Research Review™
PRODUCT REVIEW

Easyhaler®: delivering sustainable asthma management for Australian patients

Making Education Easy 2025

Independent expert commentary provided by Clinical Professor John Blakey

John Blakey is the Head of Respiratory Medicine and lead for the Airways disease service at Sir Charles Gairdner Hospital, adjunct Clinical Professor at Curtin University and senior research fellow at the Institute for Respiratory Health. He has a longstanding interest in improving the quality of multidisciplinary care for asthma and associated conditions, and related health services research. This includes addressing the information imbalance around key aspects of asthma care such as oral corticosteroid stewardship and the environmental impact of inhalers.

This review summarises the essential features of the Easyhaler, a carbon neutral, dry powder inhaler that offers an effective, sustainable and easy-to-use alternative to pressurised metered-dose inhalers. The Easyhaler device was registered in Australia in 2022 and is indicated for certain patients with asthma or chronic obstructive pulmonary disease. This review will focus on its role in asthma management as an environmentally conscious treatment option.

The environmental impact of inhalers used for asthma treatment

In September 2024, the National Sustainable Asthma Care Roadmap was published, summarising the feedback from meetings with more than 50 key stakeholder organisations across Australia.[1] The roadmap has two key objectives: to improve the quality of Asthma care in Australia, whilst reducing the environmental impact of asthma inhalers, and was born out of the Australian Government's 2023 National Health and Climate Strategy, which prioritised the reduction of greenhouse gas (GHG) emissions from the health system.[1, 2]

Of the therapies used for the treatment of asthma and chronic obstructive pulmonary disease (COPD), the greatest GHG emissions and largest carbon footprint result from the use of pressurised metered-dose inhalers (pMDIs).[3, 4] From 1987, the Montreal Protocol required the global phasing out of chlorofluorocarbons (CFCs), common propellants which cause damage to the ozone layer and contribute to the greenhouse effect.[1, 5] However, the use of CFCs continued in pMDIs until at least the mid-1990s, when alternative propellants such as hydrofluorocarbons (HFCs)/hydrofluoroalkanes (HFAs) were introduced.[1, 5-7] Moreover, HFCs/HFAs are still potent GHGs, and their use are also to be phased out as part of the Kigali Amendment to the Montreal Protocol.[3, 7]

Dry powder inhalers (DPIs) do not utilise propellants, instead harnessing patient inspiration to aerosolise the dry power contents and distribute it within the lungs.[8, 9] DPIs have a lower carbon footprint than currently available pMDIs.[3, 10]

Consideration of the environmental impact of asthma management is important, and in its 2023 guideline updates, the Global Initiative for Asthma (GINA) highlight how environmental considerations can be applied to the choice of inhaler used whilst prioritising an effective medication for asthma control and a device that a patient can use easily and appropriately.[11] With respect to device use, the National Asthma Council of Australia emphasise the importance of promoting and regularly checking patients' inhaler technique, and providing re-training as needed.[12, 13] Community pharmacists also play an important role in assessing and training patients on correct inhalation technique.[13]

In Australia, around 25 million inhalers are estimated to be dispensed each year, of which 80% are pMDIs, equating to between 560,000–665,000 annual tonnes of CO_2 emissions (CO_2e).[1] As put forth by the National Sustainable Asthma Care Roadmap, there is convincing evidence that transitioning anti-inflammatory asthma therapy from devices with a higher carbon footprint to those with a lower carbon footprint (such as DPIs), could not only reduce the environmental impact of asthma management, but also improve patient-centred asthma outcomes.[1] Person-centred care that optimises asthma outcomes can ultimately reduce the frequency of severe exacerbations, which in turn would be expected to reduce the overall use of pMDIs containing short-acting beta agonists, which have a high global warming potential.[1, 6, 14]

Focus on Easyhaler®

Although the focus of this review is on asthma, both Bufomix Easyhaler and Salflumix Easyhaler are registered and PBS-listed for certain patients with COPD. For full details, please refer to the PBS website and the relevant Prescribing Information for each product.

Available in two strengths of each formulation

Two different preparations using the Easyhaler device were approved in Australia in late-2022, each with two available strengths:

- **Bufomix Easyhaler®** (Product Information) contains budesonide/formoterol fumarate dihydrate in metered doses of 200µg/6µg or 400µg/12µg, and
- **Salflumix Easyhaler®** (Product Information) contains fluticasone propionate/salmeterol xinafoate in metered doses of 250µg/50µg or 500µg/50µg.[15, 16]

Indications in asthma

Bufomix Easyhaler is indicated in adults and adolescents (aged ≥12 years) for the treatment of asthma to achieve overall asthma control, including the relief of symptoms and the reduction of the risk of exacerbations.[16] Thus, Bufomix Easyhaler is licenced for use as a maintenance and reliever therapy (MART).[16]

Salflumix Easyhaler is indicated in adults and adolescents (aged ≥12 years) for the regular treatment of asthma where the use of a combination product is appropriate, such as patients on effective maintenance doses of long-acting beta-2 agonists plus inhaled corticosteroids, or patients who are symptomatic on current inhaled corticosteroid therapy.[15]

Dosage and administration

Bufomix Easyhaler 200/6 can be used as a MART, whereby patients take a daily dose as a preventative, with additional anti-inflammatory reliever doses used as needed.[16] The recommended maintenance dose is two inhalations per day, given as either one inhalation in the morning and evening, or as two inhalations in either the morning or evening.[16] Some patients may require two inhalations twice daily.

The recommended dose of fluticasone propionate/salmeterol as a maintenance therapy in asthma is 100µg/50µg to 500µg/50µg twice daily.[15] In patients who require the lower dose of 100µg/50µg, an alternative product will be required.[15] In patients requiring a higher dose, the recommended dose of Salflumix Easyhaler 250/50 or 500/50 is one inhalation, twice daily. Salflumix Easyhaler is not for the relief of acute asthma symptoms, and patients should be advised to have their regular reliever medication available at all times.[15]

Please refer to the full Bufomix and Salflumix Easyhaler Product Information for detailed information on dosage and administration.[15, 16]

PBS listed in 2024

Bufomix Easyhaler 200/6 is PBS-listed for use as a MART in patients with asthma, and the use of this combination therapy (formoterol plus a low-dose inhaled corticosteroid) is the preferred treatment in the GINA 2023 guidelines.[11, 17]

Bufomix Easyhaler 400/12, and Salflumix Easyhaler 250/50 and 500/50 are also PBS-listed for patients with asthma that is inadequately controlled with oral or inhaled corticosteroids.[17]

The combination of the long-acting beta agonist salmeterol plus a low-dose inhaled corticosteroid as contained in the Salflumix Easyhaler is also included in the GINA guidelines as an alternative approach to MART, in which patients can also add an as-needed, short-acting beta agonist as a reliever.[11, 15]

Please refer to the PBS website for full details of listings for Bufomix Easyhaler and Salflumix Easyhaler.[17]

Expert comment

Adverse asthma outcomes such as unscheduled healthcare use and emergency admissions continue to be a significant burden on individuals and the healthcare system in many areas of Australia. These largely avoidable episodes lead to physical and psychological harm directly, and also from the use of oral corticosteroids. A key contributor to this situation is the ongoing over-use of short-acting beta-agonist drugs, often without preventative inhaled corticosteroids. For most people with asthma, moving to a MART approach offers improved control and lower risk of exacerbations without an unreasonable medication burden. This evidence comes from randomised controlled trials, but also observations such as greater uptake of MART being temporally associated with improved population outcomes in other countries. A further device option to follow the GINA preferred management track for people with asthma aged 12 or over, and the minority better suited to regular higher-dose therapy, is therefore very welcome.

A rationally designed, carbon neutral DPI inhaler

The Easyhaler device was developed by Orion Pharma and first licensed in European countries in the mid-1990s.[18] Its design was intended to incorporate characteristics of an 'ideal inhaler', using criteria such as compatibility with the inhaled product, safety and efficacy, user-friendly inhalation technique, and good patient acceptability.[18]

It was also designed to overcome challenges with earlier DPI formations, which include variations in emitted doses (dose accuracy), as well as technical challenges with inhalation technique (such as the force of inhalation required), and the optimal deposition of particles into the lungs.[9, 18-21]

The mechanism of the Easyhaler device is shown in **Figure 1**. below.[9, 18]

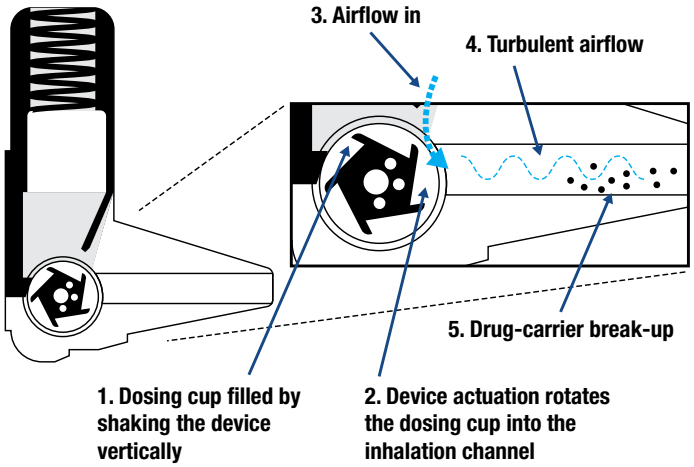

Figure 1. The Easyhaler device. Vertical shaking of the device fills the dosing cup (1), and clicking down on the metering cylinder spring rotates the dosing cup, exposing the dry powder into the inhalation channel (2). The patient inhales through the device, which draws in air through a small vent (3). This generates high resistance and creates turbulent airflow (4), which facilitates maximum de-aggregation/separation of the drug particles from the lactose carrier particles (5). The air channel within the mouthpiece ensures the accurate dose is emitted and optimises deposition of the drug into the lung tissues.[9, 18, 19]

Since 2019, Orion Pharma has conducted comprehensive lifecycle assessments (LCAs) of the Easyhaler devices in collaboration with the independent not-for-profit organisation Carbon Footprint Ltd, which has led to Easyhaler being certified as a Carbon Neutral Product.[4, 22-24] The LCAs are conducted in accordance with ISO standard 14040:2006, which provide guidelines for conducting and reporting these types of analyses; they encompass a 'cradle to grave' analysis of the environmental impacts of a product over its entire life, starting with raw materials and finishing with disposal (**Figure 2**).[22, 23] Three LCAs have been performed to date, including 2019, 2021 and 2023.[22]

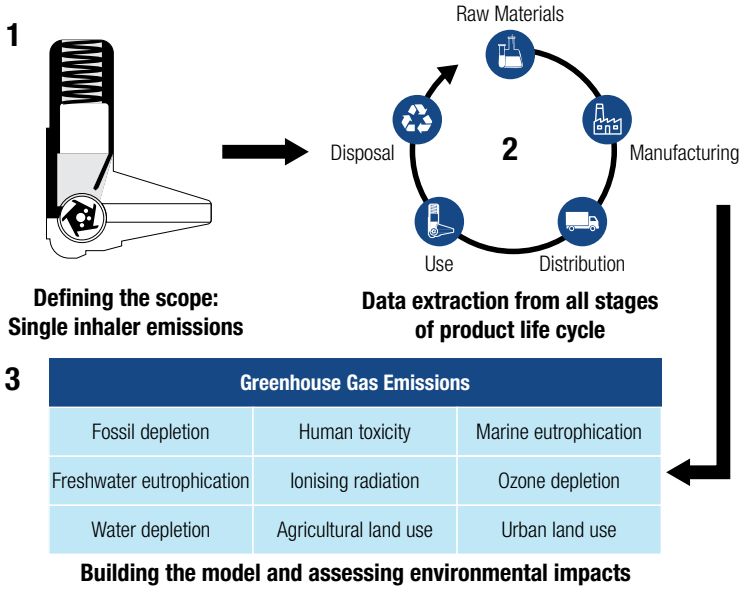

Figure 2. The LCA of the Easyhaler device.[22]

In 2023, the average carbon footprint of an Easyhaler device was 0.547 kg CO_2e (**Table 1**).[22,23] Of note, there was a 6% reduction in the carbon footprint of the Easyhaler from 2021 to 2023, and an 11% reduction from 2019 to 2023.[22] The largest reductions in carbon emissions from the Easyhaler lifecycle from 2021 to 2023 were related to manufacturing, including the formulation of the active pharmaceutical ingredient and carrier, and the inhaler assembly and packaging, with a 53% decrease in carbon footprint.[22] A large part of this decrease is attributable to an organisation-wide shift to renewable and carbon-free sources of energy.[22,23]

Table 1. Carbon footprint and emission change between the assessments for Easyhaler product portfolio*[22]

Life cycle emissions per one Easyhaler (gCO_2e)				Change in emissions (%)		
	2019	2021	2023 (per actuation)	2019–21	2021–23	2019–23
Salbutamol	664.06	619.14	586.81 (2.93)	– 6.8	– 5.2	– 11.6
Formoterol	573.69	543.65	511.32 (4.26)	– 5.2	– 5.9	– 10.9
Budesonide	NA	649.82	616.95 (3.08)	NA	– 5.1	NA
Beclomethasone	NA	610.09	577.73 (2.89)	NA	– 5.3	NA
Budesonide-formoterol	514.49	484.47	452.17 (3.77)	– 5.8	– 6.7	– 12.1
Salmeterol-fluticasone propionate	601.75	571.85	539.81 (9.00)	– 5.0	– 5.6	– 10.3

*Salbutamol, formoterol, budesonide and beclomethasone Easyhaler products are not registered in Australia

Expert comment

Climate change poses a significant and increasing challenge for people with respiratory diseases such as asthma. It is unsustainable for asthma treatment to be based around deploying billions of limited use plastic devices that contain potent greenhouse gases. As pMDIs have a carbon footprint approximately 100-fold greater than dry powder devices, the increased use of DPIs is a core component of published overall strategies to make asthma care more sustainable. The recent efforts of several companies to reduce the environmental impact of their manufacturing and distribution processes is to be commended, and that Easyhaler is recognised as a carbon neutral product is a major achievement.

Inhaler technique errors are common and confer an increased risk of poor asthma control. A simple inhaler design therefore increases the number of people that can successfully use an appropriately prescribed DPI and may facilitate a reduction in the number of pMDIs prescribed.

Consistent with its rational design, the key features of the Easyhaler device include accurate and consistent drug dosing and delivery, ease of use and inhalation technique, patient preference and satisfaction, and clinical efficacy. These topics will be discussed further here.

Accurate and consistent drug delivery

As mentioned above, achieving accurate and consistent delivery of drugs into the lungs with DPIs has been a historical challenge.[21] Studies of Easyhaler have demonstrated that optimal drug delivery can be achieved at low inhalation/peak inspiratory flow rates that are achievable in most individuals with asthma or COPD, and that it has significantly less variable dose delivery than the Turbuhaler or Diskus DPI inhalers, while maintaining accurate delivery performance across doses 1–60 of its lifespan.[19, 25-27]

Optimal drug delivery at PIF ≥30 L/min

As described in **Figure 1**, the Easyhaler generates high resistance and creates turbulent airflow by allowing air in through a small vent; as such, the inspiratory flow through the inhaler is related more to the resistance generated by the device, and less reliant on the patients' airway resistance.[18, 28] Optimal drug delivery with the Easyhaler has been demonstrated for peak inspiratory flow (PIF) levels of ≥30 L/min in patients with asthma or COPD, which most adolescents, adults and elderly patients are capable of generating.[19, 28-30]

Consistently delivers accurate doses

In a simulated real-life conditions study, the dose consistency of Bufomix Easyhaler was compared with the Turbuhaler DPI inhaler at three different flow rates (10th, 50th and 90th percentiles) of the labelled doses delivered to patients by each device.[25] Overall, the Easyhaler device had significantly lower dose variability than the Turbuhaler, which was true for all three flow rates tested (P≤0.004 for all; **Figure 3**).[25]

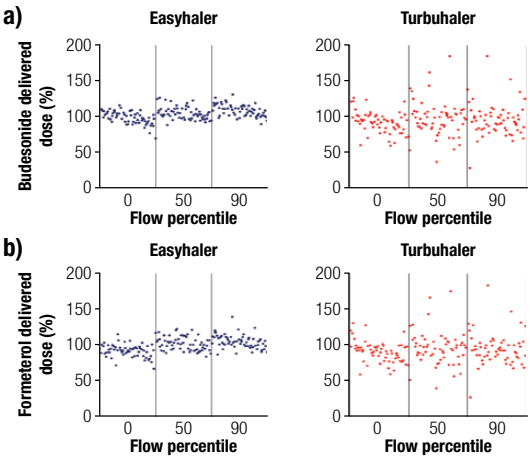

Figure 3. Comparison of dose delivery of budesonide (a) and formoterol (b) with the Bufomix Easyhaler (left) or Symbicort Turbuhaler (right) at a delivered dose of 160µg/4.5µg (equivalent to a 200µg/6µg metered dose) over three flow rates (10th, 50th and 90th percentiles)[25]

Another study compared the accuracy and consistency of the dose delivery of three different salbutamol-containing DPI devices, including Easyhaler, Turbuhaler and Diskus.*[26] Researchers assessed the dose delivery from each device at equivalent flow rates (30, 40 and 60 L/min for the Easyhaler, 30 and 60 L/min for the Turbuhaler, and 30, 60 and 90 L/min for the Diskus).[26] They also analysed the particle size characteristics of the delivered doses, specifically the fine particle dose (FPD)/fine particle fraction (FPF) and mass median aerodynamic diameter (MMAD).[26] An FPD of less than 5µm is considered to be the best approximation of the dose of an inhaled product which will reach the lung tissue and was expressed in relation to the labelled dose to determine the FPF; the MMAD describes the frequency and range of particle size which can be used to determine consistency, and was set at <10µm.[26]

Overall, the delivered drug doses were significantly less variable with Easyhaler than with Turbuhaler or Diskus (P<0.001 for all).[26] The FPF values were comparable for the three inhalers at flow rates equivalent to a 4kPa pressure drop.[26] At the lowest flow rate (30 L/min), the FPF values were 15.6%, 11.5% and 14.5% for the Easyhaler, Turbuhaler and Diskus, respectively.[26] At the 30 and 60 L/min flow rates, Easyhaler produced lower MMAD values than either other device, with peak values of 2–3µm.[26]

Lastly, it is important to understand whether a DPI inhaler can reliably deliver consistent dosing throughout its lifespan and under differing environmental conditions.[27] In their in vitro study, Turpeinen et al. sought to characterise the performance the Salflumix Easyhaler under conditions that are likely to mimic real-life use in patients, such as after being dropped, exposed to vibration or moisture, or being freeze-thawed, and to determine this across the lifespan from dose 1 through 60.[27] When looking at the parameters of delivered dose and FPD, the Salflumix Easyhaler was negligibly impacted by any of the simulated conditions of real-life use, and continued to deliver accurate and consistent doses across its lifespan.[27]

*The Budesonide Easyhaler product is not registered in Australia, and the Diskus device is available as Accuhaler

Expert comment

Medicine concordance is a major issue across all chronic diseases. However, for asthma and COPD there is the additional hurdle of appropriate inhalation of therapeutics before they reach their target organ. Breathing in too fast or too slowly are common technique errors that compromise drug delivery from inhalers. An ideal inhaler would deliver a consistent dose of smaller particle drug across a wide range of inspiratory flows. It is positive to see the drug delivery from an Easyhaler is relatively robust and has limited variability across inspiratory flow rates. Furthermore, for an inhaler that may be used as a reliever and thus carried daily, if is reassuring if they are known to be resistant to everyday knocks.

Clinical efficacy

In an open-label, non-randomised, non-interventional study, Tamási et al. sought to evaluate the effectiveness of Bufomix Easyhaler in patients with asthma or COPD in real-world clinical practice.[31] Of the 1,498 patients included in the study 621 had asthma, 778 had COPD and 99 had asthma-COPD overlap (ACO); 70% were switched from another inhaler, and 30% were newly diagnosed patients who were initiating their first inhaler therapy.[31] Patients were treated for 12 weeks, with a dosage regimen according to their diagnosis and the approved product information.[31]

The primary endpoint included changes in patient-reported outcome (PRO) measures at 12 weeks, including the Asthma Control Test (ACT), the mini-Asthma Quality of Life Questionnaire (mini AQLQ), the COPD Assessment Test (CAT), and the modified Medical Research Council dyspnoea scale (mMRC).[31]

After 12 weeks, patients experienced significant improvements from baseline in PRO measures of disease control and health-related quality of life ($P \leq 0.002$ for all).[31] In patients with asthma, the mean ACT score increased from 14.2 at baseline (with a score ≤19 indicating poorly controlled asthma) to 21.0 at week 12 ($P<0.001$).[31] This was a 6.8-point increase, more than double the 3-point change which is considered the minimal clinically important difference (MCID).[31, 32] Similar results were seen in patients with COPD, with a mean increase in ACT score from 13.6 at baseline to 18.7 at week 12 (+5.1; $P<0.001$).[31]

Vinge et al. conducted a prospective, open-label, non-interventional study to assess the effects of switching patients with asthma or COPD to the Salflumix Easyhaler in routine clinical practice.[33] This study included 211 patients, most of whom had asthma (n=160); patients had to have been using a salmeterol/fluticasone propionate combination inhaler for ≥3 months prior to the study, and have already been selected for switching to the Salflumix Easyhaler.[33] Patients were treated for 12 weeks, with a dosage regimen according to the local product registration and routine practice.[33] The primary endpoint was the change in ACT at 12 weeks.[33]

After 12 weeks, the mean ACT score increased significantly from baseline in patients with asthma (20.2 vs 18.6; $P<0.0001$). The mean change was 1.6, which did not meet the 3-point MCID, although more than 1 in 3 patients (36%) did experience a ≥3-point change in ACT score.[33]The results of this study support the efficacy of Salflumix Easyhaler in providing similar or better disease control compared with other salmeterol/fluticasone propionate combination inhalers in routine clinical practice.[33]

Expert comment

The aforementioned studies and those published on the delivery of other medicines through the Easyhaler device provide confidence that drug delivery is clinically comparable, and in some cases superior, to that from other devices. As ever, small differences between the effectiveness of drugs in the same class or between devices pale compared to the difference between those taking their treatment and those that do not. Having a further device available for effective medicines improves the chances clinicians may match individuals to a suitable device and give a better chance of long-term regular use.

Ease of use

In the switch study by Vinge et al, ease of use was the most common reason cited for switching patients to the Salflumix Easyhaler from another salmeterol/fluticasone propionate inhaler (46%).[33] When analysed further, the physician and nurse perceptions on the ease of use of the Easyhaler indicated that teaching the use of the device was 'very easy' in 2 out of 3 patients, and that in 4 out of 5 patients, this training required less than 5 minutes of their time.[33] Instructional resources available in Australia are mentioned in more detail in the *Promoting the safe use of the Easyhaler* section. From the patient perspective, 9 in 10 were considered to have achieved 'good' or 'very good' integration of using their Easyhaler in everyday life, and 8 in 10 patients reported no difficulties in handling the device and intended to continue using the Easyhaler.[33]

In a large open-label, non-randomised, non-interventional study, the real-world effectiveness of Bufomix Easyhaler was studied in 2,200 patients with asthma.[34] As part of this study, the ease of use of the Easyhaler was assessed across different characteristics at enrolment and at two subsequent study visits using a 6-point Likert scale.[34] By the end of the study, >98% of patients stated it was 'very easy' or 'quite easy' to learn how to use the inhaler, and prepare it for use.[34] Around 97% of patients also described it was 'very easy' or 'quite easy' for the level of inhalation required for use, to keep the inhaler clean and ready for use, for integrating it into activities of daily living such as sports, and to transport it with them.[34]

Patient preferences

Data from quantitative and qualitative studies highlight the clear link between patient preferences for medications and the optimal management of asthma.[35-39] In addition, data from the Asthma Satisfaction, CONtrol and Adherence (ASCONA) study, conducted in 778 patients across 59 hospitals in Spain found that, regardless of the medication used, high patient satisfaction with their inhaler device lead to improvements in treatment adherence and overall asthma control.[39]

Patient preference data support the use of the Easyhaler device as an inhaler with high rates of patient satisfaction, including results from a sub-analysis of the real-world clinical practice study by Tamási et al., as well as the Dry Powder Inhaler PREFerence versus Easyhaler in Referred asthmatic patients (DPI PREFER) study.[9, 40, 41]

As described in the *Clinical efficacy* section, 1,498 patients with asthma, COPD or ACO were switched to the Bufomix Easyhaler from another inhaler (70%), or initiated on it as their first therapy; 398 patients with asthma and 563 patients with COPD were included in the post-hoc sub-analysis.[31,40] Of those switching from another inhaler, this was most commonly from an MDI, Turbuhaler or Diskus device in patients with asthma, or Respimat, Turbuhaler, an MDI, Breezhaler or Diskus device in patients with COPD.[40] After 12 weeks, patient satisfaction was significantly higher with Bufomix Easyhaler than with their most common previously used inhalers ($P<0.0001$ for all).[40] Researchers acknowledged that there was a potential bias with rates of satisfaction due to patients likely switching therapy for reasons related to their inhaler device rather than poor asthma control.[40]

In the DPI PREFER study, 502 patients who had been receiving treatment with a DPI inhaler (containing combination long-acting beta agonist/corticosteroid) for ≥3 months prior to the study who were switched to an Easyhaler device.[41] The primary objective was to assess patient satisfaction and preferences.[41] Overall, 38% of patients preferred the Easyhaler device, compared with their previous DPI inhaler, and 46% of patients had similar preference for the Easyhaler and their previous DPI.[41] A small proportion of patients – 15% – preferred their previous device to the Easyhaler.[41]

Expert comment

The majority of people with chronic diseases wish to take their preventative therapy with the minimum of fuss, and to get on with their day. People tend to favour devices that require fewer steps in their use, with more complexity increasing the risk of error and dissatisfaction. DPIs are preferred by many individuals as they remove the need to time an inhalation around the actuation (or use a spacer). It is therefore not a surprise that Easyhalers are one of the devices usually well-liked by people with chronic airways disease. Importantly, an inhaler that is easier to use is also easier for healthcare professionals to teach to use, freeing up limited consultation time for other important aspects of management.

Promoting the safe use of the Easyhaler®

Poor inhaler technique is associated with poor asthma control, and all patients require training to demonstrate the correct inhaler technique.[12] As mentioned earlier, nurses and physicians participating in a switch study found that it was very easy to teach the majority of patients to use the Easyhaler device, and this generally required less than 5 minutes of instruction.[33]

The Asthma Australia organisation provides useful and practical information on the Easyhaler device, from how to look after it, monitoring how many doses remain, as well as crucial information on the correct technique for using the Easyhaler to avoid inadvertent errors with the device.[42]

Please refer to the Asthma Australia website for further information, which includes an instructional video (https://asthma.org.au/devices-techniques/easyhaler/).

Expert concluding comment

Clinicians are becoming increasingly aware of the global warming potential of inhaler propellants, and the need to target pMDI therapy to those who specifically need those devices until new propellants are rolled out in years to come. It is highly likely therefore we will see an increase in the proportion of inhaled medicines delivered by DPIs. The introduction of Easyhaler-delivered medicines for asthma therefore provides a welcome addition to the clinician's toolbox in both general practitioners' and specialist airways disease clinics. Common, effective medicines can be delivered via a simple device that is relatively more robust to variation in usage technique than others and resists everyday insults.

References

1. Asthma Australia and Deakin University. The national sustainable asthma care roadmap - roundtable report, https://asthma.org.au/wp-content/uploads/2024/09/Asthma-Roundtable-Report_DIGITAL.pdf (September 2024, accessed 16 January 2025).
2. Asthma Australia. New national sustainable asthma care roadmap, https://asthma.org.au/about-us/media/new-national-sustainable-asthma-care-roadmap/ (accessed 7 October 2024).
3. Woodcock A, Beeh KM, Sagara H, et al. The environmental impact of inhaled therapy: Making informed treatment choices. *Eur Respir J* 2022; 60 20220721. DOI: 10.1183/13993003.02106-2021.
4. Wilkinson A and Woodcock A. The environmental impact of inhalers for asthma: A green challenge and a golden opportunity. *Br J Clin Pharmacol* 2022; 88: 3016-3022. 20211213. DOI: 10.1111/bcp.15135.
5. McDonald KJ and Martin GP. Transition to CFC-free metered dose inhalers--into the new millennium. *Int J Pharm* 2000; 201: 89-107. DOI: 10.1016/s0378-5173(00)00401-4.
6. Montgomery BD and Blakey JD. Respiratory inhalers and the environment. *Aust J Gen Pract* 2022; 51: 929-934. DOI: 10.31128/AJGP-08-22-6536.
7. Panigone S, Sandri F, Ferri R, et al. Environmental impact of inhalers for respiratory diseases: Decreasing the carbon footprint while preserving patient-tailored treatment. *BMJ Open Respir Res* 2020; 7. DOI: 10.1136/bmjresp-2020-000571.
8. Clark AR, Weers JG and Dhand R. The confusing world of dry powder inhalers: It is all about inspiratory pressures, not inspiratory flow rates. *J Aerosol Med Pulm Drug Deliv* 2020; 33: 1-11. 20191031. DOI: 10.1089/jamp.2019.1556.
9. Lavorini F, Chudek J, Galffy G, et al. Switching to the dry-powder inhaler Easyhaler®: A narrative review of the evidence. *Pulm Ther* 2021; 7: 409-427. 20210927. DOI: 10.1007/s41030-021-00174-5.
10. Wilkinson AJK, Braggins R, Steinbach I, et al. Costs of switching to low global warming potential inhalers. An economic and carbon footprint analysis of NHS prescription data in England. *BMJ Open* 2019; 9: e028763. 20191029. DOI: 10.1136/bmjopen-2018-028763.
11. Global Initiative for Asthma. *Global strategy for asthma management and prevention, 2023 update.*
12. National Asthma Council Australia. Australian Asthma Handbook: Inhaler devices and technique, https://www.asthmahandbook.org.au/management/devices (2024, accessed 26 October 2024).
13. National Asthma Council Australia. Inhaler technique in people with asthma or COPD, https://files.nationalasthma.org.au/resources/Inhaler-Technique-info-paper-20180607-web.pdf (2018).
14. Levy ML, Bateman ED, Allan K, et al. Global access and patient safety in the transition to environmentally friendly respiratory inhalers: The Global Initiative for Asthma perspective. *Lancet* 2023; 402: 1012-1016. 20230719. DOI: 10.1016/S0140-6736(23)01358-2.
15. Orion Pharma (Aus) Pty Ltd. AUSTRALIAN PRODUCT INFORMATION SALFLUMIX EASYHALER (fluticasone propionate/salmeterol xinafoate), https://www.ebs.tga.gov.au/ebs/picmi/picmirepository.nsf/pdf?OpenAgent&id=CP-2023-PI-02130-1&d=20241007172310101 (28 October 2022, accessed 7 October 2024).
16. Orion Pharma (Aus) Pty Ltd. AUSTRALIAN PRODUCT INFORMATION BUFOMIX EASYHALER® (budesonide/formoterol fumarate dihydrate) Powder for inhalation, https://www.ebs.tga.gov.au/ebs/picmi/picmirepository.nsf/pdf?OpenAgent&id=CP-2023-PI-02033-1 (28 October 2022, accessed 7 October 2024).
17. Australian Government Department of Health and Aged Care. The Pharmaceutical Benefits Scheme, https://www.pbs.gov.au/pbs/search?term=easyhaler (accessed 26 October 2024).
18. Chrystyn H. Closer to an 'ideal inhaler' with the Easyhaler: An innovative dry powder inhaler. *Clin Drug Investig* 2006; 26: 175-183. DOI: 10.2165/00044011-200626040-00001.
19. Lavorini F. Easyhaler®: An overview of an inhaler device for day-to-day use in patients with asthma and chronic obstructive pulmonary disease. *Drugs Context* 2019; 8: 212596. 20190605. DOI: 10.7573/dic.212596.
20. Azouz W, Chetcuti P, Hosker HS, et al. The inhalation characteristics of patients when they use different dry powder inhalers. *J Aerosol Med Pulm Drug Deliv* 2015; 28:35-42. 20140509. DOI: 10.1089/jamp.2013.1119.
21. Magramane S, Vlahovic K, Gordon P, et al. Inhalation dosage forms: A focus on dry powder inhalers and their advancements. *Pharmaceuticals* 2023; 16 20231128. DOI: 10.3390/ph16121658.
22. Inget M, Hisinger-Molkanen H, Howard M, et al. Cradle-to-grave emission reduction for Easyhaler dry powder inhaler product portfolio. *Pulm Ther* 2023; 9: 527-533. 20230925. DOI: 10.1007/s41030-023-00239-7.
23. Orion. Carbon footprint assessment of Orion's dry powder inhalers, https://www.orion.fi/en/sustainability/environment/environmental-impacts-of-operations/carbon-footprint-assessment-of-orions-dry-powder-inhalers/ (accessed 7 October 2024).
24. Orion Pharma. Easyhaler® DPI product range is fully carbon neutral, https://www.orionrespiratory.com/news/orions-respiratory-business-is-now-carbon-neutral/ (accessed 26 October 2024).
25. Haikarainen J, Selroos O, Löytänä T, et al. Budesonide/formoterol Easyhaler®: Performance under simulated real-life conditions. *Pulm Ther* 2017; 3: 125-138. DOI: 10.1007/s41030-016-0025-z.
26. Palander A, Mattila T, Karhu M, et al. In vitro comparison of three salbutamol-containing multidose dry powder inhalers. *Clin Drug Investig* 2000; 20: 25-33. DOI: 10.2165/00044011-200020010-00004.
27. Turpeinen A, Eriksson P, Happonen A, et al. Consistent dosing through the salmeterol-fluticasone propionate Easyhaler for the management of asthma and chronic obstructive pulmonary disease: Robustness analysis across the Easyhaler lifetime. *J Aerosol Med Pulm Drug Deliv* 2021; 34: 189-196. 20200922. DOI: 10.1089/jamp.2020.1592.
28. Malmberg LP, Rytila P, Happonen P, et al. Inspiratory flows through dry powder inhaler in chronic obstructive pulmonary disease: Age and gender rather than severity matters. *Int J Chron Obstruct Pulmon Dis* 2010; 5: 257-262. 20100809. DOI: 10.2147/copd.s11474.
29. Ghosh S, Ohar JA and Drummond MB. Peak Inspiratory Flow Rate in Chronic Obstructive Pulmonary Disease: Implications for Dry Powder Inhalers. *J Aerosol Med Pulm Drug Deliv* 2017; 30: 381-387. 20170921. DOI: 10.1089/jamp.2017.1416.
30. Malmberg LP, Everard ML, Haikarainen J, et al. Evaluation of in vitro and in vivo flow rate dependency of budesonide/formoterol Easyhaler((R)). *J Aerosol Med Pulm Drug Deliv* 2014; 27: 329-340. 20140630. DOI: 10.1089/jamp.2013.1099.
31. Tamási L, Szilasi M and Gálffy G. Clinical effectiveness of budesonide/formoterol fumarate Easyhaler® for patients with poorly controlled obstructive airway disease: A real-world study of patient-reported outcomes. *Adv Ther* 2018; 35: 1140-1152. DOI: 10.1007/s12325-018-0753-6.
32. Schatz M, Kosinski M, Yarlas AS, et al. The minimally important difference of the Asthma Control Test. *J Allergy Clin Immunol* 2009; 124: 719-723 e711. 20090919. DOI: 10.1016/j.jaci.2009.06.053.
33. Vinge I, Syk J, Xanthopoulos A, et al. A non-interventional switch study in adult patients with asthma or COPD on clinical effectiveness of salmeterol/fluticasone Easyhaler® in routine clinical practice. *Ther Adv Respir Dis* 2021; 15: 175346662110277. DOI: 10.1177/17534666211027787.
34. Pirożyński M, Hantulik P, Almgren-Rachtan A, et al. Evaluation of the efficiency of single-inhaler combination therapy with budesonide/formoterol fumarate in patients with bronchial asthma in daily clinical practice. *Adv Ther* 2017; 34: 2648-2660. DOI: 10.1007/s12325-017-0641-5.
35. Baggott C, Chan A, Hurford S, et al. Patient preferences for asthma management: A qualitative study. *BMJ Open* 2020; 10: e037491. 20200816. DOI: 10.1136/bmjopen-2020-037491.

36. Nakanishi Y, Iwamoto H, Miyamoto S, et al. Association between patient preference for inhaler medications and asthma outcomes. *J Asthma Allergy* 2022; 15: 1539-1547. 20221025. DOI: 10.2147/JAA.S381509.
37. Israel E, Farooqui N, Gillette C, et al. A discrete choice experiment to assess patient preferences for asthma rescue therapy and disease management. *J Allergy Clin Immunol Pract* 2023; 11: 2781-2791 e2784. 20230512. DOI: 10.1016/j.jaip.2023.04.046.
38. Tervonen T, Hawken N, Hanania NA, et al. Maintenance inhaler therapy preferences of patients with asthma or chronic obstructive pulmonary disease: A discrete choice experiment. *Thorax* 2020; 75: 735-743. 20200706. DOI: 10.1136/thoraxjnl-2019-213974.
39. Plaza V, Giner J, Calle M, et al. Impact of patient satisfaction with his or her inhaler on adherence and asthma control. *Allergy Asthma Proc* 2018; 39: 437-444. 20181018. DOI: 10.2500/aap.2018.39.4183.
40. Gálffy G, Szilasi M and Tamási L. Effectiveness and patient satisfaction with budesonide/formoterol Easyhaler® among patients with asthma or COPD switching from previous treatment: A real-world study of patient-reported outcomes. *Pulm Ther* 2019; 5: 165-177. DOI: 10.1007/s41030-019-0097-7.
41. Alvarez-Gutiérrez FJ, Gómez-Bastero Fernández A, Medina Gallardo JF, et al. Preference for Easyhaler® over previous dry powder inhalers in asthma patients: Results of the DPI PREFER observational study. *Patient Prefer Adherence* 2021; Volume 15: 349-358. DOI: 10.2147/ppa.s295710.
42. Asthma Australia. Easyhaler, https://asthma.org.au/devices-techniques/easyhaler/ (accessed 7 October 2024).

Company Commissioned Article

This publication has been commissioned by Orion Pharma Australia Pty Ltd. The content is authored by Research Review and based on published studies and the authors' opinions. It may not reflect the views of Orion Pharma. Please review the full Product Information for any other product mentioned in this review via the TGA website https://www.ebs.tga.gov.au before prescribing. Treatment decisions based on these data are the full responsibility of the prescribing physician.

