SUSQI PROJECT REPORT

Inhaler Recycling in the Coventry Community

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Background:

The CWPT community children's respiratory physiotherapy team provide specialised respiratory physiotherapy management to Children and Young People (CYP) with respiratory conditions, many of whom have complex physical and neurological disabilities. CYP with neurodisability have an increased risk of multifactorial respiratory problems leading to respiratory complications which is the biggest cause of mortality (Gibson et al., 2020, p. 172).

Inhalers alone account for 3% of the NHS carbon footprint (NHS, 2020). Pressurised Metered dose inhalers (pMDIs) are widely used in managing asthma and other respiratory conditions. pMDIs (pressurised metered-dose inhaler) contain a hydrofluoroalkane gas (HFA) which acts as a propellant to deliver the medicine to the patient's lungs. The HFAs currently used in inhalers are known greenhouse gases which have a global warming potential. As well as the propellant, inhalers also contain plastics which cause harm to the environment if disposed of incorrectly.

The team observed that 25% of CYP on their caseload use high carbon pMDIs. Patients and their families often have multiple inhalers and anecdotally families have reported a lack of knowledge on the importance and process to safely dispose to prevent greenhouse gases from escaping. Staff and service users' knowledge about the environmental impact of inhalers is poor. The NHS plan

"Delivering a Net Zero NHS" (2020) outlines reducing carbon emissions from inhalers, and there are several steps that can be taken across the principles of sustainable healthcare;

- Prevention
  e.g., Reducing pollution that could potentially trigger patients with respiratory conditions and therefore reducing the number pMDI's in circulation.
- Patient empowerment
  e.g., giving patients all the appropriate information for patient centred approaches to make joint decisions, optimising inhaler use technique.
- Lean care pathways
  e.g., Use of virtual appointments.
- Low carbon alternatives
  e.g. alternatives such as dry power inhaler instead of pMDI's.
- Estates
  e.g. Safe disposal and inhaler recycling schemes
- All potential changes require education for staff and patients, influencing the culture of the importance of safe disposal of inhalers alongside ease of access to efficiently do so .

The above potential changes vary in impact and feasibility depending on multiple factors. Prevention and patient empowerment offer significant clinical, environmental, social, and financial benefits. However, implementing these broader preventive measures often requires large-scale interventions and collaborations beyond the scope of smaller healthcare teams.

As part of the SUSQI project we completed a critical reflection on analysing the impact of inhalers on the environment, and how the role as a non-medical prescriber (NMP) can help the NHS reduce carbon emissions from inhalers in CYP. Initial scoping indicated the simplest solution to reduce carbon emissions from inhalers would be to switch to dry powdered inhaler (DPI) or prescribe leukotriene receptor antagonist (LTRA):

- For the CYP on our caseload with neurodisability, switching to a DPI may not be possible since they unable to comply with treatment and cannot generate the inspiratory flows needed to activate DPIs, particularly in younger CYP and during exacerbations/acute asthma attack; also cited by PrescQIPP (2021). In addition, DPIs are not suggested for CYP <12 yrs in England due to a lack of data that CYP can use DPIs safely and effectively (Carroll W et al, March 2024). Therefore, the CYPs inhaler medication can only be effectively delivered by pMDI.
- LTRA may help to improve disease control and lower the carbon footprint of inhalers. However, CYP with neruro disability often have learning difficulties so they are unable to communicate adverse side effects. Thus, prescribing LTRA is not a viable option as these adverse side effects outweigh the benefits.

This critical reflection highlighted that these options are more challenging to implement in the paediatric population and alternative prescribing strategies to reduce inhaler emissions needs to be sought.

The authors considered the scope of the project and there was an agreement to focus on the actions below.

1) **Improving inhaler recycling rates.**

Recycling offers a direct, achievable solution for cutting down on the emissions and environmental waste associated with inhaler disposal. By returning MDIs for high-temperature incineration, where any residual propellant is safely destroyed, this contributes as a practical, yet powerful step, in reducing our environmental impact. The authors agreed that increasing awareness and empowering CYP and their families to properly dispose of inhalers, would make a measurable difference in paediatric respiratory care.

2) **Long term - correct inhaler technique and knowing when inhalers are empty**

Patient empowerment strategies, like teaching correct inhaler technique and how to monitor their inhaler's remaining doses, offer an achievable route to improvement with substantial benefits. The benefits of this would be two-fold; greater effectiveness of medication delivered and recognition when inhalers are to be disposed of.

Specific Aims:

- Short term (6 months): Increase awareness, education and practice for inhaler recycling for CYP on the paediatric respiratory caseload in Coventry.
- Longer term (6-12 months): improve education for checking if inhaler is empty and inhaler technique by way of universal resources for all population using inhalers

Method:

Current knowledge and practice of families

A survey was created to identify the level of awareness families currently have related to:

Aim 1: Knowing if an inhaler is empty and disposal recommendations.

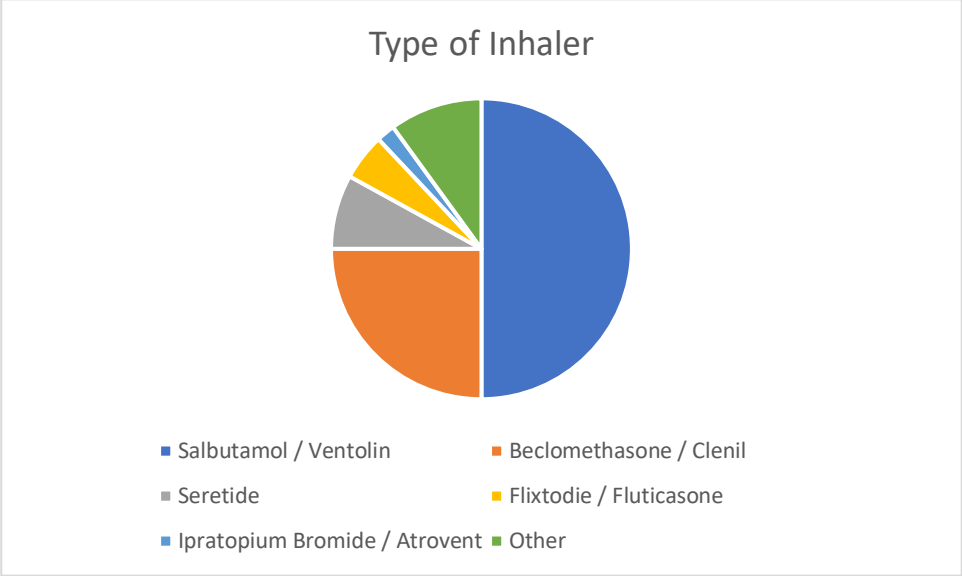
Aim 2: Whether patients knew how to assess if an inhaler is empty, and if their inhalers had a dose tracker.

The authors broadened the scope of the survey to be completed by staff, staff families and all ages of service users to increase the sample size and increase validity of results. The survey was attached to a poster with the QR code and emailed to all staff via CWPT via Trust communication including CWPT sustainability lead, Midlands Respiratory and asthma networks across the ICS (both children's and adult services, primary care), children's community nursing team, special school nurses, children's AHP teams, UHCW children's physio and consultants.

Results:

Survey Outcome:

- Out of the 27 responses, 6 were on behalf of a CYP.
- Age of person using inhaler: Between 2 to 65 years
- Type of inhaler:
  - Salbutamol / Ventolin: 50%
  - Beclomethasone / Clenil: 25%
  - Seretide: 8%
  - Flixtodie / Fluticasone: 5%
  - Ipratopium Bromide / Atrovent: 2%
  - Other: 10%



Over 50% of the respondents were on 2 inhalers (SABA – Short acting beta2 agonist bronchodilator and LABA – Long acting beta2 agonist bronchodilator)

- How many inhalers prescribed in a year?
  Results varied from 1 to 56 per year (respondents on 4 different inhalers so each inhaler approx. 14 per year). 25% of respondents answered 12 per year for 2 inhalers. Therefore, approx. 6 inhalers of each type are prescribed per year. This highlights the need for regular patient review of their medications and management e.g. use of combination inhalers.
- Knowing when the Inhaler is empty: 75% of respondents said they knew how to assess this by "*shaking, listening, weight, no visible or poor spray and no taste"*. Beat asthma (2022) state it is difficult to tell if an inhaler is empty because it may still make a noise or puff when empty due to propellant gas that delivers the medication. Thereby, patients will only be receiving the propellant and not their medication so symptoms will not be effectively managed.
- Inhalers with counters: 46% of respondent's inhaler had a counter.
  The most accurate way of knowing how long the inhaler will last is to record the number of puffs or using a counter on the inhaler. Therefore, it is likely that over 50% of the respondents do not know when their inhaler is empty and further education is needed.

Current local advice and availability of recycling

The authors explored other community disposal locations such as local pharmacies, GP practices and councils to look at their advice in the community. This includes any recycling schemes in Coventry and accessibility/availability of recycling points. The authors utilised the assistance from a volunteer to call local pharmacies and GP practices to enquire whether they would accept inhalers, and if they do, how the inhaler is disposed of. This includes if they sent for incineration to a recycling centre, if any leftover propellent gas is extracted and if the inhaler plastic was recycled.
Summary of findings:

- GP and pharmacy phone calls: Of the GP practices contacted, they reported they do not recycle. Whereas all the pharmacies offer recycling but it was not ascertained on how they recycle. One pharmacy sends them for incineration so there is no carbon footprint saving.

- Local council advice varies, including advice that inhalers are to be disposed of in black bins, as they do not have the facility to recycle inhalers. However other councils advise inhalers to be disposed of in recycling. This may be due to variations in waste management contracts, e.g. some recycling is sent to waste for energy and incinerated.
- Signposting to recycling information on local area website is variable, with evidence of broken website links

This highlighted there is inconsistent practice and a lack of information on who and how inhalers are recycled.

Planning for change

Aim 1: Knowing if an inhaler is empty and disposal recommendation.

From reviewing the current process, it became clear that recycling of inhalers is not as simple as taking it to a recycling point to reduce carbon emissions. Through analysis it was noted there was a lack of available recycling sites in Coventry. This includes variable advice available to patients and the public from the local authority and health system partners. There is evidence of a lack of continued promotion relating to inhaler recycling, however this could be addressed a more consistent approach across the ICS. This includes clear and concise resources which state the availability of recycling sites. Another suggested action is raising awareness of this issue within the wider network of respiratory colleagues, maintaining engagement with pharmacies, and addressing the misinformation that the local website advice is currently incorrect.

Aim 2: Whether patients knew how to assess if an inhaler is empty, and if their inhalers had a dose tracker

The survey identified that not all patients know how to assess if an inhaler is empty and information had not been provided on how to assess this appropriately. Suggested actions from this include education by health professionals to staff/carers/family/parental guardians that have children during home visits/school visits/clinics on how to know when an inhaler is empty through leaflets, verbally and/or signposting to relevant websites such as **Home - Beat Asthma**. The children's respiratory physiotherapy team could provide information on their website **Children's Physio.**

Additional findings:

The survey identified an increase in the number of inhalers prescribed for CYP may be due to CYP having a spare inhaler (most commonly salbutamol) kept in educational settings. The authors also identified potential opportunities to switch from Salbutamol to Salamol inhaler or to optimise prescribing, which is explored further in the discussion section of this report.

Potential outcomes

Patient outcomes:

Supporting patients to check when an inhaler is empty can ensure inhalers are no longer being used when there is no active medication still available and not clinically effective, thereby optimising management of their respiratory conditions and health. This is something the authors identified could be measured within our patient cohort on a longer-term basis via family and school reporting

such as the patients symptoms are being effectively managed leading to a reduced number of visits to GP, hospital admissions, school absences etc.

Environmental sustainability:
We have used the results of our survey data to make some predictions of potential savings should patients recycle inhalers or reduce the number of inhalers used per year. The carbon footprint (expressed in Carbon Dioxide Equivalents, or CO2e) is a common measurement used to show environmental impact.

The survey found 59% respondents were not aware inhalers should be recycled. Education was given to patients and families and the impact on environmental sustainability, with 67% reporting a desire to recycle inhalers instead of their previous method of disposal. Based on the survey, if an inhaler recycling scheme was in place and 67% (18) of the 27 survey respondents changed their behaviour to recycle their inhalers, this would save 230.3 kgCO2e per year, equivalent to driving 678.6 miles (1,092 km).

There is some benefit to collecting inhalers for incineration if inhalers were previously being sent to landfill. This will prevent HFAs being released into the environment as the canisters degrade in landfills, reducing risks of soil and water contamination. However, there is no carbon savings due to the high carbon footprint of incineration and low carbon footprint of landfill waste. It also appears that Coventry council are sending black bag waste to be incinerated (Waste to energy) and not landfill and so collection and incineration from pharmacies brings no change.

Economic sustainability:
There would be no economic benefit to the Trust if patients increase their recycling of inhalers, as inhalers would generally be disposed of or sent to recycling outside of the Trust (e.g. at patients home or returned to a community pharmacy).

Supporting patients to assess if inhalers are empty and get the full use of their inhalers could reduce how many inhalers are prescribed/used. This will provide cost savings to pharmacies and patients. A further study is recommended to consider this and the cost reduction to the ICS if less inhalers are prescribed.

Social sustainability:
In the survey, it was reported by:

- 21 respondents would feel positive knowing they are supporting the NHS to reduce environmental impact.
- 18 respondents align with their values to reduce waste/environmental impact.
- 5 respondents would take more time to return inhalers compared to their usual disposal method.
- 4 respondents would not impact them at all.

This result shows that there are positive impacts from the action of recycling by supporting people to align their care with their values. However, there are potential negative impacts with some respondents feeling this would take more time compared to their usual disposal practice. However, despite this perceived negative, all 5 respondents also reported they would change their disposal

habits to return inhalers at the pharmacy, showing the wider benefits outweighed the additional time for these respondents. This demonstrates the importance of education and knowledge can change current practices.

In the open section of the survey, we received the below comments:

- *"We are unsure when they are empty."*
- *"Is anything being done to help the reduction of the HFA or an alternative to it?"*
- *"We should use inhalers only if essential irrespective of carbon footprint."*

These responses show that for inhaler users, improving the sustainability of inhalers is important in ways beyond recycling. Supporting and optimizing inhaler prescribing (e.g., a lower carbon alternative if available), inhaler technique, and usage will support patients to improve the sustainability of their care while directly optimizing their health.

Additionally, we received open questions requesting information on recycling locations and for leaflets on recycling. As per our methods, the authors could not provide this information currently due to the lack of availability of recycling and consistent information available to patients and the public.

Discussion:

The authors recognised there were several barriers in disseminating the survey to our paediatric caseload which included:

- Short time frame to complete the survey.
- The survey required approval by Midlands Information and Governance team, trust communication team and Patient experience which took several weeks to receive responses. The authors were informed that surveys were unable to be completed over the phone or via a text service. The authors refrained from sending the survey in post, as this would increase the carbon footprint. Therefore, the survey could only be completed by service users during face-to-face visits.
- Challenges in measurement due to wide range of locations inhalers may be recycled
- Time and clinical/operational pressures due to conflicting clinical pressures.

The authors learnt that recycling of inhalers is far more complex and difficult to make an impact. The project has enabled the team to build positive relationships with the wider respiratory care community within the Midlands. In addition, it has highlighted a review of inhalers usage in schools to explore if there is inhaler waste i.e. how many are used, how are they disposed of, are the inhalers empty, do they regularly expire etc, and actions to reduce this impact such as where inhalers are collated, collected and taken to a recycling point by a nominated staff or school member.

As highlighted, Salbutamol is the most commonly prescribed inhaler and this identified potential opportunities to switch from prescribing Salbutamol to Salamol. In terms of salbutamol, the most used inhaler in our CYP is Ventolin 100mcg Evohaler which has a carbon footprint more than twice as large as other salbutamol pMDIs (Carroll W et al, 2024). If 25% of Ventolin pMDIs were replaced with Salamol pMDIs, the carbon footprint would be reduced by 106,699,451 kg CO2e over a 12-

month period, and £261,647 would be saved in terms of costs (PrescQIPP 2021). Therefore, an action for the non-medical prescriber (NMP) within the Coventry community Respiratory Team has been agreed that when prescribing salbutamol pMDI, Salamol pMDI should be the preferred inhaler of choice (noting that it is recommended that inhaler devices should be prescribed by brand name rather than generic name. It is important to note that it was not stated whether the inhalers were pMDI or DPI due to an oversight in the survey design. Thus, unable to ascertain how many of the respondents may already be on low cardon alternatives or DPIs. This is an important learning point if the survey is repeated.

The survey also identified the potential to optimise prescribing. A CYP aged 7yrs known to our service was prescribed beclomethasone clenil modulite 50 micrograms /dose pMDI inhaler four doses twice a day. The recommended dose for beclomethasone is 100–200 micrograms twice daily (JFC, 2024). The CYP could be prescribed the clenil modulite 200 micrograms/dose pMDI, one dose twice a day resulting in a 75% reduction in carbon emissions from their inhalers.

Another prescribing strategy to consider is when a CYP uses inhalers from different therapeutic groups they may be available as single combination inhalers for example CYP was regularly using salbutamol pMDI four times a week so beclomethasone was changed to seretide pMDI which includes fluticasone and salmeterol (JFC, 2024). These prescribing strategies will require engagement from key stakeholders such as NMP, GP, Pharmacists, consultants etc, in reducing the carbon emission from inhalers with the additional advantages that it is easier for CYP to administer, improve adherence and cheaper (Carroll W et al, 2024; PrescQIPP, 2021).

Key Recommendations:

- Raise awareness to GPs/ICB/Pharmacies/schools to review inhaler recycling points and optimise prescribing strategies.
- Council website to update inhaler recycling information on their website.
- Respiratory Physiotherapy Team to create a resource for identifying when an inhaler is empty and recycling points, that is in accessible formats for CYP and their families across Coventry/ICS.

Conclusions:

In summary, initially it was determined that improving inhaler recycling would reduce carbon emissions**.** The survey highlighted patient empowerment and education can impact and change current inhaler usage and disposal practices. By increasing awareness, education, and encouraging staff, patient and family participation, the NHS can support in reducing the environmental footprint of poor inhaler disposal and incorrect usage. Supporting and optimising inhaler prescribing, inhaler technique and usage will improve patients' respiratory health and can have wider impacts on reducing carbon emissions than inhaler recycling only.

The authors recommend repeating the survey in one year, to evaluate whether patients' knowledge has improved in key areas, such as identifying when an inhaler is empty and understanding disposal recommendations. This can be achieved by adopting the recommendations provided in this report.

Recognition:
The support of the Centre for Sustainable Healthcare has been key in the drive and outcome of this project. We are keen to promote the work and outcome of this project to key stakeholders and service users.

References and Resources

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- PrescQIPP (2021) Bulletin 295: Inhaler carbon footprint. 295. Inhaler carbon footprint 2.0 (prescqipp.info)

Critical success factors

Please select one or two of the below factors that you believe were most essential to ensure the success of your project changes.

People	Process	Resources	Context
Patient involvement and/or appropriate information for patients - to raise awareness and understanding of intervention Staff engagement MDT / Cross-department communication Skills and capability of staff Team/service agreement that there is a problem and changes are suitable to trial (Knowledge and understanding of the issue) Support from senior organisational or system leaders	Clear guidance / evidence / policy to support the intervention. Incentivisation of the strategy – e.g., QOF in general practice Systematic and coordinated approach Clear, measurable targets Long-term strategy for sustaining and embedding change developed in planning phase Integrating the intervention into the natural workflow, team functions, technology systems, and incentive structures of the team/service/organisation	Dedicated time QI training / information resources and organisation process / support Infrastructure capable of providing teams with information, data and equipment needed Research / evidence of change successfully implemented elsewhere Financial investment	Aims aligned with wider service, organisational or system goals. Links to patient benefits / clinical outcomes Links to staff benefits “Permission’ given through the organisational context, capacity and positive change culture.