/5/9	ICS/LABA/LAMA	NO	YES	£0.00	-13,940	YES	Cost neutral
Trimbow 87/5/9 pMDI	Trixeo Aerosphere 5/7.2/160	ICS/LABA/LAMA	YES	YES	£0.00	-14,816	YES	Cost neutral
Fostair 200/6 pMDI	Fostair NEXThaler 200/6	ICS/LABA	NO	YES	£0.00	-13,919	NO	Cost neutral
Fostair 100/6 pMDI	Fostair NEXThaler 100/6	ICS/LABA	NO	YES	£0.00	-10,761	NO	Cost neutral

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Table 7. Examples of inhaler switches that reduce carbon footprint and convey a cost pressure or convey cost pressures that may be offset by avoidance of emergency attendance or hospital admission[28,58-63]

Switch from higher carbon footprint pMDI	Switch to lower carbon footprint alternative	Therapeutic group	Different drug(s)?	Different device?	Cost impact per inhaler (£)	Indicative carbon footprint impact per inhaler (gCO_2e)	Difference in licensed indication or age range?	Cost saving/cost neutral or pressure
Seretide Evohaler 25/50 + Ventolin Evohaler	WockAIR 160/4.5 DPI	Low dose ICS/LABA plus SABA to low-dose MART/AIR license	YES	YES	£0.04	-41,415	YES	Cost pressure which may be offset by hospital attendance avoidance
Qvar 100 pMDI or Autohaler + Ventolin Evohaler	WockAIR 160/4.5 DPI	Low or moderate dose ICS plus SABA to low-dose or moderate-dose MART/AIR license	YES	YES	£0.29	-43,031	YES	Cost pressure which may be offset by hospital attendance avoidance
Qvar Easi-Breathe 100 + Ventolin Evohaler	WockAIR 160/4.5 DPI	Low or moderate dose ICS plus SABA to low-dose or moderate-dose MART/AIR license	YES	YES	£0.55	-49,924	YES	Cost pressure which may be offset by hospital attendance avoidance
Seretide Evohaler 25/50 + Ventolin Evohaler	WockAIR 160/4.5 DPI	Low dose ICS/LABA plus SABA to low-dose MART/AIR license	YES	YES	£1.54	-15,675	YES	Cost pressure which may be offset by hospital attendance avoidance
Seretide Evohaler 25/125 + Ventolin Evohaler	Symbicort 200/6 Turbohaler	Moderate-dose ICS/LABA plus SABA to moderate-dose licensed MART	YES	YES	£3.05	-42,100	YES	Cost pressure which may be offset by hospital attendance avoidance

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Switch from higher carbon footprint pMDI	Switch to lower carbon footprint alternative	Therapeutic group	Different drug(s)?	Different device?	Cost impact per inhaler (£)	Indicative carbon footprint impact per inhaler (gCO_2e)	Difference in licensed indication or age range?	Cost saving/cost neutral or pressure
Flutiform 50/5 pMDI + Ventolin Evohaler	WockAIR 160/4.5 DPI	Low dose ICS/LABA plus SABA to low-dose MART/AIR license	YES	YES	£3.10	-60,319	YES	Cost pressure which may be offset by hospital attendance avoidance
Sirdupla 25/125 pMDI + Ventolin Evohaler	Symbicort 200/6 Turbohaler	Moderate-dose ICS/LABA plus SABA to moderate-dose licensed MART	YES	YES	£4.05	-42,456	YES	Cost pressure which may be offset by hospital attendance avoidance
Sirdupla 25/250 pMDI	Seretide Accuhaler 50/500	ICS/LABA	NO	YES	£4.42	-16,588	YES	Cost pressure
Seretide Evohaler 25/50 + Ventolin Evohaler	Symbicort 200/6 Turbohaler	Low dose ICS/LABA plus SABA to low-dose MART/AIR license	YES	YES	£9.04	-42,100	YES	Cost pressure which may be offset by hospital attendance avoidance
Qvar 100 pMDI or Autohaler + Ventolin Evohaler	Symbicort 200/6 Turbohaler	Low or moderate dose ICS plus SABA to low-dose or moderate-dose MART/AIR license	YES	YES	£9.29	-43,716	YES	Cost pressure which may be offset by hospital attendance avoidance
Qvar Easi-Breathe 100 + Ventolin Evohaler	Symbicort 200/6 Turbohaler	Low or moderate dose ICS plus SABA to low-dose or moderate-dose MART/AIR license	YES	YES	£9.55	-50,609	YES	Cost pressure which may be offset by hospital attendance avoidance

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Switch from higher carbon footprint pMDI	Switch to lower carbon footprint alternative	Therapeutic group	Different drug(s)?	Different device?	Cost impact per inhaler (£)	Indicative carbon footprint impact per inhaler (gCO_2e)	Difference in licensed indication or age range?	Cost saving/cost neutral or pressure
Qvar 50 pMDI or Autohaler + Ventolin Evohaler	WockAIR 160/4.5 DPI	Low or moderate dose ICS plus SABA to low-dose or moderate-dose MART/AIR license	YES	YES	£9.63	-43,045	YES	Cost pressure which may be offset by hospital attendance avoidance
Qvar Easi-Breathe 50 + Ventolin Evohaler	WockAIR 160/4.5 DPI	Low or moderate dose ICS plus SABA to low-dose or moderate-dose MART/AIR license	YES	YES	£9.76	-50,290	YES	Cost pressure which may be offset by hospital attendance avoidance
Clenil Modulite 100 + Ventolin Evohaler	WockAIR 160/4.5 DPI	Low dose ICS plus SABA to low-dose MART/AIR license	YES	YES	£10.08	-41,601	YES	Cost pressure which may be offset by hospital attendance avoidance
Seretide Evohaler 25/125	Seretide Accuhaler 50/250	ICS/LABA	NO	YES	£10.50	-16,262	NO	Cost pressure which may be offset by hospital attendance avoidance
Flutiform 50/5 pMDI + Ventolin Evohaler	Symbicort 200/6 Turbohaler	Low dose ICS/LABA plus SABA to low-dose MART/AIR license	YES	YES	£12.10	-61,004	YES	Cost pressure which may be offset by hospital attendance avoidance

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Switch from higher carbon footprint pMDI	Switch to lower carbon footprint alternative	Therapeutic group	Different drug(s)?	Different device?	Cost impact per inhaler (£)	Indicative carbon footprint impact per inhaler (gCO_2e)	Difference in licensed indication or age range?	Cost saving/cost neutral or pressure
Airomir Autohaler	WockAIR 160/4.5 DPI	SABA only to AIR therapy/MART	YES	YES	£12.95	-8,868	YES	Cost pressure which may be offset by hospital attendance avoidance
Clenil Modulite 50 + Ventolin Evohaler	WockAIR 160/4.5 DPI	Low dose ICS plus SABA to low-dose MART/AIR license	YES	YES	£13.80	-41,601	YES	Cost pressure which may be offset by hospital attendance avoidance
Airomir pMDI	WockAIR 160/4.5 DPI	Discontinued inhaler-SABA only to AIR therapy/MART	YES	YES	£17.03	-8,235	YES	Cost pressure which may be offset by hospital attendance avoidance
Ventolin Evohaler	WockAIR 160/4.5 DPI	SABA only to AIR therapy/MART	YES	YES	£17.50	-24,255	YES	Cost pressure which may be offset by hospital attendance avoidance
Salamol Easi-Breathe	WockAIR 160/4.5 DPI	SABA only to AIR therapy/MART	YES	YES	£17.54	-9,240	YES	Cost pressure which may be offset by hospital attendance avoidance

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Switch from higher carbon footprint pMDI	Switch to lower carbon footprint alternative	Therapeutic group	Different drug(s)?	Different device?	Cost impact per inhaler (£)	Indicative carbon footprint impact per inhaler (gCO_2e)	Difference in licensed indication or age range?	Cost saving/cost neutral or pressure
Qvar 50 pMDI or Autohaler + Ventolin Evohaler	Symbicort 200/6 Turbohaler	Low or moderate dose ICS plus SABA to low-dose or moderate-dose MART/AIR license	YES	YES	£18.63	-43,730	YES	Cost pressure which may be offset by hospital attendance avoidance
Qvar Easi-Breathe 50 + Ventolin Evohaler	Symbicort 200/6 Turbohaler	Low or moderate dose ICS plus SABA to low-dose or moderate-dose MART/AIR license	YES	YES	£18.76	-50,975	YES	Cost pressure which may be offset by hospital attendance avoidance
Clenil Modulite 100 + Ventolin Evohaler	Symbicort 200/6 Turbohaler	Low dose ICS plus SABA to low-dose MART/AIR license	YES	YES	£19.08	-42,286	YES	Cost pressure which may be offset by hospital attendance avoidance
Airomir pMDI	Symbicort 200/6 Turbohaler	Discontinued inhaler-SABA only to AIR therapy	YES	YES	£26.03	-8,920	YES	Cost pressure which may be offset by hospital attendance avoidance
Ventolin Evohaler	Symbicort 200/6 Turbohaler	SABA only to AIR therapy	YES	YES	£26.50	-24,940	YES	Cost pressure which may be offset by hospital attendance avoidance

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The cost and carbon footprint impact of example switches across England, Wales, Northern Ireland, and the Isle of Man is provided in table 8.

Table 8. Carbon footprint impact for example inhaler switches across England, Wales, Northern Ireland, and the Isle of Man ($KgCO_2e$) (NHSBSA Apr-Jun25)

25% switch from higher carbon footprint pMDI to lower carbon footprint alternative		England		Wales		Northern Ireland		Isle of Man	
Brand name	**Switch grouping**	**Cost impact**	**Carbon footprint impact ($KgCO_2e$) (K=1,000)**	**Cost impact**	**Carbon footprint impact ($KgCO_2e$) (K=1,000)**	**Cost impact**	**Carbon footprint impact ($KgCO_2e$) (K=1,000)**	**Cost impact**	**Carbon footprint impact ($KgCO_2e$) (K=1,000)**
Clenil Modulite 50 + Ventolin Evohaler to WockAIR 160/4.5 DPI	ICS + SABA to MART	£2,025,426	-6,237,578K	£65,122	-200,553K	£116,781	-359,644K	£2,732	-8,415K
Clenil Modulite 100 + Ventolin Evohaler to WockAIR 160/4.5 DPI	ICS + SABA to MART	£5,674,596	-23,925,067K	£177,892	-750,022K	£252,179	-1,063,231K	£8,467	-35,699K
Qvar 50 pMDI or Autohaler + Ventolin Evohaler to WockAIR 160/4.5 DPI	ICS + SABA to MART	£375,108	-1,711,668K	£14,522	-66,266K	£9,625	-43,920K	£337	-1,538K
Qvar 100 pMDI or Autohaler + Ventolin Evohaler to WockAIR 160/4.5 DPI	ICS + SABA to MART	£233,450	-3,552,231K	£1,098	-166,315K	£586	-88,780K	£29	-4,437K
Qvar Easi-Breathe 50 + Ventolin Evohaler to WockAIR 160/4.5 DPI	ICS + SABA to MART	£90,202	-473,079K	£2,225	-11,671K	£3,047	-15,980K	£20	-102K
Qvar Easi-Breathe 100 + Ventolin Evohaler to WockAIR 160/4.5 DPI	ICS + SABA to MART	£6,338	-585,622K	£225	-20,786K	£272	-25,126K	£5	-457K

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25% switch from higher carbon footprint pMDI to lower carbon footprint alternative		England		Wales		Northern Ireland		Isle of Man	
Brand name	**Switch grouping**	**Cost impact**	**Carbon footprint impact ($KgCO_2e$) (K=1,000)**	**Cost impact**	**Carbon footprint impact ($KgCO_2e$) (K=1,000)**	**Cost impact**	**Carbon footprint impact ($KgCO_2e$) (K=1,000)**	**Cost impact**	**Carbon footprint impact ($KgCO_2e$) (K=1,000)**
Flutiform 50/5 pMDI + Ventolin Evohaler to WockAIR 160/4.5 DPI	ICS-formo-terol + SABA to MART	£57,344	-1,132,392K	£3,106	-61,339K	£1,798	-35,506K	£74	-1,469K
Flutiform 125/5 pMDI + Ventolin Evohaler to WockAIR 160/4.5 DPI	ICS-formoterol + SABA to MART	-£546,756	-3,187,692K	-£29,831	-173,917K	-£34,545	-201,404K	-£399	-2,326K
Fostair 100/6 pMDI + Ventolin Evohaler to WockAIR 160/4.5 DPI	ICS-non-formoterol + SABA to MART	-£12,485,348	-38,874,641K	-£346,007	-1,077,334K	-£232,296	-723,283K	-£40,980	-127,596K
Seretide Evohaler 25/50 + Ventolin Evohaler to WockAIR 160/4.5 DPI	ICS-non-formoterol + SABA to MART	£3,700	-3,913,529K	£117	-124,104K	£149	-157,268K	£3	-3,173K
Seretide Evohaler 25/125 pMDI + Ventolin Evohaler to WockAIR 160/4.5 DPI	ICS-non-formoterol + SABA to MART	-£569,094	-4,047,069K	-£17,172	-122,115K	-£30,629	-217,819K	-£1,505	-10,705K
Sirdupla 25/125 pMDI + Ventolin Evohaler to WockAIR 160/4.5 DPI	ICS-non-formoterol + SABA to MART	-£159,900	-1,378,337K	-£5,534	-47,704K	-£15,558	-134,109K	-£40	-341K

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25% switch from higher carbon footprint pMDI to lower carbon footprint alternative		England		Wales		Northern Ireland		Isle of Man	
Brand name	**Switch grouping**	**Cost impact**	**Carbon footprint impact ($KgCO_2e$) (K=1,000)**	**Cost impact**	**Carbon footprint impact ($KgCO_2e$) (K=1,000)**	**Cost impact**	**Carbon footprint impact ($KgCO_2e$) (K=1,000)**	**Cost impact**	**Carbon footprint impact ($KgCO_2e$) (K=1,000)**
Atimos Modulite to Formoterol Easyhaler	pMDI to DPI (COPD only)	-£22,520	-44,734K	-£404	-802K	-£57	-113K	-£44	-88K
Fostair 100/6 pMDI to Fostair NEXThaler 100/6	pMDI to DPI	£0	-11,366,737K	£0	-315,007K	£0	-211,484K	£0	-37,308K
Fostair 200/6 pMDI to Fostair NEXThaler 200/6 DPI	pMDI to DPI	£0	-4,458,979K	£0	-126,134K	£0	-114,695K	£0	-17,482K
Seretide Evohaler 25/250 to Seretide Accuhaler 50/500	pMDI to DPI	£784,991	-1,215,763K	£32,760	-50,737K	£59,506	-92,161K	£3,633	-5,627K
Sirdupla 25/250 pMDI to Seretide Accuhaler 50/500	pMDI to DPI	£119,154	-447,179K	£4,641	-17,417K	£15,041	-56,449K	£53	-199K
Symbicort 200/6 pMDI to Symbicort 200/6 Turbohaler	pMDI to DPI	£0	-1,168,053K	£0	-26,732K	£0	-78,297K	£0	-1,633K
Trimbow 87/5/9 pMDI to Trimbow NEXThaler 88/5/9	pMDI to DPI	£0	-9,766,461K	£0	-421,448K	£0	-314,078K	£0	-12,783K
Trimbow 87/5/9 pMDI to Trixeo Aerosphere 5/7.2/160 Low GWP pMDI	pMDI to low GWP pMDI	£0	-10,380,341K	£0	-421,442K	£0	-314,078K	£0	-13,586K

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25% switch from higher carbon footprint pMDI to lower carbon footprint alternative		England		Wales		Northern Ireland		Isle of Man	
Brand name	**Switch grouping**	**Cost impact**	**Carbon footprint impact ($KgCO_2e$) (K=1,000)**	**Cost impact**	**Carbon footprint impact ($KgCO_2e$) (K=1,000)**	**Cost impact**	**Carbon footprint impact ($KgCO_2e$) (K=1,000)**	**Cost impact**	**Carbon footprint impact ($KgCO_2e$) (K=1,000)**
Airomir Autohaler to WockAIR 160/4.5 DPI	SABA to AIR therapy/ MART	£96,219	-72,561K	£4,999	-3,770K	£3,667	-2,765K	£130	-98K
Salamol Easi-Breathe to WockAIR 160/4.5 DPI	SABA to AIR therapy/ MART	£3,124,418	-1,805,892K	£155,808	-90,056K	£173,854	-100,486K	£4,227	-2,443K
Ventolin Evohaler to WockAIR 160/4.5 DPI	SABA to AIR therapy/ MART	£40,245,363	-57,845,234K	£1,444,713	-2,076,506K	£853,298	-1,226,457K	£123,270	-177,178K

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Summary

The Climate Change Act 2008 (2050 Target Amendment) Order 2019 sets out the UK government's target for net zero emissions of greenhouse gases by 2050.[18] All four UK health services have committed to achieving this target.[6,7, 18-21] Inhalers are responsible for approximately 3% of the NHS's total carbon emissions, with most emissions coming from the propellant in pMDIs rather than the medicine itself.[7]

A range of strategies can support achievement of this target including optimising prescribing to achieve good disease control, switching to lower carbon footprint alternatives where clinically appropriate, reducing inhaler waste and environmentally safe inhaler disposal. Organisations should agree strategies for lowering the local inhaler carbon footprint through a relevant group such as the local Area Prescribing Committee, involving all key stakeholders and communicating any changes to them.

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Additional PrescQIPP resources

Including implementations resources and data	https://www.prescqipp.info/our-resources/bulletins/bulletin-375-inhaler-carbon-footprint/

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