FINAL REPORT

Behavioural Insights about Facilitators and Barriers to Service Users Returning Inhalers to the Community Pharmacy for Safe Disposal

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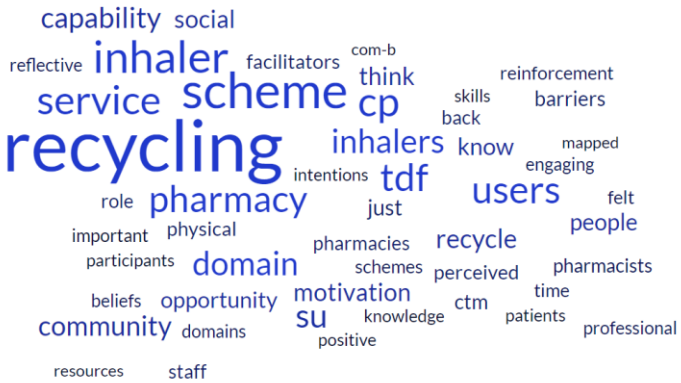

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Executive Summary

The Primary and Community Care Hub (PC Hub) within Public Health Wales (PHW) commissioned this work to enable the design of appropriate interventions to encourage pharmacy service users to safely dispose of inhaler medications in community pharmacies. Before effective interventions can be developed, it is important to identify the behavioural barriers and facilitators to undertaking this activity, both from a service user (patient) and community pharmacist perspective.

The aim of this project was to understand the factors that contribute to the decision to return used or unused inhalers to the pharmacy for safe disposal. Two psychological frameworks, the COM-B Model of Behaviour, and the Theoretical Domains Framework (TDF) were used to underpin the data collection methodology (focus groups and semi-structured interviews) to gain behavioural insights from service users and community pharmacists. These were adapted to explore the barriers and facilitators for the safe disposal of inhaler medication in Wales. The plan of work consisted of four Work Packages (WPs):

- WP1 - Establishing the project by setting up a steering committee, updating and reviewing literature search outputs, agree target behaviours and secure ethical approval.
- WP2 - Conducting focus groups and interviews with service users to explore the perceived barriers and facilitators to appropriate disposal of inhalers, using the COM-B model and TDF as a theoretical guide.
- WP3 - Conducting focus groups and interviews with community pharmacists to explore perceived barriers and facilitators to appropriate inhaler disposal, based on the COM-B model and TDF.
- WP4 - Synthesising findings from WPs 1 to 3 and designing possible interventions to address barriers identified and to promote best practice for optimising service users returning used or unwanted inhalers to community pharmacies in Wales.

The PC Hub previously undertook a review of the existing literature on safe inhaler medication disposal, this was updated for WP1. Topic guides and interview schedules for WP2 and WP3 were informed by this literature review, service user input and expertise from the project team. Qualitative data generated from focus groups and semi-structured interviews were analysed using theoretical framework and thematic analysis.

WP1 Findings – Evidence Map: In addition to twelve studies previously identified from the literature one further pilot study was found (Murphy et al 2023a) which demonstrated the feasibility and effectiveness of a postal inhaler recovery and recycling scheme. Voluntary uptake of the scheme was seen in 65% of community pharmacies in one area of the East Midlands in England. Patient engagement gradually increased suggesting that it took time for people to incorporate return of inhalers into their routine. From a small sub-sample of patients who returned their inhalers 90% responded that they were highly satisfied with the postal recycling scheme.

WP2 Findings – Service Users' Perspectives: Transcripts from the eleven service user participant interviews were mapped to the COM-B and TDF. Perceived barriers

and facilitators were mapped to all three components of the COM-B model and all respective sub-components apart from automatic motivation. Thirteen of the fourteen TDF domains were represented by the data for barriers and facilitators. TDF Domain 13 – Emotion was the only domain not represented. No other new themes emerged from the data therefore further thematic analysis was not needed. Key barriers to inhaler recycling related to *psychological capability* (i.e., awareness of scheme, lack of attention being brought to the scheme, remembering to recycle, and the ability to form new habits for recycling to happen), *physical capability* (i.e., knowing what parts of the inhaler to recycle and ability to travel to the pharmacy without additional journeys needed), *social opportunity* (i.e., pharmacies not informing them about recycling), physical opportunity (i.e., the need for the space and capacity to deliver the service) and reflective motivation (i.e., the lack of promotion of the scheme by pharmacists as an integral part of their professional role and lack of optimism about recycling). Facilitators for inhaler recycling were predominantly related to *reflective motivation* (i.e., a belief in their own capability of engaging with such a scheme, having strong intentions to use a scheme if it is simple and exists locally, that pharmacists see it as part of their professional role to encourage engagement with inhaler recycling, that they view recycling having a positive impact and that recycling aligns with their goals), *automatic motivation* (i.e., the fact they already go to the pharmacy to pick up prescriptions was seen as positive reinforcement to recycle) and physical capability (that they have the necessary skills to be able to recycle). No other new themes emerged from the data therefore further thematic analysis was not needed.

WP3 Findings – Community Pharmacists Perspectives: Perceived barriers and facilitators derived from five community pharmacist participant transcripts were mapped to all three components of the COM-B model and all their respective sub-components. All fourteen TDF domains were represented by the data for barriers and facilitators perceived by community pharmacists. No other new themes emerged from the data therefore further thematic analysis was not needed. Key barriers to community pharmacists engaging with the inhaler recycling scheme were related to *physical opportunity* (i.e., workload capacity for delivering the scheme, having the right environment in terms of space for the recycling bins, and funding issues for recycling to be commissioned), *social opportunity* (i.e., not seeing recycling as a priority within their professional role compared to other aspects of patient care), psychological capability (i.e., not having knowledge or full understanding about the scheme to be able to explain it confidently to service users and not having strong intentions to push the scheme) and reflective motivation (i.e., low intentions to engage in the scheme or negative reinforcement from seeing the success of others). Overall, facilitators for inhaler recycling were predominantly related to *psychological capability* (i.e., knowing that service users will want to recycle made them confident about the behavioural regulation required for the pharmacy team to engage with a scheme, having experience of operating the scheme meant the underpinning skills for how to deliver it were in place, having visual cues around the pharmacy served as a reminder to engage in the scheme and these also enhanced their knowledge about the scheme), *social opportunity* (i.e., social influences such as seeing services users recycling their inhalers and hearing about other pharmacies engaging successfully with the scheme), *reflective motivation* (i.e., showing optimism for building on successes so far, the enthusiasm of service users, building on experiences of being part of the scheme

enhanced their confidence in their capability, a belief that the desired goal would be attained and seeing the positive consequences of the scheme contributed to positive intentions and a commitment to the service as part of their role) and automatic motivation (i.e., reinforcement of the behaviour by praising service users who return their inhalers, seeing the quantities of inhalers being returned and the emotional perspectives of doing what is morally the right thing to do).

WP4 - Synthesis of findings from WP 2 and WP3: Both services users and community pharmacists thought that once services users knew about the existence of, need and rationale for an inhaler recycling scheme they were confident that they would use it. They felt that the scheme built on their existing recycling behaviours and linked to their moral obligations around sustainability. Service users perceived community pharmacies to play a key role in raising awareness of recycling schemes and viewed them as trusted sources of information. They perceived community pharmacy as having many opportunities to inform them of the need to recycle inhalers, however, they are currently not making the most of these opportunities. In contrast, the community pharmacists currently engaged in the Swansea Bay scheme felt they did not have the contact time with service users needed to raise awareness of inhaler recycling. The busy nature of the pharmacy environment was viewed by service users as a barrier to engaging in conversations with community pharmacists about recycling and this was a view supported by the pharmacy interview data. Feedback on the inhaler recycling scheme's success is needed for both service users and the community pharmacists. Services users very much saw inhaler recycling as something that was an integral part of the pharmacy's role. In contrast, community pharmacies welcomed a shared responsibility to inhaler recycling where all members of the healthcare team and professional organisations are on board to help promote it. Both service users and community pharmacists agreed that there is a need to raise awareness of the availability of inhaler recycling campaigns. Community pharmacists also acknowledged that they still had a responsibility to inform service users at the point of dispensing about the actual inhaler medication and to return them to the pharmacies. However, beyond that, they did not see pharmacy as having a big role in sorting out the inhalers and explaining the recycling process to patients. Both parties agreed that inhaler recycling schemes are not fully integrated into the public psyche nor integrated into community pharmacy services or day to day activities as yet. Whilst both groups were in agreement that it is '*the right thing to do*', a number of barriers that need to be addressed. Although community pharmacists had many concerns about the logistics of the scheme and how it would fit into the short and long-term running of their pharmacies, they were ultimately committed to taking part in the scheme since they felt like it would make an overall positive impact. Seeing service users actively returning their inhalers back to pharmacies was seen as a powerful motivator for community pharmacists as it reinforces that inhaler recycling is a service that their community will use.

In conclusion, this research builds on existing literature on patients' perspectives and provides new insights on community pharmacists' views about inhaler recycling. When the barriers and facilitators to inhaler recycling were mapped to the Behaviour Change Wheel, intervention functions to prioritise were: *Environmental Restructuring*, *Education, Coercion, Environment, Modelling, Persuasion, Incentivisation and Training*.

1 Overview

1.1 Background

Welsh Government (WG) is committed to achieving a carbon neutral public sector by 2030 and net zero emissions for all sectors by 2050 (WG, 2019a; WG, 2019b; WG, 2021). One area of interest includes pharmaceutical products, specifically one type of inhaler, which was identified as one of the greatest single contributors to carbon emissions across the NHS in Wales. These are metered dose inhalers (MDIs), which contain hydrofluorocarbons (HFCs) as propellants and as such have a significant global warming potential. Several initiatives are therefore, planned over the next few years to focus on the prescribing, use, waste, and disposal of inhalers (WG, 2021). The issue is particularly relevant to primary care settings in Wales where over 5 million inhalers are prescribed every year and of the 350,000 to 400,000 inhalers prescribed every month, over half of these are MDIs (AWTTC, 2022).

Currently there are no national schemes to dispose of inhalers in an environmentally friendly way. Any used or unwanted inhalers that service users return to the pharmacy in Wales are incinerated along with all other returned medicinal waste; however, these temperatures are not high enough to prevent carbon emissions from the MDIs. Even empty MDIs still contain some residual HFCs, which are likely to be released into the atmosphere during their incineration. Despite this service users are encouraged to return all unused and waste medicines (including inhalers) to the community pharmacy for safe disposal.

A 1-year pilot postal recycling scheme involving community pharmacies in one area of Northeast England saw the return of over 20,000 inhalers saving the equivalent of nearly 120 tonnes of carbon dioxide emissions (Murphy et al, 2023). One on-going pilot project being delivered in Swansea Bay University Health Board (UHB) encourages service users to return inhalers to community pharmacies across the Cluster (Upper Swansea Valley) for safe disposal. This involves collection and disposal of MDIs by a specialist waste contractor based in Oxford. The plastic ,metal and gas are recovered and reused. To maximise the impact from such a scheme, there is a need to understand what patients do with their inhalers once the inhaler cartridge is empty or the inhaler is no longer needed. For example, some service users may dispose of the inhaler with the general domestic waste or in the recycled waste. Others may already return inhalers to the community pharmacy with other waste medication,

and this is the specific behaviour that is to be promoted across Wales (PHW, 2023).

The purpose of this project was to gain behavioural insights into *service users' and community pharmacists' perspectives* with regards to returning used or unwanted inhalers to community pharmacies in Wales. To achieve this, perceived barriers, and facilitators to the responsible disposal of inhaler medication from a service users' and community *pharmacists'* perspective were explored.

Disposal of inhalers can be referred to as one of two classifications:

i) Inhalers classed as **waste -** the MDI is unused or deemed to be not needed or the medicine is out of date.

ii) Inhalers that are **used** and deemed empty by the service user.

Understanding the barriers and facilitators associated with these two types of inhaler disposal is important to develop and implement effective interventions and develop services to support responsible inhaler recycling schemes.

The goals of the Wellbeing of Future Generations (Wales) Act (WG, 2015) are also central to this work, where all seven pillars are reflected in the aims of this research: i.e., 'A globally responsible Wales' and 'A Wales of more cohesive communities'.

1.2 Research Questions

To address these aims, a series of research questions have been posed:

1. **What are the barriers and facilitators to responsible disposal of metered dose inhalers?**

2. **What interventions are likely to be effective in encouraging patients to return *used* and *waste* inhalers to community pharmacies in Wales?**

An in-depth understanding of the complexity of behaviour change is a key component of this research, where the application of robust psychological and theoretical perspectives was utilised to explore behaviours relating to the safe disposal of inhaler medication. Only when the reasons for appropriate or inappropriate disposal have been established, can the most effective behaviour change technique/s (or intervention/s) be selected.

1.3 Psychological Theories and Frameworks

The COM-B Model of Behaviour Change

The COM-B model allows the barriers to a specific behaviour to be systematically explored (Figure 1). The COM-B model is based on the concept that the interaction between several components, namely, the individual's capability (C), opportunity (O) and motivation (M) can provide an explanation for why a particular behaviour (B) is or is not performed (Sinnott et al, 2015). For an intervention to be successful, one or more of these components need to be targeted for sustained behaviour change to occur. The COM-B model has previously been applied to the behaviour of taking medication (Jackson, Eliasson, Barber & Weinman, 2014), but to date, no research has been undertaken using this model to explore how patients of dispose of their medications within community pharmacy.

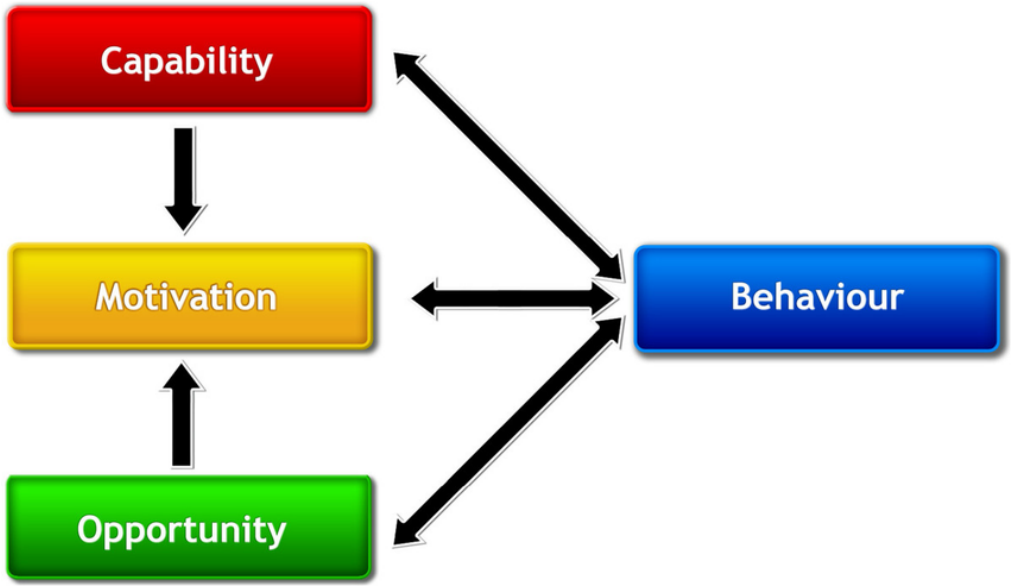

Figure 1: The COM-B model – a framework for understanding behaviour (Michie, 2011)

Theoretical Domains Framework (TDF)

The theoretical domains framework (TDF) is an additional tool for investigating barriers and facilitators to behaviour change. The TDF was specifically developed to identify determinants relating to behaviour change in healthcare and includes 14 key domains, which derive from the 83 different theoretical models of behaviour (Atkins et al, 2017). It was designed for non-psychologists to use when designing new interventions to change behaviours (e.g., in service delivery, design of interventions, adoption of new guidelines or any process which involves behaviour change. The 14 domains of the TDF and their definitions are in the table below.

Theoretical domain	Definition [21]
Knowledge	An awareness of the existence of something
Skills	An ability or proficiency acquired through practice
Social/professional role and identity	A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting
Beliefs about capabilities	Acceptance of the truth, reality, or validity about an ability, talent, or facility that a person can put to constructive use
Optimism	The confidence that things will happen for the best or that desired goals will be attained
Beliefs about consequences	Acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation
Reinforcement	Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus
Intentions	A conscious decision to perform a behaviour or a resolve to act in a certain way
Goals	Mental representations of outcomes or end states that an individual wants to achieve
Memory, attention and decision processes	The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives
Environmental context and resources	Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behaviour
Social influences	Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours
Emotion	A complex reaction pattern, involving experiential, behavioural, and physiological elements, by which the individual attempts to deal with a personally significant matter or event
Behavioural regulation	Anything aimed at managing or changing objectively observed or measured actions

It is beneficial to utilise both the COM-B and TDF together to determine potential reasons for not adopting a particular behaviour, such as inhaler disposal. When the barriers to undertaking the behaviour are categorised according to the COM-B and/or TDF, they can then be mapped on to the Behaviour Change Wheel (BCW) to select the appropriate intervention functions.

Behaviour Change Wheel (BCW)

The behaviour change wheel (BCW) was developed to improve the design and implementation of behaviour change interventions (Michie et al, 2011). The BCW provides a method of characterising interventions and linking them to the target behaviour. The COM-B elements and TDF domains lie at the core of the BCW, where the outputs of these can be mapped to appropriate intervention functions. Importantly, the use of the BCW depends very much on the context and therefore the policy categories on the outer circle of the BCW are key to influencing change and are essential to consider for interventions to be successful (Figure 2).

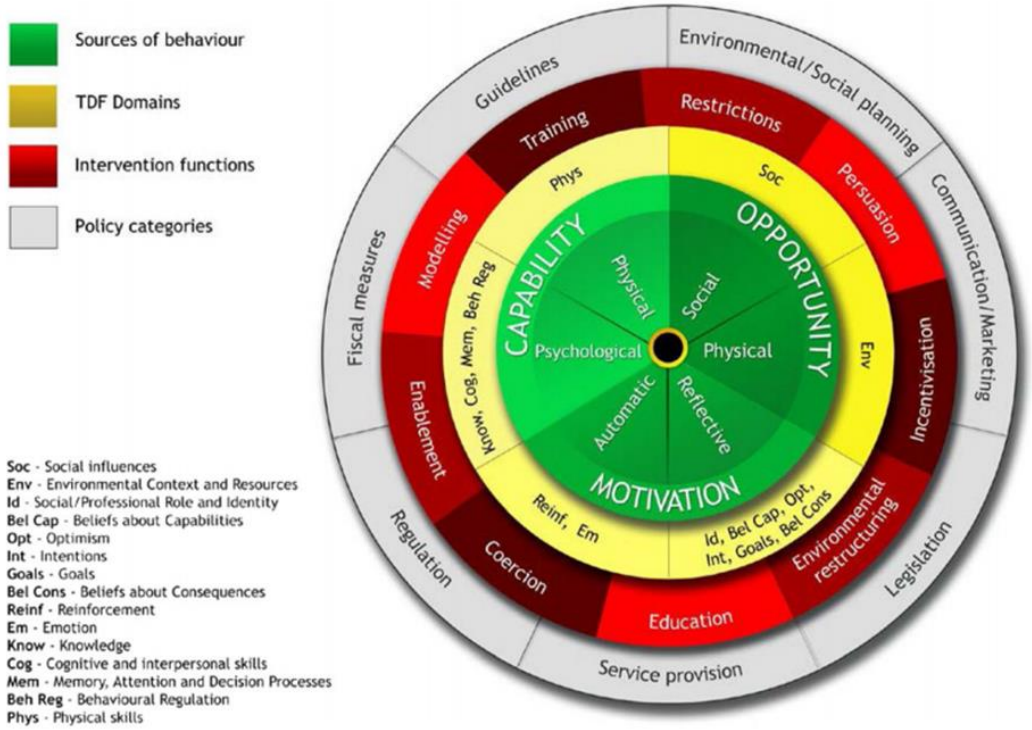

Figure 2: Behaviour Change Wheel (Michie et al 2011)

1.4 Aims and Objectives

Aims

To explore the perspectives of service users and community pharmacists about the perceived barriers and facilitators that influence the behaviours of service users in relation to returning used or unwanted inhalers to the community pharmacy for safe disposal, in order to inform the design of interventions to encourage responsible inhaler disposal across Wales.

Objectives

1. To scope what the desired behaviour should be, what behaviour needs to change, whose behaviour needs to change and when the desired behaviour should take place in relation to safe disposal of inhalers by service users to the community pharmacy.

2. To identify and report on the service users perceived behavioural barriers and facilitators to returning inhalers to the community pharmacy for safe disposal.

3. To understand experiences and perspectives of community pharmacies, currently operating an inhaler disposal pilot scheme, in one Cluster area, on the behavioural facilitators and barriers to service users returning inhalers to the pharmacy for safe disposal.

4. To identify opportunities to influence service users' behaviours in relation to safe disposal of inhalers and to increase community pharmacy engagement in schemes to return inhalers for safe disposal across Wales.

2 Methods

2.1 Overview of Work Packages

Table 1 provides an overview of the four work packages relating to this behavioral insights project with a brief description of each.

Table 1: Description of Work Packages

WP1	Establishing the project by setting up a steering committee, updating and reviewing literature search outputs, agree target behaviours and secure ethical approval.
WP2	Conducting focus groups and interviews with **patients** to explore the perceived barriers and facilitators to appropriate disposal of inhalers, using the COM-B model and TDF as a theoretical guide.
WP3	Conducting focus groups and interviews with **community pharmacists** to explore perceived barriers and facilitators to appropriate inhaler disposal, based on the COM-B model and TDF.
WP4	Synthesising findings from WPs 1 to 3 and designing possible interventions to address barriers identified and to promote best practice for optimising service users returning used or unwanted inhalers to community pharmacies in Wales.

2.2 Study Design

A qualitative approach was adopted using a combination of one-to-one semi-structured interviews and focus groups to gain the perspectives of service users and community pharmacists on inhaler recycling. Data collection materials were informed by the published literature for inhaler recycling and underpinned by two psychological frameworks of behaviour (COM-B and TDF).

WP1: Literature Review

Public Health Wales had previously undertaken a review of the literature to collate the evidence-base relating to patients' barriers to returning inhalers to the pharmacy. The protocol to describe the process to identify and report research evidence on *'why patients don't return used or unused inhalers to community pharmacies?*' is presented in Appendix 1. The same protocol was adopted to update the literature search in this area from 1st January 2023.

WP2: Service Users Perspectives

Service users from three Cluster areas in Wales (including the Upper Valleys Cluster, Swansea Bay) were recruited to explore personal understanding of inhaler recycling and views about the barriers and facilitators to safe inhaler disposal. Data from eleven

service users were collected by one-to-one interview, no focus groups were conducted due to conflicts of participant availability.

WP3: Community Pharmacist Perspectives

WP3 gathered behavioral insight from community pharmacists; these were based in the Upper Valleys Cluster of Swansea Bay Health Board. This health board was chosen as they have experience of operating a safe inhaler disposal scheme for this geographical area. Data from five community pharmacists were collected online where participants attended either a one-to-one interview (n=3) or one focus group discussion (n=2), to explore their experiences of delivering an inhaler disposal scheme within their community pharmacy.

2.3 Recruitment

All participants for both WP2 and WP3 were offered a £20 gift voucher as a token of appreciation of their time for taking part in the study.

WP2: Services Users Recruitment

Participants were recruited to WP2 via promotional recruitment posters (see Appendix 2 for English and Welsh language versions) displayed in 25 community pharmacies, these were located across three Health Boards – Betsi Cadwaladr (North Wales), Cwm Taf Mrgannwg (Mid and Southeast Wales) and Swansea Bay UHB (Southwest Wales) from September to October 2023. Recruitment adverts were also posted online via 'X™', Facebook™ (specifically Asthma UK support groups) and on Cardiff Metropolitan University's internal Viva Engage platform.

Service User Inclusion Criteria

To be eligible to participate in the study participants needed to meet the following inclusion criteria; be aged 18 years or older and prescribed one or more inhalers (at least one of these must be an MDI); or be a parent or guardian of an individual aged less than 18 years who is prescribed inhaled medication (at least one must be an MDI). Participants also needed to be resident in either one of the three UHBs in Wales (Betsi Cadwaladr, Cwm Taf Morgannwg or Swansea Bay).

WP3: Community Pharmacist Recruitment

Participants were recruited to WP3 via the PC Hub within PHW. The PC hub identified the eight community pharmacies involved in the Swansea Bay, Upper Valleys Cluster decarbonization project; pharmacies were contacted via email and telephone to recruit

potential participants (1st August 2023 to 12th September 2023). To increase engagement, further email correspondence about the study was sent by PHW and Community Pharmacy Wales (CPW).

Community Pharmacist Inclusion Criteria

To be eligible to participate in the study participants needed to meet the following inclusion criteria; be aged 18 years or older and employed in one of the eight Community Pharmacies located in the Upper Valleys Cluster in Swansea Bay UHB that operated the safe inhaler disposal scheme.

2.4 Participants

WP2: Service User Participants

Eleven services users were recruited to take part in WP2 (seven male and four female) aged between 18-65 years old. Service uses were represented across all three UHBs with four recruited from Betsi Cadwaladr, five from Cwm Taf Morgannwg and two from Swansea Bay UHBs. The two service users from Swansea Bay UHB did not live in the Upper Valleys Cluster area and therefore had no experience of the inhaler recycling pilot scheme that had been run in the Upper Valleys Cluster. None of the participants had any experience of using a inhaler recycling scheme in a community pharmacy.

WP3: Community Pharmacist Participants

A total of five participants were recruited to WP3 (four male and one female) aged from 30-60 years old. All were community pharmacists employed in one of the eight eligible community pharmacies in the Upper Valleys Cluster, Swansea Bay UHB with one participant representing one pharmacy.

2.5 Ethical Considerations

WP2: Service Users

Ethical approval for WP2 was granted by Cardiff School of Sport and Health Sciences, Applied Psychology Ethics Committee on 10th July 2023 (Project reference number: Sta-7736). An ethics amendment form was approved to use social media platforms to recruit service users (19th September 2023).

WP3: Community Pharmacists

Ethical approval for WP3 was granted by Cardiff School of Sport and Health Sciences, Applied Psychology Ethics Committee on 10th July 2023 (Project reference number: Sta-7736).

2.6 Data Collection

Following written informed consent all interviews and focus group were conducted online via Microsoft™ Teams (WP2 during September and October 2023; WP3 during August and early September 2023). Data were audio-recorded, anonymised and transcribed verbatim for subsequent analysis.

Interviews

An interview schedule was developed for WP2 and WP3 based on existing literature and using the COM-B model and TDF as a guiding framework (Appendices 3 and 4 respectively). The use of an interview schedule enabled responses to be linked to the proposed analytical approach (using the COM-B model). Introductory questions were used to gain an understanding of service users/community pharmacists experiences with inhaler-recycling initiatives and their knowledge of the environmental impact of inhalers. The interviews then explored participants' perceptions of the barriers and facilitators to inhaler disposal and recycling. The interview schedules were pre-tested with one service user (WP2) and one community pharmacist (WP3), who did not take part in the study, to ensure that the questions were understandable and followed a logical order. Only minor changes to wording were needed for both interview schedules.

Focus Groups

A focus group topic guide was developed, which was adapted from the interview schedule, informed by existing literature and the two psychological frameworks (Appendix 5 and 6). Introductory questions were used to gain an understanding of community pharmacists experiences with inhaler-recycling initiatives and their knowledge of the environmental impact of inhalers. The focus group topic guide also explored perceptions of the barriers and facilitators to inhaler disposal and recycling within the community pharmacy setting.

2.7 Methods of Analysis

Data from WP2 and WP3 were analysed separately, using the same approach for both studies. Service user and community pharmacist transcripts were analysed using framework analysis, by mapping the data to the COM-B model and TDF. Any data that did not map onto the COM-B / TDF were analysed using thematic analysis. Each line of the transcripts was coded using these analytical techniques.

For framework analysis, the codes were applied to the framework's pre-existing categorical themes (e.g., physical capability). Two researchers were responsible for reading through the entire dataset and coding the data from each transcript (AC and AH). Initial codes were presented and discussed with the research team and Steering Group which resulted in minor areas of refinement. This first stage of framework analysis was followed by an independent review of transcripts and data analysis for WP2 and WP3 by a third researcher (HS) and the synthesis of findings from both studies (WP4) was completed by a fourth researcher (DJ). The outputs for WP4 were presented and discussed with the wider research team and Steering Group which generated further areas for discussion which were incorporated into the final recommendations.

For thematic analysis, common themes across the data were identified to produce a thematic map (AC and AH). Themes identified from thematic analysis were then mapped on to the COM-B and TDF by two researchers (HS and DJ) to establish if any barriers or facilitators were not captured by the two theoretical frameworks. These stages follow the guiding principles for undertaking framework and thematic analysis (Pope & Mays, 2000; 2006, Braun & Clark, 2006).

The final stage of analysis was the mapping of the COM-B components and TDF domains to the Behaviour Change Wheel to establish the intervention functions required for behaviour change from both the service user and community pharmacist perspective.

3 Results

3.1 WP1: Literature review and evidence map

A total of 13 published studies which met the criteria set out in the protocol were found. Twelve of these had been identified during the first phase of the literature review. Repeating the literature search up to 31st January 2024 identified one further published study which is summarised in Table 2 (See Appendix 7 for combined details of the evidence map).

Table 2: Summary of published literature from January 2023 to January 2024.

Ref no.	Title and source	Population	Findings	Authors' conclusions
13	Murphy, A., Howlett, D., Gowson, A. et al. Understanding the feasibility and environmental effectiveness of a pilot postal inhaler recovery and recycling scheme. npj *Prim. Care Respir. Med.* 33, 5 (2023a). https://doi.org/10.1038/s41533-023-00327-w	Community Pharmacies and Hospitals Pharmacies based in Leicester, Leicestershire, and Rutland (LLR). .	A pilot postal inhaler recovery and recycling scheme ran for 12-months. Over 20,049 inhalers were returned to the waste management centre (approx. 2% of inhalers prescribed in LLR). Most inhalers were pMDIs (77%). The scheme saved an estimated 119.3 tonnes of carbon dioxide emissions. A survey of a small sample of patients (n=49) found that 90% of respondents were satisfied with the scheme	The pilot demonstrated the feasibility and effectiveness of a postal inhaler recovery and recycling scheme with voluntary uptake of the scheme in 65% of community pharmacies. Patient engagement gradually increased suggesting that it took time for people to incorporate return of inhalers into their routine.

NOTE: Nine further studies were found but these did not meet the protocol criteria for the literature review. These were: Day, 2024 conducted a systematic review of changes to inhaler prescribing in primary care; Gagne et al (2023) investigated avoidable greenhouse gas emissions by addressing care gaps in asthma and COPD patients; Levy et al, 2023 published a perspective piece on the need for a global initiative for the transition to environmentally friendly respiratory inhalers; Murphy et al, 2023b investigated how patients knew that their inhaler device was empty and where they were disposed; Quantz et al, 2023 explored Canadian patients' knowledge of carbon footprint related to inhalers; Sanchez et al, 2023 researched the sustainable approach to medicines management in a hospital setting; Smith et al, 2023 provided pointers to practitioners about achieving net zero asthma care and Usmani and Levy, 2023 who set out in their commentary, the environmental impacts of inhalers and how to manage asthma and COPD effectively to minimise the impact.

3.2 WP2: Service User Perspectives

Transcripts from the eleven service user participant interviews were mapped to the COM-B and TDF. Perceived barriers and facilitators were mapped to all three components of the COM-B model and all respective sub-components apart from automatic motivation. Thirteen of the fourteen TDF domains were represented by the data for barriers and facilitators. TDF Domain 13 – Emotion was the only domain not represented. No other new themes emerged from the data therefore further thematic analysis was not needed.

Perceived barriers were mapped to *psychological capability, physical capability, physical opportunity, social opportunity and reflective motivation*. Barriers to inhaler recycling were mapped to Domains 1 - Knowledge, 10 - Memory, attention and decision-making, 14 - Behavioural regulation, 2- Skills, 12 - Social Influences, 11 - Environmental context, and resources, 3 – Social and professional identity and 5 – Optimism.

Perceived facilitators were mapped to *reflective motivation, automatic motivation and physical capability.* Facilitators for inhaler recycling were mapped to Domains 4 - Beliefs about capability, 8 – Intentions, 3 – Social Professional Role / Identity, 6 – Beliefs about Consequences, 9- Goals, 7 – Reinforcement and 2 – Physical skills.

The findings are described in more detail below with illustrative quotes for each COM-B component and respective TDF domains. The codes in parentheses following each verbatim quote provides the study number for each service user for each corresponding Health Board.

Barriers to inhaler recycling

This section presents a summary of barriers to inhaler recycling that were dominant in the interviews with service users. These barriers are represented as components of the COM-B, respective domains of the TDF and illustrated with participant quotes.

Overall, the key barriers related to *psychological capability* (i.e., awareness of the ability to recycle inhalers, lack of attention to schemes that enable return medicines to community pharmacy ,, remembering to recycle, and the ability to form new habits for recycling to happen), *physical capability* (i.e., knowing what parts of the inhaler to recycle and ability to travel to the pharmacy without additional journeys needed), *social*

opportunity (i.e., pharmacies not informing them about recycling), physical opportunity (i.e., the need for the space and capacity to deliver the service) and reflective motivation (i.e., the lack of promotion of the scheme by pharmacists as an integral part of their professional role and lack of optimism about recycling).

Capability - Psychological Capability

TDF Domain 1: Knowledge

A dominant view from service users was that they and the public were unaware that inhalers could/or should be recycled. For example,

> *"I've been taking pumps for 40 years now, longer than I'd care to admit, but it has never been pointed out to me that I could take the empty inhaler back to the pharmacy. And I've been through four or five pharmacies …just mention to people as they're picking things up, you know…. you would argue it probably isn't a huge thing to just say 'you can drop these things back here, bring your old ones back and we'll give you your new one' or whatever."* (SU1 CTM).

TDF Domain 10: Memory, attention, and decision processes

Service users felt that their own lack of awareness of the need to return used or unwanted inhalers to community pharmacy was a reason why their attention would not previously been drawn to information regarding such schemes.

> *"I never gave a thought about it" (SU1, BH).*

> *"Before I saw your study, I had literally not thought about this…"* (SU2, SB).

However, once they were made aware of that it was feasible that inhalers could be recycled if returned to a community pharmacy another key perceived barrier was also related to this domain, since service users said they would find it difficult to remember to return inhalers once they were used.

> "*I think the main scenario that I can see happening is that it stays on the kitchen counter for weeks and eventually I just give up and chuck it in the bin because I haven't had a chance to go*" (SU3, CTM).

> *"Anything extra, people are less likely to do because you are likely to forget"* (SB2).

Service users highlighted that there was often a significant length of time between picking up a "new" inhaler and finishing their current inhaler, and they felt that this would make it difficult to remember to bring that inhaler back for recycling when it had finished.

> "*You can't take the old one in when you pick up the new one. So, you'd have to make, you'd almost have to make a special journey*" (SU1, CTM).

They emphasized that the size of inhalers meant that they commonly got lost before they could be correctly disposed of…

> "*I'd normally just lose them, by mistake"* (SU1, BW).

Service users suggested that it would be beneficial for pharmacy staff to provide them with a reminder about the recycling scheme when dispensing the medication. They suggested that staff could display visual cues, such as posters and/or leaflets to inform members of the public about the need for inhaler recycling and also provide patients with prompts for the correct disposal of inhalers.

TDF Domain 14: Behavioral Regulation

Service users were not currently engaging with inhaler recycling schemes. They explained that their inhalers were being disposed of in household bins as this was a habit that had already been formed over many years.

> *"So, when you're tidying up, you think, oh, just chucking it in the bin, chucking it in the recycling. So yeah, that's the problem."* (SU2 CTM).

Some service users perceived that it would be a difficult habit to break due to the behavioral regulation needed for behaviour to change.

> "…*often what happens I was a… you know was getting your inhalers is that I I just at some point I drive past the surgery pick up the prescription drop it at the pharmacy so I, you know, I don't necessarily even go home in between doing errands" (*SU2 SB).

Capability - Physical Capability

TDF Domain 2 - Skills

The percieved skills needed to recycle inhalers was another barrier identified. Service users believed that they did not have the skills needed to be able to recycle inhalers correctly at home and would prefer for the process to be overseen in the community pharmacy. All service users identified themselves as capable of recycling items as long as this followed a straightforward process (e.g., put into a recycling bin for collection) but were hesitant about dismantling an item (such as an inhaler) into the different components (e.g., the canister and the holder) prior to recycling.

"I think it's really just to hand over to them, but. I think if it was more to do with like personally sorting everything out, there might have been a bit more difficult" (SU2 BC).

Being able to easily travel to a community pharmacy was viewed a skill that was linked to the ability to engage with a recycling scheme. Some service users indicated that they relied on public transport to get to the pharmacy and that this would make it difficult to plan additional journeys to their local pharmacy to drop off their inhalers for disposal . If a service user didn't drive this was percieved as a significant barrier to engaging with community-based recycling scheme.

"I think obviously if we couldn't drive there or if we lived further away, then that might be some restrictions on if I would or not (SU2 BC).

Opportunity - Social Opportunity

TDF Domain 12 - Social Influences

The absence of social influence was a significant barrier to engagement in recycling schemes. Service users stated that pharmacy staff (across all three Health Boards) had not informed them about how to dispose of used/ and or unwanted inhalers.

"I don't think I've actually been told by a pharmacist that you can take anything back" (SU1 CTM).

"I *have asked and several others, you know, how do we dispose of inhalers? Have you got a scheme? And they sort of just look at me blank sort of well no just put them in the bin and that's it"* (SU1 SB).

Opportunity – Physical Opportunity

TDF Domain 11 - Environmental Context and Resources

Service users who used small, independent pharmacies perceived that their local pharmacy would not have the time, space, or resources to run a recycling scheme. On the other hand, those using big multiples or supermarket pharmacies believed that inhaler recycling could be easily accommodated.

"it's small and cramped and they're always very busy…. they seem incredibly short of space" (SU1 CTM).

"I don't think they're terribly well-resourced to be able to do that" (SU3 BC).

"Considering they're a big chain company, it shouldn't be a problem" (SU1 BC).

A further barrier highlighted was the busy nature of the community pharmacy environment. Consequently, service users were reluctant to interact with pharmacy staff and ask questions about recycling schemes.

> *"It's right next to my GP and it's I think it's probably the biggest GP in the area. So, they're always busy as well" (SU3 SB).*

> *"I don't think they have the time or be interested in handing out medication all the time. They're not gonna talk to me about my inhaler recycling…So little space there that a lot of the medications are all on the floor. her shelves are packed. They, they look like they're going to be tripping over the boxes because they're so they've got so much stuff on the floor. So, if you, if you put another box in there for recycling that would, they'd struggle" (SU2 CTM).*

Service users felt that the pharmacy environment did not currently contain the resources needed to highlight the availability of inhaler recycling schemes.

> *"…in my pharmacy, personally, I don't really see any posters or leaflets anywhere" (SU5 CTM).*

Motivation - Reflective motivation

TDF Domain 3 – Social / Professional Role and Identity

Rasing awareness of the availability of inhaler recycling schemes was perceived to be the responsibility of the community pharmacy hosting the scheme, however this was not necessarily the case at present. Service users believed that it was important for the community pharmacy to promote the recycling schemes as this would encourage participation, coming from this credible source.

> "*It should be up to the pharmacy themselves to advertise that they do it – recycling - rather than the user asking about the recycling process"* (SU1 BC).

TDF Domain 9 – Beliefs about Consequences

Some service users did not feel that their individual contribution to recycling inhalers would have much impact on the environment which could be a barrier to their engagement in the scheme in the future.

> *"Personally, I don't think it'll have much of an individual impact, if I recycle them or not, but I think with others it definitely will" (SU2 BC).*
>
> *.*
>
> *"I spent a lot of time trying to get people to recycle things. So, the problem is that something like an inhaler, it seems so small and. You know, you look at the amount of recycling that you put out on a weekly basis and the amount of bin bags that people put out. Recycling, what you know, an inhaler once a month. . I know it's important, but you will struggle to persuade people that it's important" (SU2 CTM)*

TDF Domain 5 – Optimism

Whilst some services users intimated that they were positive about their future engagement with inhaler recycling, others were not so optimistic.

> *"…so I'm not terribly optimistic I would actually use this" (SU2 SB).*

Facilitators to inhaler recycling

This section presents a summary of perceived facilitators to inhaler recycling that were dominant across the interviews with service users. These facilitators are represented as components of the COM-B, respective domains of the TDF and illustrated with participant quotes.

Overall, facilitators for inhaler recycling were predominantly related to *reflective motivation* (i.e., a belief in their own capability of engaging with such a scheme, having strong intentions to use a scheme if it is simple and exists locally, that pharmacists see it as part of their professional role to encourage engagement with inhaler recycling, that they view recycling having a positive impact and that recycling aligns with their goals), *automatic motivation* (i.e., the fact they already go to the pharmacy to pick up prescriptions was seen as positive reinforcement to recycle) and physical capability (that they have the necessary skills to be able to recycle).

Motivation - Reflective Motivation

TDF Domain 4 - Beliefs about Capability

Service users' beliefs about their ability to engage with inhaler recycling was a facilitator that could increase the likihood of engagement with future recycling initiatives. The physical act of returning inhalers back to pharmacies was identified by all service users as being simple to do.

> *"I have to pick mine up from the pharmacy anyway. So you know, it really doesn't get much easier than that" (SU1 CTM).*

> *"I wouldn't have thought so. I should imagine it would be simply in a matter of handing them over" (SU3 BC).*

As some service users had experience of engaging in other recycling schemes, this had influenced their beliefs about capability to engage with other forms of recycling.

> *"I do generally try to dispose of all my waste correctly and recycle if possible. So shouldn't really be any different for the inhaler" (SU3 CTM).*

TDF Domain 8 - Intentions

Service users stated that now that they are aware that inhalers can be recycled that they intended to engage with such schemes when they are offered within their local community pharmacy.

> *"I think it's definitely important to take them where they need to go and recycle them properly" (SU1 CMT).*

However, for services users' intentions to be translated into their behaviour there was a need to have access to a recycling scheme.

> *"The intention is there, but there's just no option around you to actually do that so" (SU1 SB).*

TDF Domain 3 - Social / Professional Role and Identity

Services users thought that the onus should be on the pharmacists to encourage patients to recycle inhalers, seeing this as part of their professional role…

> *"But that must be the pharmacist who's handling them out. cause you can't. You can't rely on schools or TV programmes or the government or anything like that. It's got to be the pharmacist when he gives you an inhaler. Says, you can bring that back into me to recycle it for you" (SU2 CTM).*

…showing a commitment to how the family viewed their role in recycling in general…

> *"Yeah. cause we recycle everything else. We pride ourselves on the fact. And you know, we're a family of four. And every fortnight we take out half a bin bag" (SU2 CTM).*

TDF Domain 6 - Beliefs about Consequences

Whilst some had negative beliefs about the likely consequences of their engagement in recycling inhalers, others were more positive. The belief that recycling was important and would have a positive impact on the environment was therefore also seen as a facilitator for engagement in a scheme.

> *"I think it's definitely important to take them where they need to go and recycle them properly" (SU1 CTM).*

TDF Domain 9 - Goals

> *"I like to make sure that I do recycle and stay up, stay up on sustainability (SU1 BC)*

> *"I'm quite big on not using propellant as much as possible" (SU3 BC).*

> *"I do generally try to dispose of all my waste correctly and recycle if possible. So shouldn't really be any different for the inhaler" (SU3 CTM).*

Motivation – Automatic Motivation

TDF Domain 7 - Reinforcement

Some thought that providing an incentive might help people develop the habit of recycling their inhalers.

> *"Bit like the old pop bottle scheme used to get couple of pence back when you took your pop bottle back. I mean, people will, won't they? (SU2 CTM).*

However, other thought that a reward was not needed as they already made a regular journey to the pharmacy.

> *"I would be using it regardless of whether I get a reward or not; obviously it's a nice benefit, but"… (SU1 SB).*

> *"Once a month we go there, so simply take anything that isn't used and isn't going to be used. (SU3 BC).*

Capability – Physical Capability

TDF Domain 2 - Skills

Having the necessary skills in place to be able to recycle was also seen as a facilitator for recycling.

> *"I must pick mine up from the pharmacy anyway. So, you know, it really doesn't get much easier than that" (SU2 CTM).*

3.3 WP3: Community Pharmacist Perspectives

Perceived barriers and facilitators derived from five community pharmacists', transcripts were mapped to all three components of the COM-B model and all their respective sub-components. All fourteen TDF domains were represented by the data for barriers and facilitators perceived by community pharmacists. No other new themes emerged from the data therefore further thematic analysis was not needed.

Perceived barriers mapped to *psychological capability, physical opportunity, social opportunity* and *reflective motivation* components of the COM-B model. In terms of the TDF, barriers to inhaler recycling from the community pharmacists' perspectives mapped to Domains 11 – Environmental context and resources, 3 – Social and Professional Role and Identity, 1 – Knowledge, 8 – Intentions and 7 – Reinforcement.

Perceived facilitators mapped to *physical capability, social opportunity, reflective motivation* and *automatic motivation* and the following TDF Domains - 14 – Behavioural Regulation, 10 – Memory, Attention and Decision Processes, 12 – Social Influences, 5 – Optimism, 4 – Beliefs about Capability, 6 - Beliefs about Consequences, 9 – Goals, 7 – Reinforcement and 13 – Emotion.

The findings are described in more detail below with illustrative quotes for each COM-B component and respective TDF domains. The codes in parentheses following each verbatim quote provides the study number for each community pharmacist (CP 1 to CP 5).

Barriers to inhaler recycling

This section presents a summary of the barriers to engaging in an inhaler recycling scheme that were dominant across the interviews with community pharmacists. These barriers are represented as components of the COM-B, respective domains of the TDF and illustrated with participant quotes.

Overall, the key barriers to community pharmacists engaging with the inhaler recycling scheme related to *physical opportunity* (i.e., workload capacity for delivering the scheme, having the right environment in terms of space for the recycling bins, and funding issues for recycling to be commissioned), *social opportunity* (i.e., not seeing recycling as a priority within their professional role compared to other aspects of patient

care), psychological capability (i.e., not having knowledge or full understanding about the scheme to be able to explain it confidently to service users and not having strong intentions to push the scheme) and reflective motivation (i.e., low intentions to engage in the scheme or negative reinforcement from seeing the success of others).

The findings are described in more detail below with illustrative quotes. The codes in parentheses following each verbatim quote provides the study number for each community pharmacists participant.

Opportunity - Physical Opportunity

TDF Domain 11 - Environmental Context and Resources

Most of the community pharmacists interviewed described that implementation of the inhaler scheme within their pharmacy had been difficult as staff workload was already at capacity.

" …been asked to do more and more and it's getting more stretched" (CP3).

"The pharmacy is a busy place and it's, it's- you know, it's got, it's got other agendas" (CP4).

Due to the workload pressures, responsibility for the scheme had often been allocated to other members of the pharmacy staff team, but this did not solve the issues around capacity.

"… other staff members are …so busy doing their own jobs..." (CP1).

Priority was often given to schemes that were linked to funding.

"Money rules, unfortunately" (CP4).

"…unless we're getting paid for, for collating information, you know we got bigger fish to fry…" (CP3).

Some participants felt that community pharmacies did not have the resources required to run the scheme effectively.

"…didn't have the equipment to recycle…" (CP3).

All pharmacies had been issued with a container to collate returned inhalers, but this was viewed as impractical due to its size.

"The barrel as it stands, doesn't work very effectively" (CP1).

''…the bin is so big and unsightly…" (CP3)

"Have you seen how we're gonna get it out that room when it's full? Because it's big enough for me to stand then. …. that monstrosity that we have in the stockroom" (CP2).

Some timing issues were also raised since there was a delay in getting hold of the necessary equipment to recycle the inhalers, which meant some service users had to be turned away.

"Months before we started doing it, they were putting on the on the label directions for the for all the inhalers to recycle them at their local pharmacy. That there was a period of time with us which was a little bit difficult for us was the patients were trying to bring them back for us for recycling, but we didn't have the, we didn't have the equipment to recycle them" (CP3).

Opportunity - Social Opportunity

TDF Domain 3 - Social Professional Role and Identity

Participants responded that they did not view the inhaler recycling as the responsibility of community pharmacy. The pharmacists felt that they lacked ownership of the scheme since it had been imposed on them to some extent without their prior involvement.

"…isn't [their] agenda and it isn't being driven by [them]…" (CP4).

"that's not our job to do that…" (CP2).

Community pharmacists viewed the requirement to oversee an inhaler recycling scheme as being beyond the professional role; they felt that the important aspects of their role were related to dispensing of medication and supporting service users to use medication safely.

"…making sure they are actually using the medication correctly…" (CP3).

"…providers of pharmaceutical services and pharmaceutical products…" (CP4).

Capability - Psychological Capability

TDF Domain 1 - Knowledge

Participants explained that they felt that they had limited understanding of the processes involved in inhaler recycling.

"…at zero knowledge of what the scheme was…" (CP1).

Participants felt they did not have a sufficient level of knowledge about the scheme to explain it to service users what happened to their inhalers during the recycling process.

> *"…in terms of knowing where they go after – not confident." (CP3)*

> *"…probably couldn't…explain 100% what is gonna happen to those inhalers after they leave the pharmacy…" CP4).*

Community pharmacist felt that their lack of understanding of the recycling process was a barrier to engaging in conversations about the scheme with service users.

> *"…if you could actually tell patients with confidence where it's going…" (CP1)*

In terms of service users' knowledge about the scheme, this was also perceived to be a barrier to engagement.

> *"Maybe not enough people know about returning their inhalers and maybe that's an avenue that can be explored further possibly" (CP2).*

Motivation - Reflective Motivation

TDF Domain 8 – Intentions

There was an admission that maybe the scheme had not been promoted as strongly as it could have been which may have been related to some of the previous barriers identified.

> *"If I'm to be honest, we haven't really pushed it as hard as we could have" (CP3).*

TDF Domain 7 – Reinforcement

When comparison of the scheme's success was made to other community pharmacies this could lead to negative reinforcement since it had reduced motivation to continue with the scheme for one individual.

> *"His bin was probably 60-70% full…it was like a little bit of a, a demoralising thing for us…" (CP4).*

Facilitators to inhaler recycling

This section presents a summary of facilitators to inhaler recycling that were dominant across the interviews with community pharmacists. These facilitators are represented as components of the COM-B, respective domains of the TDF and illustrated with participant quotes.

Overall, facilitators for inhaler recycling were predominantly related to *psychological capability* (i.e., knowing that service users will want to recycle made them confident about the behavioural regulation required for the pharmacy team to engage with a scheme, having experience of operating the scheme meant the underpinning skills for how to deliver it were in place, having visual cues around the pharmacy served as a reminder to engage in the scheme and these also enhanced their knowledge about the scheme), *social opportunity* (i.e., social influences such as seeing services users recycling their inhalers and hearing about other pharmacies engaging successfully with the scheme), *reflective motivation* (i.e., showing optimism for building on successes so far, the enthusiasm of service users, building on experiences of being part of the scheme enhanced their confidence in their capability, a belief that the desired goal would be attained and seeing the positive consequences of the scheme contributed to positive intentions and a commitment to the service as part of their role) and automatic motivation (i.e., reinforcement of the behaviour by praising service users who return their inhalers, seeing the quantities of inhalers being returned and the emotional perspectives of doing what is morally the right thing to do).

The findings are described in more detail below with illustrative quotes. The codes in parentheses following each verbatim quote provides the study number for each community pharmacist participant.

Capability - Psychological Capability

TDF Domain 14 – Behavioural Regulation

The idea that recycling was a behaviour that was already incorporated into many service users' daily routines was viewed by pharmacists as a facilitator for increasing the likelihood that a community inhaler recycling scheme would be successful.

> *"People get recycling now, especially in Wales….Wales has you know, been recycling a long time. So, I think they would. People would be happy to do it just for the sake of doing it" (CP1)*

Most participants described how their pharmacy teams had planned to incorporate behaviours that encouraged inhaler recycling within their daily practice. It was clear that action planning was perceived an aspect which was important to the success of the recycling scheme and there was an awareness that it would take time for the behaviours needed to be embedded into routine practice.

> *"…we've got recycling bins in the pharmacies, and we encourage the patients just to return any used or unused inhalers to the pharmacy" (CP5).*

> *"…it becomes a natural routine and we'll just [get] into that habit…" (CP2).*

The extent to which the recycling scheme had been embedded into regular practice varied across the five community pharmacies. Some revealed that they had not been frequently engaging with the scheme in their workplace and did not consider the behaviours around inhaler recycling (e.g., prompting service users, promoting the service) to be habitual.

> "…*it's not something that we're sort of doing on a regular basis" (CP2).*

> *"But I'm not against promoting inhaler. I hope in response to this scheme and everything I'm more aware of and promoting it more...but it's not routine" (CP1)*

Despite acknowledging that there had been limited engagement in the scheme at their workplace it was noted that several service users had formed a habit of returning inhalers.

> "*They will come in when they've got a few inhalers, and they bring in them and hand them over and we can dispose of them. So, people are really good…Some people are so disciplined now, they just come in and they put them in there [themselves] anyway" (CP2).*

Community pharmacists indicated that they were actively monitoring the success of the scheme by reviewing how full the inhaler recycling container had become.

TDF Domain 2 - Skills

Having experience of operating the inhaler recycling scheme was seen as a facilitator in terms of having the skills in place for engaging with the scheme.

> *"…obviously we've got quite a few members of staff. They all sort of know how to. To take the inhalers in" (CP3).*

TDF Domain 10 – Memory, Attention and Decision Processes

Having posters, leaflets, stickers, and other visual resources to inform service users about inhaler recycling had been an enabler for the increase in inhaler uptake as it had been getting that message across to patients. Community pharmacists had been provided with posters and other resources to display by the local health boards, as well as stickers to stick onto the bags of patients. These resources acted as a reminder for both the Community pharmacists and the service users to have conversations about inhaler recycling, and the stickers were viewed as easy to add to patients' bags.

Capability - Psychological Capability

TDF Domain 1 - Knowledge

An enabler for the safe disposal of inhalers for community pharmacists was the help received from the scheme's organiser. The information packs that they received at the start of the pilot scheme, the resources (e.g. stickers, posters, leaflets) and the knowledge learnt about inhaler recycling and its process aided them in encouraging service users to return their inhalers back to pharmacies. Whilst the feedback was not all positive about this, it would have been a much more difficult to incorporate the scheme into pharmacies without them.

A view was also reported that services users were now more likely to have got the message about recycling inhalers in Wales.

> *"People get recycling now, especially in Wales, and I'm not sure about across the border in England or Scotland, but Wales" (CP1).*

Opportunity - Social Opportunity

TDF Domain 12 – Social Influences

Community pharmacists felt that social influences were important facilitators and would encourage participation in the recycling scheme since having service users already engaged with the scheme could influence others to engage in recycling behaviours.

> ***"…****sometimes it's actually people have been in the pharmacy at the same time as somebody else who is returning them. So it's not just by us, it's by watching other people as well and watching other patients" (CP2).*

Some community pharmacist participants revealed that having other community pharmacies successfully trialing the scheme had been helpful and encouraged participation in their pharmacy setting,

"I've been lucky that I've had the success of another pharmacy to sort of trail blaze for me" (CP4).

Media coverage around climate change and the benefits of recycling was also percieved as an important social influence on motivations to behave sustainably.

"Every channel you turn on now it's got programmes on global warming and in newspapers. And there's something about sustainability and the environment almost every day" (CP5)

Reflective Motivation

TDF Domain 5 – Optimism

Participants felt optimistic that an inhaler recycling scheme would be successful within their pharmacy. When reflecting on their experiences to date, most participants felt that there had been a reasonable uptake by service users.

"I think we've had a good response from patients" (CP5).

"….it has been a success so far (CP4).

There was also optimism that the public would become more aware of the important of sustainability and that this would boost engagement with inhaler recycling schemes.

"I think people, people are more environmentally aware now that they and I think it's it's a you know people are quite positive about returning" (CP2).

This was coupled with the view that delivering the recycling scheme was contributing to the desired goals of saving the planet.

"Quite happily there to to, to, to help facilitate and and and move, move the world forward" (CP4).

TDF Domain 4 – Beliefs about Capability

Having experience of delivering the recycling scheme was viewed as a facilitator in terms of increasing the pharmacists' confidence in their capability of implementing the scheme.

"…runs pretty confidently and I can't think of any areas we're not confident about" (CP5)

.

TDF Domain 6 – Beliefs about Consequences

Again, experience of being involved in the scheme made pharmacists aware of the potential benefits of recycling and the value of being involved in such a scheme.

"It's got to be a benefit, especially when you see the quantity in either the box or in the tub. So you you realise how much is being dispensed on a weekly on a monthly basis within our small community" (CP2).

Even though the scheme may require improvements, community pharmacists were supportive of recycling and did believe that the returned inhalers were better being recycled in the pharmacy than being sent to landfill.

TDF Domain 3 - Social Professional Role and Identity

Inhaler recycling was perceived by CPs as a moral responsibility rather than it being a part of patient care, but because of the environmental benefits it was viewed by some as the right thing to do.

"As providers of pharmaceutical services physical products, we would, you know, ….. we have got a duty and we and we have always taken important our duty to take in waste medicines from patients" (CP 2).

However, there were limits to the extent of responsibility that the pharmacists were willing to accept.

"*But, you know, we and we're happy to facilitate the recycling, but that's about as much work, as much extra that we can do" (CP4).*

TDF Domain 8 – Intentions

It was suggested that now is the right time to engage in inhaler recycling and this was seen as a driver to enhance participants' intentions to do it.

"I think it is the right time to do it because of the situation we're in with global warming and such, but…Ohh we confident in…..sort of encouraging our patients to return them, but it's not a conversation we have every time we handout and inhaler on prescription. It's only if they instigate the conversation that we will encourage them then…So we're pretty good recycling everything. Yeah. Yeah. I mean, not just inhalers medication, things like that. You know, we've all the recycling schemes" (CP2).

TDF Domain 9 – Goals

Inhaler recycling was something that aligned with the life goals of some of the participants.

"I think my opinion is people they want to recycle and whether that be in, in their domestic lives in in you know your food waste or whatever. But I think we're all very evident that can see that …People want to recycle, you know, they we do it all with all doing it every day in in the homes with the packaging and it's pretty obvious to see that there's a hell of a lot of packaging in these inhalers …Leave the planet better in a better condition than you know for their grandchildren and great grandchildren" (CP3).

Automatic Motivation

TDF Domain 7 - Reinforcement

Reinforcement was used by staff to encourage the service users' continued participation in their local recycling scheme. Participants perceived that service users who had received individual praise for engaging in the scheme were more likely to continue with this behaviour.

> *"If they've been thanked once then yeah, they're more willing to come back" (CP2).*

> *"it's having that upbeat thing when somebody bring them brings back and it's like oh great. Thank you. Great we'll go will get we're gonna go and recycle them now and and make making I suppose making a fuss of that" (CP4)*

> *"The people who bring them back I think as long as we show that we're very grateful and that they're doing the right thing, I think it's just positive reinforcement for them all the time. And if they've been thanked once then yeah, they're willing to come back and yeah, it's just getting into that habit" (CP2).*

Some of the participants believed that if service users were able to gain monetary incentives for engaging with the scheme that this would further improve uptake.

> *"If if there's any sort of monetary value on on schemes that definitely does improve" (CP5).*

In terms of reinforcement for pharmacy staff it was felt that seeing the number of inhalers returned by service users served as a useful way of increasing their commitment to running the scheme.

> *"It's got to be a benefit, especially when you see the quantity in either the box or in the tub. So you you realise how much is being dispensed on a weekly on a monthly basis within our small community" (CP2).*

TDF Domain 13 – Emotion

Positive emotions were displayed towards the need to become more sustainable. For some it was their sense of moral duty that keep them motivated to engage with the inhaler recycling scheme.

> *"I think it's more. It's more a moral. Um, responsibility. If I'm honest with it" (CP4).*

> *"I'm quite passionate about the environment and yeah, it definitely does help because it keeps you motivated and engaged" (CP5).*

3.4 WP4: Synthesis of Service User and Community Pharmacist Perspectives

This section considers the key areas of commonality and divergence across the service users and community pharmacist data.

Service users interviewed for this study had low awareness of the importance of inhaler recycling and were currently not using any inhaler recycling schemes. However, both services users and Community pharmacists thought that once services users knew about the existence of, need and rationale for an inhaler recycling scheme they were confident that they would use it. They felt that the scheme built on their existing recycling behaviours and linked to their moral obligations around sustainability.

Service users perceived community pharmacies to be well placed (especially if part of a well-knit community) to offer a recycling scheme as they were not prepared to go out of their way to recycle (preferring a 'One-Stop-Shop'). It was important to service users that inhaler recycling schemes were straightforward to use (e.g. returning it directly to the pharmacy) as they felt that they would not want to take part in a scheme if it was complex (e.g. sorting of inhaler types or dismantling into components).

Service users perceived community pharmacies to play a key role in raising awareness of recycling schemes and viewed them as trusted sources of information. They perceived community pharmacy as having many opportunities to inform them of the need to recycle inhalers, however, they are currently not making the most of these opportunities. In contrast, the community pharmacists currently engaged in the Swansea Bay scheme felt they did not have the contact time with service users needed to raise awareness of inhaler recycling. This explains why labels on the inhaler medication packaging had been used as the main intervention to promote the need for inhaler recycling to patients).

The busy nature of the pharmacy environment was viewed by service users as a barrier to engaging in conversations with pharmacy staff about recycling and this was a view supported by the pharmacy interview data. Community pharmacist participants reported that they were hesitant to fully engage with inhaler recycling schemes due to working in an extremely busy environment with many competing tasks.

Feedback on the inhaler recycling scheme's success is needed for both service users and community pharmacists. Service users stated that being thanked for their engagement in the inhaler recycling schemes would motivate them to engage in with the service, however they were not looking for monetary incentives. They would

appreciate feedback on the benefit to the environment and impact that the inhaler recycling schemes were making. Community pharmacies were also keen to gain feedback on how successful their scheme had been (for example, the number of inhalers recycled, are we doing it right, what happens to the inhalers, progress with the scheme etc.) and felt that this would optimise engagement with the recycling scheme in the future.

Service users very much saw inhaler recycling as something that was an integral part of the pharmacy's role. In contrast, community pharmacies welcomed a shared responsibility to inhaler recycling where all members of the healthcare team and professional organisations are on board to help promote it. Having visual cues to recycling in GP surgeries or other health settings would provide visual cues to patients to recycle their inhaler. Both service users and Community pharmacists agreed that there is a need to raise awareness of the availability of inhaler recycling campaigns, the use of social media campaigns could help support this. Nevertheless, Community pharmacists also acknowledged that they still had a responsibility to inform service users at the point of dispensing about the actual inhaler medication and to return them to the pharmacies. However, beyond that, they did not see pharmacy as having a big role in sorting out the inhalers and explaining the recycling process to patients.

Both parties agreed that inhaler recycling schemes are not fully integrated into the public psyche nor integrated into community pharmacy services or day to day activities as yet. Whilst both groups were in agreement that it is '*the right thing to do*', a number of barriers that need to be addressed. In particular the community pharmacists thought that more investment is needed from community pharmacies, but this will only happen if they see the scheme 'taking off'. The community pharmacy environment is busy, community pharmacists felt that having too many competing priorities within setting would also be a barrier to engagement. Community pharmacists had felt discouraged by the size of the drums used to store inhalers and suggested that these should be smaller.

Although community pharmacists had many concerns about the logistics of the scheme and how it would fit into the short and long-term running of their pharmacies, they were ultimately committed to taking part in the scheme since they felt like it would make an overall positive impact. Seeing service users actively returning their inhalers back to pharmacies was seen as a powerful motivator for community pharmacists as it reinforces that inhaler recycling is a service that their community will use.

4 Discussion and Recommendations

4.1 Summary and Discussion of Findings

The purpose of this project was to gain behavioural insights into *service users' and community pharmacists' perspectives* with regards to returning used or unwanted inhalers to community pharmacies in Wales. The first research question posed was: *'What are the barriers and facilitators to responsible disposal of metered dose inhalers?*' To address this, perceived barriers to, and facilitators for the responsible disposal of inhaler medication from a service users' and community pharmacists' perspective were explored.

Service Users' Perspectives

This was explored by interviewing eleven service users who were prescribed inhalers but had no prior experience of recycling them through their community pharmacy. The key perceived barriers to future engagement with an inhaler recycling scheme were related to the following COM-B components - *psychological capability, physical capability, physical opportunity, social opportunity, and reflective motivation*.

In terms of *psychological capability* - service users in this study were generally unaware that they could return inhalers to the pharmacy, and many were disposing of their inhalers in domestic the waste (TDF Domain 1 – Knowledge and Domain - 10, Memory, attention and decision process). This behaviour is consistent with the wider literature which indicates that most inhalers are not recycled (Murphy et al. 2023) and that up over 90% of patients dispose of their inhalers in household bins (Chebbot & Murphy et al. 2021; Sivarajasingam, 2021).

In terms of *social opportunity*, service users viewed community pharmacies as a trusted sources of information about disposal of medications but felt that limited information had been provided on how to appropriately dispose of inhalers (TDF Domain 11- Social Influences).

In terms of *physical capability*, it was important to service users that inhaler recycling schemes should be straightforward to use (e.g. returning it directly to the pharmacy) as they felt that they would not want to take part in a scheme if it was complex (e.g. having to sort different inhaler types or dismantling into components) (TDF Domain 2 – Skills). If inhaler recycling is not convenient, then it was deemed to be problematic and not worth the extra task. Findings from Murphy' et al. (2023) pilot "postal scheme" provided patients with pre-paid and pre-addressed envelopes to return inhalers for recycling; many patients engaged with the scheme with over 20,000 d inhalers being

returned to waste management centres over the 12-month period. However, despite its simplicity only 7% of the pre-paid envelopes were returned (1041/14,805 envelopes returned), this suggests that even schemes which are deemed as feasible by service users may have limited uptake.

When considering service user views relating to *psychological capability* it is important to acknowledge that for patients to engage with inhaler recycling schemes, they will need to change a pre-existing behaviour (i.e. disposal of inhalers in domestic waste). The service uses interviewed felt that changing how they currently dispose of inhalers maybe be difficult as they had formed a habit of putting the inhaler into household bins (TDF Domain 14 - Behavioural regulation). Habits are recognised as a key driver of environmental behaviours; Verplanken & Whitmarsh (2021) suggest that informational approaches alone are generally ineffective at encouraging people to adopt new sustainable behaviours and that interventions should also incorporate behavioural prompts, incentives, or implementation intention setting.

In terms of *physical opportunities* service users felt that their local community pharmacy environment did not currently contain the resources needed to highlight the availability of returning inhalers to community pharmacy for disposal (TDF Domain 11 - Environmental context, and resources). Recycling bins that are distinctive have been shown to be effective at advertising availability of recycling schemes and can prompt the engagement in recycling behaviours (Smith, Harrison & Simmons, 1999). Lack of promotion of the inhaler schemes alongside reluctance to interact with pharmacy staff due to the busy nature of community pharmacy were barriers to service user engagement.

Despite these barriers, it is also important to acknowledge the potential existing facilitators for engagement with a recycling scheme so that these can be capitalized upon. For this study, the facilitators identified mapped to three components of the COM-B - *reflective motivation, automatic motivation, and physical capability.*

In terms of *reflective motivation*, inhaler recycling schemes were viewed as acceptable to service users with a strong intent stated to use such schemes in the future (TDF Domain 8 - Intentions). Geiger et al, (2019) identified that there is often a mismatch between intended recycling behaviour and observed behaviour; their meta-analysis of 91 studies of recycling behaviours found that underlying psychological constructs such as attitudes, perceived behavioural control and perceived social norms were better

predictors of intentions to recycle than self-reported or observed recycling behaviours. This indicates that future evaluation of inhaler recycling schemes should seek to incorporate measures of both behavioral intentions and observable recycling behaviours.

When considering *reflective motivation*, service users' beliefs about their ability to engage with inhaler recycling was seen as a facilitator which could increase their likelihood of engagement with future recycling initiatives (TDF Domain 4 – Beliefs about capability). Service users linked their intention to engage with an inhaler recycling scheme to their moral responsibility to improve sustainability (TDF Domain 9 - Goals). Feelings of personal responsibility and moral obligations have been identified in the broader literature as key predictors of recycling behaviours (Czajkowski, Hanley & Nyborg, 2015).

In addition to this, when considering *physical capability*, the physical act of returning inhalers back to pharmacies was identified by all service users as being simple to act upon (TDF Domain 2 – Skills). Several service users were already returning other forms of medication to the pharmacy and considered their experiences of this to be positive.

Community Pharmacists Perspectives

This was explored by interviewing five community pharmacists currently involved in an inhaler recycling pilot scheme. To date there is no published literature on the views of community pharmacists on inhaler recycling. In this study, the key perceived barriers to future engagement with an inhaler recycling scheme were related to the following COM-B components- *psychological capability, physical opportunity, social opportunity* and *reflective motivation*.

In terms of *physical opportunity,* it was felt that they did not have the capacity for delivering the scheme due to high workload issues and practical issues relating to not having the right environment or space to store the large recycling bins (TDF Domain 11 - Environmental context and resources). Funding issues were also raised as a barrier, however, this changed during the latter part of the study when new contractual arrangements were introduced in Wales in September 2023 for inhaler recycling to be a commissioned service.

Considering *social opportunity* inhaler recycling was not seen as a priority within their professional role compared to other aspects of patient care (TDF 3 – Social and

Professional Role and Identity). This contrasted with the service users' views who very much saw it as being part of the pharmacist's responsibility. However, pharmacists viewed inhaler recycling as more of a moral responsibility, than being part of their professional duty.

In relation to *psychological capability* respondents did not think that they had sufficient knowledge or full understanding about the scheme to be able to explain it confidently to service users (TDF 1 – Knowledge). For example, participants were knowledgeable in the process of inhaler recycling but were unclear about what happens once they leave the pharmacy, and this caused hesitancy when interacting with patients about the scheme.

Reflective motivation was seen as another barrier where some respondents reported that they did not have strong intentions to promote the scheme as much as they could and seeing the successes of others could be demoralising leading to negative reinforcement). (TDF Domain 8 – Intentions and Domain 7 - Reinforcement).

Several facilitators for engagement with the inhaler recycling scheme were also identified. For the community pharmacists, these mapped to three components of the COM-B *psychological capability, social opportunity, reflective motivation and automatic motivation.*

For *psychological capability,* knowing that service users are keen to recycle made them confident that it would happen and having now had experience of operating the scheme they were confident that would be able to deliver similar schemes in the future (TDF 14 – Behavioural Regulation). Pharmacists saw the need to develop a habit of promoting and participating in the inhaler recycling scheme. Also, having visual cues around the pharmacy served as a reminder to engage in the scheme and also enhanced their knowledge about the scheme (TDF Domain 10 - Memory, Attention and Decision Processes).

In terms of *social opportunity* pharmacists were influenced to engage in the scheme when they saw services users recycle their inhalers and hearing about other pharmacies who were also having success with the scheme (TDF Domain 12 – Social Influences). Sustainability was seen as being a being a hot topic in the media and participants thought they could capitalize on this to build awareness of inhaler recycling and inform service users about the scheme.

When considering *reflective motivation* this was evident when they showed optimism for building on successes so far, the enthusiasm of service users (TDF Domain 5 – Optimism) and building on experiences of being part of the scheme enhanced their confidence in their capability (Domain 4 – Beliefs about Capability). A belief that the desired goal would be attained and seeing the positive consequences of the scheme contributed to positive intentions and a commitment to the service as part of their role (TDF Domain 6 - Beliefs about Consequences, Domain 9 – Goals).

For *automatic motivation* pharmacists saw their role as having positive reinforcement on service user behaviour, for example by praising those who returned their inhalers to the pharmacy. From their point of view, seeing the quantities of inhalers being returned and the emotional perspectives of doing what is morally the right thing to do was a motivator for the community pharmacists (TDF Domain 7 – Reinforcement, Domain 13 – Emotion).

4.2 Mapping to Behaviour Change Wheel (BCW)

The second research question posed was 'What interventions are likely to be effective in encouraging patients to return used and waste inhalers to community pharmacies in Wales?' Based on these data, several recommendations can be made to support the development of future schemes for recycling inhalers within community pharmacies. Data from the TDF and COM-B analysis were mapped to their respective BCW intervention functions as follows to identify priority areas:

4.3 Priority Areas Identified

Environmental restructuring – to make it clearer to services users that inhaler can and should be returned to the community pharmacy for disposal and that inhaler recycling is feasible in the future. This will also address the practical issues in the pharmacy. Addressing logistical issues of the "Swansea Bay Scheme" such as size of the recycling drums currently being utilised.

Education – to promote awareness of any inhaler recycling scheme both nationally and locally where available. Raising public awareness of the existence of, need and rationale for inhaler recycling. Educational campaigns should be targeted a national level but include publicity of schemes within the community pharmacy setting. Providing education to the whole pharmacy team before implementation (rather than one member of the team taking responsibility for the scheme) would enhance engagement. After implementation the pharmacy team should receive regular

feedback on progress within the scheme. Both service users and community pharmacy staff should be informed on how the scheme is making a difference to the environment.

Coercion – to provide feedback to service users and community pharmacy staff in the form of encouragement from pharmacy staff to service users and more descriptive data back to the pharmacy about the impact of any scheme.

Environment – to display more posters and other visual cues to raise awareness and prompt service users to remember to return medicines to the pharmacy and participate in any recycling scheme if available.

Modelling – to be able to observe others recycling their inhalers will encourage new service users to do so and provide positive reinforcement for pharmacy staff to engage with the scheme.

Persuasion – to ensure that community pharmacy staff use any opportunity possible to encourage service users to return medicine to pharmacy and recycling inhalers where schemes are available. Community pharmacy should take a lead role in driving engagement with any recycling scheme within their local settings to improve engagement with the recycling scheme.

Incentivisation – to show appreciation for those who engage in recycling – both from the service user perspective (in the form of acknowledgement or praise) and community pharmacy (financial incentives to make sure it is built into the daily routine but also a sense of moral duty that it is the right thing to do). Showing appreciation for those service users who recycle their inhalers via the scheme would help encourage future engagement. Developing systems of work that creates the perception for service users that inhaler recycling is part of the daily routine in community pharmacy in ore to remove any misconceptions the service users may have about the role of pharmacy in this initiative.

Training – to ensure that any inhaler recycling scheme is easy for service users to engage with and needs limited training for pharmacy staff. Service users view the community pharmacy setting as a convenient location for such schemes due to their proximity. However, they would not engage with a scheme that requires them to go out of their way to recycle or that requires additional effort (e.g. requires the service user to sort inhaler components or types).

4.4 Limitations

There are a number of limitations to this study and some methodological challenges were experienced when conducting this research. First, it is important to recognise that the goals and motivations around sustainability captured in the interviews (and broader literature on recycling) could have been influenced by the recruitment strategy used to encourage participants to engage with the study. Self-selection bias may have meant that service users who already held positive attitudes towards recycling and sustainability, were recruited to the study and therefore these views may not be representative of the general community. At time of the interviews there was no requirement for pharmacies to actively encourage patients to return in inhalers to pharmacy for safe disposal other than the pilot in operation in the Upper Valleys Culture area. The service user participants were not from the Upper Valleys Cluster area and therefore would not have had any contact with community pharmacy inhaler recycling schemes.

Amongst the general public there was low awareness the need to return used/or unwanted inhalers to community pharmacy for disposal and this may have impacted on engagement in the research. Service users may not have felt confident discussing issues that they were unfamiliar with in face-to-face interviews or focus groups. Alternative data collection methods such as qualitative surveys may encourage a broader range of service uses to engage with research on topics that they are unfamiliar with.

4.5 Methodological Challenges

Several methodological challenges were encountered during this study. These are summarised in Table 3.

Table 3: Methodological Challenges and Lessons Learnt

Challenge	Our Learning
Use of monetary incentives to take part in interviews drew 'imposter participants. There was a high volume of requests to participate in the study by individuals who did not meet the inclusion criteria (e.g. individuals lived outside of the Wales, or did not use inhalers)	A screening tool was introduced (short interview) prior to selection to the study. Based on this screening tool, 61 people were found to be not eligible for interview.
None of the recruited service users had engaged with the Swansea Bay recycling scheme.	At the time of the interviews, there was no national inhaler recycling scheme integrated into any community pharmacy services or day to day activities. This may have limited the extent to which service users were engaging with schemes. Recruitment methods relied on service users contacting the researcher after seeing the advert/poster, it may have been more convenient for service users to take part in the interviews whilst they were at the community pharmacy. This however places strain on the resources within the pharmacy e.g. consultation rooms.
Slow recruitment of community pharmacists to focus groups and interviews from Swansea Bay scheme.	Workload pressures may be a barrier to participating in research. Community pharmacists may also be reluctant to take part in research that focuses on a scheme that was not yet fully integrated into their service. There may have been hesitation to report negative views about the scheme due to conflicting loyalties with the instigator of the scheme.

4.6 Further Research

Areas for further research include the following:

- Repeating the behavioural insights study after a funded inhaler recycling service in Wales is introduced .
- Gathering views of service users (patients) who have experience of using an inhaler recycling scheme.
- Evaluating uptake of inhaler recycling as part of the pilot operating in the Upper Valleys Cluster in Swansea Bay UHB.

- Undertaking quantitative research to establish any changes in behaviours after the implementation of any future recycling schemes across Wales (for service users and community pharmacy staff).

4.7 Conclusion

In conclusion, this research builds on existing literature on patients' perspectives and provides new insights on community pharmacists' views about inhaler recycling. When the barriers and facilitators to inhaler recycling were mapped to the Behaviour Change Wheel, intervention functions the prioritise were:

- *Environmental Restructuring* of the community pharmacies
- *Education* of the service users and community pharmacists
- *Coercion* of service users to recycle their inhalers by community pharmacists.
- *Environment* by adding visual cues to the pharmacy setting.
- *Modelling* by making the service more visible for all to see in the pharmacy.
- *Persuasion* by community pharmacy staff at every opportunity
- *Incentivisation* by showing appropriate acknowledgement or appreciation to those who recycle and
- *Training* of service users to engage in the scheme.

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Appendix 1 – Protocol for literature review undertaken by Public Health Wales

Protocol for evidence review: Why don't patients return used or unused inhalers to community pharmacies?

Author(s): Nick Gregory	
Date: 15/11/2022	**Version:** V0a
Publication/ Distribution:	
Review Date: NA	
Purpose and Summary of Document: To set out a protocol to describe the process to identify and report research evidence on why patients don't return used or unused inhalers to community pharmacies?	
Work Plan reference: NA	

1.0 Purpose

This evidence map provides a summary of the relevant evidence identified to develop the evidence statement. Hyperlinks to freely available full text of references are included to enable further review of the research studies should this be of interest. Some of the evidence summarised below is only published as an abstract.

2 Methods

2.1 Review question

This research evidence review will address the question:

- Why don't patients return used or unused inhalers to community pharmacies?

2.2 Search strategy

An initial search in Google Scholar and the Cochrane database was undertaken although no systematic reviews were found which were relevant to the question under review. Search terms were therefore developed by the Public Health Practitioner and scrutinised by the Consultant in Public Health prior to undertaking the search. Searches in Embase/Medline and NHS evidence were undertaken as well as a search for grey literature and for publications by the UK's public health bodies, the World Health Organisation and other professional bodies. Studies were included if they were UK based and published since 2010. Studies were identified using the following search terms:

((inhaler*) AND (dispos* OR recycle* OR return*) AND ("community care" OR "community pharmac*" OR pharmac* OR "primary care" OR "secondary care"))

Date of search: 21/09/22

Electronic searches

An initial search in Google scholar and the Cochrane database will be undertaken to identify key literature/ evidence reviews in relation to patients returning used and unused inhalers in community pharmacies. Search terms from good quality systematic reviews will be used, if available, to ensure all relevant search terms are included in further database searches. If no systematic reviews are available, relevant search terms will be developed by the Public Health Practitioner and Consultant in Public Health. Searches in Embase, Medline, NHS evidence and grey literature will be undertaken.

Reports commissioned or produced by national and international public health bodies will also be identified through searching of the relevant websites e.g. Public Health England, Public Health Wales.

Reports by relevant professional organisations will also be searched.

2.3 Inclusion/exclusion criteria:
Type of study:

Include: primary research studies, well designed large scale population studies including; longitudinal cohort studies, cross sectional surveys, randomised controlled trials (can include grey literature)

Exclude: Articles which do not report original findings; articles (published paper or grey literature) which do not report original findings and articles not written in the English language, articles published before 2010 and outside of the UK.

Publication date:

Include: Sources published after and including 2010

Exclude: Sources published before 2010

Language:

Include: Sources written in English language

Exclude: Sources written in any other language

Population:

Include: Adults and children; Locations: UK,

Exclude: Rest of world. If a study is published in a population outside of the UK but is demographically similar, a discussion will be held with the Consultant in Public Health to decide if inclusion is appropriate.

Outcome measures:

Include: Provides data which report on reasoning/enablers/barriers for/for not disposing of inhalers at pharmacies or similar clinical settings

2.4 Article screening

All retrieved reviews/articles will be screened at title to determine relevance according to the inclusion/exclusion criteria. Where titles are unclear the article will be retained for the next screening step. Abstracts of retained articles will then be screened using the same criteria. If relevance of any article is still unclear after abstract screening the article will be retained for the next screening step. The full-texts of all articles included after abstract screening will be obtained where possible. Decisions will be recorded in the inclusion/exclusion diagram (Figure 1).

2.5 Critical appraisal

Critical appraisal of included studies will be undertaken using appropriate frameworks relevant to study type (e.g. AXIS for cohort studies)

2.6 Data extraction

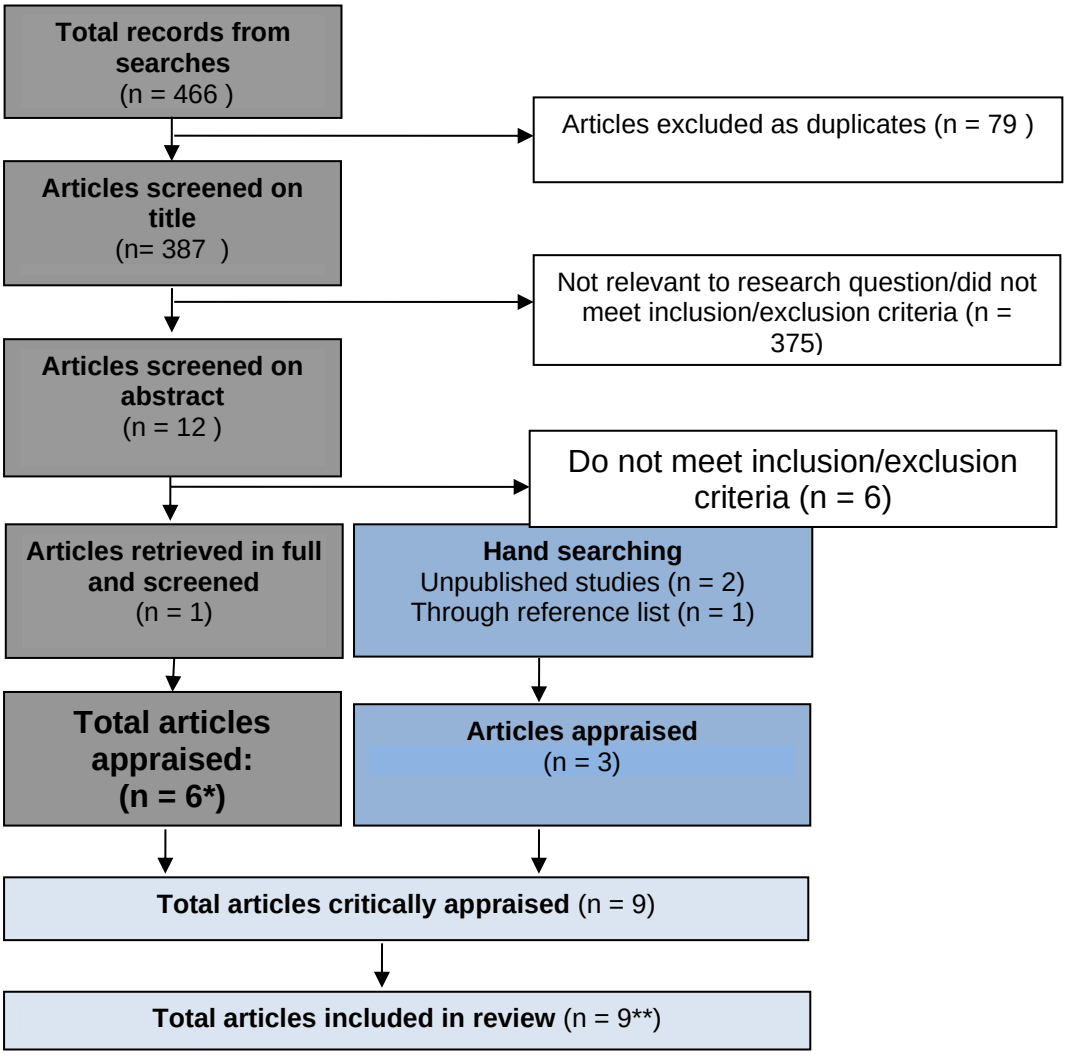
Data extracted will include: title and source of article, study population, main findings and authors conclusions.

3. Review outputs

The following key outputs will be available:

- An inclusion/exclusion flow diagram
- Completed evidence table
- Completed evidence statement

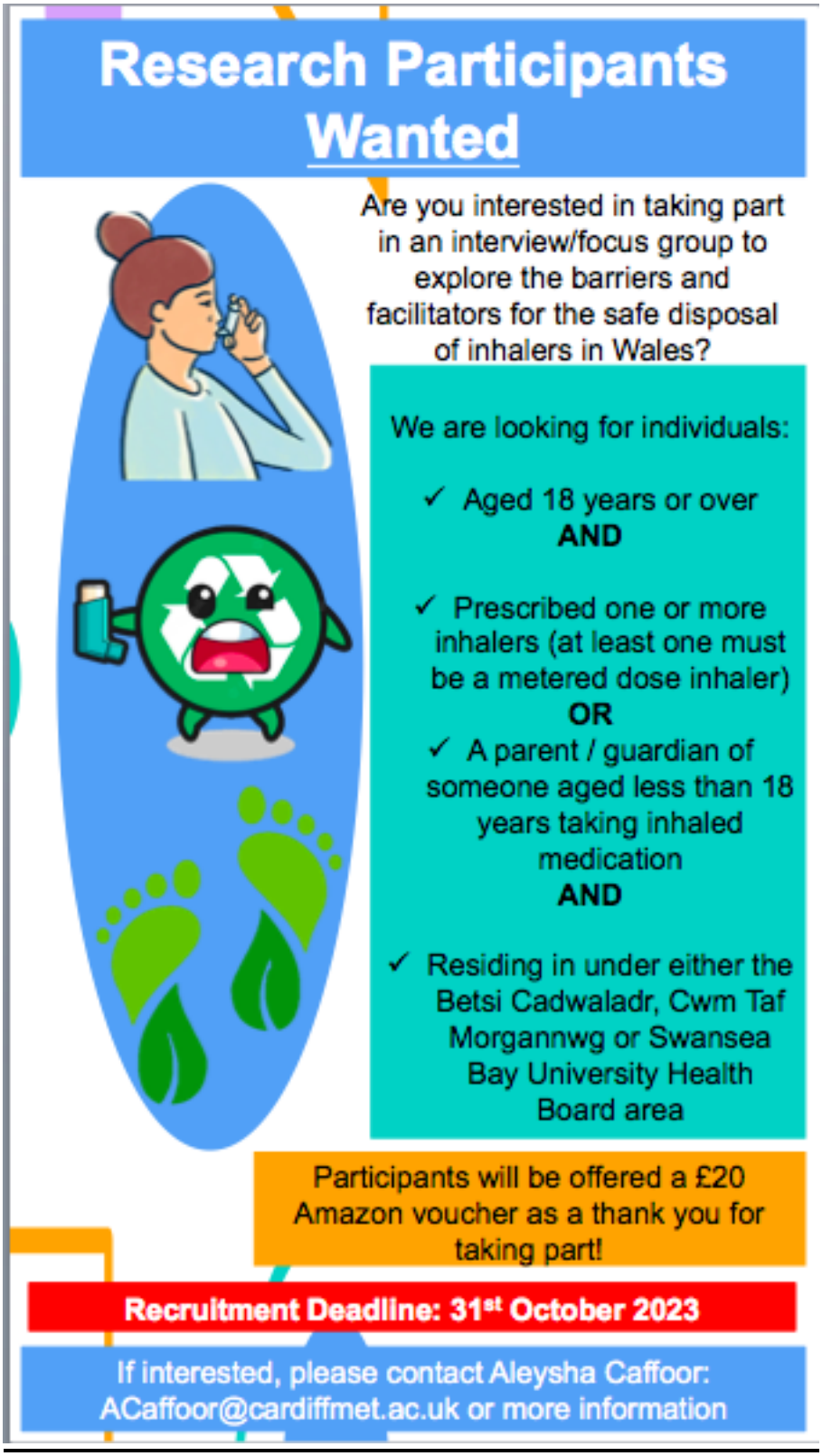
Figure 1: Inclusion/exclusion flow diagram



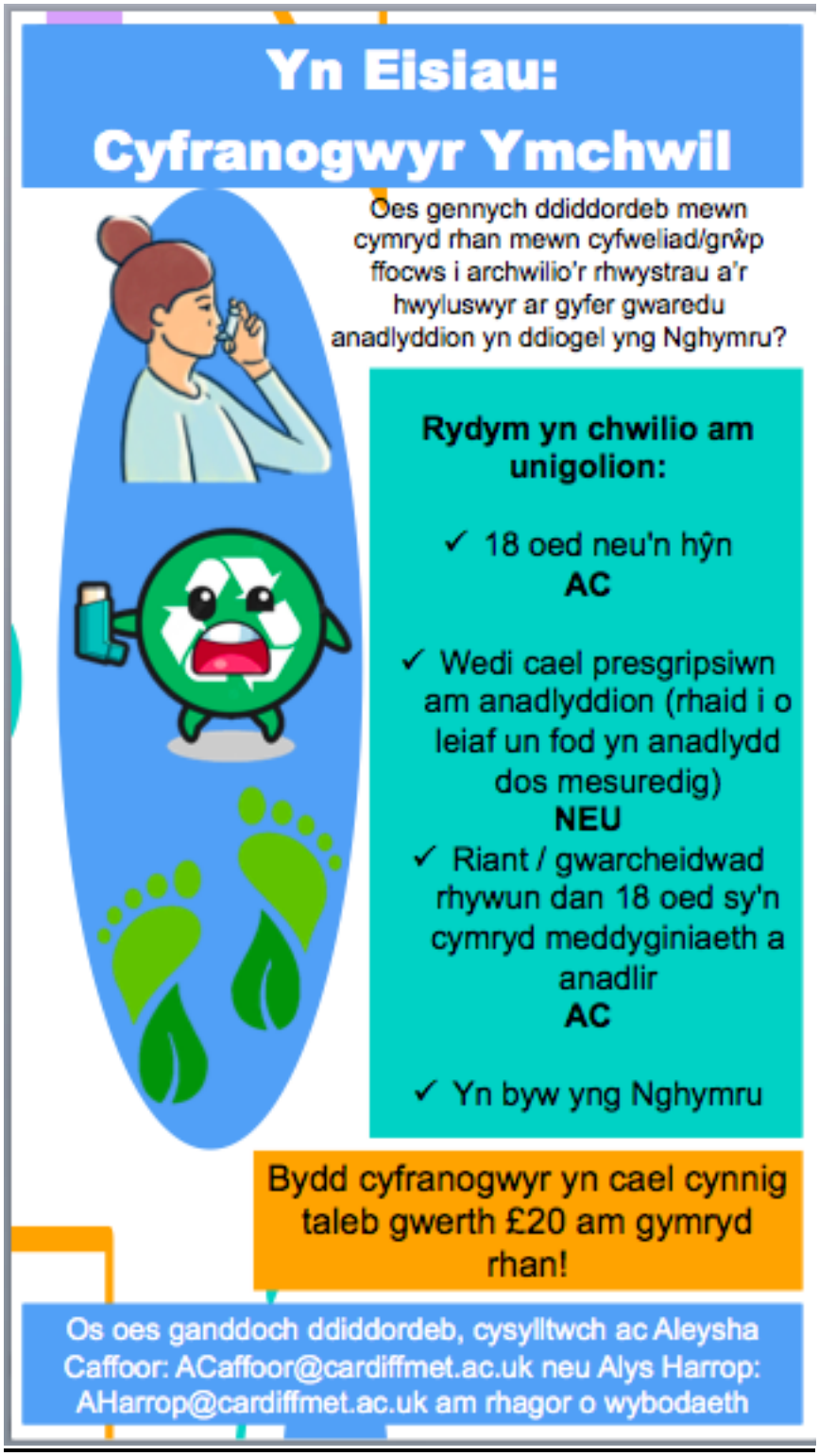
* Some abstracts did not have full paper publication and therefore abstract only studies were included in the final appraisal process. Out of the six studies identified as eligible, five were abstract only.

** Following the later decision to include international studies, a further three studies were included which met all eligibility criteria (minus the requirement to be UK based) to take the total to 12 studies overall.

Appendix 2 - Service User Promotional Poster (English Version)



Appendix 2: Service User Promotional Poster (Welsh Version)



Appendix 3: Service User Interview Schedule

Introductory Questions

1. Which community pharmacy do you mainly use?
2. Are you aware of whether this community pharmacy has an inhaler-recycling scheme? If you were to create an inhaler-recycling scheme, what would it look like?
3. Does your community pharmacy have a recycling scheme for any other medication?
4. Are you aware of the environmental impact that the gases within inhalers have on the environment? Could you tell me what you know about it?

Interview Questions

COM-B MODEL	THEORETICAL DOMAINS FRAMEWORK	QUESTION
PSYCHOLOGICAL CAPABILITY	Knowledge	What methods and/or processes of inhaler recycling do you know of, if any?
	Memory, attention and decision process	How easy or difficult is it to remember to bring back your empty/unwanted inhalers back to the pharmacy?
	Behaviour regulation	Do you ever receive advice about the disposal of inhalers by community pharmacy staff? In terms of recycling, do you ever receive feedback on your performance of inhaler disposal from community pharmacy staff?
PHYSICAL CAPABILITY	Skills	How do you dispose of your inhalers?
SOCIAL OPPORTUNITY	Social influences	Does community pharmacy staff guide you on how you should recycle and correctly dispose of your inhalers?
PHYSICAL OPPORTUNITY	Environmental context and resources	To what extent does your pharmacy environment have the sufficient resources to: 1. Inform you about what you should do with your used/unwanted inhalers. And 2. Recycle your inhalers.
REFLECTIVE MOTIVATION	Social/professional role and identity	To what extent do you consider performing the steps in the correct disposal of inhalers a part of your role?
	Belief about capability	Are there any steps of returning your inhaler back to the pharmacy that you are more or less confident about performing (and why)? What step(s) would you be most/least confident about performing (and why)?

	Optimism	How optimistic or pessimistic are you that you would return your inhalers back to the pharmacy for correct disposal and recycling in the future?
	Intention	To what extent do you intend to correctly recycle your inhalers by returning them back to your pharmacy?
	Goals	Do you have any specific goals revolving around inhaler recycling? Do you have any specific goals for improving sustainability through correct inhaler disposal?
	Belief about consequences	To what extent do you believe that returning your inhaler back to the pharmacy for recycling could improve sustainability both now and in the future?
AUTOMATIC MOTIVATION	Reinforcement	Are you aware of any rewards given to service users for returning their inhalers to pharmacies to be recycled? Would you be more likely to return your inhalers back to the pharmacy if there was a reward scheme in place?
	Emotion	Why don't you return your inhalers back to the pharmacy to be recycled? To what extent do you feel that your emotional state towards sustainability affects your performance of inhaler disposal?

Appendix 4: Community Pharmacy Interview Schedule

Introductory Questions

1. **Which community pharmacy do you mainly work at?**
2. **Does this community pharmacy have an inhaler-recycling scheme? How long has the scheme run for?**
3. **Are you aware of the environmental impact that the gases within inhalers have on the environment? Could you tell me what you know about it?**

Interview Questions

COM-B MODEL	THEORETICAL DOMAINS FRAMEWORK	QUESTION
PSYCHOLOGICAL CAPABILITY	Knowledge	What methods and/or processes of inhaler recycling do you know of, if any?
	Memory, attention and decision process	How easy or difficult is it to remind service users to bring back their empty/unwanted inhalers back to the pharmacy (to be recycled)?
	Behaviour regulation	Do you receive any feedback from other healthcare organisations on your performance of recycling inhalers that service users bring back?
PHYSICAL CAPABILITY	Skills	How do you dispose of returned inhalers? How do you manage the service users in recycling their inhalers? Can you tell me the process of recycling inhalers in this pharmacy?
SOCIAL OPPORTUNITY	Social influences	Are you guided by healthcare organisations in terms of implementing inhaler-recycling schemes? If so, which ones?
PHYSICAL OPPORTUNITY	Environmental context and resources	To what extent does your working environment have the sufficient resources needed to: 1. Encourage service users to return their inhalers back to the pharmacy for correct disposal. And 2. Recycle inhalers.
REFLECTIVE MOTIVATION	Social/professional role and identity	To what extent do you consider performing the steps in the current disposal of inhalers a part of your role as a healthcare professional? What happens when service users are inconsistent in returning their inhalers back to the pharmacy?
	Belief about capability	Which aspects of encouraging service users to bring back their

		inhalers to pharmacies are you most and least confident about? Are there any particular steps in the inhaler recycling process that you are more of less confident about performing?
	Optimism	How optimistic or pessimistic are you that getting service users to return their inhalers for correct disposal holds the potential to improve sustainability for the future?
	Intention	To what extent do you intend to remind service users to return their inhalers back to the pharmacy?
	Goals	Do you have any specific goals for increasing the number of service users returning their inhalers back to the pharmacy? Do you have any specific goals for improving sustainability through inhaler recycling?
	Belief about consequences	When should you advice service users about the process of returning their inhalers back to pharmacies to be recycled? To what extent do you believe that recycling inhalers can improve sustainability?
AUTOMATIC MOTIVATION	Reinforcement	Are there any ways in which recycling inhalers is rewarded? Do you believe that service users would be more inclined to bring back inhalers if there was a reward scheme in place?
	Emotion	How do you handle the situation when service users do not return their inhalers back to the pharmacy to be recycled? Why don't you recommend/ encourage service users that they should return their inhalers back to the pharmacy? To what extent do your emotions toward sustainability affect your recommendations of patients returning inhalers back to pharmacies to be recycled?

Appendix 5: Service User Focus Group Schedule

- **Welcome.**
- **Research assistant and service user introductions to the focus group.**
- **Housekeeping:** Explanation of moderator and research assistant roles.
- **Overview of the topic:** Check all have read the participant information sheet and signed consent forms. Double check all are willing for the discussion to be recorded. Re-state confidentiality e.g. what is spoken of in the group does not get taken 'outside'.

1a. Which community pharmacy do you mainly use?

1b. Are you aware of whether this community pharmacy has an inhaler-recycling scheme? If you were to create an inhaler-recycling scheme, what would it look like?

1c. Does your community pharmacy have a recycling scheme for any other medication?

1d. Are you aware of the environmental impact that the gases within inhalers have on the environment? Could you tell me what you know about it?

2a. What methods and/or processes of inhaler recycling do you know of, if any?

2b. How easy or difficult is it to remember to bring back your empty/unwanted inhalers back to the pharmacy?

2c. Do you ever receive advice about the disposal of inhalers by community pharmacy staff?

2d. In terms of recycling, do you ever receive feedback on your performance of inhaler disposal from community pharmacy staff?

2e. How do you dispose of your inhalers?

2f. Does community pharmacy staff guide you on how you should recycle and correctly dispose of your inhalers?

3a. To what extent does your pharmacy environment have the sufficient resources to:

- Inform you about what you should do with your used / unwanted inhalers
- Recycle your inhalers.

3b. To what extent do you consider performing the steps in the correct disposal of inhalers a part of your role?

3c. Are there any steps of returning your inhaler back to the pharmacy that you are more or less confident about performing (and why)?

3d. What step(s) would you be most/least confident about performing (and why)?

4a. How optimistic or pessimistic are you that you would return your inhalers back to the pharmacy for correct disposal and recycling in the future?

4b. To what extent do you intend to correctly recycle your inhalers by returning them back to your pharmacy?

4c. Do you have any specific goals revolving around inhaler recycling?

4d. Do you have any specific goals for improving sustainability through correct inhaler disposal?

4e. To what extent do you believe that returning your inhaler back to the pharmacy for recycling could improve sustainability both now and in the future?

4f. Are you aware of any rewards given to service users for returning their inhalers to pharmacies to be recycled?

4g. Would you be more likely to return your inhalers back to the pharmacy if there was a reward scheme in place?

5a. Why don’t you return your inhalers back to the pharmacy to be recycled?

5b. To what extent do you feel that your emotional state towards sustainability affects your performance of inhaler disposal?

Appendix 6: Community Pharmacy Focus Group Schedule

- **Welcome.**
- **Research assistant and community pharmacist introductions to the focus group.**
- **Housekeeping:** Explanation of moderator and research assistant roles.
- **Overview of the topic:** Check all have read the participant information sheet and signed consent forms. Double check all are willing for the discussion to be recorded. Re-state confidentiality e.g. what is spoken of in the group does not get taken 'outside'.

1a. Which community pharmacy do you mainly work at?

1b. Does this community pharmacy have an inhaler-recycling scheme?

1c. Could you describe the inhaler recycling scheme? How long has the scheme run for?

1d. What has your experience within your community pharmacy been with the implemented inhaler recycling scheme?

1e. How have you been involved with the inhaler recycling scheme?

1f. Are you aware of the environmental impact that the gases within inhalers have on the environment? Could you tell me what you know about it?

2a. What methods and/or processes of inhaler recycling do you know of, if any?

2b. How easy or difficult is it to remind service users to bring back their empty/unwanted inhalers back to the pharmacy (to be recycled)?

2c. Do you receive any feedback from other healthcare organisations on your performance of recycling inhalers that service users bring back?

2d. How do you dispose of returned inhalers?

2e. How do you manage the service users in recycling their inhalers? How have service users interacted with the scheme?

2f. Has there been a lot of engagement? Why do you think there has/hasn't been that level of engagement?

3a. Can you tell me the process of recycling inhalers in this pharmacy?

3b. Are you guided by healthcare organisations in terms of implementing inhaler-recycling schemes? If so, which ones?

3c. To what extent does your working environment have the sufficient resources needed to:

- Encourage service users to return their inhalers back to the pharmacy for correct disposal / Recycle inhalers.

3d. To what extent do you consider performing the steps in the current disposal of inhalers a part of your role as a healthcare professional?

3e. What happens when service users are inconsistent in returning their inhalers back to the pharmacy?

3f. Which aspects of encouraging service users to bring back their inhalers to pharmacies are you most and least confident about?

3g. Are there any particular steps in the inhaler recycling process that you are more of less confident about performing?

3h. How optimistic or pessimistic are you that getting service users to return their inhalers for correct disposal holds the potential to improve sustainability for the future?

3i. To what extent do you intend to remind service users to return their inhalers back to the pharmacy?

4a. What needs improvement with the scheme? Tell me about the disappointments you've had with the inhaler recycling scheme.

4b. Do you have any specific goals for increasing the number of service users returning their inhalers back to the pharmacy?

4c. Do you have any specific goals for improving sustainability through inhaler recycling?

4d. When should you advise service users about the process of returning their inhalers back to pharmacies to be recycled?

4e. What has been going particularly well with the scheme? Tell me about the positive experiences you've had using the inhaler recycling scheme.

4f. To what extent do you believe that recycling inhalers can improve sustainability?

4g. Are there any ways in which recycling inhalers is rewarded?

4h. Do you believe that service users would be more inclined to bring back inhalers if there was a reward scheme in place?

4i. How do you handle the situation when service users do not return their inhalers back to the pharmacy to be recycled?

4j. Why don't you recommend/encourage service users that they should return their inhalers back to the pharmacy?

4k. To what extent do your emotions toward sustainability affect your recommendations of service users returning inhalers back to pharmacies to be recycled?

5a. What can community pharmacies across all health boards to do make the scheme better?

5b. If you were coming up with an inhaler recycling scheme, what would you do? What would it look like?

Appendix 7 – Findings for Evidence Map

Why don't patients return used or unused inhalers to community pharmacies?

A total of 12 published papers which met the criteria were included in the results for the evidence map conducted in September 2022 and update monthly until January 2023. See tables below for information about the title, source, a description of the population, findings plus authors' conclusions for reference numbers 1 to 12.

The literature search was repeated in July 2023 and repeated monthly up to January 2024. One additional published paper was found, details of which are summarised in Table 1 below.

Table 1: Findings from updated literature search to inform evidence map (n=1)

Ref no.	Title and source	Population	Findings	Authors' conclusions
13	Murphy, A., Howlett, D., Gowson, A. et al. Understanding the feasibility and environmental effectiveness of a pilot postal inhaler recovery and recycling scheme. npj Prim. Care Respir. Med. 33, 5 (2023a). https://doi.org/10.1038/s41533-023-00327-w	Community Pharmacies and Hospitals Pharmacies based in Leicester, Leicestershire, and Rutland (LLR) .	The pilot postal inhaler recovery and recycling scheme ran for 12-months. Over 20,049 inhalers were returned to the waste management centre (approx. 2% of inhalers prescribed in LLR) Most inhalers were pMDIs (77%) The scheme saved an estimated 119.3 tonnes of carbon dioxide emissions. A survey (n=49) that 90% of respondents were satisfied with the scheme	The pilot demonstrated the feasibility and effectiveness of a postal inhaler recovery and recycling scheme. Voluntary uptake of schemes in 65% community pharmacies within LLR Patient engagement gradually increased suggesting that it took time for people to incorporate return of inhalers into their routine.

Reference number and corresponding database in which study was found.
EMBASE/Medline - Reference number 13.
NHS Evidence - None
Studies found outside of formal search procedure - None
Grey literature – None
International Evidence - None

Ref No.	Title & Source	Population	Findings	Authors conclusions
1.	Vos et al. 2020 Inhaler recycling prevalence in a secondary care clinic in England Available here (Abstract only)	261 inhaler users in a secondary care clinic in England	Only 35% (92/261) recycled their inhalers through the appropriate scheme. 57% (148/261) weren't aware that inhalers could be recycled & put their inhalers in the bin. 21 patients (8%) put their inhalers in the kerbside recycling bin, so had attempted recycling but were not aware that these inhalers would still end up in landfill. 100% said they would appropriately recycle their inhalers in the future.	Knowledge around inhaler recycling is poor & consequently only 1/3 of inhalers are recycled. Inhaler recycling should be discussed routinely, ideally as part of inhaler technique checks, to increase knowledge around recycling facilities as patients are keen to recycle their inhalers. Pharmaceutical companies should also encourage recycling on the packaging & every pharmacy should support inhaler recycling.
2.	Walpol et al. 2020 Ease of use, effectiveness and environmental impacts: Evaluating inhaler prescriptions, patient preferences and opportunities for improvement Available here (Abstract only)	20 patients prescribed DPI or MDI inhalers in Newcastle Hospitals, Newcastle Upon Tyne, undertook a survey to assess patients' inhaler prescriptions, technique and preferences.	4/20 knew that they could return inhalers to pharmacies for recycling. 6/20 knew that inhalers should not be put in council recycling bins.	No further conclusions outside of given results: Education and awareness appear key contributors
7.	Walpol et al. 2021 An investigation into hospital prescribers' knowledge and confidence to provide high-quality, sustainable respiratory care Available here	102 secondary care prescribers from NHS trusts	13/102 (12.7%) have previously discussed inhaler recycling with patients. 28/102 (27.5%) were aware that recycling is possible but do not discuss it with patients. 57 (55.9%) did not know that inhalers can be recycled at pharmacies.	46% of respondents expressed that they would educate patients about the environmental impacts of inhalers if they were provided with education and support to do so. Awareness of the environmental impact of inhaler choice is an area that should be targeted.

9.	Roome et al. 2021 Reducing the environmental impact of inhaler use and disposal within paediatrics and the local community Available here (Abstract only)	Patients and staff at Frimley Health Trust enrolled in an inhaler recycling scheme, with education about the importance of safe inhaler disposal.	Gained positive feedback from staff and patients who felt empowered to make sustainable choices, and all expressed a willingness to dispose of inhalers to reduce the negative environmental impacts.	No further conclusions outside of given results: Education and awareness appear key contributors
Ref No	**Title & Source**	**Population**	**Findings**	**Authors conclusions**
3.	Nurse et al. 2022 Improving environmental sustainability of inhaler use in paediatric asthma patients Available here (Abstract only)	Patients in Evelina Children hospital, London surveyed to measure baseline awareness of the safe disposal and environmental impact of MDIs.	Following awareness interventions, three rounds of patient survey data post clinic were collected. Patient awareness of correct inhaler disposal in round one (n=3) was 0%. In the second round (n=12), 25% showed awareness. However, 0% of participants with awareness attributed this to the interventions. Round three (n=16) showed 50% of participants had awareness, with 62.5% of this population directly attributing their awareness to the interventions	Interventions shown promising initial impact on awareness, although it would be prudent to further push messaging via social media, especially involving Asthma UK. This information needs to become implemented into asthma care as standard to make a larger impact.
8.	Liatsikos et al. 2021 A regional study of the availability, uptake and barriers to inhaler recycling: Promoting environmental sustainability Available here (Abstract only)	21 pharmacies in Liverpool surveyed to determine how many inhalers they dispensed and whether they offered safe disposal and recycling. If they recycled, what scheme was used and how it was promoted. If not, why and what would encourage them to participate.	Received 21 questionnaire responses from 14 of 21 pharmacies approached. 64% (9/14) accepted inhalers for safe disposal and 28% (4/14) reported accepting inhalers for recycling. However, on further investigation, this was for safe disposal only. Only 9.8% of inhalers dispensed were returned for safe disposal. Sustainability and monetary incentives were the main reported driving factors for recycling engagement, and all pharmacies would consider subscribing to a recycling scheme	Safe disposal uptake is very low. Promotion, patient education and investment are required for the NHS to meet its sustainability targets.

Ref No.	Title & Source	Population	Findings	Authors conclusions
4.	Baithun et al. 2022 'I know where you bin': inhaler use and disposal practices within paediatrics at Milton Keynes University Hospital Available here (Abstract only)	Surveys administered to staff and patients between October 2021 - January 2022. The staff survey was open to all health professionals in Paediatrics. The patient survey was aimed at parents/carers of children who use inhalers in both inpatient and outpatient settings.	36 staff responses and 60 patient responses 61% of staff respondents felt they were not very well informed on the environmental impact of inhalers, and less than 20% said they advise patients on how to dispose of their inhalers. 36% of staff surveyed did not know of any methods for responsibly disposing of inhalers. Results from the patient survey showed that 48.3% of respondents cared for a child who had been using inhalers for five or more years, but only 10% returned used inhalers to the pharmacy for incineration. Most parents/caregivers (68.3%) were disposing of inhalers in the general waste bin. Only one respondent to the patient survey asserted that they had ever been given advice about how to dispose of an inhaler. Promisingly, 98.3% of respondents stated they would like to use a recycle point if it were available, and the majority said they would seek this out (51.7%).	There is limited knowledge of the environmental impact of inhalers amongst paediatric staff and parents/caregivers. However, most are open to receiving more information and parents and caregivers would value access to an inhaler recycling point.
Ref No.	**Title & Source**	**Population**	**Findings**	**Authors conclusions**

5.	Sivarajasingam, 2021 Understanding patients' knowledge of inhaler recycling Available here	100 patients registered at a GP practice in London asked to comment on the method of disposal of their inhalers. Age range; 3–93 years; 44% were male (n = 44); 56% female (n = 56). There were 16 children aged <10 years for whom the parent answered questions. 91% of patients used their inhalers for >6 months, the majority from childhood.	Of 100 patients, two recycled their inhalers correctly by giving back to the local pharmacy. 87% (n = 87) were not aware that inhalers could be recycled and put their inhalers in the domestic bin. 11% (n = 11) put their inhalers in the domestic recycling bin, so had attempted recycling but were not aware that these inhalers would still end up in landfill. All responders confirmed they would return their unused, expired, or empty inhalers to their pharmacy in the future. Patients were surprised that such fundamental information was not shared by clinicians during consultations, or pharmacists during dispensing.	The study highlights a lack of knowledge and understanding on safe disposal of inhalers among the patient population. Engagement and empowerment of patients regarding the safe disposal of inhalers should be a priority General practice is ideally placed to introduce changes. Safe disposal instructions should be provided by all healthcare providers in routine patient education. Primary care clinicians can easily provide instructions on how to dispose of the inhalers when prescribing and issuing prescriptions. Persistent education towards communities will no doubt heighten the understanding of the importance of appropriate recycling of inhalers.
6.	Sivarajasingam, 2021 How general practice can support safe asthma inhaler disposal Available here	70 patients registered at a GP practice in London were asked about their use of inhalers, inhaler disposal practice, current knowledge of recycling of inhalers and, if they were aware of recycling, where they had obtained this information.	Only one patient (who was a pharmacist) recycled their inhalers correctly by taking it back to the local pharmacy. 86% (60/70) were not aware that inhalers could be recycled and put their inhalers in the domestic bin. 13% patients (9/70) put their inhalers in the domestic recycling bin, so had attempted recycling but were not aware that these inhalers would still end up in landfill. 100% said they would return their unused, expired or empty inhalers to their pharmacy in the future. All patients felt the information about safe disposal of inhalers was not shared by clinicians during consultations or pharmacists during dispensing. A few patients welcomed the idea of having a 'recycle bin' for the inhalers in the practice which could be collected by the pharmacy	There is a lack of knowledge and understanding on how to dispose of the inhalers amongst the patient population. Engagement and empowerment of patients regarding the safe disposal of inhalers should be a priority. Safe disposal instructions should be provided by all healthcare providers in routine patient education. Inhaler recycling should be discussed routinely, ideally as part of inhaler technique checks, to increase knowledge around recycling facilities as patients are keen to recycle inhalers where possible. Displaying information in waiting rooms and posting to social media and the surgery website would further highlight this. Patients should be encouraged to return their inhalers to a pharmacy for safe disposal.

Ref No.	Title & Source	Population	Findings	Authors conclusions
10.	Sim et al. 2018 Development and Validation of the Return and Disposal of Unused Medications Questionnaire (ReDiUM) in Malaysia Available here	338 Community-dwelling adults who were able to answer the questionnaire in English	The majority of participants (94.4%) knew that improper drug disposal has harmful effects on the environment. **However, knowledge was low (11.2%) regarding the disposal of pressurized metered-dose inhalers in the garbage**. 72.0% agreed that media reports and campaigns would influence their willingness to return unused medications. Discarding unused medications was deemed wasteful by 75.7% of participants. Although 84.3% of participants were willing to donate their non-expired, unused medications to reduce waste, as high as 63.2% agreed that their willingness to return unused medications was influenced by whether there was any monetary incentive for doing so. Additionally, if they paid for their medications, 46.4% expected a refund when returning medications.	Public education campaigns may be needed in Malaysia to further improve public knowledge on safe methods of disposal for unused medications, which could modify their behaviour with regard to possession and disposal of unused medications. Information gathered from the administration the ReDiUM questionnaire can inform policymakers to formulate strategies to reduce wastage of medications and thus reduce its harmful effects on the environment
11.	Ong et al. 2020 Knowledge, attitude and disposing practice of unused and expired medicines among the general public in Malaysia Available here	483 general public subjects involved in a descriptive, cross-sectional survey conducted across Malaysia using a pre-validated questionnaire designed to study the public's knowledge, awareness and practice of disposing of unwanted or unused medicines	13.8% of the respondents scored >80% in their knowledge of the proper disposal methods. Majority of the respondents were very mindful of their responsibility towards the environment (95.3%), living species on earth (94.6%) and family members (96.7%) attributable to unintentional harmful exposure to unused medicines. **Only 14.3% of the respondents understood that it was wrong to dispose of pressurized meter-dose inhalers in the garbage**. A substantial correlation has been established between the knowledge of improper disposal methods and their current practices.	Knowledge and awareness of disposal methods had a major impact on actual disposal practice. This finding suggests that lack of knowledge and awareness is a major factor in the improper disposal of unused medicines

12.	Wajid et al. 2020 Prevalence and Practice of Unused and Expired Medicine—A Community-Based Study among Saudi Adults in Riyadh, Saudi Arabia Available here	337 people living in Riyadh, Saudi Arabia. The majority of respondents were university graduates (n = 251) who completed a cross sectional web-based design to collect data on the prevalence and practice of unused and expired medicine	The prevalence of unused or expired medicine (**including inhalers**) among the Saudi community was 89.3%. When we asked about what they do with unused or expired medicine, 219 (65%) of the respondents keep the medicine until it expired while 48.1% throw away in household garbage, 46 (13.7%) agreed to give it to friends or relatives; only 18 (5.4%) said they give it back to the medical store. 85.5% said that the government is responsible for creating awareness about the proper disposal of unused and expired medicines while 38.3% agreed that it should be the pharmaceutical industries.	Increasing awareness through education programs about proper disposable guidelines is necessary for controlling the medication wastage.

Key: Reference numbers and corresponding database in which study was found.

EMBASE/Medline - Reference numbers 1, 2, 7, and 9.

NHS Evidence - Reference numbers 3 and 8.

Studies found outside of formal search procedure - Reference number 4.

Grey literature – Reference numbers 5 and 6.

International Evidence - Reference number 10, 11 and 12.