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Greener Asthma Prescribing: A qualitative study
exploring primary healthcare professional
perspectives on reducing prescribing of metered
dose inhalers for asthma

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DECLARATION

This thesis was undertaken as part of an intercalated degree between fourth and fifth year of an undergraduate medical degree (MBChB) at Keele University.

The idea for the project arose from initial discussions with Dr Helen Twohig and was supported by Professor Christian Mallen. The project began in August 2022.

I carried out all the interviews with the participants included in this study. The transcripts were produced using the automated feature in Microsoft Teams and were subsequently checked by myself. The analysis, interpretations, and discussion of findings in this thesis are my own.

ABSTRACT:

Background: In 2020, the NHS developed its carbon net zero goals and highlighted metered dose inhalers (MDIs) as a focal point for change. MDIs are commonly prescribed for asthma in primary care and contain potent greenhouse gases, accounting for 3% of the NHS' carbon footprint. Despite targets to reduce MDI prescribing and increase use of dry powdered inhalers (DPIs), there is little evidence to support active implementation of this guidance and realisation of these targets. This study aims to explore healthcare professionals' perspectives on reducing the prescribing of MDIs for people with asthma.

Methods: Semi-structured interviews with general practitioners, practice nurses and clinical pharmacists were performed, using topic guides that were iteratively developed using a constant-comparison approach. Participants were recruited through supervisor networks alongside snowball and purposeful sampling. Data were analysed using thematic analysis. A patient and public involvement and engagement group (PPIE) were involved in this study at the research design phase.

Results: 18 healthcare professionals were interviewed: 8 general practitioners, 6 practice nurses and 4 clinical pharmacists. The findings are divided into two sections. The first section focuses on factors that influence decision-making when choosing which inhaler to prescribe for asthma and includes the themes: Patient-centred care; Making assumptions; Status quo; and Clinician confidence and knowledge. The second section discusses barriers and facilitators to reducing the proportion of MDIs prescribed and includes the themes: Awareness; Attitudes towards change; Engagement with sustainable prescribing; the role of incentives; and Guidelines and systems.

Conclusions: Prescriber, consultation and external factors influence inhaler device decision-making in primary care. Clinicians lack knowledge of key elements of asthma management, importantly inhaler technique. Organisational culture impacts decision-making and must be adapted to accommodate low-carbon asthma care. Education will play a vital role in improving the quality of

asthma management in primary care and reducing carbon emissions associated with inhaler prescribing.

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I would like to thank the PPIE team for giving me insight into their asthma experience, which has inevitably shaped the project for the better.

Special thanks go to my friends and loved ones for being sources of constant motivation and support throughout this process.

MOTIVATIONS FOR UNDERTAKING THIS INTERCALATED MPhil

My aim is to have a career divided between clinical and academic medicine, so the MPhil appealed to me as it allows me to explore academic medicine full-time and to see if this is a viable career path for me. During medical school, I have completed a few small research projects, through a summer studentship and clinical audits. This has given me a basic understanding of quantitative research and academic writing. Despite this, I haven't had the opportunity to explore qualitative research or conduct a systematic review. Therefore, a huge motivator for carrying out this degree was to gain different research skills, through research training and through the project itself, to prepare for applying to an academic foundation programme in 2024. I was also motivated by the opportunity to explore extra-curricular interests within this year.

At this point in time, I am unsure which medical speciality I would like to go into however I am certain that I am passionate about the environment and reducing healthcare's impact on the planet. I am an advocate for climate action within my personal life, as well as through the Planetary Health Report Card (PHRC). Since my second year in medical school, I have been Keele University's Lead for the PHRC, an international organisation to evaluate and promote the inclusion of sustainability and planetary health within the medical school curriculum. Since the beginning of this project, Keele has continuously ranked at top in the UK. Following on from this, I have represented the UK on their international committee for 2022/23 as their data and analytics lead and have been invited to both the British Medical Association (BMA) and General Medical Council (GMC) to discuss the importance of incorporating this into the medicine curriculum. Throughout this advocacy work, my passion for climate action has only strengthened and combining this with my future career as a doctor only seems natural.

Since the NHS carbon net zero goals were announced in 2020, the carbon emissions associated with healthcare has become a more prevalent topic within the UK, especially regarding inhalers. Given

the important role inhalers play in reducing carbon emissions and the opportunity this brings to impact current clinical practice, designing an MPhil focussing on this was ideal as it aligns with something I'm passionate about.

ABBREVIATIONS

DPI	Dry Powder Inhalers
GWP	Global Warming Potential
HCP	Healthcare Professional
MDI	Metered Dose Inhalers
MDI	Pressurised Metered Dose Inhalers
SMI	Soft Mist Inhalers
SABA	Short-acting beta agonist
ICS	Inhaled corticosteroids
LABA	Long-acting β 2-agonists
RCGP	Royal College of General Practitioners
IIF	Investment and Impact Fund
GP	General Practitioner
PN	Practice Nurse
CP	Clinical Pharmacist

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1. BACKGROUND

In this chapter, I will outline the impacts of climate change on human health and healthcare systems, as well as introducing the concept of sustainability. I will also provide an overview of asthma and describe how the current management of asthma is contributing to healthcare's carbon footprint.

1.1 CLIMATE CHANGE, HEALTH AND HEALTHCARE

1.1.1 Introduction to Climate Change

Climate change is the most important issue facing our world today, having profound implications for the natural world and those who inhabit it. The term 'climate change' refers to the shift in average weather patterns, including temperature, rainfall, and humidity, secondary to global warming (1). Greenhouse gas (GHG) emissions, primarily carbon dioxide, are the largest contributor to global warming and reducing the release of these gases is an important strategy in addressing climate change (2). The Intergovernmental Panel on Climate Change (IPCC) suggest that global temperatures should not rise 1.5°C above pre-industrial levels, but this is predicted to occur within the next 30 years without immediate climate action (3). This recommendation was made in order to prevent millions of climate change associated deaths, however an increase of 1.5°C will still vastly impact health and healthcare systems, discussed further in Section 1.1.2 (3,4). In 2015, the Paris Agreement was created at the COP21 Conference in Paris and was initially negotiated by 197 parties, including the European Union (EU) (5). This treaty legally commits all signatories to lowering emissions to limit global warming to 2°C by the end of this century and is widely considered a landmark piece of legislation in the fight to halt global warming (5,6). To adhere to both IPCC advice and the Paris Agreement, total GHG emissions need to be reduced by 50% by 2030 and reach net zero by 2050 (3). To reach net zero levels of emissions, the amount of anthropogenic GHG emissions would have to be equivalent to the GHG removal from the environment, which can either be achieved through a zero-emission state or through increasing removal efforts (7). In order to achieve this, immediate action

needs to be taken to reducing carbon emissions, altering the way that we produce and consume resources and fundamentally how we live our lives.

1.1.2 The Impact of Climate Change on Health

Climate change is widely considered to be the biggest threat to human health that has faced humanity so far (4,8,9). It is expected to precipitate an additional 250,000 deaths annually from 2030 onwards, as well as compromising the last 50 years of improvement to public health and progress made towards reducing health inequalities (4,8,9). Climate change will have both direct and indirect impacts on human health; however, the most significant threat comes from the increase in climate variability and extreme weather events. The increased frequency and severity of extreme weather events, such as flooding and heatwaves, are already having detrimental direct consequences to physical and mental health and are expected to worsen as global warming persists (9).

Flooding is one of the UK's biggest climate threats and is expected to impact 2.6 million people in the UK by 2040; it poses an immediate threat to life as well as significantly increasing the risk of mental health disorders, specifically post-traumatic stress disorder (PTSD) (9). Alongside direct threat to human life from extreme weather events, the biggest threats to mortality from climate change internationally will come from increased risk of infectious disease, heat stress, diarrhoea, and malnutrition (4). The incidence of communicable diseases has decreased internationally over the last century due to improved sanitation, hygiene and prevention measures, however, is set to increase due to climate change. The pattern of infectious disease spread has already started to change due to the increase in average temperatures across different countries (10). This will particularly affect vector-borne diseases, such as malaria, dengue and leishmaniasis, which are predicted to become established in countries where it is currently too cold to allow for disease transmission (10,11). The most marked example of this is the prediction of malaria transmission within the UK as early as 2030 (12). Diarrhoeal diseases, such as cholera, are also predicted to vastly increase in incidence (4).

Alongside direct impacts to human health, there will also be indirect impacts, through changes to ecosystems and our social infrastructure. One of these key indirect impacts will be food insecurity. The IPCC estimate that if global average temperatures rise more than 2°C, there will be severe effects on food availability, due to poor soil health, decreased pollinators and reduced biodiversity, resulting in widespread malnutrition and micronutrient deficiencies (13).

The impact climate change will have on our health is predicted to disproportionately impact vulnerable and disadvantaged groups, such as ethnic minorities and those in poverty, which has the potential to widen pre-existing health inequalities (4,9).

Alongside GHG emissions, there are other closely linked drivers for ill-health that impact our environment and have detriment effects on our health, such as air pollution (14). These changes to our environment are expected to worsen chronic conditions, for example respiratory disease and diabetes, and increase the number of associated hospital admissions (4,9). A study from the Environmental Research Group at Kings College London suggests that higher numbers of out-of-hospital cardiac arrests, strokes and hospitalisations from asthma occur on days when air pollution levels are higher, which increases demand for emergency care and puts pressure on healthcare services (15,16). Unfortunately, the number of days with 'moderate' or higher air pollution is increasing, from 4 days in 2021 to an average of 9 days in 2022 across monitored urban sites; this is predicted to further increase hospital admissions and have detrimental impacts on population health (17).

The severe health and social consequences associated with climate change emphasise the importance and urgency of reducing GHG emissions. To account for this, many large healthcare institutions have declared a climate emergency, including the UK Surgical Royal Colleges, the Royal College of Psychiatrists (RCPsych) and Royal College of General Practitioners (RCGP), alongside many NHS trusts (18–20). By doing so, these organisations are acknowledging their need to change their

policies and promise to act towards reducing their carbon footprint and improving their overall sustainability (21).

There are several co-benefits of climate action for human health. An example of this is the introduction of green transport schemes such as bicycle lanes, which reduce air pollution and GHG emissions. These schemes act to reduce the number of air pollution related deaths as well as decrease the incidence of diabetes, dementia, and depression due to increased exercise (9).

Another example is adopting a climate friendly diet, consisting of more plant-based foods and less red meat. Adopting a plant-based diet reduces the incidence of cardiovascular disease, bowel cancer and type 2 diabetes mellitus and is predicted to reduce the number of years prematurely lost by 7 million as well as an incidental carbon saving of 17% (22–25). Thoughtful adaptations to urban design, such as the inclusion of green spaces, have also proven beneficial to improve physical activity, psychological well-being, and social connectivity, whilst providing cooling spaces to help cities adjust to increasing heat waves (26). Therefore, whilst climate change has potentially devastating consequences for human health, climate action provides us with an opportunity to consider how simple and achievable initiatives can benefit public health.

1.1.3 The Impact of Healthcare on Climate Change

In 2019, Healthcare without Harm provided the first global estimate of healthcare’s contribution to carbon emissions, estimating the total carbon footprint to be equivalent to 2 gigatons (27). This equates to 4.4% of the total global net carbon emissions which means that if healthcare was a country, it would be the 5th largest emitter of carbon. Out of the total 2 gigatons of carbon, 17% can be attributed to the direct emissions from healthcare buildings and vehicles and 12% can be attributed to indirect emissions from purchased electricity and steam from national grids (27). However, most of the global healthcare carbon emissions (71%) are released indirectly within the supply chain. The larger contributor of indirect emissions is the pharmaceutical industry, which accounts for 12% of total healthcare emissions globally (28). Other indirect emissions include patient and employee travel, offsite waste treatment and medical equipment.

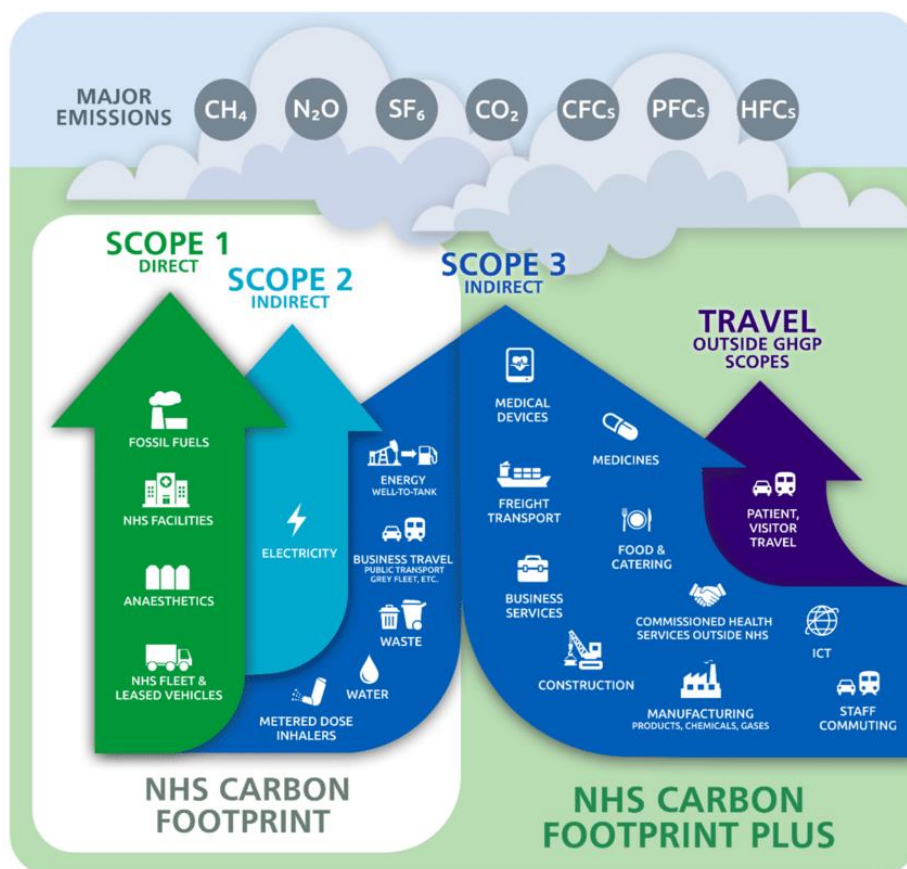


Figure 1: The Greenhouse Gas Scopes, the NHS Carbon Footprint and NHS Carbon Footprint Plus Scheme as set out in the Delivering a Net Zero National Health Service Report (29)

In the UK, the NHS contributes to 4% of England’s total GHG emissions (29). These emissions can be broadly categorised into Scope 1, Scope 2 and Scope 3. Scope 1 refers to direct emissions from owned or directly controlled sources on NHS sites. Scope 2 refers to indirect emissions from the generation of purchased energy, mostly electricity. Scope 3 refers to all other indirect emissions that occur in producing and transporting goods and services, including the full supply chain. Patient and visitor travel and over-the-counter medicines are considered outside of these three scopes. Figure 1 depicts which areas of emissions count under which scope and how the NHS Carbon Footprint and Carbon Footprint Plus schemes are divided.

Figure 2 shows the most accurate estimate for the proportion of total NHS emissions that each sector contributes. Much like the proportion seen globally, the supply chain accounts for the largest proportion of carbon emissions in the NHS at 62% (8). Because these are indirect emissions and harder to influence, the direct emissions are the current focus for change, allowing the NHS to change the carbon emissions that they have control over.

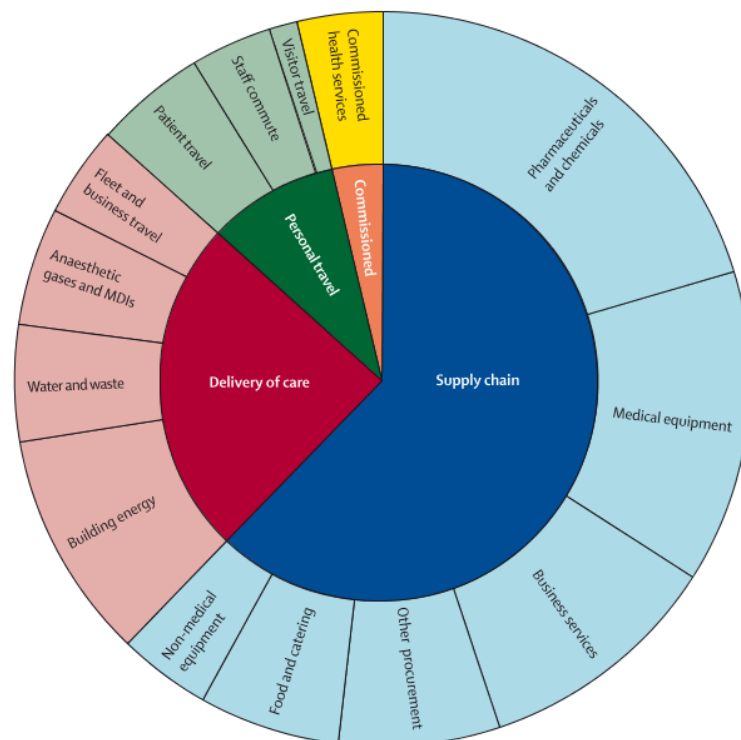


Figure 2: Estimated proportion of GHG gas emissions in the NHS by Sector (8)

Understanding which areas of healthcare have the highest carbon footprint is vital in reaching carbon neutrality, especially as every activity associated with healthcare is intrinsically carbon releasing. However, global carbon neutral healthcare is achievable, through the development and use of carbon-saving technologies as well as the streamline of existing pathways and treatments (28). As the healthcare sector will be burdened with the consequences of climate change, there is an urgent need for the healthcare sector to reduce emissions to avoid further contribution and worsening to a public health emergency.

1.1.4 A Carbon Neutral NHS

In 2020, the NHS established the Greener NHS goals and published their pathway to becoming net zero (29). These goals are to reduce the carbon emissions that the NHS directly control by 80% by 2032 and become net zero by 2040. Indirect emissions produced throughout the supply chain are planned to be net zero by 2045. If this is achieved, the NHS will become the world's first net zero healthcare system (29). Early steps for action are included within the NHS Long Term Plan Document, which include retrofitting pre-existing NHS buildings, building 40 new 'net zero hospitals' and developing a zero emission ambulance services as well as reducing the carbon associated with medical care (14,29).

The NHS has been monitoring its carbon footprint since 2008, to comply with the Climate Change Act, meaning that all carbon emissions must be reported and published (25). Through these reports, it is evident that progress has been made towards carbon neutrality within the NHS. It is estimated that the emissions categorised as the NHS Carbon Footprint have been reduced by 62% from the 1990 baseline emission level and the emissions categorised as NHS Carbon Footprint Plus (including indirect emissions from the supply chain) have been reduced by 26% (8,29). Despite the improvements that have been made, there is still significant progress to be made to hit the ambitious net zero target.

A key factor which will determine the NHS progress towards the net zero goal is the increased demand on NHS services. From 2010/2011 to 2018/2019, there was 15% increase in hospital admissions alone (30). Since 1990, there has been a gross 62% reduction in the carbon emissions associated with a single admission, however, this now represents a 26% net reduction, given the increase in use of NHS services and an increase in the number of the services offered (8). With the UK's population increasing and the overall health of the UK's population declining, preventative medicine will play a vital role in reducing the demand on healthcare services and therefore reducing overall healthcare associated emissions. This is discussed further in Section 1.2.2.

1.1.5 Low Carbon Primary Care

Primary care is an important area of focus for carbon savings, given that it is responsible for 23% of total NHS carbon emissions yet accounts for 90% of total patient encounters within the NHS (8,31). 79.4% of primary care emissions are considered clinical and 20.6% non-clinical (32). Non-clinical emissions include gas and electricity usage, staff and patient travel and equipment associated emissions, which are expected to decrease due to sustainable improvements to the approximately 9000 buildings in primary care (32). The clinical carbon footprint mostly consists of medications, which account for 57% of primary care emissions (32). The way that medications are prescribed has been highlighted as a key area to focus on in the NHS Long Term Plan, given that they contribute 25% of total NHS emissions (14,29). The reduction of over-prescribing and waste, as well as deprescribing, benefit both patient care and reduce emissions. Inhalers alone account for 43% of primary care emissions and present a great opportunity for change; a reduction of 50% of the emissions directly caused by inhalers would amount to 4% of the total carbon savings needed to meet the NHS's 2030 carbon target (33). The carbon footprint of inhalers is discussed further in Chapter 1.4. Other areas such as social prescribing and smart use of remote consultations have also been highlighted to benefit the planet and patient care.

To engage primary care staff in achieving sustainable practice, Greener Practice was established. Greener Practice is community of primary healthcare professionals, which allows passionate clinicians to network with other clinicians in their area, as well as advocating at local and national levels and providing practical information to staff on how to make sustainable changes (34). The RCGP and the National Union of Students (NUS) SOS-UK charity developed the Green Impact for Health Toolkit, which supports practices by providing extensive information on different actions that can be taken to make improvements (33,35). To align with NHS carbon net zero goals, the updated version of the toolkit contains a plan to reduce the emissions associated with the non-clinical side of a practice by 50% by 2030. Changes to the GMS Contract in 2020/21 have been made to support sustainable change, such as funding for social prescribers and goals for sustainable prescribing (33). It is unknown how effective these incentives are and how they are being utilised.

1.2 SUSTAINABILITY

1.2.1 Principles of Sustainability

Whilst there are several different definitions for sustainability, the most notable one originates from the United Nations Brundtland Commission (1987) which states that sustainability refers to ‘meeting the needs of the present without compromising the ability of future generations to meet their needs’ (36). Conventional use of the term sustainability refers solely to environmental policy however it can in fact be separated into three different concepts, referred to as the three pillars of sustainability: environment, society and economy (37). Although often used synonymously, sustainability refers to a long-term goal whereas sustainable development refers to the processes and actions taken to achieve this (38). For any development to be considered sustainable, it must consider each of the three pillars of sustainability. This reinforces the point that during the development of sustainable initiatives, more than just isolated carbon savings need to be acknowledged and that the wider economic and social impact cannot be compromised. In 2015, the Sustainable Development Goals (SDGs), were created by the United Nations, consisting of 17 interlinked objectives designed to act as a framework against which countries and organisations can compare their initiatives to ensure that sufficient progress is made towards each component of sustainability (39). These goals focus on building a healthy and just society, a stable economy and living within environmental means. The UK Health Security Agency and NHS England have both used SDGs within their Sustainable Development Strategy for NHS, Public Health and Social Care systems as well as within workforce policy, to ensure that their policies hit these goals (40,41).

1.2.2 Principles of Sustainable Healthcare

The Centre for Sustainable Healthcare have described four principles of sustainable healthcare: prevention, patient empowerment, lean pathways, and lower carbon emission options (42,43).

Figure 3 demonstrates these four principles.

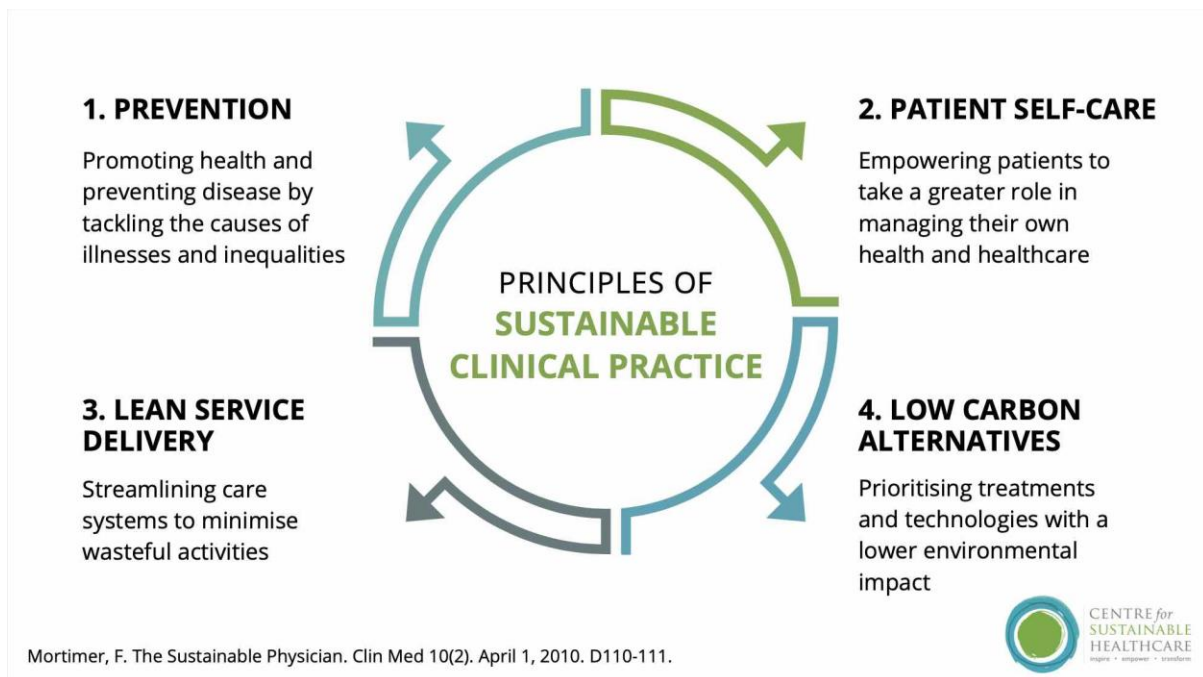


Figure 3: The Four Principles of Sustainable Healthcare Diagram from Centre of Sustainable Healthcare (43).

Prevention and health promotion acts to remove the burden of disease and demand for healthcare intervention (44). With an increasing population and rising incidence of chronic disease, the strain on healthcare services will continue to grow, leading to higher carbon emissions due to volume of use. Given the complex relationship between good health and health inequalities, progress in disease prevention will have to be multidisciplinary, with involvement from primary care and public health and significant improvement in social policy (44). Health promotion interventions also have the potential to provide co-benefits for the climate, for example through the reduction in pollution associated with increased access to green spaces and cycle lanes.

The second principle is patient self-management, which relies on patient empowerment. This includes patient education with the aim of patients being more informed about their health and taking ownership of their own care (43). Whilst this does not have the strongest connection to carbon savings, it could see the reduction of polypharmacy and duplication in appointments as well as better control of chronic disease and consequently reduced hospital admissions (45).

The third principle is streamlined pathways and reducing duplication of prescriptions and appointments, which could increase NHS capacity, provide economic savings, and reduce excess emissions (45).

The fourth principle is focused on lowering the carbon emissions of healthcare, which can be achieved through low carbon alternatives to medications, reusable surgical instruments and reducing waste (45). Telemedicine and remote consultations will also play an important role, by decreasing emissions associated with staff and patient travel, as well as meeting increased demand for care. When considering introducing low carbon alternatives, the impact on patients and staff must be considered for any development to be viable in everyday clinical practice (41).

1.3 ASTHMA

1.3.1 Introduction to Asthma

Asthma is a chronic inflammatory respiratory condition, characterised by airway hyperresponsiveness to specific triggers, resulting in airway outflow obstruction (46). This airway obstruction causes the dyspnoea, wheezing and cough symptoms classically associated with asthma. The causes of asthma are multifactorial, comprising a combination of genetic and environmental factors (47). Asthma is now seen to be a heterogeneous condition with several phenotypes, after long being considered a single disease; these phenotypes vary in age, sex and presentation (48). More research is being undertaken to further understand these phenotypes and their role in the future diagnosis and management of the condition. Acute exacerbations of asthma are characterised by short-term worsening of symptoms that usually require immediate treatment. The triggers of acute asthma exacerbations can broadly be categorised into allergic (e.g. house dust mites, pollen) and non-allergic (e.g. cold air, tobacco smoke, exercise) (46).

1.3.2 Epidemiology

Asthma is the commonest chronic respiratory condition in the UK, with 5.4 million people currently receiving treatment, as well as being the most common long-term health condition amongst children and young people (49,50). In the UK, 1 in 12 adults and 1 in 11 children are affected by asthma (49). Globally, it is estimated that 339 million people have asthma, making it one of the most prevalent non-communicable diseases and a common cause of morbidity and avoidable mortality (51). Several demographic and social factors influence the incidence and severity of asthma. Globally, more women have asthma than men, as well as having more frequent exacerbations and worse health outcomes because of their condition (52). The relationship between sex and asthma severity is poorly understood however it is thought that oestrogen upregulates a type 2 inflammatory reaction, which is downregulated by male androgen hormones (52). There is also a significantly higher incidence of asthma in the UK in black and minority ethnic (BAME) groups (53). People from

deprived areas are more likely to have asthma; incidence rates of asthma are 36% higher in the most deprived areas, compared to the least deprived areas (54). In addition to increased incidence, these populations are more likely to be exposed to environmental causes of acute asthma exacerbations, such as air pollution and indoor mould exposure (55). People from a deprived background are also more likely to be hospitalised for their asthma.

1.3.3 Diagnosis

A diagnosis of asthma is based on a clinical assessment, which can be supported by objective tests used to demonstrate bronchospasm (56). There is no gold-standard diagnostic test for asthma, however tests such as spirometry and repeated peak flow measurements can be useful to separate those who are suspected to have asthma or those who have an indeterminate diagnosis (57). Given that symptoms of asthma vary throughout the day and with exacerbations, these standard diagnostic tests have high levels of both false positive and false negative results which limits their usefulness in proving a diagnosis (57,58). Primary care is where most diagnoses of asthma are made, however secondary care may be involved in the diagnosis of young children or if specific tests (e.g. Fractional exhaled nitric oxide (FeNo)) are needed. Underdiagnosis, as well as overdiagnosis, in asthma is a widespread issue (58).

1.3.4 Management

Whilst there is no cure for asthma, it can be managed using medications and non-pharmaceutical management to lessen the impact of symptoms on patients. Integral to asthma management is supported self-management, which aims to give patients the confidence to have an active role in the management of their chronic condition (57). For this, patient education is vital to ensure that they are fully informed about their condition and can engage in discussions about their health. A large component of self-management education is a Personalised Asthma Action Plan (PAAP), which describes a document completed during a consultation with a GP or nurse to summarise a patient's individualised asthma care plan (57). It contains information for patients on their preventer

therapies and the importance of adhering to these, alongside what to do if asthma symptoms worsen or if they have a severe exacerbation. Where asthma action plans have been used effectively, they have shown to improve asthma outcomes (57).

Patients should also have an annual appointment to monitor their condition, during which the core components of asthma, such as current symptoms and risk of future exacerbations, should be assessed (57). At the core of conservative management is good inhaler technique and patient information however it can also include weight loss and smoking cessation (56). Other non-pharmaceutical measures vary depending on the subtype of asthma that the patient has. For example, if the patient has occupational asthma, a large component of their management will include identifying and avoiding occupational triggers.

The British Thoracic Society (BTS) recommends a stepwise approach to the pharmacological management of asthma, shown below in Figure 4. Patients should be prescribed both a reliever and a preventer inhaler, or one inhaler in the form of a Maintenance and Reliever Therapy (MART) regime (57). Short-acting β_2 agonists (SABA) can be prescribed as reliever medication and, for patients with good asthma control who have a suitable preventer inhaler, there would be little or no need for them to use their reliever inhaler. However, SABA inhalers are frequently overused. A cross-sectional primary care study in London estimated that over 25% of patients were being prescribed over six SABA inhalers a year and in the population who were underusing ICS, this rose to over 80% (59). Similar findings were found by part of the SABRINA Global Programme, who found a third of all UK asthma patients had high SABA use (defined in this study by three or more cannisters a year) (60). The overuse of SABA reliever inhalers is associated with poor asthma outcomes with increased exacerbations and mortality (60,61).

Inhaled corticosteroids (ICS) are the most effective preventer treatment for children aged 5-12 and adults and should be initiated if patients are symptomatic more than 3 times a week or waking symptomatic for one or more night a week (57). ICS therapy should be initiated at an appropriate

dose to match the severity of their asthma and the lowest dose of ICS that is effective for managing symptoms should be used. For patients where ICS alone do not adequately control their symptoms, inhaled long-acting β 2-agonists (LABA) can be added and have been shown to decrease frequency of asthma attacks in both adults and children (57). This can be given as a combination inhaler which not only ensures the medications are taken together but also improves overall adherence to maintenance therapy. If a patient's asthma is still poorly controlled after the addition of a LABA, the ICS dose can be increased or further add-on therapies such as leukotriene receptor antagonists can be used (57).

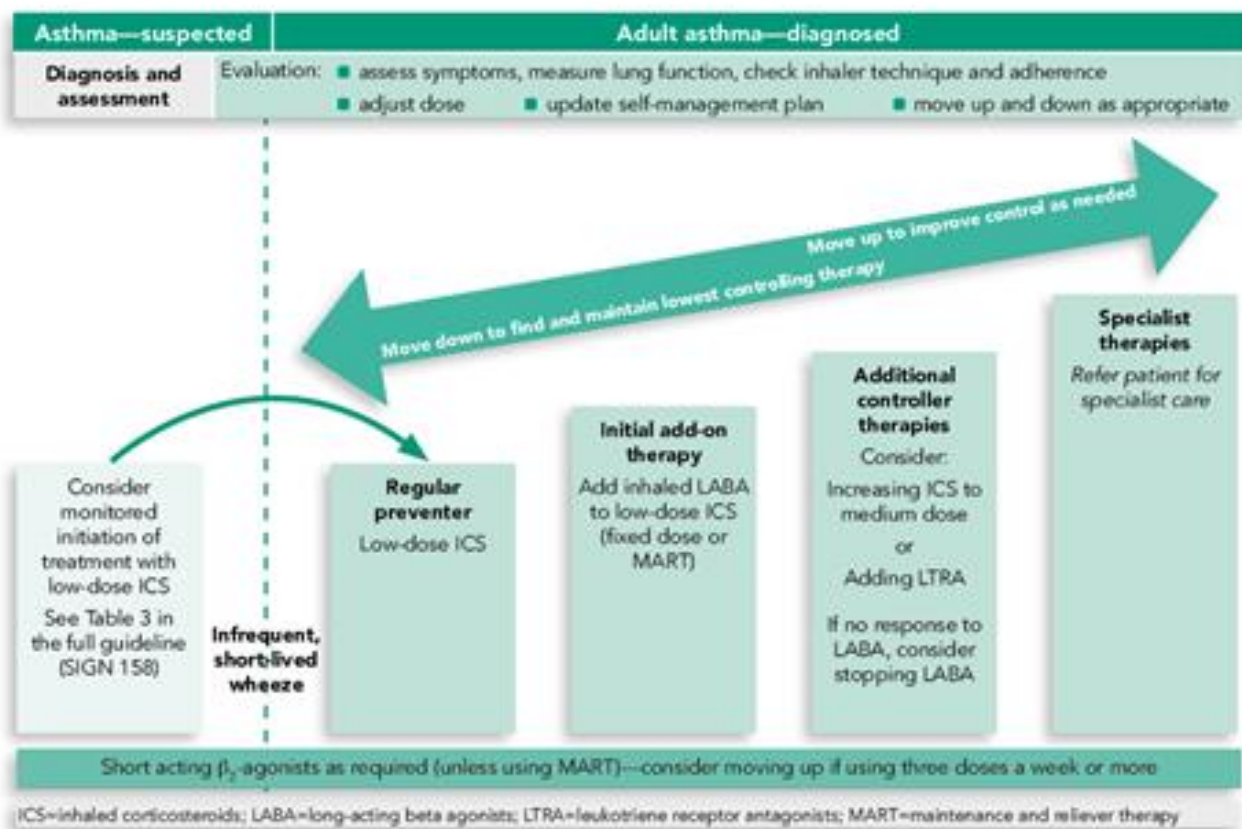


Figure 4: British Thoracic Society Guidelines- Stepwise Management for Asthma (57)

1.3.5 Different Types of Inhalers

There are three different types of inhaler devices that can be used in the management of chronic respiratory conditions: Metered Dose Inhalers (MDIs), Dry Powder Inhalers (DPIs) and Soft Mist Inhalers (SMIs).

1.3.5.1 Metered Dose Inhalers

Metered Dose Inhalers (MDIs) can be used in a variety of chronic respiratory conditions, including asthma and chronic obstructive pulmonary disease (COPD) and are the most prescribed type of inhaler in the UK, totalling 70% of inhaler prescriptions (62). They were first developed in the 1950s as the first portable device for bronchodilators (63). MDIs can be used in maintenance therapy and in the treatment of acute exacerbations. It is recommended that patients use MDIs with a spacer, however some patients opt to use the inhaler device alone. The most prescribed MDI in the UK is the Ventolin Evohaler, which is a reliever inhaler containing the bronchodilator salbutamol, however MDIs can be used for ICS, combination inhalers and MART regimes (57,64). MDIs are reliant on the medication being suspended within a gas propellant to properly dispense the medication to the patient, upon compression of the canister.

1.3.5.2 Dry Powder Inhalers

Dry Powder Inhalers (DPIs) are an alternative type of inhaler to MDIs and are also used in the treatment of asthma, COPD and other respiratory illnesses. Unlike MDIs, they do not require a propellant to dispense the medication, instead relying on the patient's inspiratory pressure to breathe the powdered medication in. BTS consider DPIs as effective as MDI and a spacer in adults and children >5 years old for maintenance therapy of stable asthma (57). However, given the variety of different DPI devices available, there are varying techniques and varying efficacy associated with different devices (65). Because the device relies on a drop of 1kPa inspiratory pressure, DPIs are not seen as suitable in those who cannot develop enough pressure, including very young children and those with severe respiratory disease (66). There is uncertainty about the effectiveness in DPIs in

acute exacerbations and in maintenance therapy in children and I am working on a systematic review to address this.

1.3.5.3 Soft Mist Inhalers

Soft Mist inhalers are another type of propellant-free inhaler, however these are much less commonly prescribed in the UK. Currently, the only soft-mist device to have a license is Respimat, which can be used in both asthma and COPD (67).

1.3.6 Factors that Influence Inhaler Device Choice

When choosing between the different devices, the British Thoracic Society recommends the use of a MDI and a spacer for acute exacerbations of asthma and for children <5 years old, however states that a MDI and a spacer are as effective as any other handheld device for the treatment of stable asthma in children 5-12 years old and adults (57). However, aside from this guidance, the decision of which inhaler device to use relies on the prescribing clinician.

Given the numerous different medication and device combinations and different patient needs, matching patients to an appropriate inhaler can prove a challenge for prescribing clinicians (68). To help clinicians make optimal device decisions, Dekhuijzen et al suggests using a four-question approach. This consists of “Who” (disease characteristic) “What” (type of drug) “Where” (the target for the medication); and “How” (considering matching the patient, molecule, dose and device) (69). Within the “How” element of this model, several person-centred factors should be considered when deciding on device. These include which age, cognitive status, manual dexterity, and coordination (70). Inhaler effectiveness fundamentally depends on the ability of the user to effectively use the device (71). MDIs require coordination of the compression of the cannister and an inward breath, which some patients find difficult and often results in incorrect use. Whilst DPIs have fewer user errors than MDIs, they are still used incorrectly in a large proportion of patients (72). Patient opinions and preferences are also important factors to consider when deciding on inhaler device as patient satisfaction results in higher adherence to treatment (73).

However, despite patient-centred factors, a 2020 retrospective analysis of inhaler prescriptions by GPs and respiratory specialists for two different ICS / LABA options, suggests it is the choice of medication which is the key factor whether a clinician prescribes a MDI or a DPI in the management of asthma (74). Given that suitable DPIs are available for each combination of medication at each stage of the stepwise approach to asthma management, it is unclear why they are not being more widely utilised.

1.4 ASTHMA CARE AND THE ENVIRONMENT

1.4.1 Principles of Sustainable Asthma Care

The fundamental principles of sustainable asthma care focus on providing people with high quality asthma care with low-carbon choices and reducing overall waste. Results from the SABINA UK study, part of the global CARBON programme to establish the environmental cost of healthcare, suggest that well-controlled asthma has one-third of the carbon footprint of poorly controlled asthma (75,76). Therefore, good-quality asthma care is beneficial to the environment and would produce a lower carbon footprint, regardless of any other sustainable changes that can be made. The benefits of well-controlled asthma are vast, including improved quality of life, psychological benefit, and improved patient satisfaction (77). To achieve well-controlled asthma, patients need a combination of the correct inhaler to manage their symptoms alongside good inhaler technique and adequate asthma education and follow-up (57). Inhaler types themselves vary in their environmental impact and carbon footprint, which will be discussed further in Section 1.4.2.

Once a patient has been prescribed an appropriate inhaler device and appropriate inhaled medications, it is vital that they understand the correct inhaler technique for their prescribed device. Inhaler misuse is a widely reported problem, resulting in wasted medications and increased emissions (72,77). Not only does incorrect use of inhalers increase carbon footprint, but it also contributes to poorer health outcomes and more frequent exacerbations. Therefore, improving inhaler technique is in the best interest of patients and the environment (78). Despite a variety of strategies to improve inhaler technique being trialled and implemented, inhaler misuse has not improved globally or nationally over the last 40 years (79). As a result of this, it may actually prove more environmentally friendly to keep a patient on an inhaler with a higher carbon footprint if their asthma was well-controlled and there was a risk that changing device types would disrupt this.

1.4.2 Inhalers and Emissions

There are associated emissions at every stage of the lifecycle of an inhaler, from the production to the disposal of the device, shown in Figure 5 (80).



Figure 5: Stages of the lifecycle on an inhaler associated with carbon emissions (81)

Inhalers represent 3% of total NHS carbon emissions and a large proportion of these are from the propellant used in MDIs for dispersing the medication (29). In the 1990s, the propellant relied on was chlorofluorocarbons (CFCs), an ozone-depleting chemical later banned by the Montreal protocol (8,81). The gas used in MDIs currently is hydrofluoroalkane (HFA) and, whilst this is not ozone-depleting, it still has a very high global warming potential (GWP). The most used HFA is HFA-134a, which has a GWP 1300 times that of carbon dioxide, however other HFAs used can be up to 3320 times (64). As a result of the gas propellant, the carbon footprint of MDIs is much higher than DPIs. To put it into a real-world context, Ventolin Evohaler, one of the most prescribed MDIs, produces 28kg of CO₂ per inhaler, which is equivalent to driving 175 miles in a standard petrol car. In

comparison, Accuhaler, a DPI, uses 0.6kg CO₂, which equates to driving less than 4 miles (64).

Therefore, large carbon savings can be made by replacing MDIs with DPIs where clinically appropriate.

The disposal of inhalers is problematic for the environment as it increases plastic waste as well as releasing residual propellant gas. Action is being carried out to impact the emissions associated with the disposal of inhaler devices through the introduction of inhaler recycling schemes (82). These seek to separate the inhaler device into its component parts and maximise what can be recycled; however each scheme varies depending on the company. The aluminium canisters can be crushed, which results in solid blocks of reusable metal. During this process, the high GWP propellant gas is released and collected. Schemes such as the 'Complete the Cycle' utilise excess propellant from within MDIs and sell it to manufacturers however these still rely on adequate use of pre-existing recycling schemes (82). The plastic casing of an inhaler is problematic for the environment, given that manufacturing and disposal both result in large volume carbon emissions, however during inhaler recycling, this can be melted down and reused (78). Any non-recyclable materials can be converted into energy using the process energy-from-waste (83). Practically, for the patient, these schemes involve returning inhalers to pharmacies or posting them to the manufacturer themselves.

Whilst these schemes are available in some areas, they are manufacture-led and there are no current plans for an NHS-led national inhaler recycling scheme. Pharmacies must opt into inhaler recycling which means that there is variable access to these schemes for patients. Approximately 73 million inhalers are prescribed each year in the UK, however only 0.5% of MDIs are recycled through these systems (81). This means a large proportion of inhalers still end up in landfill, estimated to be as high as 90% in some areas (84). Widespread availability and increased uptake of inhaler recycling schemes have the potential to help in reducing carbon emissions down to the NHS' carbon net zero goal.

1.4.3 Prescribing Patterns

Inhaler prescribing varies vastly across Europe, with the average European country prescribing 47.5% MDIs and 39.5% DPIs (62). MDIs account for 70% of the UK's total inhaler prescriptions, making the UK the highest proportional prescriber of MDIs across Europe (85,86). This contrasts with countries, such as Sweden, who prescribe less than 10% MDIs and 90% DPIs. The UK has one of the worst mortality rates in Europe for asthma with 2.21 asthma deaths per 100,000 in 2015 compared to the EU average of 1.32 per 100,000 (87). Given this information, it would be unrealistic to suggest that prescribing high levels of MDIs is providing real-world clinical benefit (88). Prescribing high proportions of MDIs has not always been the case in the UK. In 2000, 50% of total asthma inhalers and 66% of inhaled corticosteroids prescribed were DPIs, which fell to 30% and 9% respectively by 2016-2017 (89). This change reflects a drive to reduce the financial cost of asthma treatment in the UK, given that, at the time, MDI SABA and ICS inhalers were cheaper than their DPI equivalents (90,91). Low-carbon footprint inhaler (LCFI)- which includes DPIs and SMIs- prescriptions are rising again, estimated to be 26.3% of prescribed inhalers in 2021 (91). If the UK prescribed a higher proportion of DPIs and adopted the same distribution as Sweden, the UK would save more than 500kt of CO₂ emissions, making it one of the most efficient methods of carbon-saving for the NHS (86). Switching between an MDI and a DPI for most individuals is seen to be safe and to make no difference to the incidence of asthma exacerbations. Some studies have shown an improvement in some patient's asthma control after switching device (89). Since this switch is appropriate for a large proportion of patients and seen to not disadvantage them, clinicians are being encouraged to consider switching patients on MDIs to DPIs, providing this is done during a consultation and with patient agreement. To support this change, Greener Practice developed a High-Quality Low-Carbon Toolkit to provide healthcare professionals with guidance on how to integrate changing prescribing into their practice and into quality improvement (92).

1.4.4 Decreasing MDI use

Because of the significant carbon savings associated with changing inhaler prescriptions, the NHS has prioritised reducing the proportion of MDIs that are prescribed. It is recommended that the number of MDI prescribed is reduced by 50% by 2028 as part of its NHS net-zero goals and a working group was developed to achieve this goal (93,94). Since most of the oversight of inhalers occurs in primary care, it would be intuitive to focus on primary care to drive this change.

Broadly, there are three main ways in which MDI prescriptions can be decreased. One of these ways is switching MDI users to DPIs. This change would impact two groups of people- those with clinically stable asthma or those who with poorly controlled asthma who require a change of treatment. For the clinically unstable group, it may that using a DPI would have been the next step in their asthma management and would have been the correct clinical decision, regardless of the associated carbon savings. A second way to reduce MDI prescriptions is by initiating newly diagnosed asthmatics on DPIs, which would prevent the need to switch them to a different inhaler device in the future. The third way to reduce MDI use is through reducing SABA overreliance. SABA overreliance attributes to a larger carbon footprint in multiple ways, given that it increases overall MDI use and is associated with poor asthma control, which has a carbon footprint 3 times that of well-controlled asthma (76). Given that a large proportion of SABAs are prescribed in MDI form, reducing SABA use would reduce overall MDI use, as well as improving overall asthma outcomes (60). SABA overreliance is complex, however ensuring patients are on suitable maintenance regimes and improving their inhaler technique could both prove effective in tackling this issue.

There are a few initiatives in place to aid primary care staff in decreasing MDI prescriptions. Notably, the most widespread initiative is the MDI prescribing targets specified within the Investment and Impact Fund (IIF). The IIF for 2022-2023 offered financial incentives for practices where less than 50% of inhalers, excluding salbutamol, prescribed are MDIs, as well as offering incentives for reducing SABA overreliance (93,95). There is no current information available about whether this

financial incentive was effective in reducing MDI prescriptions, nor clinicians' views on it. There are some issues with the funding provided within the IIF, including a lack of support with how to improve towards these targets. The IIF guidance stated that 'additional guidance and advice will be provided alongside rollout of these indicators to support shared decision making and patient choice of inhaler' (95). It is unclear whether this guidance was ever published or was accessible to prescribing clinicians. Furthermore, the inclusion of a financial incentive has led to some patients being switched to a more environmentally friendly device without a consultation, which could have significant impact on the patient's ability to take their inhaler and their overall asthma control (96). The GP contract for 2023-2024 no longer includes greener asthma care incentives (97).

NICE have also created a decision-making tool for clinicians, which is designed to be used to aid shared decision making when discussing inhalers with patients (98). It outlines the environmental impact of different inhalers as well as providing patients with information about how they can make their asthma care sustainable. It is unclear whether this tool is being utilised and whether healthcare professionals find this useful.

1.4.5 Progress to reducing MDI use

There have been many reported successes of MDI switching such as the Salford Lung Study (99). This study included the use of a DPI containing fluticasone furoate/vilanterol against MDI maintenance therapy. This not only suggested large savings to carbon emissions, but also showed improvements to clinical outcomes.

A case study of an area taking significant action to change their prescribing is the Wyre Forest Health Partnership, who have trained green facilitators across all sites, removed the two inhalers with the highest carbon emissions from their formulary and have agreed DPIs to be the default option for all adults and children over 12 years old (100). Environmental concerns were included within their asthma reviews and pop ups were used to remind clinicians prescribing MDIs first line to consider

low-carbon alternatives. The combined efforts of these initiatives reduced the proportion of non-salbutamol MDIs from 64% to 53% in 5 months (100).

In terms of progress towards the inclusion of higher and lower carbon footprint options within prescribing guidance, there is significant variation between Integrated Care Boards (ICBs), previously known as Clinical Commissioning Groups (CCGs). A study of local variation in low carbon inhalers in prescribing guidelines for adult asthma by Twigg et al, found many CCGs still recommend MDIs over DPIs, with 11.8% explicitly stating a preference for MDIs, compared to 3.4% for DPIs (101). MDIs were included as first-line for 100% of guidelines for SABA and ICS inhalers, whereas a DPI option was included as first line for SABAs and ICSs inhalers for 77% and 78% of guidelines respectively. Therefore, despite inhalers being isolated as an area for improvement in the NHS Long Term Plan, this has not yet been reflected in most CCG guidelines. However, this study was of CCG guidelines before the COVID pandemic and may have changed since to reflect the introduction of different prescribing incentives and the change of CCGs to ICBs. Local education projects have also been developed to target General Practice and Community Pharmacy Teams (102). However, it is unreported as to whether these educational programmes have had significant impact on prescribing habits.

1.4.6 Financial Implications of Sustainable Asthma Care

A potential barrier to switching from MDIs is the higher per unit cost of some DPIs (88). A 2019 study based on the UK's 2017 prescribing patterns suggests that DPIs could be a more cost-effective option provided prescribers switched from MDIs to the least expensive DPI, with a potential saving of £8.2 million per 10% of MDIs changed (103). Most of these saving come from switching the more expensive LABA/ICS MDIs to DPIs. However, if the prescribers swapped from MDI to the DPIs based on current proportions of brand prescribing, this would increase the amount spent on inhalers by £12.7 million per 10% MDIs changed. It would be cost-neutral to exchange from an MDI to DPI for the same-branded LABA/ICS combination. Given the difference in price between brands and

between contents of the inhaler, it is hard to compare the two inhaler device types based solely on price alone. Because the UK prescribes fewer DPIs, there may be larger scope for price change as demand increases. In addition to this, up-front cheaper price of MDIs does not take into consideration the wider financial cost of the environmental impact of climate change (88). There is also opportunity to improve the cost-effectiveness of inhalers, by minimising waste due to incorrect technique or early disposal of inhalers that are not empty.

1.4.7 Patient Views on Sustainable Asthma Care

In 2020, Asthma and Lung UK (ALUK) conducted their Annual Asthma Survey, which received responses from over 12,000 asthma patients and carers and included questions to investigate patient and carer's knowledge and attitudes towards the carbon footprint of their inhalers (104,105). This study concluded that 65% of patient were unaware of the environmental impact of their inhalers and 85% of patients believe that asthma patients should be encouraged to use environmentally friendly inhalers (105). In addition to this, 60% of MDI users would consider changing their device for environmental reasons, with their most important concerns being that the device would work for them, that they'd know how to use it and that their asthma routine would be unaffected (105). Similarly, a study by The Health Foundation found that 64% of patients would be willing to consider the environmental impact of their treatment options as part of deciding their treatment, however this study also reported that 30% of patients were unwilling (106). This study reports those who were older were less likely to be willing to be in favour of environmental change to treatments.

Liew and Wilkinson also investigated whether carbon footprint of an inhaler was important to patients when deciding which device to use (107). In this study, patients rated cost and carbon footprint to be as important as each other however the most important factor influencing their decision was ease of use. This study also compared patients' opinions to the opinions of secondary

care respiratory clinicians and found that patients rated carbon footprint as more important to them than the clinicians did.

The Wyre Forest Health Partnership, whose actions towards sustainability friendly asthma care were discussed in Section 1.4.5, report that they have had positive responses to discussions with patients around the environmental impact of their inhalers and many patients are opting to change to a more environmentally friendly device (100). Whilst these results weren't quantified, it is a reassuring that patients are receptive to these discussions in primary care. Whilst it seems patients are responsive to changing inhaler devices for the environment, further assessment and qualitative work needs to be done to further understand patient views on environmentally friendly patient prescribing.

1.4.8 Clinician Views on Sustainable Asthma Care

Primary care clinicians are vital in changing the way inhalers are prescribed. Ensuring they understand the importance of a switch between device types and that they feel confident to do so is crucial to reduce MDI prescribing by 50% by 2028 (29).

A large proportion of healthcare staff are aware of the climate crisis and 98% of healthcare professions believe it to be important that the NHS acts in a sustainable manner (108). Two studies have investigated the perceptions and motivators of health professionals who are engaged in healthcare sustainability or sustainability advocacy in the USA and Canada (109,110). These studies show that individuals are motivated by their concern about the health implications of climate change, how climate change will impact health inequalities and waste associated with healthcare and found that knowledge gaps, not feeling it is within their professional role and organisational and policy limitations were all barriers for advocacy. There is no research into healthcare professionals who are not engaged within climate change advocacy.

Despite being aware of climate change, many healthcare professionals are not aware of the environmental impact of healthcare, especially inhalers. A 2019 GlaxoSmithKline (GSK) study of 550 healthcare professionals showed that 60% of clinicians were unaware that different inhaler types

have different carbon footprints and 67% were unaware that MDIs have a higher carbon footprint than DPIs (111). In 2021, one survey tested the knowledge of 102 secondary care respiratory clinicians on inhalers and their environmental impact (112). This study concluded that healthcare professionals who work with patients who have respiratory conditions have a lack of knowledge about inhaler device types and the environmental impact of inhalers. Out of these respondents, only 8.8% were already engaging in discussions with patients, 46.1% would feel confident to do this if given further support and 41.2% do not feel confident discussing this with patients. Given the large numbers of those in this study who would feel confident if given support, there is an opportunity for education and inclusion within guidelines to promote these conversations. There are no other published studies outlining clinician knowledge of sustainable asthma care, their confidence engaging in these discussions or how clinicians feel utilising more DPIs.

1.5 THE RESEARCH GAP

Primary care has an important role within the continued management of asthma patients and is the primary focus for interventions to achieve change to inhaler prescribing patterns. Whilst there are studies assessing the factors that affect inhaler prescribing, these rarely focus on environmental concerns, making it unclear as to whether these are considered in the decision-making process. In addition to this, there are few studies of clinician understanding on environmental factors, none of which solely include primary care clinicians. Given the push for reducing MDI prescribing is mostly based on carbon savings, it is vital to understand clinician awareness of the key reasons for this, and their perceptions about initiating these prescribing changes (67). It is unknown what is promoting these prescribing patterns in successful practices, what barriers exist where change has not been made and whether clinicians are apprehensive about this change. An appreciation of these will inform future interventions to reduce the gap between current practice and high quality, sustainable asthma care.

2. THESIS AIMS AND OBJECTIVES

2.1 RATIONALE

Improving current asthma care is essential to improve overall asthma control and reduce primary care's impact on climate change. Sustainable asthma care aligns with excellent practice and includes optimising inhaler technique and preventer use as well as reducing SABA over-reliance, alongside appropriate use of DPIs. Sustainable asthma care is encouraged by Greener NHS and the British Thoracic Society as well as independent organisations, such as Greener Practice. Policies have been adapted to support sustainable change, such as including financial incentives within the Investment and Impact Fund (IIF), and some local guidelines and formularies have been changed to include low-carbon inhalers and carbon emission information. There is currently no evidence base to inform these policies and interventions, and no information to assess how they are affecting inhaler prescribing. There is some evidence of progress towards utilising more low carbon inhalers in some areas in the country, however it is unclear what is driving these changes. Overall, there is a lack of understanding about clinician perspectives towards sustainable asthma care and whether environmental concerns play a role in prescribing decisions.

This thesis presents a qualitative study designed to provide further insight into what influences current inhaler prescribing and the key factors that affect a healthcare professional's decision-making process in relation to inhaler prescribing. These results seek to appraise whether clinicians understand the environmental impact of different inhaler device types and whether this impacts their prescribing. It also explores what motivates clinicians to change their clinical practice to be more sustainable and whether clinicians experience any systemic barriers to this. This study has the potential to inform future primary care interventions and incentives designed to encourage good-quality and sustainable medical practice.

2.2 AIMS AND OBJECTIVES

The primary aim of this study was to explore healthcare professionals' decision-making process when prescribing inhalers for asthma management, as well as their perspectives on reducing the proportion of MDIs prescribed to reduce primary care's carbon footprint.

The objectives of this study were:

Objective 1

To explore primary healthcare professionals' perspectives on what influences their decision-making when prescribing inhalers for asthma and how these decisions are made within a consultation.

Objective 2

To explore primary healthcare professionals' awareness and understanding of the environmental impact of MDIs and whether this influences their prescribing.

Objective 3

To explore primary healthcare professionals' perspectives, motivations, concerns, and confidence around switching to using more DPIs.

2.3 THESIS STRUCTURE

I have outlined the content of the following 5 chapters below.

Chapter number and title	Contents
<i>Chapter 3: Methodology</i>	This chapter outlines the philosophical underpinnings of this research as well as the approach taken to thematic analysis.
<i>Chapter 4: Methods</i>	This chapter discusses the preparation prior to the study and how the data was collected and analysed.
<i>Chapter 5: Results</i>	This chapter describes the results of the study, presented across two different sections: 'Factors that influence decision making when choosing which inhaler to prescribe for asthma' and 'Barriers and Facilitators to reducing the proportion of MDIs prescribed'.
<i>Chapter 6: Discussion</i>	The main findings of this research are summarised and discussed within the context of pre-existing literature. The strengths and limitations of this study have been described. It also include how this study could influence clinical practice and policy as well as recommendations for further research.
<i>Chapter 7: Reflections</i>	In this chapter, I reflect on the research process and the implications of this study on my future career.

3. METHODOLOGY

In this chapter, I will examine the philosophical underpinnings of qualitative research and my own epistemological stance. I will also reflect on how this has impacted my research design and research question. This chapter describes the theoretical basis for the steps taken to carry out the study, which are described further in the next chapter, Methods.

3.1 QUANTITATIVE VS QUALITATIVE RESEARCH

Scientific research in a healthcare setting relies on the detailed observation of phenomena in a systematic and rigorous way to produce trustworthy evidence. There are broadly three different methodological approaches that can be undertaken within healthcare research: quantitative, qualitative and mixed methods (113).

Quantitative research involves testing and confirming hypotheses by collecting numerical data using a predetermined design (113). Its large sample sizes and structured sampling methods seek statistical significance and reproducibility without the inclusion of bias, to improve the generalisability of the results. Quantitative research takes a positivist approach, defined by its belief that reality can be studied objectively and the observed truth from controlled experiments is reality. This type of work has a vital role in healthcare research as it underpins most of the evidence that influences clinical guidelines, such as drug and treatment efficacy studies. The traditional hierarchy of evidence is designed to segregate articles by scientific rigour to assist clinicians in choosing good quality evidence to apply to their clinical practice. Within this, randomised controlled trials (RCTs), a quantitative method, are seen as the most valid and generalisable type of study, following systematic reviews and meta-analysis (114). Since this hierarchy was proposed, it has been heavily criticised because it does not account for the quality of a study, meaning a poorly designed RCT would be seen as providing superior evidence to a well-designed cohort study. This hierarchy can also lead to a bias towards quantitative methods over other research methods.

Traditionally, healthcare research has taken a positivist approach through quantitative-driven studies, pushed by their generalisability to a wide population. However, there is now a greater appreciation for qualitative research and its role within evidence-based medicine. Whilst a quantitative approach undeniably has its role within healthcare research, it is insufficient to truly understand certain types of phenomena, namely social phenomena (115). Qualitative work aspires to explore and better understand a phenomenon rather than quantifying or measuring it. The most common comparison given is that quantitative work seeks to answer 'how many' and 'how much' questions whereas qualitative work answers 'what', 'how' and 'why' questions. Whilst qualitative work was designed and traditionally utilised by the social sciences, its inclusion within healthcare research is not new and has become more prevalent over recent years (116). Qualitative research within healthcare has allowed for the discovery and deeper understanding of previously unexplored behavioural and psychological phenomena, in relation to both patients and healthcare professionals. The overall increase in published qualitative research has allowed for a deeper, more contextualised understanding of the patient experience, and the experiences of those who treat them, and now frequently impact the guidelines that underpin the practice of clinical medicine. For this reason, conducting and publishing this type of research is encouraged and, especially advocated for in the UK by the National Institute for Health Research (NIHR) and UK Medical Research Council (MRC) (116).

Quantitative and qualitative approaches arise from different philosophical standpoints and are used to answer different types of research question, however neither is seen to be superior to the other. They both seek to help further understand medical and social phenomena and together can provide complementary knowledge to better understand the same condition or problem. The third methodological approach, the mixed methods approach, makes best use of these differences. This methodological approach uses both quantitative and qualitative methods to collect and analyse data within the same study (113). Given the intricate nature of health conditions and healthcare systems, using combined methods can synthesise a wide range of data to provide greater understanding of

the complexities of the issues in question. Mixed methods studies have an important place in guideline development by making use of the types of information that both methodologies provide (117).

The research question I address in this thesis explores the factors that affect prescribing decisions and clinician perspectives towards sustainable prescribing, both of which are regarded as social phenomena. This question is suited to a qualitative approach, given that it would allow for a deeper understanding of the issues facing clinicians. I appreciate that within this question and area of interest there was scope to carry out a mixed-methods approach, which could have included a quantitative survey to assess how many primary care clinicians are considering the environmental impact of their prescribing. However, this would not have been possible to conduct given the time constraints of an MPhil, and a qualitative approach alone will still generate a rich and informative dataset.

3.2 PHILOSOPHICAL POSITION

Quantitative and qualitative researchers adopt different philosophical positions on knowledge and theoretical perspectives depending on their research question. Because research is inherently impacted by the researcher's interpretation of the social world, it is essential to appreciate the philosophical position of the researcher to truly understand the context of the work. Understanding an individual's philosophical position and perspectives prior to the research design process allows for high quality research to be conducted as well as considered reflexivity to be undertaken during the analysis process.

When designing research within the social sciences, Crotty suggests that there are four interlinked elements that need to be considered, classically depicted by the eponymous Crotty diagram depicted in Figure 6 below (118).

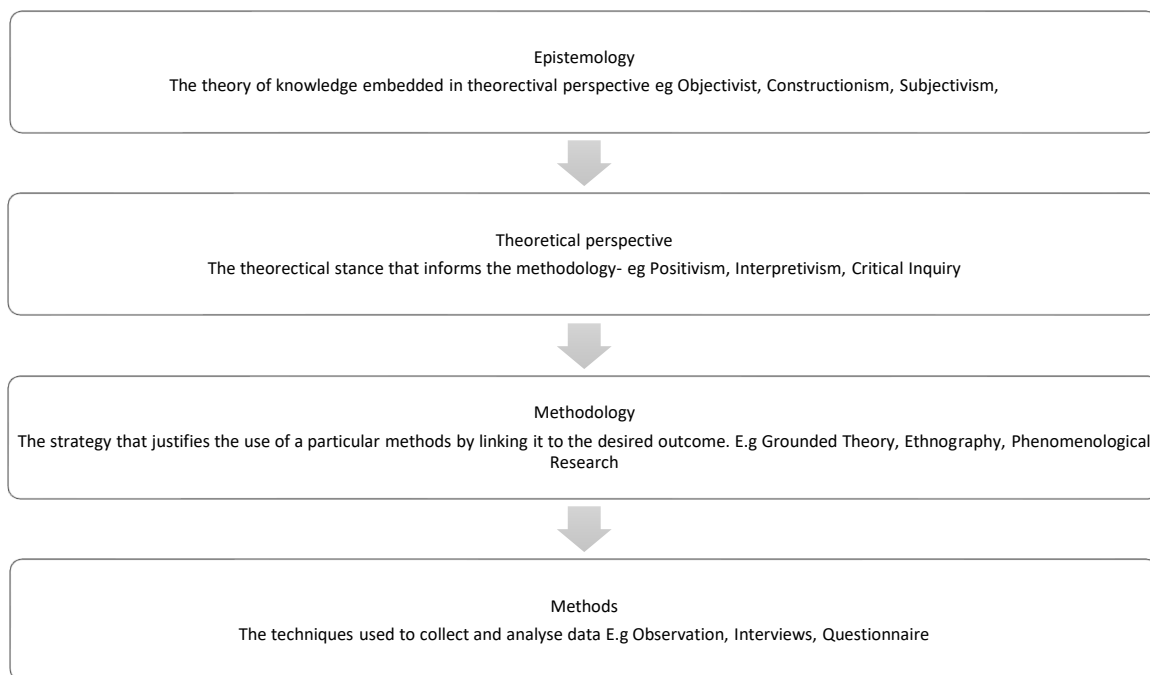


Figure 6: Crotty's Four Stage approach to the research process (119)

3.2.1 Ontology and Epistemology

When considering the philosophical underpinnings of research, understanding the concepts of ontology and epistemology is vital. Ontology refers to the study of reality (119). This was traditionally discussed as a dichotomy between realism, where an external reality exists beyond the individual interpreting it, and relativism (or idealism) where multiple realities exist created by different individuals' subjective understanding, however it is more commonly considered a continuum in modern literature, shown in Figure 7 (116). On the more idealist end of this continuum sits post-modernism where it is thought that there are multiple realities, socially and contextually constructed, by multiple individuals. A researcher's ontological position influences the theoretical perspective of their work and subsequently the design and methods used to acquire information. Within health research, data regarding the efficacy of treatments or prevalence rates is derived from a realist perspective, assuming that there is one reality of how effective a treatment is. However, a relativist approach is taken when qualitative work is used, for example in studies regarding patient experiences.

differing from constructionism in that the meaning does not arise from the relationship between subject and object (118).

Many qualitative researchers adopt an idealist ontology and a subjectivist epistemology, which accepts that there are multiple realities influenced by one's subjective experience and allows them to collect data to explore these different realities (120). Within qualitative work, the knowledge of reality is socially constructed by the participant and then also socially constructed by the participating researcher, which limits the discovery or replication of an objective reality.

Many biomedical healthcare researchers adopt subtle realism, a position outlined by Hammersely and outlined in detail by Pope and May (116,121). This allows for the explanation that there is an independent reality that exists, for example mechanism of disease, however the subjective interpretation of these phenomena gives it meaning. This encompasses the perspective that there is one objective truth in biomedical science, for example, the effectiveness of a medication, however this information is meaningless without our social interpretation of that data.

This project was carried out from a constructionist point of view, which maintains that there is no objective truth and multiple socially constructed realities coexist. I felt that this was an appropriate perspective to adopt for this project, given that I am exploring individuals' personal experiences and perspectives, which will be influenced by their interaction with the world and their past experiences.

3.2.2 Theoretical Perspective

A researcher's theoretical perspective describes their assumptions about the world they are going to investigate. There are many theoretical perspectives that a researcher can adopt, however I am going to discuss the two traditional research paradigms, positivism and interpretivism, and how these differ from pragmatism (122).

A positivist theoretical perspective adopts the view that the principles of scientific research and methods can be used to acquire knowledge about a single reality (118). This aligns with an

objectivist epistemology and is most associated with quantitative research. This differs from post-positivism which states that theories can be proven false, but never proven true, and therefore our understanding of realities will always be uncertain and incomplete.

Interpretivism takes a different approach, in that it takes the view that there are multiple realities which are subjective and socially constructed and that there is not one correct way to obtain knowledge (122). This theoretical perspective aligns with the constructivism and subjectivist epistemologies previously discussed and is closely associated with qualitative methods. It seeks to give a deeper and richer understanding of social phenomena and how people interpret the world around them.

Whilst these two approaches can be seen as distinct entities, a pragmatic approach is based on the view that there are many ways of interpreting the world and that the most appropriate scientific method should be used, regardless of associated theory (116). This can result in studies that use a combination of different methods, from the perspective that it would result in a broader understanding of the phenomena being investigated. Pragmatists can adopt this mixed method approach however this is not required; it is more essential that they adopt an approach that they have appraised to be suitable to the research question.

I have adopted an interpretivist approach for this research. This is because I will be exploring different prescriber perspectives and experiences and an interpretivist perspective allows for the deeper exploration of these social phenomena.

3.2.3 Methods of Data Collection

A variety of methods can be utilised for data collection in qualitative studies, some of which can only be used with specific methodologies and some of which can be used regardless of the chosen methodology (120). The methods themselves need to be conducted rigorously, like all scientific research methods, as well as compatible with the research question and the philosophical and theoretical perspectives that underpin the research itself (118). I will discuss three common qualitative methods (interviews, focus groups and ethnography) and justify the methods I used for this project.

Interviews are the most common form of data collection in qualitative research and describe a conversation held between a participant and a researcher, with the content of the conversation driven by the area of research. These can take a structured, semi-structured, in-depth or narrative format. Structured interviews consist of a pre-determined set of questions which need to be asked in a specific order in each interview carried out to ensure comparability between participants (122). For a semi-structured interview, the researcher produces a topic guide for the intended topics covered, however the questions can vary in content and order depending on the answers and the importance placed on different topics by the participant. In-depth interviews describe an interview with less structure and fewer topic areas to discuss, however these areas can be discussed in much further detail, depending on the responses received. A further type of interview is a narrative interview, which is when the interviewer encourages the participant to tell their story; this is a technique that is increasingly being used within healthcare research to further understand the lived experiences of patients (122).

Focus groups describe a group interview, where the interplay between the participants affects the data collected (116). It allows participants views to be challenged and considered, both internally and by others, which can allow for a different or deeper response than if the interview had been

one-to-one. Focus groups also produces additional data on the way people communicate with each other about certain topics, which should be analysed in addition to their opinions shared.

Ethnographic studies can provide in depth information about different behavioural and social phenomena that occur within the everyday lives of the participants (123). These studies can be immersive, where researchers involve themselves within the cultural context in which they are studying, or it can be done objectively. These studies can be carried out in isolation or can be combined with interviews and focus groups to provide a deeper understanding. Within healthcare research, ethnographic studies can provide vital information on the lived experiences of those with chronic illness as well as how different populations perceive health and healthcare professionals (124).

For this study, I used semi-structured interviews for data collection. I felt that this interview structure would allow me to explore the views of clinicians sufficiently, as well as being suitable for the timescale of the project. Focus groups could have been an effective method for this study, however, given the scarcity of primary care clinician time, I felt it was easier practically to conduct this study with individual interviews to fit in around individuals' availability. Whilst prescribing itself is not controversial, discussions around climate action are intrinsically political, which participants may not feel at liberty to share within a focus group setting. This may have affected the richness of the data collected from focus groups, meaning interviews were chosen as a suitable method. The semi-structured format allowed me to gather information on the areas of interest as well as cover new topics that arose during the interviews. I also used an iterative approach, where the topic guide is reassessed in response to analysis of earlier interviews.

3.2.4 Methods of Data Analysis

I have chosen thematic analysis for the method of data analysis. Thematic analysis can either take an inductive or deductive approach (116). An inductive approach to thematic analysis means that the data determines what themes are constructed, rather than being based on a previous theoretical

framework. This differs from a deductive approach, where theoretical frameworks and existing knowledge form the basis for some preconceived themes which the researcher maps the data to. Thematic analysis has previously been considered a methodology, however it is now widely considered a method due to Braun and Clarke's interpretation (125).

There are several variations of thematic analysis outlined in current literature, however I based my analysis on the six-step process for reflexive thematic analysis outlined by Braun and Clarke in their book 'Thematic Analysis. A Practical Guide', published in 2022 (126). These six steps are an updated version of their six-step process initially published in 2006, which remains one of the most cited papers in qualitative research (125). Braun and Clarke's six step process has been outlined below.

Phase 1: Familiarising yourself with the dataset.

Within this phase, researchers are encouraged to immerse themselves into the data and make brief initial notes referring to analytical insights for the data set as a whole and individual data points. Practically, this involves re-reading or re-listening to the interview data.

Phase 2: Coding.

To code the data, researchers systematically work through the data, assigning meaningful descriptions to data points which align with their research question. This can be described as latent, where an implicit meaning is assigned to the code, or semantic coding, where coding is more surface level. The individual data points assigned to each code are then grouped allowing them to be interpreted within the next stage.

Phase 3: Generating initial themes.

After the data points with the same code have been collected, the researcher can begin to identify shared meaning between quotes and construct themes about the data. This differs from the initial Braun and Clarke method (2006), where this phase was referred to as 'Searching for Themes'. This

was altered as 'searching' implies passivity and this new title reflexes the active role the researcher has in interpreting the data.

Phase 4: Developing and reviewing themes.

This phase involved appraising whether the generated themes accurately represent the coded extracts and the full data set. Through this process, themes may be changed, separated, combined, or discarded entirely to represent the data and the wider context of the research more appropriately.

Phase 5: Refining, defining and naming themes.

In this phase, themes are clearly defined from one another and given a concise, yet descriptive name, to reflect the content of the theme.

Phase 6: Writing up.

This is the final phase of the analysis. This is vital in accurately conveying the findings of the study, as well as accurately portraying the outlook of the researcher and their reflexive process.

Whilst this process is outlined in a chronological structure, it should be noted that this process rarely conducted step after step and often results in the researcher returning to previous steps to change their resulting themes.

3.3 QUALITY ASSESSMENT IN QUALITATIVE WORK

As previously described in Chapter 4.1, qualitative and quantitative work differ in their philosophical basis and methodological structure. With quantitative work, the product of data analysis is considered to be the truth, aligning with the realist assumption that there is one reality independent to human interpretation. This allows quantitative work to be assessed for quality based on validity (the appropriateness of the research process and data), generalisability (the extent to which the findings of this study can be applied to other situations), and reliability (the extent to how a research method produces consistent results) (127). There is some debate as to whether these are suitable criteria to be used for quality assessment in qualitative work. One argument suggests that since qualitative and quantitative work both aim to describe one reality, they can be assessed on the same criteria of validity, reliability and objectivity, however the tools used to assess these criteria may vary (116). However, a contrasting, and more widely regarded, argument was put forward by Lincoln and Guba, and suggests that qualitative research should not be assessed based on the same criteria, and instead should be assessed for 'trustworthiness' (128). Within this, there are four main components used to establish 'trustworthiness': credibility, transferability, dependability, and confirmability (128).

Credibility evaluates whether the study accurately represents the views of the participants involved, and therefore how well the study represents reality. It concerns true value and is comparable to internal validity in quantitative research. Lincoln and Guba made several recommendations for studies to fulfil the trustworthiness criteria, which include triangulation and debriefing with an impartial researcher.

Transferability refers to whether the conclusions of this research are relevant to other specific settings and relates to applicability. Within quantitative work, applicability is assessed via external validity or generalisability. To fulfil this criterion, the qualitative study must be described in sufficient detail to allow a reader to assess whether it is applicable to their setting of interest.

Consistency is assessed in qualitative work by dependability, which evaluates whether the research progress, including methods and decisions made by researchers, are logical and can be clearly followed, to the extent that the study could be replicated by a different researcher. This is comparable to reliability assessed in quantitative work, however, differs from the perspective that the social world is constantly changing so the results produced represent a certain point in time. This may mean if the study was replicated, different findings may be produced, to reflect the differing populations and time.

Confirmability assesses the way in which the researcher has influenced the results of the study. Because qualitative researchers' perspectives have the potential to influence the way that data is interpreted, it is important to ascertain how the findings have been shaped by their preconceptions or motivations. Confirmability is similar to objectivity, which is used to assess neutrality within quantitative work, however, differs by acknowledging the unique role that the researcher's views and backgrounds play in the interpretation of their work. To improve researcher neutrality, it is recommended that a detailed diary of the research process is kept, and triangulation is used for credibility, as well as the use of reflexivity to increase transparency about researcher presumptions and background.

Reflexivity refers to questioning one's own preconceptions and biases in relation to the research topic and should take place throughout the research process (126). Given that the researcher intrinsically affects the way they interpret the data as well as the way that the data is reported, it is vital to understand the position of the researcher when interpreting the work (129). The vital role of reflexivity has been highlighted by many qualitative methodologists, particularly by Creswell who suggested that 'reflexivity increases the credibility of the study by enhancing more neutral interpretations' (129). The use of a reflexive diary is widely regarded as the most common method to record the reflexive process and the report produced afterwards should contain these reflections

(126). In Appendix 8, there is an excerpt from an interview completed in this study, alongside a portion of the reflexive diary completed during the interview and during the analysis.

To improve the quality of the reporting of this study, I have included a COREQ checklist in Appendix 9, as recommended by Tong et al (130).

3.4 CONCLUSION

For this study, I have adopted a constructionist position and have taken an interpretive approach to the data. I have concluded that semi-structured interviews are an appropriate method of data collection, however I did consider other approaches whilst designing the study. Reflexive thematic analysis, based on the six steps process outlined by Braun and Clarke, is my chosen method of data analysis. Within my study design, I considered how to ensure my study was trustworthy, by considering credibility, transferability, dependability, and confirmability and the important role that reflexivity has in my data interpretation. In the next chapter, I discuss the methods for data collection and analysis undertaken in the study.

4. METHODS

In this chapter, I will outline the preparation undertaken prior to the study and how the data was collected and analysed.

4.1 ETHICS

Ethical approval for this study was sought from Keele University's Research Ethics Committee. An initial application was made on the 9th September 2022 which was later rejected due to a lack of consent form attachment. A repeated online application was completed on the 14th October 2022, which included the participant information sheet, consent form, demographic questionnaire and a drafted topic guide version 0.1. The Keele University's Research Ethics Committee gave a favourable ethical opinion for the project, reference number 0380, on the 21st November 2022 and a copy of this letter can be found in Appendix 1. The ethical application process and corresponding documents were developed by Helen Twohig and myself. The participant information sheet, consent form and demographic questionnaire can be found in Appendix 5, 6 and 7 respectively.

4.2 PATIENT AND PUBLIC INVOLVEMENT AND ENGAGEMENT GROUP (PPIE)

At the beginning of the research process, a patient and public involvement and engagement (PPIE) group were consulted, to ensure patient perspectives informed the topic guide. PPIE describes the active involvement of patients and service users at any stage in the research process, from research design to results analysis and has been recognised by NIHR to play an important role in developing relevant research (131). This was designed to ensure that, rather than being carried out 'for' members of the public, research is carried out 'with' or 'by' them. High quality PPIE is thought to have an overall positive impact at each stage of the process and has been suggested to increase researcher understanding of their area of interest, increasing the quality of the research and

improving the appropriateness of the studies themselves and their corresponding materials (132,133).

This study utilised PPIE within the research design process. A PPIE group was assembled, through pre-existing Musculoskeletal and Mental Health PPIE groups at Keele. The PPIE group for this study consisted of 3 patients with asthma. Two meetings took place on the 11th and 14th of October 2022 to account for member availability. During these meetings, the background behind the project was explained and the contents of the topic guide was discussed. The PPIE group helped to develop the topic guide by emphasising what they felt is important to them as service users, as well as editing wording of questions within the topic guide to avoid confusion. Areas of significant discussion arising from this meeting included:

- Members of the PPIE group felt it was particularly important to include how clinicians made their decisions within the topic guide. It was queried whether healthcare professionals were aware of the environmental impact of inhalers and whether this would impact their prescribing.
- Members highlighted how patients may feel about switching to a different inhaler and that patients may be reluctant to change inhaler device type if their asthma is stable. All PPIE members highlighted how good control of their asthma was the most important thing to them as patients and patients can be scared to change inhalers to avoid experiencing symptoms.
- There was discussion about the wording of some questions as they were felt to be leading, such as including the phrase 'environmental reasons' in questions surrounding feeling confident switching to DPIs, as this was felt to be provocative.

As a result of this meeting, questions around the factors that influence clinical decision-making were reworded and were prioritised to account for the PPIE groups feeling that this was important. The

wording of some questions in the topic guide were also altered to improve understanding for participants in the study and to make less provocative.

Throughout the PPIE process, the enthusiasm of the members was apparent, with the members asking many questions and sharing that they felt this was important to them as patients. This further justified to me why carrying out this research project is going to be beneficial, as it will help clinicians to make environmentally friendly choices for their patients. In addition to this, this was the first time I have discussed the environmental impact of asthma care with asthma patients, and it was important for me to understand the perceptions of those that this research will inevitably impact.

A potential limitation of this PPIE group which needs consideration is the demographics of the members. Members of the PPIE groups at Keele are typically white, middle class older adults, which means the views of the members may not be representative of the population. This bias is a well-reported issue with using a PPIE group and steps have been taken at Keele to change recruitment to improve diversity.

The results of this study will be disseminated to the members of this group following the submission of this thesis.

4.3 STUDY POPULATION

4.3.1 Inclusion and Exclusion Criteria

This study population included general practitioners, practice nurses and clinical pharmacists who are currently employed at a primary care practice in England and have an active role in the care of patients with asthma. Clinical pharmacists were required to be independent prescribers or responsible for asthma medication reviews at the practice to be included within the study. There were no geographical restrictions to participation in this study.

4.3.2 Recruitment and Compensation

Participants were recruited via email using the research team's primary care contacts initially, followed by snowball sampling methods. Snowball sampling describes when participants assist in finding participants for the study. Practically, in this study, this involved asking participants at the end of their interview if they thought anyone else from their practice or from other working networks may want to be interviewed. This resulted in several incidences of those working within the same PCNs or practices being recruited. Following initial interviews, the demographics of the participants were reviewed, and purposive sampling was carried out to ensure there was representation from a variety of practices (assessed by Index of Multiple Deprivation (IMD) and rurality) as well as clinician experience and role. Participants were offered a gift card as compensation for participating in the study.

4.4 DATA COLLECTION

4.4.1 Participant Demographics

Participants were asked to complete a demographics questionnaire prior to interview which includes their age, gender, job role, years qualified in their current position and the postcode of the practice where they currently work.

The postcode of the practice was converted into an Index of Multiple Deprivation (IMD) score. IMD is a tool used to compare the deprivation of different areas in the UK. It combined 37 separate indicators of deprivation across 7 domains, including income, employment, education, health, crime, barriers to housing and services and living environment. This results in each geographical area receiving a score. This score allows areas to be ranked on a scale of 1-10, where 1 is the most deprived and 10 is the least most deprived. This can be further divided into quintiles which gives a score between 1-5. The care provided by general practices can vary by deprivation. There is evidence to suggest that general practices within deprived areas have a short average length of consultations, lower patient satisfaction, lower QoF performance and lower Care Quality Commission scores (134).

Therefore, it is important to ensure that there is representation across the IMD scores within a sample to ensure that clinician views from a diverse range of practices have been included. For this study, an online IMD calculator was used to synthesis the IMD score (135). The corresponding IMD score has been left in the 1-10 deciles.

4.4.2 Interviews

This study used semi-structured interviews for data collection. The inclusion criteria, study setting and recruitment for the interviews are outlined below. Before each interview, the participant was given a participant information sheet, a consent form and a demographics questionnaire. At the beginning of each interview, the interviewer clarified with the participant that they had read the participant information sheet and participants were invited to ask any questions they had regarding the study. The consent form was filled in prior to the beginning of the interview and one copy was retained by myself and one by the participant. The patient demographic questionnaire was filled in prior to interview and was labelled with an assigned anonymous participant number and a copy was retained.

4.4.3 Study Setting

Participants were given the option of the interviews being in person at the participants' practice or on Microsoft Teams. The rationale behind using virtual interviewing was to allow for individuals from a wide geographical area to participate in the study, to reduce the influence of local prescribing guidelines, as well as reducing the study's carbon footprint by eliminating travel. All interviews were carried out on Microsoft Teams and were recorded within the software. For transcription, the automated feature in Microsoft Teams was utilised and errors were corrected by LF post-interview. After an adequate transcript had been produced, the interview recording was deleted from local and cloud storage from Microsoft teams. The transcripts were subsequently uploaded to the thematic analysis software, NVivo 12, to assist with the analysis.

4.4.4 Consent

Informed written consent was gained prior to each interview, via a consent form shown in Appendix 6. Before signing the consent form, participants were given the opportunity to ask any questions about the study as well as prior to the start of the interview. Consent forms were stored securely on a university drive.

4.4.5 Topic Guide

4.4.5.1 Topic Guide Development and Contents

Two topic guides for interviews were developed: one for general practitioners and practice nurses and one for clinical pharmacists. This was to reflect the difference in roles they have in primary care. The general practitioner and practice nurse topic guide was developed initially by HT and me for the ethics application, informed by HT's clinical expertise and a literature review. This topic guide was shared with the PPIE group and two other academic GPs for feedback. This topic guide was then used in a practice interview with an academic GP, who had no prior knowledge of the study, to ensure that questions were suitably worded and structured. A separate topic guide for clinical pharmacists was developed and shared with two clinical pharmacists for feedback. The topic guide used for GP and practice nurses can be found in Appendix 2 and topic guide for clinical pharmacists can be found in Appendix 3.

Both topic guides were modified as interviews were carried out and analysis completed, following an iterative process reflecting on themes. Below are some examples of how the topic guide was changed:

- Following interview 5, the question 'Do you think the NHS should be prioritising sustainability at the moment?' was included, following on discussions around the NHS crisis and burn-out.

- As the interviews went on, the question “What is your understanding of the environmental impact of metered dose inhalers?” changed for some participants to “Do you feel that you have enough understanding of the environmental impact of inhalers?” as some participants seemed to feel that this question was quite accusatory rather than exploratory. The original question was still utilised where a clear understanding had not been established and following on from the new question if needed.

4.4.6 Determining Sample Size

Determining a sample size in qualitative research depends on different epistemological, methodological, and practical factors (136). There is a lack of consensus about which method should determine the exact size of a qualitative sample, with different tools and formulaic approaches being suggested by methodologists (136,137).

Saturation is a popular method to determine sample size and describes a point where sufficient data has been collected and collecting further data will not provide further insight or new themes (122). It was first introduced by Glaser and Strauss for grounded theory, however is now used across different qualitative methods (138). Research needs to report how saturation is achieved within the piece of work, which is inconsistently done (137). Data saturation is controversial within qualitative researchers as different scholars debating different definitions and variations. Saunders et al propose four different models for saturation (139). When carrying out this project, I adopted the data saturation model which describes an approach where saturation is reached when new data is repeating what has been discussed in previous interviews. Data collection ceased when data saturation was reached in the different professional groups, as well as the overall sample.

4.5 DATA MANAGEMENT AND STORAGE

This study was conducted in line with Keele University's Standard Operating Procedures (SOPs) and in accordance with the NHS Research Governance Framework Information and principles of Good Clinical Practice in research studies (140,141). Information collected for this study was held securely and managed electronically at Keele University and complies with General Data Protection Regulation (GDPR). All personal information, including consent forms and demographic information, collected during the study was kept confidential and stored on a secure University network drive. During this study, each participant was assigned an anonymous participant number, which was used across their demographic forms and transcripts. The participants' personal details were stored separately from the anonymised transcripts to prevent cross-identification.

All research data, except participant names and contact information, will be stored securely for 10 years after completion of the study, before being destroyed, to comply with Keele Medical School's Standard Operating Procedures. Participant names and contact information were deleted on completion of the study.

4.6 DATA ANALYSIS

The data were analysed on my personal laptop connected to the University's Virtual Private Network (VPN). I used the software NVivo 12 to analyse the transcripts using a Keele software license. I independently analysed the interview transcripts and then HT analysed interviews and coded for consistency.

Throughout the data analysis, I utilised a constant comparative approach. This approach refers to examining differences and similarities between newly collected data and previously collected data and allows for researchers to develop themes or theories within their data. Practically, this meant that after an interview had been conducted, transcribed and coded, I would return to previous interviews and analyse whether patterns within the data were developing.

The transcripts were analysed using an iterative approach. An iterative approach describes repeatedly revisiting previous data and using what you have learnt to influence the topic guides of future interviews (142). This allowed for the data that has been collected to highlight potential areas to explore in future interviews. I have discussed how this method influenced the topic guide in Section 4.4.5.1.

5. RESULTS

5.1 OVERVIEW OF RESULTS

The results of this study are divided into two topics: ‘Factors that influence decision-making when choosing which inhaler to prescribe for asthma’ and ‘Barriers and facilitators to reducing the proportion of MDIs prescribed’.

The primary aim of my study was to explore healthcare professionals’ decision-making process when prescribing inhalers for asthma as well as their perspectives on reducing the proportion of MDIs prescribed to reduce primary care’s carbon footprint. My objectives were:

Objective 1

To explore primary healthcare professionals’ perspectives on what influences their decision-making for asthma inhalers and how these decisions are made within a consultation.

Objective 2

To explore primary healthcare professionals’ awareness and understanding of the environmental impact of MDIs and whether this influences their prescribing.

Objective 3

To explore primary healthcare professionals’ perspectives, motivations, concerns, and confidence around switching to using more DPIs.

The first topic relates to Objective 1. I identified the following themes: Patient-centredness; Making assumptions; Status quo; and Confidence and knowledge.

The second topic relates to Objectives 2 and 3. I identified the following themes: Awareness; Attitudes to change; Engagement with sustainable prescribing; Role of incentives; and Guidelines and systems.

Table 1 outlines the results chapter, by section, theme and subtheme.

Table 1: Results chapter outline

Section	Themes	Subthemes
Factors that influence decision making when choosing which inhaler to prescribe for asthma	Patient-centred care	The 'best' inhaler Shared decision-making
	Making assumptions	Age Deprivation Ethnicity & Language Barriers
	Status quo	What is a normal inhaler? Familiarity The 'normal' asthma experience
	Clinician knowledge and confidence	Core elements of good quality asthma care Confidence in DPI use The role of education
Barriers and Facilitators to reducing the proportion of MDIs prescribed	Awareness	Understanding around environmental impact of inhalers Perfectionism Visibility
	Attitudes towards change	Clinician perceptions of change Barriers to change Prescribing as a habit Patient perceptions of change
	Engagement with sustainable prescribing	Stigma The role of the healthcare professional Widespread change is necessary Role of Integrated Care Systems and PCNs
	The role of incentives	Financial Incentives as a facilitator Issues with financial incentives Other incentives
	Guidelines and systems	External resources impact prescribing The role of computer systems Structural limitations to change

5.2 PARTICIPANT DEMOGRAPHICS

Table 2 shows the demographics of the participants.

18 participants were interviewed between December 2022 and May 2023, with each interview lasting an average of 32 minutes across the interviews and a range of 22-40 minutes. Out of the 18 participants interviewed, eight were General Practitioners (GP), six were Practice Nurses (PN) and four were Clinical pharmacists (CP). Their age ranged from 24- 54 years old, and the number of years qualified ranged from 1 to 28 years. The Index of Multiple Deprivation (IMD) of the practices covered the full range 1-10, with higher representation from practices in more deprived areas.

One practice nurse had trained as an Advanced Nurse Practitioner, giving her 28 years total experience as a nurse practitioner in primary care where 1.5 years of that was as an advanced nurse practitioner. This has been identified in the table.

Some clinicians worked at the same practices. GP5 and GP6 worked at the same practice and CP4 and GP8 also worked at the same practice at the time of interview.

Table 2: Demographics of the Participants

Participant	Age	Gender	Role	Years Qualified	IMD (/10)
GP1	37	M	GP (Partner)	9	1
GP2	36	F	GP (Partner)	6	2
GP3	38	F	GP (Partner)	8	5
GP4	40	F	GP (Salaried)	12	2
GP5	36	M	GP (Salaried)	7	4
GP6	34	M	GP (Salaried)	2.5	4
GP7	47	M	GP (Salaried)	18	1
GP8	50	M	GP (Partner)	19	5
PN1	51	F	PN	13	7
PN2	54	F	PN	28 (1.5 years as ANP)	2
PN3	45	F	PN	18	1
PN4	40	F	PN	4	2
PN5	51	F	PN	17	7
PN6	38	F	PN	11	3
CP1	24	F	CP	1	10
CP2	37	M	CP	1	5
CP3	54	F	CP	11	1
CP4	27	M	CP	4	5

When referring to an individual's role within the table and for the remainder of this thesis, GP is a general practitioner, PN is a practice nurse, and CP is a clinical pharmacist.

5.3 FACTORS THAT INFLUENCE DECISION MAKING WHEN CHOOSING WHICH INHALER TO PRESCRIBE FOR ASTHMA

This chapter focuses on what primary healthcare professionals feel influences their decision making for asthma inhalers and the process by which these decisions are made within a consultation. This chapter discusses the following themes: Patient-centred care; Making assumptions; Status quo; and Clinician confidence and knowledge.

5.3.1 Patient-centred care

When discussing their decision-making process for prescribing inhalers, participants felt that they choose an inhaler device based on what would be best for the patient. The concept of the 'best' inhaler weighed up a variety of different factors, including which inhaler would be the most clinically effective, which device would the patient's technique suit, which would the patient prefer and which is the patient going to adhere to and use correctly.

"So I would look at the history to see if and what inhalers are already on and I would work out what's happening with them. If they're stable, if they're uncontrolled, if they're using too much of something, too little of something. And base my decision on what I feel will be better for them. So it's always a clinical decision based on what would suit the patient best, but I often explain to patients with inhalers, it's often a trial and error process and it's finding the right one for them." (PN6)

Participants considered the ideal inhaler for the patient to be the most important factor to affect their prescribing and felt that this is more important than external factors such as cost or environmental factors.

“Our care should be patient focused and should be, you know, about ensuring that it's the right inhaler for the patient. Yet of course there is a drive to say it should be all about the green agenda and everything else. And, whilst I'm 100% supportive of that, that can't be to the detriment of patient care.” (GP7)

“And is it the environment the first thing I think of when I start prescribing? Not necessarily, because I'm looking for the right drug for that individual person.” (PN2)

Patient-specific factors that were commonly identified to influence device choice included practical considerations, such as dexterity and willingness to use a spacer, as well as patient preference.

Patient preference was thought by some to play an important role in medication compliance and overall asthma control. The importance of individualised care was reinforced through discussions about different patients having different needs and preferences from their inhaler devices. A variety of factors affecting perceived patient preference were discussed; some participants reported their patients enjoyed the convenience of DPIs as they can be used without a spacer and have a dose counter.

“Lots of my patients are preferring the DPI, mostly as they find it easier to just click and click and go. There's no coordination required.” (GP1)

“So you wanna have one that's quite easy to put in your pocket and carry around. And sometimes that's how I might perhaps sell it. And you know, that's the benefit of powder because they've literally just got that little, you know, one to carry around their pocket, not with the spacer and that kind of thing. And yeah, a lot of people don't wanna carry spacers around with them as well.” (PN5)

Whereas other participants have found patients don't like DPIs with the sensation after inhalation, coughing and difficulty using the device all being reasons why patients have asked to change back to an MDI.

"Cause some patients really like the fact that they can taste it and then other patients really, really hate the fact that they can taste it. And some people think that that means that they are getting it better and some people think that they don't. And a lot of people complain of coughing." (PN3)

"The blunt reality is if you give someone a medication they don't want, then they're not gonna be as compliant with it. So what do I actually achieve by choosing a DPI in that situation?" (GP7)

Patients' social circumstances also affected decisions on inhaler prescribing. For example, one participant reflected on the concept of fragmented families and how this means that often children need more inhalers so they can keep one at different houses. One nurse discussed the concept of the 'chaotic' patient and described a patient with a turbulent social situation which prevents them from prioritising their asthma control.

"Myself and the prescribing pharmacist review all of the patients that have more SABA than they have ICSs to see if there's a reason for that, it's just we have a lot of fragmented families so often they keep one in lots of places." (GP1)

“You know, like that Lady the other day even if she haven't had a DPI previously, the chaos of her life and the poor control of her asthma meant that I was like up to my eyeballs, which made environmental factors absolutely the bottom of the list.” (PN3)

A patient's existing inhaler technique was highlighted by some as a key driver in whether a patient is prescribed a MDI or a DPI. Clinicians described matching a patient to a DPI or an MDI based on their ability to use the device, rather than choosing a device and teaching perfect technique. Participants discussed the benefits to patients of using a device that their technique suits, including better control of asthma and less waste of medications. Some considered checking a patient's technique in an asthma review to be a useful tool to identify which patients may need to switch device types.

“And how most people, even who have given an aerosol, aren't doing it right. Their technique is a dry powder, so I tend to now look at someone's technique more, basing it on whether or not I'm gonna switch them to a dry powder. (PN1)

“Yeah I would broach changing device entirely, particularly if they've got sort of poor technique. And then I would sort of say, ‘well, let's try a different device entirely and see if you're more comfortable with that and if your controls better with that’. And then review them sort of after a month to see if they're happy.” (GP8)

“But when I look at their inhaler technique and that's quite a driver as well for me to sort of mention ‘now look at your technique’, you know you're going to need a spacer. You know you could change it to this one. It's more environmentally friendly, but also improve your technique and everything so. It's kind of a combination of things I think really.” (PN5)

Some participants discussed the importance of using shared decision making within asthma management and incorporating the patients' thoughts and beliefs into their consultations. These consultations were viewed as a one-way conversation for some clinicians whereas others described a negotiation between clinician and patient.

"I think it needs to be a shared decision because if it's me saying 'right you go on this inhaler' then they're not gonna be necessary, you know, compliant or concordant in that, are they? So it's got to be of their choice." (PN5)

When discussing switching inhalers to low carbon options, some described listing the patient benefits of using a DPI and then saying it has an environmental benefit, rather than environmental benefits being the first point discussed, with the idea that patients are more likely to support the switch if it has a personal benefit.

"And I tend to sort of explain the device, it's differences, the clinical benefits, so the dose counter, the technique potentially meaning that they're gonna administer the drug better. And all of the clinical benefits to them. And then at the end I'll say, 'oohh and actually this one's also much more environmentally friendly as well so that's an added bonus'. And so that they know that it's very much about their condition and getting the treatment right for them rather than a green choice that's being pushed upon them kind." (GP3)

Demonstration devices and decision-making aids were identified as being used to educate patients and help them decide what inhaler they may prefer.

“I've got a bag full of demo stuff that I'll show people [...] Very, very patient led to decide what's happening. I'll give them options and such. But generally it's a conversation.” (CP4)

“So sometimes I think that if you can show them the inhaler, if you've got that placebo in your drawer and you can show them what it looks like, it's much easier to kind of win them over in a way than just saying I'm putting you on this inhaler [...] And I think that being able to demonstrate how to use it is great but and making sure that they understand that this is not a permanent thing, that if it needs to be changed, it can.” (PN4)

Several participants felt differently and said their asthma reviews and management was more clinician-led and their patients play less of an active role in the decision-making process. There were no clear differences between which professional groups were engaging in shared-decision making and how they were undergoing this process.

“I find it's often quite doctor-led and even when initiating, I've made the choice based on my thoughts. I've not asked out loud whether that needs to be their most important factor or not.” (GP4)

Where patients are having discussions around changing inhalers, a good-doctor patient relationship was highlighted as vital to making asthma care easier.

“Patients generally are quite happy to take my advice on board and particularly if there's someone who I've got a decent relationship with or I've known them for a little while. So I've only been at the

practice for about three years but yeah I've got those who I've seen and managed their asthma or their chest symptoms for some time and tend to be more on board with that.” (GP6)

5.3.2 Making assumptions

Participants were asked what factors they felt impacted their inhaler choice and whether they would be more likely to prescribe a certain type of inhaler to specific groups of patients. Several demographic factors were identified to affect the inhalers that clinicians were likely to prescribe, based on assumptions about an individuals' ability to use an inhaler and their presumed device preferences. The three demographic factors of age, deprivation and ethnicity influence some clinicians' prescribing and have highlighted inequalities between who is accessing good quality asthma care and what inhaler device they are likely to be prescribed. These three factors also seem to influence with whom clinicians are more likely to start discussions about the environmental impact of their healthcare and who is offered low-carbon inhaler options.

Assumptions based on a patient's age were common and often referred to a patient's ability to use a device and their device preference. Some felt that older patients were more likely to struggle with the technique of a DPI due to insufficient inspiratory effort and would be less likely to be able to use the inhaler effectively. Older patients were also thought to be more difficult to educate around inhaler technique and therefore some clinicians would be less likely to switch them over to a different inhaler device.

“They often can't grasp new inhalers. They can't put their mouth right. They can't do this. They can't do that, and they can't often get that big, short, big breath that you need for that. They're more slow and steady, and I think they would be harder to educate as well as their ability to do it.” (PN1)

“As I've mentioned, you know, sort of the age again, the elderly, where they struggle with good inspiratory and robust inspiratory effort.” (GP7)

There was a perception from a few participants that older patients wouldn't be able to manage having their inhaler switched or may get confused if their inhaler was changed and therefore, they would be less likely to offer switching inhaler device types to these patients.

“There's a little old lady that came into my head that straight away I thought there's no way I'd ever change her inhaler. And you know, she just wouldn't cope with it so. Again, it's looking at that patient holistically, isn't it? And just thinking yeah, they probably wouldn't cope with the change.” (PN4)

“Some of the older ones I think probably just because they can manage [MDIs] a little bit better, they don't get confused if you change it, you know. They can get ones where they don't need to think about it too hard.” (PN3)

Some healthcare professionals considered a patient's age to affect their preferred device, subsequently affecting the inhaler device they were likely to offer the patient, with older patients being more likely to be offered an MDI and younger adults more likely to be offered a DPI.

“As I say, slightly younger people have DPI preference and MDI for older patients usually with a spacer.” (CP4)

Some participants also made assumptions around different patient priorities for their healthcare based on age. Older patients were considered less likely to be interested in considering the environmental impact of their care, and younger patients were perceived to be more receptive and engaged in discussions around sustainability. Some HCPs therefore felt they would be less likely to discuss environmental issues with older patients as it is not a priority for them.

“But actually if you're using four salbutamol inhalers a year, that is making a huge contribution to your carbon footprint and I think a lot of younger people will certainly respond to that. I don't know how people in their 80s and 90s would respond to it.” (GP2)

“If they're engaged in the conversation and they're younger, I think it's an easier conversation to have.” (CP3)

To reduce carbon emissions, some practices have been switching inhaler device types within asthma reviews, commonly switching from an MDI to a DPI. When discussing which patients were appropriate for device switching, deprivation was a factor which influenced some patients' asthma management. Some participants felt that people from deprived areas would be less likely to be interested in low carbon asthma care and engaging these groups would be more difficult. However, it was also considered that those from affluent areas may also not be interested.

“Like the very, very affluent maybe won't be as bothered, whereas the, you know, like, say, quite deprived areas also not bothered- they have more pressing matters to deal with themselves in deprived areas.” (CP4)

Deprivation also played a role in other aspects of asthma management such as what regime patients are put on. A few clinicians considered the cost of repeat prescriptions in their choice of inhaler and felt that MART regimes can provide real benefit to patients by reducing prescription charges.

“And I think financially as well, again the area we work in are really deprived, so if they're on three different inhalers and they're not affording them or they're sharing them around the house, which often happens, you've got a family that are using each other's inhalers. I'll try and get them on just a combined all-in-one inhaler so it's cheaper for them as well.” (PN6)

“Cost wise, there's a lot of talk about MART regimes and I'm a big advocate for MART regimes and I think that we could have that discussion with a patient if they're paying for prescriptions. If they're buying two prescriptions or maybe they've got a Fostair, maybe they've also got a SABA. Maybe we should be just using the one inhaler and only have to buy the one inhaler.” (CP2)

“And I work in a really, really deprived area, so you know, getting them to even have the money to be able to afford to take an inhaler, let alone then changing it and then having the, you know, the clarity of thoughts, to remember to take it and stuff like that is a lot more of what we're doing.” (PN3)

Ethnicity and language barriers also seem to influence the care some clinicians are providing for their patients. One clinician felt that they would be more likely to prescribe MDIs to those who are not White British based on the perception that this technique was easier for these patients to understand and easier for them to grasp. In this instance, language did not seem to provide a barrier to patient understanding.

PN6: I work in quite an ethnically diverse population, so patients whose understanding around inhaler technique is quite poor. I'll use a tidal breathing and the MDIs and spacers with them just because I know it's easier for them and they get their inhaler that way."

LF: Okay and can I just clarify why it's easier for them?

PN6: Because I think they're not doing a technique, it's just breathing in and out. So you know there's no...yeah, there's no limitations. So with the MDI, they don't have to, you know, do the technique as with the dry powders. They don't have to....they've gotta get their breathing right, not breathe in too hard. And so yeah, it's just a simple breathing exercise in and out."

The same participant also felt that they'd be less likely to discuss the environmental impact of healthcare with patients who are South Asian or Slovakian as they perceived these groups to be less educated about the climate crisis and less interested in the carbon footprint of their care.

"I think the majority of our patients are very uneducated about it and don't understand you know, the impact on the environment and what certain things do and how negative impact things can have. And again that I think that's comes from culture as well in the cultures that we have in the practice. So our population is largely South Asian and Slovakian. And so they're cultures you know are very.... not up to speed on the greener, you know, than the white British population for example, unfortunately." (PN6)

Language barriers also seemed to result in some patients receiving different care to fluent English speakers. Some participants expressed difficulty when communicating using translation services and interpreters with patients about their asthma, preventing them from providing the same quality of

care they were providing to other patients. Some said they wouldn't attempt to switch a patient's inhaler device type if interpreters were going to be used, as this was perceived to be too difficult. One nurse described frustration at language barriers and described this as an issue across her other consultations, not just asthma reviews.

“And if I'm totally honest, which is probably wrong, but we have two sites. We have one which is very white working class and we have one which is massively ethnically diverse and we have to use interpreters all the time and totally honestly, I wouldn't even think about doing it there because the usually the interpreters are on the phone.” (PN3)

“The issue I have is that a lot of the patients where I'm at don't speak English, so directing them to AsthmaUK to look at the pictures on the Internet for how to use these may be a bit of a challenge for them, because they're not gonna understand the words [...] Oh God, if you've worked with them it can be a nightmare and we go down to basic English to be quite honest, very basic to 'you have pain?' and 'where is pain?' and 'can you point to me on your body?' and a lot of them don't know which bits inside their body do what.” (PN2)

Considering this, there seems to be significant inequalities within the care some patients are receiving, based on stereotypes about their ethnicity, in regard to their normal asthma management and who is considered for low-carbon inhaler alternatives. These views were shared by 3 individuals and were not expressed by the other clinicians interviewed.

5.3.3 Status quo

Whilst discussing the process of how participants carry out asthma reviews, some cultural norms about inhalers and several assumed truths were identified. This was through both the language participants used when describing asthma care, as well as when describing their decision-making process. Most participants identified MDIs to be the most commonly prescribed inhaler in the UK with some referring to MDIs as the 'normal' or 'standard' inhaler. Reliever and preventer inhalers were often described by the corresponding colour of traditional MDI devices, such as 'brown and blue', regardless of whether participants were referring to a DPI or an MDI. DPIs were perceived by some to be newer devices and some did not prescribe them regularly, if at all.

"The kind of almost standard that were coming into, if that makes sense, what the established like... precedent which you know has been before is MDI, which is you know the staple within the UK. That's what the majority of prescribers and patients are familiar with. And then that's often what is initially started." (CP1)

"To be honest, most inhalers tend to be started by a doctor. And they always do the standard blue and brown." (PN1)

Two participants identified that MDIs haven't always been the most prescribed device type and that DPIs used to be the 'normal' inhaler to be prescribed.

"Being qualified 30 years ago, the norm was for us to get the dry powder. It was very rare to get a MDI." (CP3)

“Because it's funny, because I have some patients that come in and I'll put them on like a Turbuhaler, like a Symbicort. And they'll go. ‘Ohh. I used to have that years ago. Like, that's like really old type thing’” (CP1)

Overall, participants felt more comfortable prescribing MDIs and some were more likely to prescribe them for both reliever and preventer therapy. Even within device type, participants had brand names that they were more familiar with and more likely to choose that over other brands.

“I suppose I would tend to go well for the Turbuhaler shape, because I'm more familiar with that than the Easybreathe shape” (PN2)

Participants felt that familiarity plays a role in inhaler prescribing decisions and felt they were more likely to prescribe an inhaler that they knew and they trusted to be effective.

“We know that clinicians are comfortable with prescribing what they know and tend to prescribe what they know also” (GP8)

“I think it's getting clinicians to a point where they feel they trust those options, both in terms of feeling familiar prescribing and reviewing them and being confident that pharmacies will have them in stock. [...] I think it is about familiarity and habit.” (GP4)

Some participants also felt that prior patient experiences impacted their prescribing, with both positive patient reactions and negative reactions to certain inhalers impacting future decision making. The reactions referred to most were gaining good asthma control, patient preference or bad asthma exacerbations.

“Yeah, they get comfortable with certain inhalers and certain brands and they find their niche as well, I suppose. And I think that comes from experience. If they've had a good experience with an inhaler and managed to get a patient controlled then ‘ohh well, I’ll use that next time and see if I can, you know, get another one controlled on that same inhaler’.” (PN6)

Patient and carer familiarity were also considered in some participants’ prescribing decisions. Clinicians acknowledged that they would be more likely to prescribe inhalers based on what device type the patient was familiar with. Patients were considered to be more familiar with MDIs, given that this is the ‘normal’ inhaler, and some participants would therefore prescribe an MDI as their inhaler. Some felt patients may get upset if they tried to change a device that the patients were familiar with and would be more likely to keep the devices the same.

“And so either, you know, if I don't have time to have that discussion with the patient then it's kind of like I'll just leave them on what they know without kind of upsetting them.” (GP5)

“Sometimes you just have to let that slide because you know if you try one the other ones and you know if you're gonna offer one of the newer ones, they'll go ‘No, I'm not using that’”(GP8)

Familiarity with devices also had a perceived benefit in some clinical situations. Some participants mentioned being more likely to prescribe MDIs for patients who have carers or school-aged children because those helping the patients with their inhaler are more likely to know how to use the device. One pharmacist felt that he would be more likely to prescribe children the same inhaler device type as their parent to reduce having to teach a new technique.

“Obviously asthma has quite strong family links. Usually mum or dads got it and you're more likely I think to get it drilled home rather than teach parent a new technique to show to kid, whereas you could improve parent's technique of their own inhaler and then they're gonna show the kid better”
(CP4)

Aside from MDIs being the normal inhaler, participants considered some other features of asthma care to be normal, including patients having poor inhaler technique. Some participants assumed all of their patients have poor inhaler technique, regardless of device type, and make it a key part of their review process.

“So I will always start with whether they're actually using them, getting to actually tell me what they're using and when they're using it cause inevitably it's wrong.” (PN3)

“So it's kind of starting from the basics and making sure that you don't assume that patients know what they're doing with their inhalers. You can't assume that ever. [...] I mean the times that I've said to someone, cause we always ask bring you inhaler with you to the appointment, and I mean it's horrendous sometimes when you see what they're actually doing. I mean one man sprayed it on his

neck. And you just like, that's how you take your inhaler? And you know, some people hold their breath and you know, just do wacky things.” (PN4)

In addition to presuming a patient is taking their inhaler incorrectly, poor asthma control and subsequent asthma symptoms seem to be normalised by both the clinicians and their patients. Several participants remarked that patients have a poor understanding of their condition and think they will always have a wheeze due to their asthma, not because their asthma is poorly-controlled.

“A lot of the time I find asthmatics normalised their condition so they could, you know day-to-day just have this residual wheeze and like they are in the morning and things like that and they say ‘oh, that's because I'm asthmatic and that's that.” (CP1)

“Because it becomes normal so you know, a chronic cough becomes their norm. It's just everyday until you pointed it out to them and say that is not normal. And they'll do ‘Well, of course it's normal. It's just me. It's how my asthma is.’ Yeah, but that's not how asthma should be. It can be, you know, it's quite a light bulb moment for them, like, ‘ohh. What do you mean that's not how it should be. That's just how it's always been.’ Um, so, unless they're really, you know, they've got really bad chest infection or they're really suffering. We do have patients like that and it's pointing it out to them that that's not controlled and that's poor asthma...poor asthma control.” (PN6)

Another feature of asthma care that has been normalised is the lack of confidence clinicians have in their knowledge about asthma, which will be discussed next.

5.3.4 Clinician confidence and knowledge

Throughout the interviews, participants demonstrated a lack of confidence in their knowledge about key areas of asthma care. Confusion around inhalers was common, with some participants uncertain as to key differences between MDIs and DPIs and their respective inhalation techniques. GPs were considered to have the least knowledge by themselves and other professional groups.

“I'm not entirely convinced I know the difference in terms of all the different devices, cause I often don't initiate things” (GP6)

“I bet if- I'm just making so many horrid assumptions about our wonderful GPs, but they are brilliant- but I think I feel like if I ask them actually tell me how you take, even an MDI they wouldn't have a clue about. And I don't think they'd know the difference between how you do an MDI or DPI.” (PN3)

Knowledge regarding which inhaler devices are available with specific medication preparations was identified as a particular area of weakness, with some participants using external resources during consultations to fill knowledge gaps. One GP in particular felt that she would not feel comfortable prescribing inhalers without access to her chosen resources. Other clinicians felt that they needed to review core asthma management information before consultations in order to carry out suitable asthma reviews.

“I mean, I always constantly feel like I need training in pretty much everything because things change so quickly and that is why I never do things without having my crib sheets available.” (GP2)

“The knowledge is good, but sometimes I have to go over again and say, you know, look basic stuff, revisit technique, revisit adherence, that sort of thing.” (CP4)

Technique, both for MDIs and DPIs, was a particular area where participants felt their knowledge was poor. Most identified this as a common issue and one clinician described a remembered statistic outlining lack of understanding. Some participants felt that this lack of knowledge was a barrier in teaching patients' adequate technique and would prevent them from switching a patient to a different inhaler device. Overall, whilst the importance of technique was recognised, poor understanding of technique was seen as normal, and participants seemed passive to acting to change this.

“7% of healthcare professionals understand exactly and can demonstrate how to use an inhaler. That's not good enough. So we actually need to be taught properly ourselves, so we need to do effective training, which then will mean our patients are trained.” (CP3)

“I think technique is a problem and I do think a lot of practices don't train people properly on how to do it.” (CP4)

Some clinicians felt they understood the technique of a DPI less than the technique of an MDI. One nurse outlined that she felt much more comfortable explaining the technique of an MDI to patients because she teaches it frequently and knows what to say, whereas does not have the words or 'little tricks' memorised for a DPI. DPIs in general were a particular area where some participants felt their knowledge was poor, referring to availability of certain medications in the devices and which patients DPIs are appropriate for.

“I guess I’d be more reluctant to [switch to a DPI] for, and that I think it’s partly just a confidence thing because I don’t prescribe that often for people with asthma, people who are well controlled on the certain type or have used them for years” (GP6)

Most participants identified a patient group or situation for which they were unsure about prescribing DPIs. The key situation mentioned was the use of DPIs for the management of acute symptoms or exacerbations. This divided clinicians with some feeling confident to prescribe DPIs for acute symptom management, however others were uncertain, and a few deemed it to be dangerous.

“You can’t do a short sharp breath when you’re having an asthma attack, but that is what I would say there is some concerns that way around. But dry powder wise people are having good effects, good benefit from them. But I do wonder about someone who’s having an asthma attack being able to take their blue inhaler properly.” (PN1)

“I’ve heard, at least anecdotally, I haven’t seen any patient myself, you know, where the switch has been made and because it’s a dry powder and maybe isn’t appropriate for that patient with like a poor inspiratory effort, then there’s that’s exacerbating their asthma and then running the risk like proper exacerbation, you know, risk of harm, risk of hospital admission.” (GP5)

“From a clinician’s point of view and it might because of maybe lack of experience, I’m not sure, I worry about changing the salbutamol or the reliever inhaler over to metered dose without having anything in the background, just in case they’re in an emergency situation and they haven’t quite got the hang of it.” (CP3)

For participants who were confident in their knowledge about DPIs and their efficacy, some attributed the current evidence base to be the reason for their confidence. The widespread use of DPIs in Scandinavia was also specified by a few clinicians to provide them with reassurance that DPIs can be used on a wider scale.

“I think currently I'm tending to use dry powder inhalers if I can. Partly because the evidence from the respiratory consultants is that, you know, actually people don't utilise the MDIs that well either and actually in exacerbations patients seem to do better with the dry powder ones acutely and are actually getting better delivery than the MDIs.” (GP8)

“You know when if you read about studies in other countries, like in Sweden and things where you know the majority of their salbutamol inhalers are DPIs, then it does give me confidence that, Oh no, it can actually...it's like it's quite safe and it is been done. So why can't we do it?” (CP1)

The important role education will have on improving confidence around inhalers was discussed in most interviews. A large proportion of participants felt they required additional training to keep their knowledge up to date. Two of the GP participants had led training on increased use of DPIs and the environmental impacts of inhalers within their respective PCNs and described receiving positive feedback from staff. Some participants also identified the importance of including sustainable asthma care within the medical and nursing curriculums to improve incoming clinician knowledge.

“Yeah, just you have to change it from the beginning, from these young students when they're coming through becoming GPs and becoming doctors, if they're not doing this first line, nobody's gonna change.” (PN1)

“And then I think through education is the key here. So making resources available or training available for clinicians, or at least a clinician from a practice to push this. And then I think it starts from the bottom as well, so through medical school and through nursing placements” (GP6)

Whilst the general consensus was that additional training activities would be useful, some clinicians recognised a few issues that local educational activities face. Some felt they have a lack of time to dedicate to CPD activities. There were also concerns about information overload.

“And there’s only so many education meetings you can do on inhalers before people switch off before you even started.” (GP1)

“If I’m brutally honest, it doesn’t feel like a priority for me because I feel like, you know, I’m so behind on so much training” (PN3)

5.4 BARRIERS AND FACILITATORS TO REDUCING THE PROPORTION OF MDIS PRESCRIBED

This chapter focuses on primary healthcare professionals' understanding of the environmental impact of MDIs and whether this impacts their prescribing, as well as their perspectives, motivations, concerns and confidence about switching to using more DPIs. This chapter discusses the following themes: Awareness, Attitudes towards Change; Engagement with sustainable prescribing; the role of incentives; and Guidelines and systems.

5.4.1 Awareness

Within the study, participants were asked about their understanding of the environmental impact of inhalers. All participants demonstrated an awareness that inhalers have an environmental impact, with some able to give specifics about the carbon emissions associated with inhalers and targets for sustainable prescribing.

"I think inhalers account for around 3 to 4% of the carbon footprint of the NHS and I know that the NHS want the DPI use to be around about the 75% mark of non-salbutamol inhaler usage around 75 percent, 25% MDI." (CP2)

"And what I understand is that they're about 1 to 2000 times more potent than carbon. So even though they're tiny volumes, you're creating massive issues for greenhouse gases when you're using those inhalers." (GP2)

Despite all participants demonstrating an awareness of the environmental impact of inhalers, there was variation in the level of understanding. When prompted within the interview, some clinicians

were able to give a very comprehensive answer about the impact of MDIs however others were more uncertain. Where this was the case, clinicians often recognised gaps in their knowledge.

“I guess there's the plastic kind of... the amount of plastic in the packaging and stuff. And there's also it's the CFCs, isn't it? The fact that those are bad for the environment. I can't work out if it's something to do with gases and I don't really understand it. I just remember something on Blue Peter, when I was about 10, about fridges and CFCs. So I know that it's bad from that point of view. I don't know anything more than that, if I'm honest.” (PN3)

“Like I say the words but I don't really know what I mean. I say ‘it reduces the carbon footprint and it's good for the environment’.” (CP3)

Participants often justified their lack of understanding, attributing it to a lack of time or available training. One participant suggested her lack of understanding was due to her age and that younger clinicians may have a greater understanding.

“It's been talked about more. I'm not sure I can really say that it has been a big push on my part. I haven't really accessed anything to either be taught or to explore this or just haven't had the time or the energy to look into that alongside everything else that's been going on so.”(GP6)

“And I do think it's a real generational thing. I'm in my 50s and you know, it's a modern thing to talk about. Do I really understand it? No, I don't. I understand about landfill. I understand about some things and cars and whatever, but that's probably the level I get to. And so I think it is the lack of

understanding and maybe the younger generations understand it more because they're more into it. That must make me sound very old.” (CP3)

Some found that information about the associated carbon emissions can be hard to access and should be more visible in key documents for prescribing such as guidelines and British National Formulary (BNF).

“But the information, wasn't there in, say things like the BNF and stuff. They don't tell you which ones you know... so actually how do you find that information out?” (GP8)

In addition to varying levels of knowledge, there was variation in when and how clinicians have become aware of the environmental impact of inhalers. Most clinicians acknowledge they have been made aware of this recently, however, other clinicians recognise the switch to inhalers being CFC-free in 2008 as when they became aware that asthma care had an environmental effect.

“I don't think until two years ago I would even thought about the possibility that an inhaler was a pollutant and it was causing greenhouse gases which is mental, but it's clearly something that all of a sudden, we're, like, hang on a second. What's going on?” (GP2)

“And obviously I'm old enough that I remember switching to CFC-free inhalers and that being something that would pop up as a choice. So I guess that was probably the oldest acknowledgement that these are harmful.” (GP4)

Despite most becoming aware of the environmental impacts recently, one participant showed frustration that it has taken so long to come into the public eye.

“Shocked and frustrated because when you just look at, you know, Scandinavian countries and other countries, frustrated that no one cottoned on sooner. But I guess that goes with everything with the environment. But yeah, shocked to kind of think having never considered, you know, that something you prescribe can have an environmental impact.” (GP3)

Some participants discussed how a lack of knowledge of environmental impacts may be perceived negatively by patients and limit the conversations you are able to have with them.

“You know, if you're not educated on it and a patient says, ‘well why are you moving to me to that?’. Because I've been told to. It's not a good enough answer, is it?” (PN6)

A few participants described a fear of not knowing enough and the expectation of professionals to have irreproachable knowledge. Doctors, in particular, felt that there was this expectation and were less likely to bring sustainability into the conversation without a perfect understanding, with the worry of judgement from patients or colleagues.

“And people don't like admitting their flaws or their lack of understanding, particularly as I think as medical professionals here, you're expected to perform well no matter what.” (GP6)

“Kind of fear that you don't know enough and therefore you don't want to kind of put your neck out and say anything because you might be criticized for not being eco enough or, yeah, appearing ignorant about something that as a professional, you think you probably ought to know about.”

(GP3)

A lack of knowledge about the environmental impacts of inhalers was thought to impact on the ability to communicate this information to patients. A key area of concern was not being able to explain these concepts in a clear and concise manner that patients would understand.

“I mean, I don't completely understand it. And in terms of how are you meant to know, you know? I mean...I'm not...I've never... I did science and stuff at school but it wasn't there. I wouldn't be able to explain it simply enough to a patient.” (GP8)

“It's just the propellants, you know, produce a greenhouse gas which then affects the carbon footprints. And that's it really in simple terms. That's all I really know. [...] I don't know enough to be able to explain it in its simplest terms.” (PN5)

Whilst discussing why clinicians felt they didn't understand environmental impacts, the issue of visibility was raised. Some clinicians ascribed their lack of understanding to the fact that carbon emissions are not visible and therefore difficult to attribute meaning to. To make the environmental impact of inhalers clearer, carbon emissions were compared by several participants to their equivalent car miles. These comparisons were thought by some to be useful tools when having these discussions with colleagues and patients to help put the impact in 'real terms'.

“I think it's hard to see....I've got no idea what a ton of CO2 looks like or what having a ton less of CO2 in the atmosphere actually means.” (PN2)

“I think it's an easy tool to show the patient because obviously I think for a lot of patients it [carbon emissions] doesn't mean anything. Yeah, we tell them its got a monumental impact but what does that mean.” (GP8)

It was felt that plastic waste associated with inhalers was a greater issue and should be focussed on more than the associated carbon emissions as a visible form of waste. One participant identified sustainable changes, such as improving recycling within their practice, to be much easier compared to changes to prescribing, as this was a visible change to people and one where they could see the impact of not contributing.

The vital role of education in increasing sustainable prescribing was explored by most. The importance of undertaking CPD activities in this area was identified, with potential benefits of feeling more confident with their understanding and therefore being able to engage in these conversations with patients.

“I think that the education of the prescribers themselves should be a priority. For this switch, public health drives to kind of get patients to speak to their GP about certain things certainly can become useful, but that's only good if the clinician is able to engage in that conversation themselves.” (GP6)

“If somebody said to me ‘what impact would it have?’, I wouldn’t know. I think actually I need to probably do some CPD around that, so I can actually say to a patient ‘well this is the impact’”. (CP3)

5.4.2 Attitudes towards change

When asked about barriers to making prescribing more sustainable, participants identified clinician attitude towards change as a key hurdle to overcome. Of the clinicians interviewed, there were a variety of perspectives about how clinicians perceive change and the barriers to changing prescribing habits. Some felt that overall clinicians do not like changing their prescribing habits and would prefer to stick to what they’ve always prescribed.

“Well getting anyone, especially a doctor in the NHS, to change is very hard and that’s not specific to inhalers or anything, so that’s probably the main barrier, just like people don’t like change. They know what they know and kind of stick to old guidelines.” (GP5)

In contrast to some participants viewing change as negative, others viewed changing to low-carbon inhalers as a straightforward, simple action. These clinicians were already engaging in sustainable prescribing or were based at practices or Primary Care Networks (PCNs) where widespread change to using more DPIs was happening.

“It’s not that hard to do better at, if that makes sense, like it’s to me it’s like nonsensical. Like, why aren’t we already doing this type of thing?” (CP1)

“I feel strongly that we should try and reduce it as much as we can, especially when there are equivalents available that are much less environmentally harmful. And it’s a no brainer really. Like

they're the same price or cheaper, and a better for the environment and the patient outcomes are the same, so." (GP1)

Several participants felt age impacted a clinician's view on change and their subsequent ability to alter their knowledge and prescribing. It was thought that changes would be poorly received by older clinicians and better received by those who are newly qualified.

"I think the younger doctors are kind of like just learning the guidelines and very much happy to kind of understand that new guidelines are coming out and we adopt them, whereas maybe a more senior doctor [...] You know, maybe they're less willing to change. They think they're gonna retire in a few years and, you know, don't care about new guidelines so much." (GP5)

"It's generally the older school GPs [who] are more resistant [to change]." (CP4)

When asked what makes implementing prescribing changes difficult, several key factors were identified, which include time constraints, clinician burnout and the habitual nature of prescribing. Time of consultations was discussed as a key limiting factor for some participants switching a patient to a different inhaler device, with key concerns over not being able to educate a patient about their new device or teach a new inhaler technique. Some felt that time limitations would prevent a patient successfully switching from an MDI to a DPI.

"Probably time I think and yeah cause we're just so busy now. And patients' expectations of a consultation and what they want sorted out. There's not necessarily that time to be able to do it and

change people over and making sure that, you know, if you do change them over that they're using the inhaler correctly and confidently so.” (PN5)

“There's lots of other things that that need to be done within primary care in particular and so that time constraint when we've got just two practice nurses who tend to deal with all of this and they haven't got three appointments for four to six weeks to be able to book the patient in. And so for us to then ask them to do extras or spend longer with certain patients to explore that is tricky.” (GP6)

Despite recognising time constraints in consultations could prevent clinicians from switching patients to a different inhaler device type, one participant reflected that environmentally-friendly asthma care shouldn't take longer than standard asthma care, as education and revisiting technique should be a key component of every asthma review.

“Is it always an extra thing though, because you should be able to tie it in with your normal management. I know I'm saying like time, but you should be able to kind of introduce it, or at least education and inhaler technique should be part if you change people over anyway?” (PN5)

The total time cost to primary care of engaging in inhaler device switches was also considered and in some instances was felt that other clinical issues may outweigh the importance of low-carbon asthma care.

“If we are making those switches, it's gonna take a lot of time across primary care and that time could be used elsewhere. So that's my main concern.” (CP2)

“I actually had a message from one of the technicians a couple of weeks ago saying that there was various patients that they're looking at switching and asking whether or not we could get them in. But you know it's the wrong time of year for it really, QOF and everything.” (PN3)

Clinician burnout in the context of the NHS crisis was also perceived as preventing clinicians from changing their prescribing. It was felt that practices would struggle to implement changes to prescribing and switches, due to concerns of adding to individual's and primary care's workload, in an already pushed system.

“Something has to give. And sometimes sticking with the status quo is the thing that makes life able to be tolerable and to stop your GP from having to work 14-15 hours a day. So if the difference between burning out and having no GPs is keeping people on rubbish inhalers then that's probably the thing that would win.” (GP2)

“And just the fact that everyone's burn out, the NHS is so stretched and everyone's so burnt out that the idea of considering something new or something different is just more than anyone has kind of the headspace to think about.” (GP3)

Change was also perceived to be difficult due to the habitual nature of prescribing. Most participants felt they prescribed the same inhaler to patients, and some referred to their thinking when making prescribing decisions as 'automatic'. This was thought to make implementing prescribing changes more difficult as participants would have to challenge learned behaviours to choose low-carbon options as first-line.

“So I think it is very hard to change people's opinions and even yourself you find, you know, if you're seeing someone like or let's try some asthma treatment with you, you're automatic go...you suddenly just put Clenil in without thinking it. You know, and you don't. And then afterwards, you like, why did I do that? You know, I know I'm trying to do dry powder first, but you just didn't twig, you know.”

(PN1)

“If I'm looking for a steroid inhaler I do tend to use Clenil. Just as it was the [location of the practice] policy, it was their first line choice for ages and I think that's still in my head.” (GP4)

Limited time within consultations and clinical workload mean that some participants feel their prescribing becomes habitual to cope with these external factors.

“You're very limited time wise. I would love to be able to spend half an hour with every single patient and look things up and make those shared decisions and all of that together. But 10 minutes is not easy. So therefore, I think we do get into habits.” (CP3)

“When people have got a lot of other things to think about, it's always gonna be hard to break that habit.” (CP4)

Incorporating sustainable prescribing into daily prescribing and making low-carbon choices the ‘automatic’ option was considered by some as an effective way to make long-term change.

"I guess a bit of an argument between yourself sometimes, and I would never be thinking about this necessarily at the forefront of my brain but once it becomes second nature, then you start to do it as part of just your standard care and that's that. That's where the difference comes. Right." (GP2)

"And as we're looking forward, thinking about what we can change without much effort, which is what we're initiating as first choices. We could really change that. I think there's a lot of stress or push back from the idea of trying to switch because that's really time and workforce intensive, but with no effort we could switch our new behaviour and I think us not doing that, is probably because we're stuck in the patterns." (GP4)

Despite change seeming difficult for most participants, both changes to mindset and changes to prescribing habits were considered possible, with the right support and strong guidance.

"So I think on a leadership level, if the powers, be that on a citywide and that nationwide level, made that a priority then, then habits would change, and then when habits have changed, you've got the new generation of clinicians coming through with that change and just like we have done with lots of brand switches. People that have been prescribing one way for years can change what they're doing. And it becomes a normal so it doesn't have to be a green choice for everybody if that's not something that's their priority, but it could be considered. As most of these aren't...they're not worse choices, they're just possibly less familiar choices." (GP4)

"I think it is, [change] is difficult. But it depends how you go about it. Even if you have the right data, if you have the right training, if you have the right support, it is hard. And again it comes back to incentive and time and stuff. If you have that backup then it's easier to do." (CP4)

Attitudes of patients towards change was also considered, with most participants feeling that they wouldn't consider switching inhalers or inhaler device types given the perception that patients don't like change.

"People don't like change and I think that's the problem with asthma. People think they know the condition and they don't like change. And so when they switch to a new device and it is different and they... it's not... the habits that they have. It doesn't conform to the habits that they have." (CN2)

"They don't want to change. They, you know, like say, all that's very well and good, but I want my brown one I can. Yeah. Like I'm all for changing the environment. But I'm not for changing my inhaler." (PN1)

Clinicians felt that patients don't like change for a variety of reasons. Some considered patients to be in a routine with their current inhaler and subsequently wouldn't want to change from their current habits. Some clinicians also felt that their patients perceive change to be risky and would be less likely to change if they had stable asthma. Other felt that patients automatically feel that change means to a lower quality medication, based on previous cost-saving changes to prescribing.

"And I think people, you know, don't like to change. Sometimes they're worried because their asthma stable and they don't want to rock the boat. So that stops a lot of them from changing." (PN5)

“I think patients are sometimes a bit weary of us changing their medication. I think traditionally that's because it's been cost driven. And so when whenever we then propose a new change, sometimes your...the initial reaction is no, because they're worried that you just changing them to something cheaper, which they' equate to be something less efficacious.” (GP1)

Habitual use of SABA inhalers and subsequent SABA overreliance was a significant issue that was raised, with some clinicians reporting salbutamol was perceived by patients as a ‘crutch’ and a ‘safety blanket’. One participant described a particular case of SABA overuse that she’d recently seen at an asthma review and how this patient is reluctant to change her current inhaler use, even though SABA overuse has proven worse patient outcomes.

“I have a lady who's been using three [salbutamol inhalers] in a month last week. Yeah, and just refuses to not use it, so it's really difficult when you've got patients like that to try and bring down. [...] I think, yeah, I think they get definitely get stuck in habits and routines and you know for them, for some of them like that Lady, it's an addiction. She can't not have it [...] trying to take that off somebody who's had it for 20 years is extremely difficult, especially giving them a dry powder. You know, use this instead. It is, it just doesn't work.” (PN6)

One nurse felt that patient education about the environmental impact of their inhalers will play a vital role in encouraging patients to consider a change to their inhaler.

“Yeah, we do but it's quite hard to do, isn't it? When people feel quite happy with what they're doing and they don't like change. But it's about education, isn't it? And it's about them, you know,

contributing towards our planet and so hopefully, if you've set in the right way, that most people are willing to change. Say 'I'll give it a go'. So most people say that 'I'll give it a go' so." (PN5)

5.4.3 Engagement with Sustainable Prescribing

Participants reflected on the ways that the organisational culture of their practice impacted the way in which they prescribe and how, in some instances, it has prevented them from making prescribing changes with sustainability in mind. Some participants considered shared ways of thinking and how environmental concerns challenge the preconceived 'accepted' way of managing an asthma patient, particularly the norms discussed in Status quo (Section 5.3.3).

Some clinicians felt that they may be judged for bringing up environmental concerns or that they may experience stigma from patients and other prescribers.

"Some people roll their eyes and go 'ohh, you know the environment' and you know those people who are always gonna be sceptical" (PN4)

"And I suppose a part of me. I'm not not embarrassed, but its almost... and it's not right, but it's just how I feel. But it's almost like the sustainability kind of argument or kind of point for doing something almost isn't as valid and that's how I feel." (CP1)

Interestingly, during their interview, one participant was quite critical of the sustainable change and what he referred to as the 'green agenda'. His perception was that by considering the environmental impact of healthcare, this would automatically put patients at risk and was not in their best interest.

“And I'm not criticising it but I have an issue with any target that does not allow us to come up with the correct approach for the patient.” (GP7)

Even though environmental concerns were considered more topical and acceptable now by participants, some felt they may still be isolated in their decision to factor them into their prescribing decisions.

“Yeah, like nowadays, I think the culture has changed enough where it would be completely accepted and understandable, but I think it would still be kind of, you know, you'd be like you're possibly the only one like considering that. It's not like everyone's like ‘Ohh yeah. Great. That's a great idea. I'm gonna do that as well straight away this afternoon’. It would be a bit more like ‘OK I'll you know it's good you're doing that but I'm kind of like not like completely receptive to it or something’.”(GP5)

Some participants felt that it is was not within their role as clinicians to advocate for sustainable healthcare and felt that their job was purely to focus on medical management. Some felt that prescribing decisions should be based around what is best for the patient and did not consider environmental factor to contribute to that. The degree to which environmental concerns were considered to be relevant to patient-focused management varied dramatically between participants, with some feeling they come hand-in-hand and some feeling they opposed each other.

“I just don't know that it's a priority. I'm not sure that it is. A patient comes to us as professionals looking for advice. My advice should be based around what's right for the patient.” (GP7)

“They kind of probably don't see it as really their responsibility. Their responsibility is as a clinician looking after the patient, you know they maybe don't feel environmental impacts are a part of their role to be considered.” (GP5)

Despite some clinicians feeling that environmental impacts were not of concern to patients, some participants reported incidences of patients bringing up low-carbon asthma care to them.

“But obviously now there's quite a big push for environmental reasons and, you know, I've had quite a lot of patients come to me and sort of want to change their inhalers to be more eco-friendly or more environmentally friendly.” (PN5)

Clinicians were variably engaging in conversations with patients about the environment for a variety of reasons. Some clinicians felt hesitant to engage in discussions around sustainability or bring sustainability into their decision-making process as they felt patients would think the clinicians as having an ulterior motive, rather than the best care for the patient, and therefore view them as less trustworthy and consequently less professional.

“So if I said to a patient ‘oh I'm switching you over to this’ because of the environment, like whether it's me just assuming or you know it's based on past experience, patients might be like, oh, like, who cares?” (CP1)

“What I think they will expect from the doctor and their expectations of like a kind of like unbiased professional, you know with only their interests at heart. I think as soon as you start saying anything

about like, well, this is a bit cheaper, this is a bit better for the environment, I think you sometimes lose a bit of trust and they think that you're like trying to con them into getting something that's inferior and you're just doing it for that some alternative reason" (GP5)

Conversations with patients about carbon-saving were also perceived as difficult, however easier conversations to have than those about cost-saving measures.

"It can sometimes be tricky to have those conversations. I think the environmental side of things is slightly easier to sell than just a cost and yeah, you certainly do come up against resistance if you're trying to change someone without sort of justifiable reason." (GP6)

Not all clinicians considered an in-depth discussion around the environmental impacts of inhalers appropriate or necessary. Some deemed it not to be of interest to the patients, whereas others felt that patients would be quite willing without much further information.

"Probably because when I deal with my patients, it's not generally the number one thing on their mind. Yeah I just don't think it's something that has naturally fallen into my thinking, really. And I'm not sure if it falls into the patient's thinking either. My priority at that point is the right inhaler for the patient, not the potential environmental impact. I cannot think that I have ever discussed that with patients because I'm not sure it's a lever that really will have much bearing on the patient's decision to use one inhaler over another." (GP7)

“So I don't really go into much detail because I think most people are just kind of like, ohh yeah, anything to help the environment. Most people like that. We don't have to really say too much.”

(PN5)

One clinician was encouraged by her practice to discuss the environmental impact of DPIs with patients when switching over from MDIs, without giving her guidance about how to carry these out; this meant that she was uncomfortable having these conversations and was overall glad when she wasn't switching inhaler device type.

“Yeah so we're being asked to do that now because of the carbon footprint and so this is a conversation that we're having with every single patient where obviously where it's appropriate. And I feel quite relieved when I have a patient already on a dry powder inhaler that I don't have to have that conversation.” (CP3)

Despite stigma being a barrier to environmental considerations, a few participants commented that it is easier today to make changes and introduce sustainable prescribing. Some of this has been attributed to different sustainability projects, including script switching, or formulary changes. In practices where significant changes to prescribing have been made, utilisation of weekly newsletters and the creation of sustainability- focused prescribing aids based on local guidelines were identified as key drivers in normalising environmental considerations.

“But a few years ago I'm pretty sure it was really tricky to prescribe environmentally with inhalers. I'm pretty sure the DPIs either weren't on our like local formulary or something or they weren't in stock. And you know, it was almost impossible. You were prevented by the system. And I think that

has changed. I think people have done work to say, you know, these need to be prescribable, you know, we need them in stock. We need them on formularies. And I think that work has happened. So, you know, worse than it may, but it felt like it was preventable and now maybe we're moving in the direction, you know, of more sustainable healthcare.” (GP5)

In practices engaging in changing prescribing habits and inhaler switches, participants often put this down to the actions of motivated individuals. It seemed that often changes were implemented into practices because an individual has taken initiative and brought this issue to the forefront. One pharmacist said members in her practice refer to her as the ‘inhaler lady’ because she’s been advocating for change in her practice and trying to encourage other prescribers to alter their habits. The role of strong leadership has also been considered to have a role in making environmental considerations normal in prescribing decisions and to equal out stigma, with several clinicians mentioning specific individuals who are promoting this within their own practice or PCN.

“And I think often they tend to have one or two GPs that are driving that, so a lead on that and that often tends to be people with sort of a personal interest, either in respiratory itself, but it's usually the environmental factor. So yeah, I can think of a couple of practices where there are GPs who are really sort of pushing this and making a big difference actually [...] it only takes one or two GPs within a practice to really push this forward” (GP6)

“That kind of strongly leadership at least has got rid of a bit of that stigma and kind of normalized it a bit and started to change that culture” (GP5)

Several participants highlighted that a widespread change would allow for more change to be made and, whilst individuals have been vital for initiating change, all members of the team need to be involved to change the culture around sustainable prescribing.

“I think it has to be the whole area has to be onboard with it and so within a primary care network, all the practices and GPs and nurses need to be upskilled at the same time and start this across the board and in agreement to which guidelines you use [...] everyone needs to be singing from the same hymn sheet” (CP2)

“It's all very well and good you're having three or four motivated people in a practice but if you've got eight other GPs working there who aren't aware of it as an issue, then you're going to get people being started on the, you know, the bog standard salbutamol for...just to see and then you have to be changing those people so you know that would make a difference I think.” (GP2)

Clinicians reflected on the need for strong leadership for sustainable prescribing to be a priority and to encourage clinicians to include environmental considerations within their day-to-day prescribing. Organisational systems, such as Integrated Care Boards (ICBs) and Primary Care Networks (PCNs), were identified as being key groups who can implement and encourage their practices to make changes.

“Yeah, I think it would just be such an effective way to make quicker change if this came from a supported message from higher up because then it would engage clinicians that are seeking out that information, but also clinicians that haven't particularly sort it out but are very happy with that idea” (GP1)

“It's the kind of thing you need a whole system approach to, and you can't...I always find as an individual GP even now as a partner you still need a system to be changing rather than just an individual.” (GP2)

A few clinicians said that their ICBs were already promoting low carbon asthma care at their practice and that this was making day-to-day changes to the prescribing habits of clinicians.

“So my line management encourage us to do so and also the, I can't remember what they called anymore, the CCG or the local authorities, so they're encouraging it as well. And so I think it's come down from there which has come down from further up in their government.” (CP3)

PCNs were also identified as an opportunity for clinicians to share knowledge about this area and to promote increased DPI use within other practices. Two of the clinicians I spoke to had delivered an education package to other clinicians within their own PCN regarding the environmental impact of inhalers.

“I'd presented to the practice and then to the PCN about the inhaler switches and so had kind of delivered a bit of an education package there. [...] And then I kind of also promoted the Investment and Impact fund and continued then to sort of promote that throughout last year. [...] I also met with the lead nurse from the PCN a couple of times. And kind of let him know about the asthma toolkit and had discussions about how we could get more engagement and work on the Investment and Impact fund.” (GP3)

The role of incentives was highlighted as providing support to initiate prescribing changes, which will be discussed next.

5.4.4 The role of incentives

When asked what factors drive prescribing changes, participants highlighted the important role that incentives play in day-to-day clinical practice. Financial incentives were identified to be key drivers in encouraging practices to prescribe more DPIs and to switch patients who are on MDIs over to low-carbon alternatives. The monetary support offered in the Impact and Innovation Fund (IIF) was noted by most to have prompted wide-spread inhaler switches or influenced prescribing habits at their practice.

“There is like no way in hell that the whole PCN would have switched over to Ventolin...from Ventolin to Salamol if it wasn't for that financial reward.” (CP1)

“So, yeah, admittedly, if it wasn't for the IIF, I wouldn't have put a big push on that, whereas at the moment with the IIF, I definitely lean toward DPIs.” (CP4)

Switching inhaler device types was recognised to add to the clinical workload of primary care and in some practices, the support from financial incentives was used to employ more staff to account for this.

“I think PCN incentives will always be quite effective, because actually it's particularly now funding streams are getting smaller and smaller for GPs and we're getting less and less money. So if you can

do something simple that is just trying to change inhalers which isn't a massive bit of work and we're getting the funding to pay for the pharmacy tech, then that's a good incentive [...] the only things that are going to make changes easier is having more money to employ more people to do more work because at the end of the day GP is literally on a shoestring.” (GP2)

Financial incentives were perceived to influence different clinicians in different ways. When asked if financial incentives such as inclusion in the IIF would motivate clinicians to make change, it was felt that GP partners in particular would be influenced more by financial initiatives, compared to other members of the primary care team.

“Paying GPs to do something equals getting it done. I must be quite perfectly and completely honest with that. And because if they think there's gonna be money at the end of it, they'll do it. And they'll actively encourage the nurses that are prescribing to do it as well.” (PN2)

“Yes, because money is involved and I think certainly as a partner yes. As a salaried GP, there's certainly less incentive but yeah I think including in something like the IIF would be good.”(GP6)

Contrastingly, nurses felt that financial incentives didn't impact their prescribing decisions and they felt that they are more driven by what is best of the patient.

“I'm not saying it's not for doctors, but with the nurses, it's always seeing that it's going to make a difference and that it will make their compliance and their control better.” (PN3)

Some participants felt that there were wider benefits of including sustainable prescribing targets with financial rewards. One participant felt that its inclusion within the IIF has raised awareness about the topic and has provided a platform for discussion.

“[I’ve] known about this issue for a good couple of years, but with this backing, it’s been good for me because it gives you kind of a monetary, you know, value to be able to get people on board and get people listening and saying and actually wanting to do the work as such rather than, just, you know, the good of the planet.” (CP1)

Whilst the clinicians were overall in favour of financial incentives and agreed they are effective, some individuals expressed disappointment that incentives are required to make change to clinical practice, rather than improvements being directed by best patient care.

“You know, changes should be done because it’s what’s best for the patient and what’s best, you know, in general. But sometimes it’s the only way to get things done, isn’t it, to actually sort of incentivise it. Because that sort of primes people to think about it, cause they know they’re gonna get paid for doing it, and then once they’re doing it, then obviously that’s the norm.” (GP8)

“Unfortunately you get a lot that are motivated by incentive. Which doesn’t work. It works to them, but it doesn’t work in the whole environment because we haven’t got the money. The NHS hasn’t got that kind of money. But there are some individuals that will only be incentivised by that and that alone. [...] It’s a shame but that’s how some people are. That’s how some humans are made.” (CP3)

Some participants highlighted potential problems with introducing financial incentives within prescribing, such as increased workload, difficulty in reaching thresholds and prescribing DPIs inappropriately to reach targets.

“We're at a point where we're now swapping a lot of patients over and people are going to be doing a lot of work, but we still won't reach the target. So I think that it'll then be hard to continue that work come next April because people will say we worked really hard and we still didn't hit it.” (GP1)

One general practitioner felt very strongly that financial incentives are dangerous and targets to increase DPI prescribing would be risky to patient lives.

“I think setting targets on DPIs risks patients, who should not be on a DPI for all of the reasons I've mentioned, ending up on one with potential risk. Asthma still kills and we have to make sure that patients are on the right inhaler for them.” (GP7)

Aside from financial incentives, other incentive schemes were highlighted with a key example being the RCGP Green Toolkit Award Scheme, where practices work towards a gold, silver or bronze award. Several HCPs felt that reducing the carbon footprint of their prescribing and benefitting the environment was an incentive within itself. Some clinicians suggested that sustainable prescribing has a role within QOF or quality improvement projects and some outlined current or previous audits that their practice has undertaken.

“And I think doctors and prescribers probably need, you know, a good reason to do it though, like, you know, either financially, like mostly NHS has run on, or something where you know you could be kind of saying either to yourself or to others that we're doing a good thing here by changing. Whether this resides somehow part of like your appraisal to say, like I've done this audit and I've changed loads of inhalers and you know the environmental impact has massively reduced and you can kind of be doing it as a bit of a like quality improvement kind of work.” (GP5)

One participant highlighted that the benefits of sustainable practice go much further than financial incentives and actually the benefits to population health and the workforce should be motivating to clinicians.

“Yeah, kind of, making it easy for people and showing the benefits, showing the fact that, tackling this can create benefits for patient health, benefits for staff morale, retainment recruitment, financial savings. And that it's easy and achievable.” (GP3)

Aside from individual or practice level benefits, two clinicians described the benefit to future generations as enough of an incentive within itself and mentioned their children as a key driving factor for this.

“And at the end of the day, I have two children and my children have to live in the world and this...if we can make small differences as the NHS is one of the biggest, you know it's the biggest sort of employer in the country. If a big employer like that can start to make differences then it hopefully makes small differences overall to bring everything down.” (GP2)

“Yeah, I mean, I'm very keen to make changes. I have children myself, so I know that the impact of, you know, past generations is probably gonna affect the future generations.” (PN4)

Other facilitators to change were explored, including the prioritisation of low-carbon options within prescribing guidelines which will be discussed next.

5.4.5 Guidelines and Systems

Participants discussed the decision-making and prescribing tools they utilised within asthma reviews to aid prescribing. Participants often referred to national or local prescribing guidelines whilst prescribing and found them to be important factors impacting inhaler device choice. Some clinicians found the variation between different guidelines confusing and were uncertain as to which is the best one to use.

“Of course one of the problems we always have with sort of asthma is well which guideline do I use? And I think if there is clear and unequivocal combined guidance produced regarding the use of DPI preferentially over MDI, then I think that would put us in a much better position” (GP7)

Some participants felt that guidelines should include low-carbon alternatives as first-line and that this would be an important step to initiating wide-spread change across clinicians. Some felt this would target those who have not been considering the environmental impact of inhalers within their prescribing decisions. One general practitioner felt that clear guidance would be more effective than the financial incentives previously discussed in changing everyday prescribing habits, however this opinion wasn't shared by other participants.

“It's my view that new guidance and effective guidance will change practise more than offering people 5P per changed inhaler.” (GP7)

One clinician felt that information about the environmental impact is difficult to find and should be included on guidelines and within the BNF. He felt this would make the information more accessible to clinicians to consider carbon emissions within their prescribing process.

“I was aware that we were trying to sort of find ones with a lower burden. But the information, wasn't there in, say things like the BNF [...] so actually how do you find that information out?” (GP8)

Practical systems involved in prescribing also impacted prescribing decisions. Local formularies and inhaler licenses were also felt to have significant influence over what clinicians prescribe for their patients.

“So obviously I see what inhalers they actually need and it will go by what is in the local formulary as well. So that would be like things to consider what's on there for me, what they prefer us to prescribe.” (PN5)

“So every time I have to prescribe, I always have to open the formulary and go by that so.” (GP3)

Most participants expressed pharmacy stocks have also influenced the inhaler they prescribe and, in some cases, prevented clinicians from prescribing inhalers with a lower carbon footprint.

“At the moment, availability will always influence it and if I could, I had a pound for every ‘We don't have any of this at the moment’ message I got through, I'd be very rich.” (GP7)

“So when we first started to switch people, we were looking at doing a bulk switch for people on Ventolin to another MDI and we were looking to swap them all to Airomir, which was the one that had to the smallest amount of CO2, but they couldn't produce enough stock.” (GP1)

“Probably wrongly, I would then shy away from [DPIs] because I think like it's gonna be hard, the pharmacies are less likely to have it in, the patient's gonna need to wait each month for pharmacy to order it in” (GP4)

Some formularies were reported to have been adapted for sustainable change and either contain environmental information or have DPIs as first-line options. One general practitioner reflected on how changes to local formularies and ensuring that pharmacies have sufficient stocks have made a difference as clinicians feel able to prescribe DPIs.

“I think people have done work to say, you know, these need to be prescribable, you know, we need them in stock. We need them on formularies. And I think that work has happened. So, you know, worse than it may, but it felt like it was preventable and now maybe we're moving in the direction, you know, of more sustainable healthcare.” (GP5)

Participants outlined the important role that external resources have within making prescribing decisions, often citing RightBreathe, and Asthma UK as good sources of information. Some felt that

external resources are vital within their prescribing process and help to determine what inhalers are available as a low-carbon alternative.

“I have actually got a big chart that shows me what device and what colour it's in and what medication it contains, so I'd often have to refer back to that to know which drug can I get in that particular shape type.” (PN2)

One pharmacist had created a prescribing resource for other clinicians within his PCN, outlining the inhalers available within their formulary, their cost, and their environmental impact. A GP at the same practice remarked how useful it has been for communicating information to patients and has been a key driver in implementing environmental concerns within his prescribing decisions.

“I think I'm reasonably confident in it now that we've got all the charts and stuff. As I said before, I wouldn't have been as aware without them.” (GP8)

Participants also noted the impact that the computer software they use has on their prescribing. Including information on the environmental impact of inhalers within EMIS or System One has encouraged some clinicians to prescribe more DPIs, by either displaying the environmental impact information or providing the low-carbon options as first in a list. Pop-up notifications whilst prescribing were also noted by some to be useful and resulted in them changing the inhaler device they initially prescribed. Despite this, 'pop-up fatigue' was noted as potentially impacting this mechanisms effectiveness.

“We also had a script switch alert so that if someone tried to prescribe, I think it was a generic salbutamol or Ventolin it would suggest a dry powder inhaler or suggest considering it, so we had a bit of an alert [...] I think there's a risk of pop-up fatigue isn't there when you have so many things coming up.” (GP3)

Several participants explained that they were having conversations about the environmental impact of inhalers with patients because this was included within the template their practice was using for their asthma reviews, not because they are motivated by environmental considerations. The Arden's asthma template was specifically named as promoting clinicians to make sustainable change.

“If you want the truth, it's because its included on the template” (PN1)

“You know on the Arden's template, on system one, it kind of tells you what devices there are and has a little picture of them and has their environmental impact on there as well. And I'm like quite keen on that so I always try to choose the lowest environmental impact yeah first and then yeah, but it also tells you the cost of the inhalers and stuff like that.” (GP5)

5.5 RESULTS SUMMARY

My results show that there are a variety of different factors that affect the inhaler device that clinicians prescribe for their patients and that some factors prevent or promote the prescribing of more DPIs. These factors can be separated into prescriber-centred, consultation-centred and external factors.

Prescriber-centred factors include the internal perspectives and values of the prescriber, as well as their knowledge and confidence with asthma prescribing. These factors differ between prescribers and determine how a prescriber interacts with the consultation and external factors. Consultation-centred factors refer to how different styles of shared-decision making and the practical aspects of a consultation influence choice of device type, as well as how the views of the patient are considered. External factors include the organisation of primary care practices, PCNs and ICBs, as well as some of the practical limitations around prescribing such as formularies. I have illustrated these three categories in Figure 8.

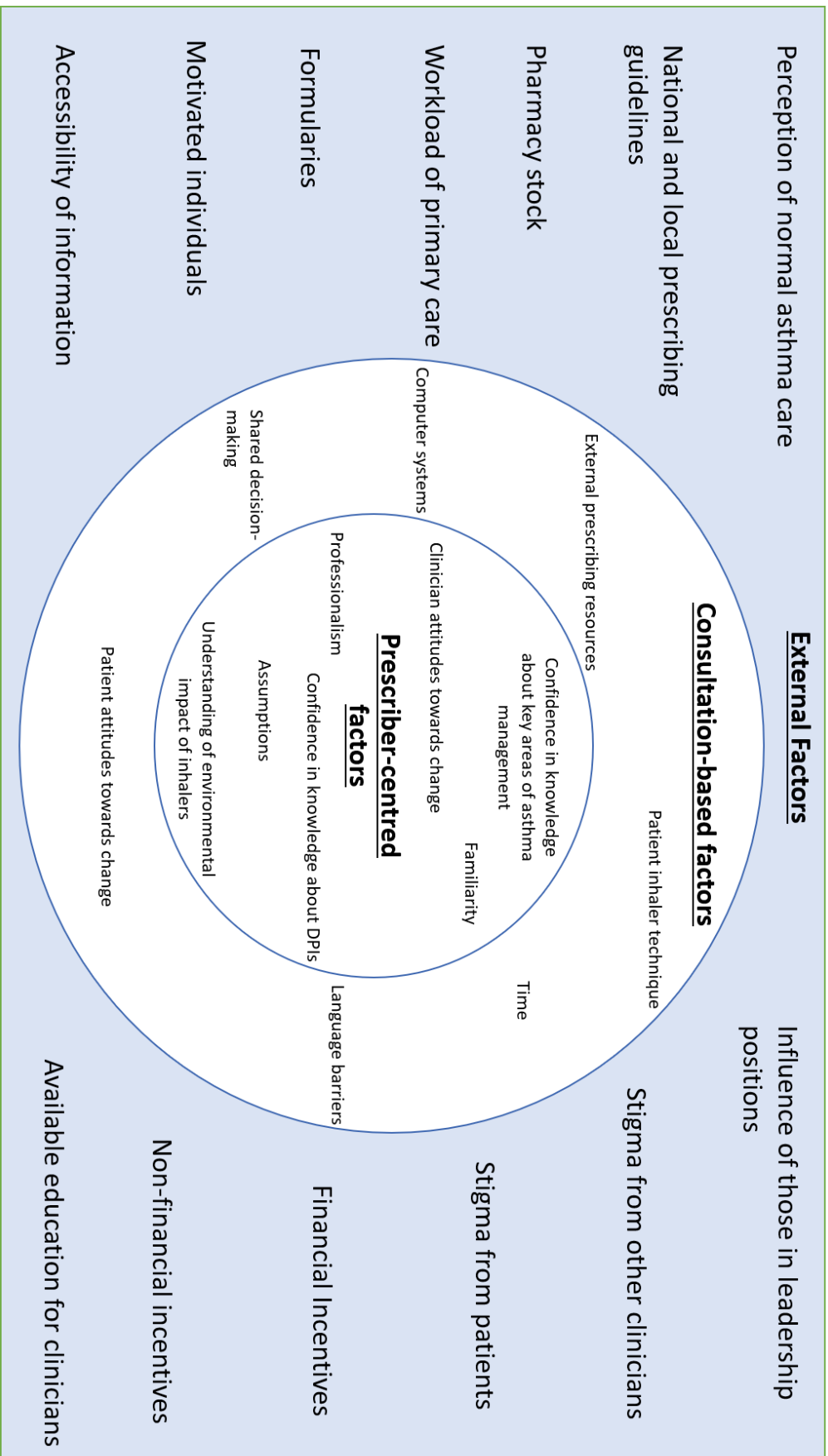


Figure 8: Summary of the factors that influence inhaler device choice

6. DISCUSSION

6.1 INTRODUCTION TO DISCUSSION

In this chapter, I will discuss the key findings of the study, within the context of existing published literature about inhaler prescribing and sustainable healthcare. I will also evaluate the strengths and limitations of my study and discuss potential implications for policy and areas for future research.

As discussed previously in my study rationale, there is a lack of research about the barriers and facilitators for implementing low-carbon healthcare into clinical practice, despite low-carbon inhalers being identified as a priority in the NHS Long Term Plan and the Greener NHS *Delivering a Net Zero National Health Service* report (14,29). Overall, there is very little qualitative work exploring what clinicians feel impacts their prescribing decisions and how these decisions are made with the patient. Some quantitative literature is available regarding the factors which affects inhaler device prescribing, most notably Lavorini et al.'s retrospective analysis of patient prescriptions (74). This study adds to the quantitative literature by providing a key understanding of clinician perspectives on what influences decision-making in asthma management. This study is unique as it explores the views of different clinical groups on implementing sustainable asthma care into primary care, of which there is currently no available evidence. This provides vital insight into what needs to change for low-carbon prescribing to be integrated into daily clinical practice.

6.2 SUMMARY OF FINDINGS

Below is a summary of the main study findings, split by theme and highlighting key subthemes.

Patient-centred care

Participants considered prescribing the ‘best’ inhaler for their patient to be the most important factor influencing their decision-making. Important practicalities, such as dexterity and patient preference contributed to deciding which inhaler is the ‘best’. Participants felt a patient’s inhalation technique was important in choosing between an MDI and a DPI and often matched a patient to an inhaler based on their existing technique. Consultation styles varied between participants when undertaking asthma reviews, with some clinicians using a shared decision-making model and others being more clinician-led.

Making assumptions

Several demographic factors, including age, deprivation, ethnicity and English fluency, influenced clinicians’ inhaler choice and their judgement of whether a person was more likely to be interested in sustainable healthcare. In some instances, language barriers and cultural assumptions seemed to affect a clinician’s ability to provide good quality asthma care.

Status quo

Clinicians felt they were more likely to prescribe an inhaler they and the patient were familiar with, and, for most of the clinicians, this was an MDI. Poor inhaler technique and poor asthma control were thought to be normalised by patients and clinicians.

Clinician confidence and knowledge

Clinicians felt that they lack essential knowledge around standard asthma care, often citing inhaler technique as a common area of weakness. Many clinicians used external resources, such as websites like RightBreathe and Asthma UK, when managing asthma patients to fill these knowledge gaps.

Awareness

All participants demonstrated an awareness that inhalers have an environmental impact, however there were varying levels of understanding between clinicians. Barriers to understanding were discussed, including lack of time for training, age of clinician and the lack of visibility of carbon emissions. Most clinicians felt that their own limited understanding of climate science and links with health and healthcare was a barrier to engaging in discussion about sustainable healthcare with patients, for fear of being judged. Education was seen as an important step to improve understanding, including CPD activities and inclusion within medical, pharmacy and nursing curricula.

Attitudes towards change

Most clinicians perceived change as difficult and felt that overall clinicians are reluctant to change their prescribing habits. Time, clinician burnout and the habitual nature of prescribing were thought to be barriers to implementing widespread prescribing changes. Clinicians also perceived patients to not like change and expected them to be reluctant to change inhaler.

Engagement with sustainable prescribing

Some clinicians felt that they may experience stigma from other clinicians or patients if their prescribing choices were influenced by concerns over carbon emissions. Participants had varied views on the role of healthcare professionals and whether it was appropriate for them to consider sustainability within their decision-making process and discuss this with patients; some felt it was unprofessional and felt it was not in the best interest of patients. Practical changes, such as formulary changes and newsletters, have impacted prescribing habits and initiated change in some practices. Individuals are thought to play a key role in initiating change at their practice however the need for strong leadership from CCGs and PCNs on the topic was considered essential.

The role of incentives

Financial incentives, particularly incentives included within the IIF, were key in encouraging practices to prescribe more DPIs or low-carbon alternatives (such as lower carbon SABA MDIs). Whilst widely considered effective, some clinicians felt financial incentives were problematic by increasing clinician workload and in some instances, found them to be unethical. Financial incentives were not the only type of incentive seen as effective, with participants giving key examples such as award schemes.

Guidelines and Systems

Healthcare professionals discussed the decision-making tools they have used when managing patients with asthma and conducting asthma reviews. National and local guidelines, local formularies, inhaler licenses and pharmacy stocks were all identified to influence which inhaler a clinician prescribes for their patients. Clinicians felt that external resources such as reliable websites and posters give them confidence when prescribing inhalers and can help clinicians choose low-carbon options. Computer software also impacted clinician prescribing practice and the contents of their asthma reviews and effective use of software, template and pop-ups could encourage sustainable prescribing choices.

6.3 COMPARISON TO CURRENT LITERATURE

6.3.1 Factors that influence decision-making when choosing which inhaler to prescribe for asthma

My study suggested that there were several factors that clinicians evaluated when deciding which inhaler device type to prescribe for a patient. This included both patient-centred factors, clinician-centred factors and cultural factors.

Patient-centred factors identified by this study included social circumstance, patient preference, inhaler technique, age, social class, and ethnicity. The perception that patient-centred factors influence device choice was also found by Cvetkovski et al, during a survey of general practitioners looking at their preferences and experiences with different inhaler devices (143). Cvetkovski's study found that when prescribing inhalers, GPs considered the patients' experience with inhalers, their age, their preference, and dexterity when matching the inhaler to the patient. The concept of the 'best' or ideal inhaler has been explored within the literature with ease of use particularly highlighted as vital for patients, however a large proportion of studies regarding ease of use or the concept of the 'best' inhaler are funded directly from pharmaceutical companies about their own inhalers, which may impact on how clinicians view these findings (144–147).

My results suggest that age, deprivation, ethnicity, and English fluency impact on asthma management and that some of the participants in my study had prejudices based on these different demographic factors, which has resulted in inequalities in the care they provide. Age was thought to impact prescribing and meant that older patients were often prescribed MDIs and a spacer, despite evidence that older patients prefer DPIs and often have better technique with them (148). There is some evidence to suggest that age can impact the number of inhaler technique errors and a patient's ability to learn a new device, however these studies include patients with cognitive decline, meaning that their results may not be applicable to all older adults (149,150). This means that

asthma management for older patients may need to be adapted to optimise inhaler use, however there is no evidence to suggest an MDI should be prescribed in preference.

I found that some participants altered their asthma prescribing for patients who they perceived to be from a deprived background. Whilst there are currently no other studies that indicate that deprivation affects device choice, there is some description of how social class influences other components of asthma management such as a patient's ability to engage in shared decision-making (151). As patients from deprived backgrounds are more likely to have an acute exacerbation and be hospitalised for their asthma, there is a need for specific interventions in primary care to resolve inequities in care access and provision and ensure that these patients are prescribed a device most suitable for their care (55,152).

Unfortunately, prejudices against ethnic minorities were identified within my study, particularly aimed towards South Asian patients. The care disparities between South Asian patients with asthma and other ethnicities in the UK is profound; South Asian patients have worse asthma control and are more likely to be hospitalised, despite insignificant differences in which medications they have been prescribed (153–156). There are no studies exploring the extent to which ethnicity has affected the choice of inhaler device, which means that potentially unjust treatment based on cultural biases is being left unexplored and certain communities may be left underserved. Several barriers to gold standards of care have been identified for people from ethnic minorities, including access to appropriate translation services, which was identified as a barrier for shared decision-making within my study (153). To improve access to care, BTS and NHS England guidelines suggest that access to appropriate translation services should be available for all (57,157). Even though access to translation services without cultural interventions is considered unlikely to resolve differences in asthma outcomes, it has the potential to increase the quality of shared decision-making as well as allow those who are not fluent in English to be educated about asthma self-management and be given the option of a low carbon inhaler (57,156,158). Further engagement and understanding of

how different ethnic minorities perceive sustainable healthcare could provide further insight into this population as well as resolve prejudices of prescribers.

The benefits and disadvantages of each device type are well reported by those managing asthma patients and derives from the understanding that different patients will have different inhaler needs (144,159). To assist clinicians in weighing up these patient-centred factors, several different models have been developed, including Dekhuijzen's 4-question approach, which was been previously discussed in Section 1.3.6 (69,159). These models all vary in the patient-centred factors that they consider and prioritise, reflecting the lack of consensus around which factors should impact decision-making in asthma prescribing. Whilst this study has added to the literature about which factors clinicians felt influenced their prescribing, it does not provide evidence about what factors should influence prescribing.

Whilst in this study clinicians felt they matched inhaler device to patient-centred factors, this does not translate into prescription trends. Lavorini conducted a large retrospective study of inhaler prescriptions in over 500 patients across primary and secondary care to determine which factors influenced prescribing (74). This study concluded that patient-centred factors do not influence inhaler device choice and that the contents of the device is the most strongly associated factor in device decision-making. Notably this study was based on data from Italy with no comparable evidence from the UK's prescribing data meaning it is unclear whether this trend applies in the UK.

Prescriber-centred factors affecting prescribing were also identified in this study. Participants in this study felt that they were more likely to prescribe a device that they were familiar with and one that they were confident explaining to patients. The theme of familiarity is reflected in other research focussing on healthcare professionals working within primary care and their perceptions on different elements of asthma management, including Cvetkovski's study on inhaler device preference (143,160). The role of familiarity in prescribing is discussed more widely within primary care literature, affecting prescribing for conditions such as hypertension (161,162). The benefits of

familiarity in prescribing have been noted, with the Royal College of Physicians publishing a guide on rational prescribing (163). This report discusses the role of familiarity and the concept that if a prescriber prescribes something they aren't familiar with, the patient has a higher risk of poor clinical outcomes. Ensuring that clinicians feel familiar with DPIs could therefore be beneficial in encouraging more DPI prescribing and has the potential to improve the education they provide to patients.

The clinicians interviewed as part of this study described having different consultation styles, with some clinicians practicing shared decision-making and some taking a more clinician-led approach. The role of shared decision-making in asthma management for patient empowerment and improving patient outcomes is well-documented within primary and secondary care research (164–167). Global Initiative for Asthma (GINA) guidelines emphasise that the shared decision-making process needs to be individualised to each patient, given that a patient's desire to engage in self-management may vary depending on social and cultural factors (166,168). Whilst our research didn't discover why some clinicians weren't engaging in shared decision-making, common barriers, such as lack of guidance, time pressure and a perception that patients are not willing, have been identified in other studies (169,170). The participants of our study reflected on the usefulness of decision aids within the consultation, for example practice-made aids. The usefulness of decision aids is reflected in available evidence on shared decision-making, however, given the vast number of different decision-making tools, some are more represented in the research than others (171,172).

My study highlighted that clinicians feel that they have poor knowledge of key areas of asthma care, especially inhaler technique. Healthcare professionals' poor understanding of inhaler techniques is a widely reported phenomenon and affects both MDIs and DPIs, with one study suggesting that only 64.5% of HCPs felt they were somewhat competent in being able to educate their patients about their devices (143,160,173,174). There is also literature to suggest that clinicians lack confidence in their knowledge of self-management of asthma and that they lack knowledge when stepping people

up and down management (160,175). A study into secondary care providers' understanding of different inhaler device types also highlighted that a lack of knowledge may go further than just primary care and affects different healthcare professionals involved in asthma management (112). Lack of clinician knowledge is seen as a key barrier in educating patients about their device and their inhaler technique (176,177). Good inhaler technique plays an important role in environmentally friendly asthma management as it can help improve asthma control and reduce the waste associated with poor inhaler use, meaning that clinician understanding of technique needs to improve (78).

Most participants in this study had an overall lack of confidence in prescribing DPIs with some clinicians being unsure on their use in acute exacerbations. There is some evidence to suggest that DPIs are equally as effective in acute exacerbations of asthma as MDIs, however there isn't a unifying systematic review assessing the quality of this evidence (99). BTS guidelines still recommend an MDI and a spacer for mild and moderate asthma exacerbations, however this guideline is due to be updated and may change to reflect available evidence (178).

This study identified that there are cultural norms associated with asthma management, with clinicians viewing MDIs as the 'normal' inhaler and feeling that patients also identified MDIs as the standard inhaler. The concept of 'normal' asthma care has not been explored within the literature and further qualitative research into this area is required to acknowledge the role cultural norms are playing in prescribing.

6.3.2 Barriers and Facilitators to prescribing more DPIs

When discussing the barriers and facilitators to prescribing more DPIs, organisational culture was seen to be both an encouraging and a limiting factor. In this section, I describe models of organisational culture and describe each aspect of culture relevant to my findings in the context of the literature.

6.3.2.1 Introduction to Organisational Culture

Organisational culture refers to the collective practices, beliefs, expectations, habits, and values of a team; these are communicated and reinforced through a variety of methods to shape team members' behaviours and understanding (179). Culture is often left undescribed within company guidelines and policy and is formed from the actions of those in leadership positions, meaning that different organisations have different cultural set-ups despite having seemingly similar values (180). Cameron and Quinn devised a model which outlines the four distinct types of organisational culture described within literature and their associated benefits and drawbacks (181). The four types of organisational culture is depicted in Figure 9.

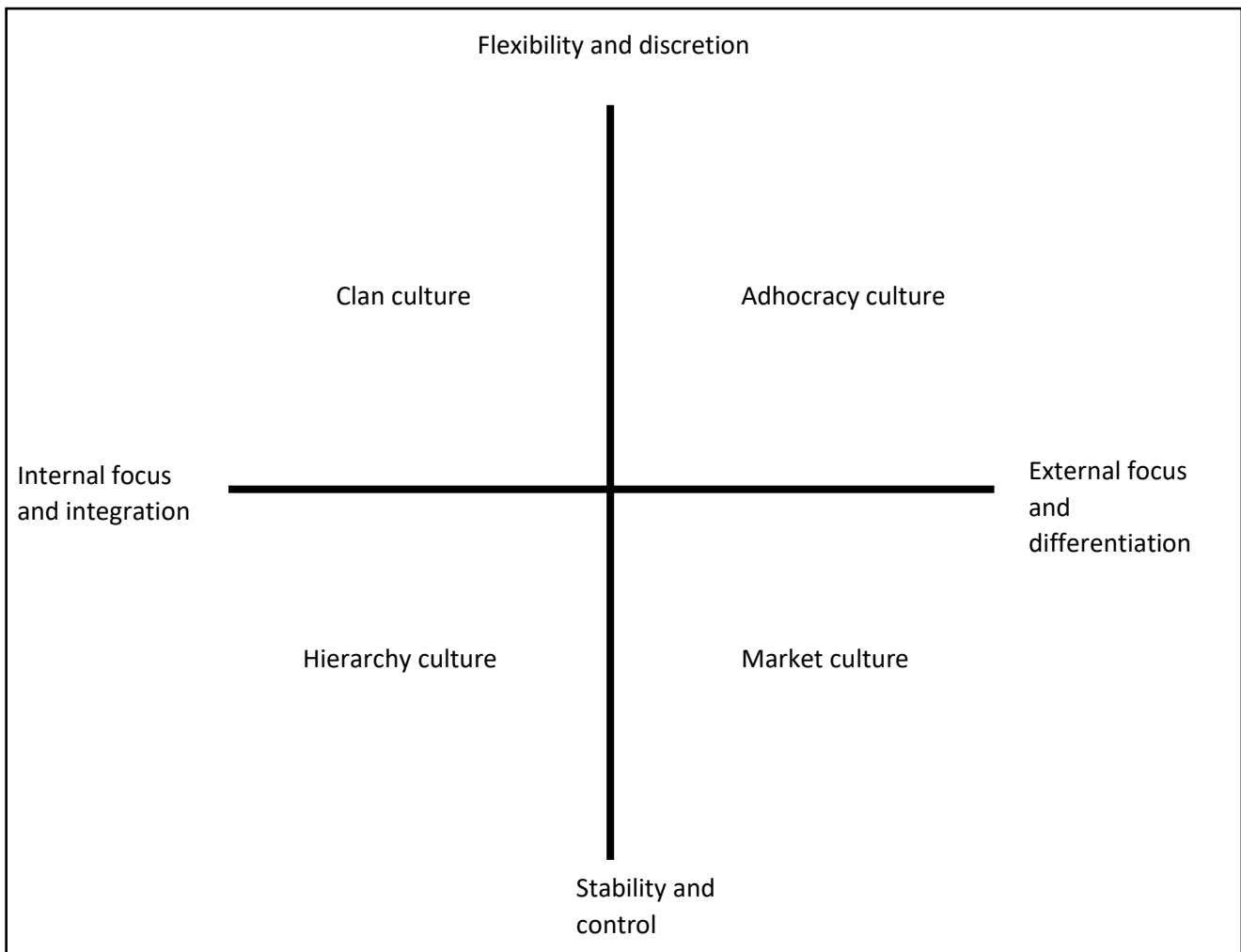


Figure 9: The four different types of organisational culture, as described by Cameron and Quinn (181)

The organisational culture of healthcare can refer to the culture within the NHS, the culture within different primary care practices and hospitals, or the culture within different working teams. Subcultures within cultures can form, defined by different professional groups, those who work towards specific projects and objectives, or those within leadership roles (179). The organisational culture of healthcare is well-reported within secondary care, however there is a lack of understanding of the culture of primary care practices and how this influences day-to-day clinical work (182). Organisational culture is thought to impact the quality of patient care provision, with a healthier and more productive culture being associated with a variety of positive patient outcomes, most notably patient satisfaction and quality of life (182–184). However, the evidence supporting this is considered low quality, given the difference in cultural definitions between researchers and, in some cases, poor methodology (184,185). In terms of the different types of organisational culture in healthcare, where research has been carried out, clan culture is seen as preferable. Within this type of culture, there is a cooperative and comfortable work environment where the leader is seen as a mentor and members feel that their opinions and views are valid (186). This culture creates a collaborative work environment associated with high-performing team members and has proved beneficial during other implementations of change to healthcare, notably providing benefits to care coordination pathways (180). It is also preferable for staff well-being where it has been shown to be associated with fewer instances of staff burn-out (187).

6.3.2.2 Theory of Organisational Culture

Organisational culture has different definitions and concurrent theories, depending on the researcher, their context and their ideologies (188,189). The most cited explanation of organisational culture is the three layers model from Schein, which explains that there are three interlinked levels to organisational culture: artefacts, shared views and beliefs and deep assumptions (190). This model infers that culture evolves over time as members challenge assumptions to solve

internal and external problems, which are then shared and passed on to incoming members to the culture. Using this model as a basis, Mannion and Davies went on to explain how this theory can be applied into a healthcare setting (185,191).

Schein's model can be depicted in several ways, from a pyramid to interlinking boxes. I have chosen to adopt the model discussed in the Third Edition of *Organizational Culture and Leadership* by Schein, published in 2004 (Figure 10) (190).



Figure 10: Schein's Organisational Culture Model (190)

Schein's model for organisational culture provides a useful framework to understand the implementation of change within an institution and, in *Organization Culture and Leadership*, Schein

discusses the different strategies that can be employed to implement cultural change. Schein's model also provided the basis for academics such as Lewin to develop their own models for change implementation such as the Unfreeze-Change-Refreeze model (192). This model is based on the idea that to sculpt a culture, there is a need to prepare the organisation to accept that change is necessary, then implementing change through education and leadership and then implementing the changes. As the culture sits, it can adapt and 'unfreeze' again to adapt to new goals or new information.

Within the context of encouraging more DPIs and fewer MDIs to be prescribed, each of the barriers and facilitators discussed in my results can be mapped to this model. I have described these by each level of culture as set out in Schein's model.

6.3.2.3 Artefacts

Level one of Schein's model is 'artefacts', which refers to visible manifestations of culture, physical architecture and observable patterns of behaviour (190). Within a primary care context, these can include building set up, rituals and reward systems. None of these individually will alter the culture of a primary care practice however the presence of different physical and structural system can begin to subconsciously challenge beliefs and values.

Key artefacts in primary care that can impact on the prescribing of MDIs and DPIs identified by my study are: financial and non-financial incentives, prescribing guidelines, formularies, pharmacy inhaler stock, computer software, weekly newsletters and sustainability focused prescribing aids. Visible behaviours which fall under artefacts also include the use of external resources such as RightBreathe and AsthmaUK, peer discussion about sustainability, sustainability QOF activities, motivated individuals at the practice, leadership from individuals at the practice and leadership from PCN/IHB.

Participants interviewed highlighted the importance of financial incentives in initiating prescribing changes to low carbon inhalers within their practice. There have been very few studies into the influence of financial incentives on asthma management, especially in the UK, however studies from other countries suggest they improved outcomes for patients with asthma and improve the quality of asthma care (193,194). Looking more broadly, there is more evidence surrounding the use of pay-for-performance initiatives in the management of chronic diseases, however the conclusions about the effectiveness of pay-for-performance schemes in the improvement of quality of care were variable depending on the context and the scheme (193,195). When looking at overall prescribing trends in the UK, MDI prescribing has changed in recent years. The amount of carbon emissions associated with salbutamol inhaler MDI prescribing has decreased nationally, according to open prescribing data, however the number of MDIs prescribed as a proportion of all inhalers (excluding salbutamol) is higher than it was before introducing the IIF (196). It is unclear from available evidence the extent of the impact the IIF has had on these changes, however my study suggests that they have been a key driver. Whilst the clinicians in my study felt financial incentives were effective, some clinicians had negative views of such schemes. This has been reflected in some literature, with some studies suggesting GPs have concerns about incentive schemes focusing on non-specific targets, the prioritisation of certain conditions over others and the risk that this may cause clinicians to practice less holistically (197,198). Whilst being included in the 22/23 IIF, domains and targets incorporating sustainable and low-carbon healthcare have been removed for the 23/24 IIF, meaning that practices will no longer be financially compensated for this work (97). It is unclear how this will affect clinician perceptions and overall progress towards low-carbon asthma care.

This study identified several non-financial incentives, such as award schemes, that have influence change in prescribing habits, however there is a lack of literature about such schemes with most research being focused on financial incentives.

Other practical influences on prescribing such as guidelines and computer systems were discussed, which were seen as both a barrier and a facilitator. Participants in my study felt that guidelines played an important role in their prescribing process, however they found multiple guidelines confusing and expressed a need for guidelines to be unified, a perception also found by Bloom et al (160). Opinions on the usefulness of clinical practice guidelines in primary care vary between professional group, study and country, with some regarding them as useful tools and some finding them restricting (199,200). Other aspects such as decision aids and websites were identified within this study, however there is a lack of available research about the roles these play in primary care, especially given the variation in resources used by individuals. NICE has produced a patient decision aid specifically designed to help in consultations to support the change to low-carbon asthma care, however very few participants of this research were aware of this decision aid and there is no published data about this decision aid's efficacy (98).

Participants recognised the actions of motivated individuals and the presence of strong leadership in implementing effective change into their practices. The presence of strong and consistent leadership is seen to be effective for driving changes in healthcare, across primary and secondary care, and could prove to be an effective facilitator in encouraging more DPI prescribing (201,202). If leadership is seen to be inconsistent with frequent changes or ineffective, this can prove to be barrier for change (203). Truly transformational leadership is commonly associated with a 'clan' structure of culture, outlined by Cameron and Quinn and discussed earlier in Section 6.3.2.1 (204). Even across different models of organisational culture, leadership is seen to be key throughout to promote an effective working culture (192).

6.3.2.4 Shared views and beliefs

Level two of Schein's models refers to beliefs and values and is referred to as 'shared ways of thinking' in some variations of this model. These describe common values and beliefs within a group and are used to justify the artefacts used within the culture and to justify new proposed artefacts. In clinical practice, this can include views on consent, patient safety and patient needs. For example, the basis for quality improvement projects and service improvement is based on a shared belief that patients deserve a high standard of healthcare. Within this study, several key shared values were identified. These include clinician understanding of the environmental impact of healthcare, perception of limited time and whether sustainability should be prioritised within patient care.

The participants in this study demonstrated an awareness of the environmental impact of inhalers however lacked knowledge about this, specifically carbon footprints. This agrees with current literature about healthcare and climate change more generally (97,205,206). One systematic review carried out in 2017 aimed to assess how health professionals perceive the health implication of climate change and concluded that clinicians internationally have an awareness of the health implications of climate change, however lack key knowledge such as the health implications of climate change (206). Knowledge of the environmental impact of inhalers has been explored to a much lesser extent with available literature suggesting that healthcare professionals lack knowledge about emissions associated with inhalers (111,112). This agrees with the participants from this study, who felt they lacked confidence in their understanding. The knowledge of the health implications of climate change, how climate change will impact health inequalities and the waste associated with healthcare were seen as key motivators for healthcare professionals already engaged in sustainability advocacy, suggesting that improvement of clinician knowledge of these areas could promote individuals to prioritise sustainability (109,110).

Participants in this study highlighted knowledge and time as key barriers to including sustainability in shared decision-making. This agrees with Kotcher et al who conducted an international survey of

clinician understanding and concluded that 54% of participants found that time was a barrier for communicating with the public about climate change and 41% found knowledge as a barrier (109,110,205). Limited time is a well-described barrier to providing good quality healthcare and can limit shared decision-making, increase evidence to practice gaps and prevent staff training across a variety of conditions managed within primary care (207–209). Even patients acknowledge healthcare professionals have limited time within consultations to practice shared decision-making (210). Despite our participants concerns over time to educate on an inhaler technique, one study measured the time it took pharmacists to educate a patient about two different types of DPI, including verbal instructions, demonstrations with placebo devices and assessing the patient's technique, which averaged to take 2.5 minutes within a consultation (211). There may well be a difference between perceived time on how long inhaler education takes and how long it actually takes and this mismatch may be a psychological barrier to change. There is also a perception that organisational and policy limitations can also affect the inclusion of sustainability within patient management, however this has only been explored in US studies (109,110).

6.3.2.5 Deep assumptions

Level 3 considers assumptions, which refers to the unconscious and preconceived values existing within the culture. These are the values which underpin the activities of those within the culture and are often taken for granted as they are seen as presumed truths. In healthcare, this could include assumptions about patient safety, autonomy or prioritisation of different factors, such as cost, when making management decisions. These can vary between subgroups of the same culture which look at the same issues through different lens and this difference can provide leverage for overall cultural shifts. Assumptions about the role of healthcare professionals, fear of stigma and attitudes towards change were all discussed within this study as barriers to prescribing low-carbon inhalers.

Some participants within this study felt that advocating for sustainable healthcare is not within the scope of their role as a healthcare professional and that this differs from what is medically best for the patient. This contrasts much of the literature and the guidance within the Lancet Countdown report where healthcare professionals are considered well-suited to communicate the implications of climate change on health and the role of climate action as preventative medicine to patients (212–214). In addition to this, Luo et al found that clinicians who were already involved in climate activism were motivated by the privileged position of being a healthcare professional and acknowledged the influence they have over the public and policy makers (109). Large studies from the National Medical Association, American Thoracic Society and American Academy of Allergy, Asthma and Immunology feel that physicians have a responsibility to convey the health effects of climate to the public and their patients (215–217). It also seems that patients trust healthcare professions to communicate this information and a US study found that a primary care physician is be the most trusted source of information on this, compared to public health organisations (212). Much of this research is based within the US; differences between my findings and this literature may be driven by how different roles of healthcare professionals are viewed in the different countries as well as the different structures of healthcare systems.

Clinicians within this study also felt that they may experience stigma from other clinicians or members of the public for considering the environment. The influence of stigma in healthcare, based on climate action, is relatively unexplored within the literature and its role in preventing environmentally conscious prescribing, especially within primary care, is unclear. There is a small amount of evidence to suggest that clinicians think that other staff do not approve of sustainability. One online survey into UK and Ireland based surgeons suggested that 58% of surgeons found that staff attitudes towards sustainability would be a barrier to implementing low carbon surgical initiatives (218). Within the UK, clinicians have the ability to practice medicine incorporating their own beliefs and ethical values, providing it is not at the detriment to patients and complies with legislative guidance, which would include views about sustainability (219). Groups such as Greener

Practice have been important in normalising low-carbon medical practice, however their influence over the acceptability of sustainability amongst clinicians is unknown. There is more evidence to suggest that perceived stigma prevents discussions with patients with Kotcher et al reporting that that 14% of participants in their study were reluctant to bring up climate change with patients, as they found this topic to be too risky to them professionally (205). The findings from Sanderson et al's study also reflected this, finding that clinicians feel the politicisation of climate change is a barrier, and prevents them from communicating risks to patients as there is an expectation that they are unbiased professionals and shouldn't 'push and agenda' (110).

How participants viewed change seemed to be a barrier, with participants often assuming that change is difficult and that clinicians are reluctant to change their current prescribing behaviours. Change is widely considered by clinicians to be difficult and the habitual nature of clinical practice has been acknowledged within available literature (220–223). Barriers to change include concerns over learning new information and implementing new knowledge into practice (224,225). There is also a perception that whilst introducing new practices is hard, unlearning outdated practices is even harder. The process of unlearning is complex and pre-existing models for unlearning need updating to reflect the complex and rapidly evolving nature of clinical practice (221,226,227). Perceptions towards change are vital as a low confidence in one's capabilities to execute change can reduce motivation to initiate change (228). Cultural change is also considered to fail when members are passive to the change being implemented so changing attitudes towards change will be vital to the success of low-carbon asthma care (229).

My study also showed that clinicians perceive that patients do not like change. In Blooms et al's qualitative study on stepping down patients with asthma, they also found a barrier to changing asthma treatment was a clinician perception that patients do not want their inhalers changed (160). Despite this, several studies have explored patient perceptions on changing inhalers (105,230). One study surveyed asthma patients and concluded that 100% would change their inhaler if it was more

effective, 80% would change inhaler if it was easier to use and 80% of patients being willing to change their inhaler to one with a lower carbon footprint (105,230). This presumption needs to be challenged within the shared decision-making process by asking patients their views on trialling a lower carbon inhaler.

Below I have mapped each element of culture identified by this study onto Schein's original model for organisational culture.

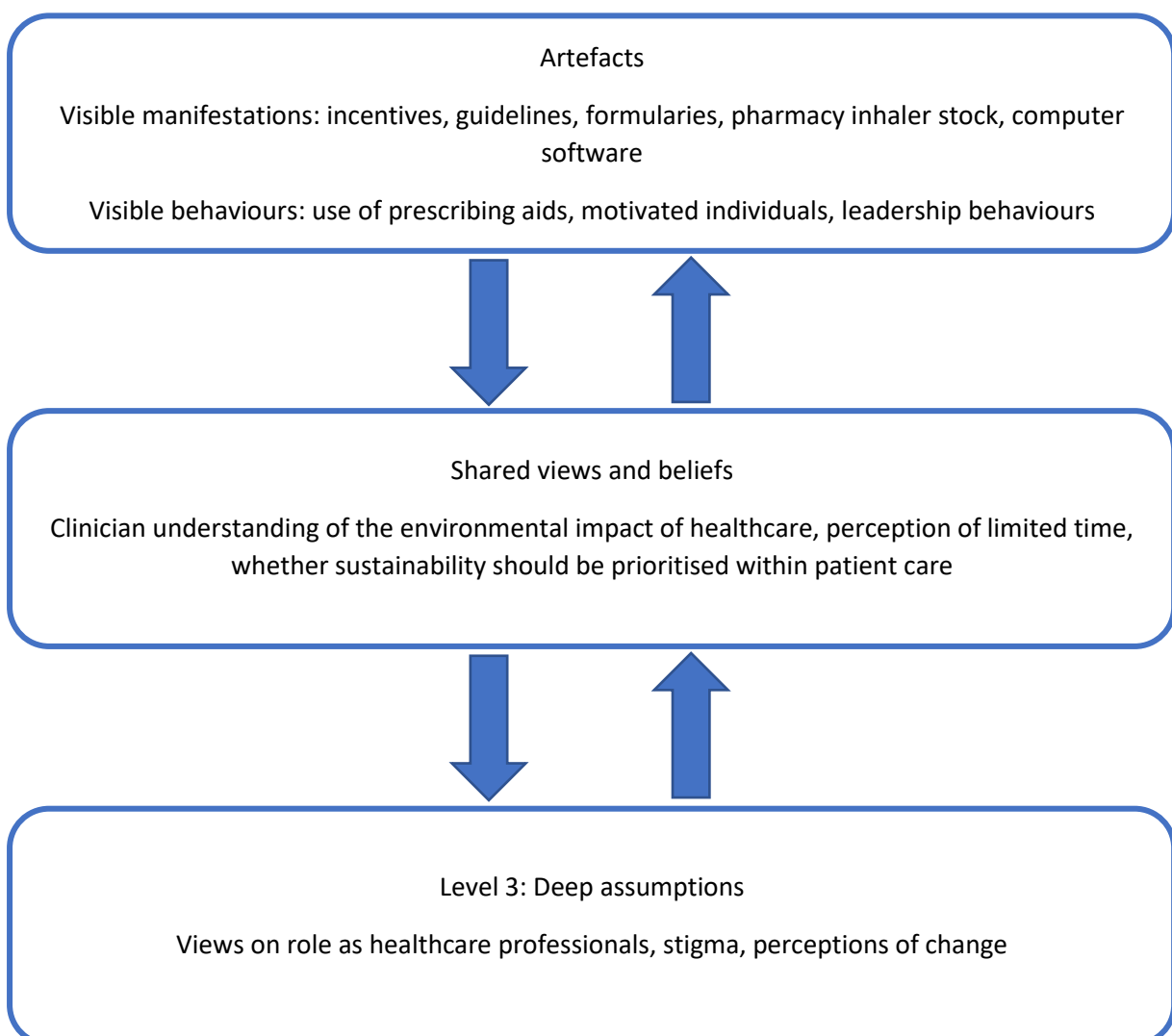


Figure 11: The barriers and facilitators to prescribing fewer MDIs and more DPIs as found in my study, mapped to Schein's model of Organisational Culture Model (190)

6.3.2.6 Implementing change

In terms of progress towards integrating low carbon asthma care into practice, many of the artefacts discussed are facilitators for low-carbon inhaler prescribing and provide positive opportunities for change. However, shared views and beliefs and deep assumptions are often barriers and should be a focus for those interested in altering the culture to make primary care sustainable.

The influence of culture to initiate change in primary care has also been explored in models such as Lau's contextual framework model (203). Lau et al developed a framework to describe the different factors that affect implementing change in primary care, following a systematic review into reducing evidence to practice gaps. Lau et al separated these barriers and facilitators into professional, organisational and external context barriers. This model contains many of the factors explored by my study and there are similarities to Figure 8 in my results chapter summary. This model is depicted in Figure 12 below.



Figure 12: Lau's conceptual framework model for reducing evidence-to-practice gaps

Lau et al also discuss the importance of organisational readiness and how a lack of readiness can be a barrier to implementing change. Organisation readiness for change describes the concept of organisational members seeing the value of change and being committed to implement the change into daily action (203,231). Change is most likely to be efficient where members value the change and feel confident that change is possible (231). Organisational readiness differs from organisational capability, in that readiness can be thought of as psychological and capability is the practical limitations for change. An organisation's ability to be ready is determined by a positive working climate and a history of successful change implementation (231). To implement change into primary care practice, both psychological readiness and practical readiness will have to exist for change to be thought of acceptable and easy. Given the results of this study implying that change is difficult, it seems that structurally many practices within the UK are yet not ready for change and initiatives need to be developed to support practices.

When looking at developing interventions to overcome barriers, the Capability, Opportunity, Motivation, Behaviour (COM-B) model is a well-cited example of behavioural theory (232). This theory outlines the interplay within the three components- capability, opportunity and motivations- and implies that behaviour changes can be encouraged by optimising these three elements (232).

Figure 13 demonstrates the interaction of these three components.

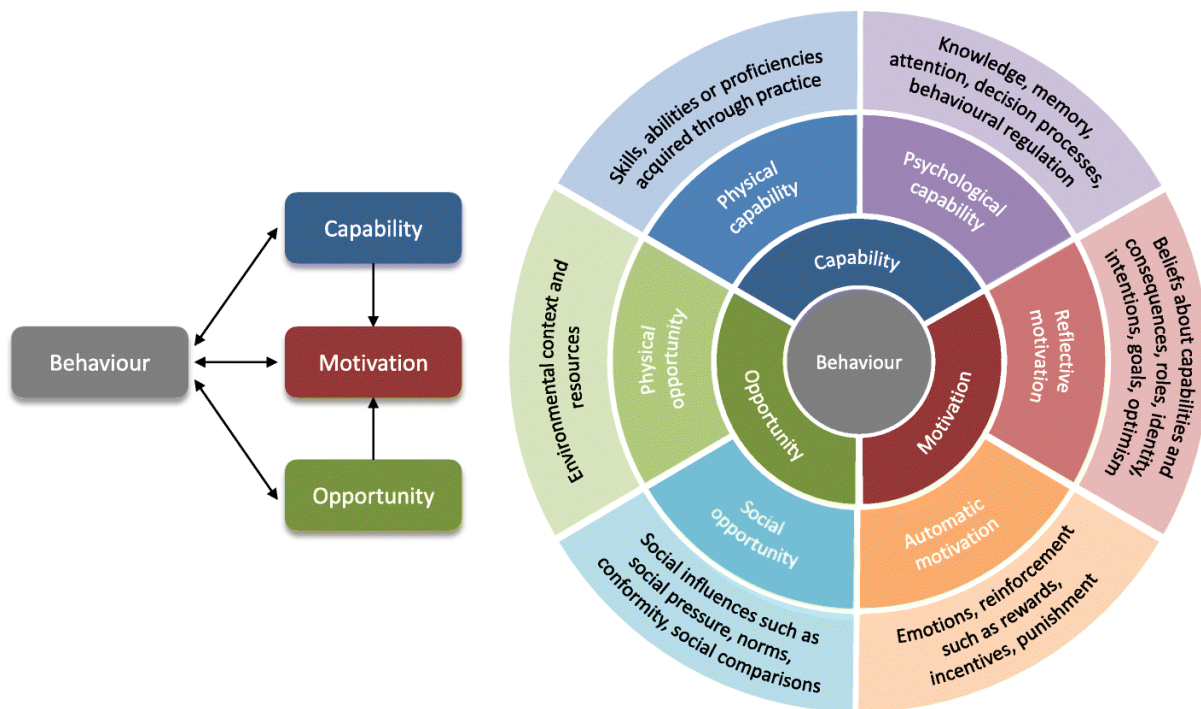


Figure 13: COM-B Model (310)

Capability describes organisational readiness as well as structural preparation. Within the context of increasing the number of DPIs prescribed, capability can be improved by improved clinician knowledge of the environmental impact of MDIs, improved confidence including it within shared decision-making and greater confidence prescribing DPIs in general. Opportunity includes the environment and external influences that influence change. In the context of primary care prescribing, this may relate to guidelines, formularies and PCN and IHB influence, of which all could be optimised to support DPI prescribing. Motivation can be emotionally driven, belief driven or intention drive. In the context of sustainable prescribing, this could include motivation from an emotional response to extreme weather events (emotional), understanding that low-carbon healthcare coincides with good patient care (belief) or receiving financial rewards (intention).

6.4 STRENGTHS

I feel that the range of participants included provided strength to my study. I interviewed different primary healthcare professionals (GPs, Practice Nurses and Clinical Pharmacists) with variation in the years qualified, gender, age and IMD of the practice within each of the professional groups, which meant that the data I collected was from a wide variety of people, working within different PCNs, with different experiences and, therefore, perspectives. Interviewing the different professional groups who impact asthma management allowed me to explore the influences to prescribing from a variety of different lenses and compare differences across the professional groups. By incorporating a snowball recruitment strategy, I interviewed several healthcare professionals from the same practices, which allowed me to be able to use data triangulation and gain a deep understanding of the cultural influences of a practice from different points of view and compare the perceptions within the same working culture. Triangulation is seen to improve both the credibility and validity of qualitative research, where a researcher can adopt a variety of different approaches to include this method within their work (233). Whilst I did not intend to recruit from the same practices initially, I feel that this has enriched my data and validated the phenomena discussed within interviews, as well as highlighting the differences in opinions of those working within the same organisations. A key example of this was CP4 and GP8, where they both discussed the culture and organisation of their practice and the common barriers that they faced.

Throughout my study, I adopted an iterative approach which meant that I was able to refine the topic guide and adapt the content of subsequent interviews to reflect the developing themes. This allowed me to enrich developing themes. Using an iterative approach and how this influenced my topic guide is further discussed in Section 4.4.5.

Data saturation was achieved across the whole sample as well as within each professional group.

The role of data saturation has been discussed previously in Section 4.4.6.

A further strength of this study was the use of a Patient and Public Involvement and Engagement (PPIE) group. The use of a PPIE group is recommended by several international bodies, to improve the overall quality of a study. INVOLVE considered the involvement of the public in research can make the study more ethical, give researchers a greater understanding of the context of the work and provide outputs with greater impact (234). The involvement of the PPIE groups within this piece of work, as well as the benefits of using PPIE groups has been discussed further in Section 4.2.

I feel that my position as a medical student may have been a strength and also a limitation for this study as I am not a prescriber and therefore do not have a deep understanding of the barriers that affect day-to-day prescribing in general practice. I feel that, by having this position, I was able to approach the data without preconceptions from my own working life, which allowed the data to drive the theme development without the inclusion of my own bias. However, this did limit my understanding of the context in which this work fits and the implications for prescribing it may have. I carried out the vast majority of the data analysis, however HT had significant input at the theme development stage, which provided great insight and different perspectives on the data, given her background as a clinician with qualitative research experience. This introduced new concepts into the work which I had not considered, with my lack of understanding of the context of prescribing.

6.5 LIMITATIONS

Recruitment proved challenging for this study, especially regarding ensuring geographical diversity. As a result, half of the participants within this study are based within the same geographical area. Whilst there was a variety of clinicians based at urban and rural practice and different PCNs, it is unclear as to whether there are local policies which could have impacted the results of this study. However, with the geographical variation of the other participants, I feel that, overall, the participants still provided sufficient insights into sustainable asthma prescribing to be nationally generalisable.

It is important to recognise that the participants of this study likely have an interest in sustainable healthcare, given that they have voluntarily taken part in a research study about sustainable asthma care. Three participants were linked to the Greener Practice network and therefore may have a greater interest and understanding of sustainable prescribing than someone not associated with that network. This may mean that their views may not align with other healthcare professionals who are less interested in sustainability.

Individuals were financially compensated for their time with a voucher. Opinions regarding the ethics of providing financial compensation for participation in research are widely discussed with benefits including increased diversity in studies and overcoming barriers to participation (235,236). In some contexts, financial compensation could be viewed as coercive, impacting those who are financial vulnerable and impact their judgement for voluntary decision-making (235,236). This is arguably less of an issue when interviewing professionals rather than members of the public however still needs to be considered. The voucher amount was included within the research ethics approval and was appropriate given the subsequent work and individuals taking part did so on their own volition.

This was my first qualitative study and consequently was my first-time interviewing people.

Conducting good quality, effective interviews is a complex skill and requires practice and experience which was something that I didn't have with my earlier interviews. Prior to starting, I did conduct a practice interview with a GP, which I feel helped build my confidence, however it wasn't until approximately interview five where I felt fully confident in my ability to adapt the conversation to the participant's responses and ask the most impactful follow up questions. I have read my earlier interviews and there are questions I wished I'd asked and that I feel would have allowed me to more deeply explore the participants perceptions and experiences however it is only with the experience that I now have that I appreciate this.

6.6 IMPLICATIONS FOR CLINICAL PRACTICE

Below I have discussed some of the implications for clinical practice and policy, defined by participant data. So far, this chapter has discussed key areas of current clinical practice that need prioritising or adapting, particularly regarding the process of an asthma review and how decisions are made within this context. Asthma reviews need to be patient-focused and include a thorough clinical assessment to determine the appropriateness of inhaler devices as well as assess a patient's inhaler technique. Clinicians who manage asthma patients should be engaging with shared decision-making practices, given that it improves adherence to medications and asthma control (167). To achieve this, clinicians need to be confident in their understanding of asthma management in order to provide clear and accurate information to their patients. Improving inhaler technique and asthma control as well as prescribing more DPIs would provide vital carbon emission savings if integrated into primary care's asthma management. A lack of clinician knowledge is currently a barrier to this integration and needs to be addressed to achieve carbon neutrality.

Education will prove an important tool in improving the quality of the asthma care that primary care clinicians provide, with a particular focus on technique. This has the potential to improve clinician confidence prescribing DPIs where appropriate and equip them with the knowledge to communicate to patients. If clinicians were equipped with more knowledge regarding the environmental impact of inhalers, clinicians might be more confident to engage in conversations about sustainability with patients. Given the relationship that this has with deeper assumptions within the culture of primary care, there is a real importance in including this within the undergraduate and postgraduate training to ensure that clinicians across the board are considering the environment within their practice.

6.7 IMPLICATIONS FOR POLICY

My study has suggested that financial incentives play an important role in increasing DPI prescribing and encouraging sustainable healthcare within practices. The financial incentives focused on by participants of this study were IIF based incentives, where funding was included across 2 domains of the 22/23 plan (95). Since the initiation of this study, the 23/24 IIF metrics have been published, which no longer include the sustainable asthma care objectives (97). It is unclear how this change in policy will affect the current changes that have been made within practice and whether this will alter the progress towards low-carbon asthma care. My research supports a reinstatement of financial compensation into the IIF, given that clinicians have found this a real motivator and has enabled real changes to prescribing habits. I feel that, given the urgency of the climate crisis, this reinstatement needs to be for the 24/25 guidance to allow for work regarding low-carbon asthma management to continue. Whilst my study highlighted issues with financial incentives, I feel that the benefits outweigh these, especially as a starting point for change.

Guidelines impact clinician prescribing and inhaler device choice, however the differences between guidelines can be confusing for clinicians. Guidelines need to be unified in their support for using DPIs in appropriate clinician scenarios and need to provide key information regarding carbon emissions to assist clinicians with their decision-making. My study also highlighted the importance of strong leadership from PCNs and IHBs in encouraging the transition to more sustainable healthcare. These networks need to integrate sustainability within their policies and provide clear guidance and support for clinicians and practices to prescribe more DPIs.

Overall, the organisational culture of primary care will have to evolve to allow low carbon healthcare to succeed. Given the complexity of organisation cultures within the NHS, it will take multiple different strategies through education and policy to support this change to prescribing, however, once successful, may lay the foundations for different low-carbon healthcare alternatives to be introduced.

6.8 RECOMMENDATIONS FOR FURTHER RESEARCH

This qualitative study has added to available evidence on what influences inhaler prescribing, as well as providing new insight into the barriers and facilitators clinicians may face when trying to reduce the carbon emissions associated with their inhaler prescribing.

Within inhaler prescribing, there are vast quantities of research outlining inhaler misuse as well as many industry-led studies on patient device preference, however there is a lack of understanding as to which factors that influence inhaler prescribing and a lack of consensus about what should impact prescribing. This study adds to this work done by Cvetkovski and provides further information on the decision-making process of the prescriber. I feel that there is the scope for further research in this area, especially in regard to the themes of Making assumptions. Concerningly, this research found inequalities within patient care based on age, social class, and prejudices based on ethnicity, which I feel should be further explored. A quantitative investigation of inhaler device prescribing focusing on UK data, looking at age, deprivation, and other demographics, would add to the understanding of what factors are impacting choices for clinicians nationally. Similar work has been done focusing on contraceptive prescribing and I feel that a study like this would provide interesting insight into unconscious and conscious bias that plays a role in which device is prescribed (237).

Several key barriers to prescribing more DPIs were highlighted, such as confidence using DPIs in particular clinical scenarios. I am currently undertaking a systematic review looking at the effectiveness of using DPIs in maintenance therapy for children and in acute exacerbations for both adult and children, both key areas of uncertainty for clinicians. Hopefully this piece of work will add to the available evidence surrounding using DPIs in these scenarios and can provide clinicians with confidence to prescribe more DPIs.

Within this study, clinicians shared their perception of patient opinions however, there is the scope for a qualitative study of asthma patients looking at their views on the environment impacts of their

care and their concerns over changing to a DPI. There has been previous work on this in the form of a survey however this doesn't provide the same level of in-depth information as an interview study.

Given that a large proportion of pre-existing research regarding clinician perspectives on sustainable healthcare uses those already involved in climate activism in their cohorts, I feel that there needs to be further study into the views of those who are not actively engaged with sustainable healthcare.

My research included both of these groups and I feel that this has been more representative of the perceptions of clinicians as a whole. In addition to this, many pre-existing studies are focused on the views of American physicians which may not apply fully to the UK, given the difference in healthcare structure. This study has been unique in focussing on UK clinicians and is an especially vital addition to the evidence base, given that widespread clinician change is needed to make significant progress towards NHS net-zero goals. I also feel that research regarding sustainable healthcare should incorporate other aspects of sustainable primary care much more widely than asthma care, as the green impact of social prescribing and improving medication adherence is often underrecognised.

6.9 CONCLUSION

A variety of different factors affect which inhaler device a clinician prescribes for a patient. Patient-centred factors play a key role in healthcare professionals decision-making process and inhaler device choice. There are inequalities in the care that patients of different ages, social classes and ethnicities receive, with certain demographic characteristics determining which inhaler device is more likely to be prescribed. Cultural norms, familiarity and prescribing habits also influence clinicians' decision-making process and how acceptable they perceive a device to be to patients. Healthcare professionals lack knowledge of key elements of asthma management, importantly inhaler technique.

Clinicians lack confidence when prescribing DPIs and have a lack of understanding of the environmental impacts of inhalers. Certain aspects of the organisational culture of primary care can be a barrier or a facilitator for clinicians prescribing more DPIs. The current workload pressures of primary care, the attitudes of clinicians towards change and practical restrictions such as time and pharmacy stock, are all potential barriers for low-carbon inhaler alternatives being prescribed. Incentive schemes, the action of motivated individuals and strong leadership are all key facilitators for low carbon asthma care. Education will play a vital role in improving the quality of asthma management in primary care, as well as reducing carbon emissions associated with inhaler prescribing. In order to implement widespread sustainable change, low-carbon healthcare needs to become a shared value between clinicians and sustainability can become a shared priority amongst staff.

7. PERSONAL AND PROFESSIONAL DEVELOPMENT

In this chapter, I have reflected on the research process and the process of completing my MPhil. I have reflected on what I feel I have learnt throughout the research process and how this will impact my future career choices.

7.1 THE ROLE OF REFLEXIVITY

Reflexivity is a vital part of qualitative research and increases the credibility of a piece of work (126). It is important to understand the researcher's background and the impact that this has had on why they have chosen their research topic, their methods and their interpretation of the data (117). To include reflexivity within my study, I wrote a reflexive diary after each interview and during data analysis, as well as noting down other elements as I went through the project. An interview excerpt and reflexive diary can be found in Appendix 8.

Within this section, I have outlined my personal circumstances to provide an understanding of the motivations behind this MPhil and the lens through which I was designing the study and interpreting the data. I have also included what I feel that I have learnt from completing an MPhil and the skills that I have developed.

7.1.1 My personal circumstances

I conducted this MPhil as an intercalated degree between the 4th and 5th year of medical school. I have previously conducted a variety of quantitative projects, including data analysis for large epidemiology studies and a variety of audits. Despite this, I have never been involved with any qualitative projects, nor have I completed any formal research training. Therefore, I was excited to complete an MPhil to gain some experience with a different methodology and have a dedicated year for research. In my spare time, I have an extensive list of hobbies and love to keep myself busy. I refer to advocating for climate action as a hobby, which I have fortunately managed to link in with

my Medicine degree. Since 2020, I have been working with the Planetary Health Report Card to further advocate for the inclusion of planetary health and sustainability within the medical school curricula and wider activities. I have been immensely grateful for the amazing people internationally that I have been able to connect with through this project. They are a constant source of inspiration and motivation for action within the climate space and it is encouraging to know there are other healthcare students even more passionate than I am.

I feel that my life experiences have shaped my understanding of how necessary climate action is. Most of my family work in agriculture and my immediate family currently live on a cider apple orchard in rural Herefordshire. Agriculture has such an interesting and complex relationship with climate change, given that it is one of the largest contributors to GHG emissions, however, is set to be vastly impacted by extreme weather events and temperature changes (238). With a rising global population, meeting the nutritional needs of future generations is going to prove challenging with climate change resulting in decreased crop productivity. I feel that growing up surrounded by agriculture is responsible for my interest in climate change, as I have an appreciation of how reliant our food chain is on our environment and how unreliable our food sources will become with global warming.

Further passion for the environment descends from exposure to extreme weather events and seeing how this impacts a community. I was brought up in Tenbury Wells, a small town in Worcestershire on the River Teme, which frequently, and very extensively, floods. Flooding is set to be one of the UK's biggest threats to human health, with up to 2.6 million people at risk of flooding by 2050 (9). Flooding has life-threatening consequences from a health point of view, directly increasing the risk of injury and death as well as increasing poor mental health and PTSD in those affected (9). Flooding is scary and has devastating repercussions on a community, which becomes all more real when you've physically seen and experienced it. Whilst flooding has always been a problem for Tenbury, the floods are set to worsen and become more frequent with climate change and climate action has

the potential to minimising the risks for its inhabitants. I believe healthcare professionals have a duty of care to improve population health, which intrinsically comes with advocating for climate action. Having experienced extreme weather events, I feel that I have both a personal and professional responsibility to champion sustainable healthcare.

7.1.2 Reflections on difficult interviews

Whilst all the interviews I conducted were interesting and thought-provoking, two in particular were more challenging than others. I have reflected on these interviews and my role as the interviewer.

One interview I conducted was particularly difficult as I found that the participant was giving quite short answers and what I perceived to be quite surface-level information. This was despite asking very open questions and often asking follow-up 'why' questions to the participant. I left the interview feeling that they were disinterested in the conversation and reflecting on how I could have better built a rapport with them. However, when I listened to the interview back to amend the transcript, I was amazed by how rich this interview turned out to be. Whilst the participant was giving short answers, I felt as a third party watching it back, there was a good rapport and the participant just articulated themselves very clearly and concisely. When coding the interview, it became apparent that this participant was actually providing vital information that developed my evolving themes. This has since made me reflect on how, even though you are present in the interview and listening to what your participant is saying, you are not truly retaining what they are saying and how they are saying it as you are focusing on adapting the conversation. I have gained an appreciation for taking time to watch and rereading the interview to truly understand your participants views and how these fit within the wider study.

I found another interview particularly difficult to conduct and to analyse as their views on sustainability contrasted mine. Up until this point, I had only had positive or indifferent reactions to climate action so this was surprising. It felt like during the interview, they were essentially scolding me for being passionate about sustainability and found the 'sustainability agenda' to be dangerous. Throughout the interview, I maintained complete neutrality and asked questions which would help me to understand their point of view more clearly. Since reading about the role of neutrality as an interviewer, it seems that different researchers handle this differently, with some choosing to act unaffected and some challenging ideological differences to advance the conversation (239). I feel that my neutral approach was appropriate within this context, as it allowed for them to share their concerns, whereas if I'd have challenge them, I feel that they would have been closed-off for the rest of the interview. Climate change and climate action is intrinsically political which can lead to extremely divided opinions, and I should have been more prepared for my own view to be challenged. Whilst I was aware of the impact my preconceptions and biases have on my data interpretation, I didn't realise how they could impact the way I interview someone and the influence over the information collected.

These reflections are based on a reflective diary that I updated after each interview and data analysis. I have included an interview excerpt and corresponding reflective diary in Appendix 8.

7.1.3 The political context of this work

I conducted this research during the 2022/23 NHS Nurse and Junior Doctor strikes, which I feel added to the study by providing vital insight into the systemic barriers of our healthcare system and how the culture of the NHS can prevent gold standard asthma care. Throughout my placements in medical school, I have been aware of some of the barriers to providing good quality medical care however I didn't realise that most of these are self-inflicted by the NHS and could be resolved by suitable policy, changing staff conditions and increasing morale. The impact of the NHS crisis on my study does leave me questioning what my career will be as a doctor and whether truly sustainable

healthcare is possible. The systemic barriers to implementing low-carbon asthma care are largely culture-based, which will require a complete overhaul with significantly increased funding and strong leadership. This change needs to be immediate, given the time-sensitivity of meeting IPCC carbon emission targets and the NHS' carbon net zero goals. This piece of work demonstrates the need to prioritise the workforce in government action and policy to allow sustainable healthcare to be implemented and will add to the evidence base around sustainable healthcare in the UK. This project has been important to me and I feel that its results have great potential to support the action of advocates for carbon neutral healthcare, by addressing key knowledge gaps.

7.2 WHAT HAVE I LEARNT?

I think the most surprising thing I have learnt is how well I've fitted with qualitative research and its methodologies' and how much I actually enjoyed the process. During medical school placements, I have always enjoyed speaking to patients and their families, often much more interested in their story and their social circumstances than their actual pathology. Exploring someone's perspectives and their lived experience is the core of qualitative research, whether it be interviews, ethnography or other methods like storyboards. Throughout this project, I was able to talk to people from a variety of different professions and backgrounds and understand why they make certain decisions and how they feel their working environment impact them. I can appreciate the importance and richness that this information has to policy makers, something that I feel is often overlooked in favour of more 'measurable' evidence. I didn't expect to enjoy this research process so much and I am keen to explore other qualitative methods, through further projects and a PhD in the future.

This year has taught me several vital skills, external from my research project. Time management is an integral part of completing a postgraduate degree and for writing a thesis. Before starting this project, I believed myself to be organised and to have good time management skills, however this perception has been constantly challenged throughout the whole project. Every step of the project took longer than I had anticipated, especially writing chapters for my thesis, and I now feel that I understand how to set reasonable goals. Task prioritisation and effective planning have proved to be vital to the completion of this project and will be important skills to translate into clinical medicine or future postgraduate degrees.

The flexibility that this year has provided me with has allowed me to continue with university societies, volunteering and to take up new sports, of which I am ever grateful for. It has allowed me to explore how I can develop a work-life balance and how having a work-life balance actually increases my productivity. If I had continued into my final year of medical school, whilst I may have graduated sooner, I feel that I wouldn't have graduated as fulfilled as I now am. I feel that this year

has provided me the opportunity to remember that medicine is not my sole purpose and that it is okay to have a life outside of it, which seemed somewhat impossible when faced with my final exams last year.

7.3 IMPLICATIONS FOR MY FUTURE CAREER

By undertaking my MPhil I have been able to explore academic medicine and confirm that a career where I can undertake both academic and clinical work is what I am aspiring for. I intend to apply for a Specialised Foundation Programme (SFP) with an academic block based in the West Midlands for after I graduate next year. I'm hoping that I will continue to develop my research skills through an SFP to prepare for applying to become an Academic Clinical Fellow. Undertaking an MPhil has given me great insight into what life doing a PhD is like, given that at Keele MPhils and PhDs are greatly linked and I have been able to meet many PhD candidates within the faculty. Ideally, I would have loved to have continued and converted this project into a PhD however I need to return to finish my final year of medical school. I am determined to return to complete a PhD at some point in my postgraduate training, hopefully within low-carbon healthcare and using qualitative methods. I am hoping that sustainable healthcare has advanced significantly by then and many of the barriers I have discussed have resolved.

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9. APPENDICES

9.1 APPENDIX 1: ETHICAL APPROVAL LETTER

21/11/2022

Dear Helen Twohig,

Project Title: Greener Asthms Prescribing (GAP) study

REC Project Reference 0380

Type of Application Main Application Form

Keele University's Research Ethics Committee reviewed the above Main Application Form.

Favourable Ethical opinion

The members of the Committee gave a favourable ethical opinion of the above research on the basis described in the application form, protocol and supporting documentation, subject to the conditions specified below.

Conditions of the favourable opinion

Reporting requirements

The University's standard operating procedures give detailed guidance on reporting requirements for studies with a favourable opinion including:

- Notifying substantial amendments
- Notifying issues which may have an impact upon ethical opinion of the study
- Progress reports
- Notifying the end of the study

Approved documents

The documents reviewed and approved are:

Document Type	File Name	Date	Version
Consent forms	GAP study consent form version 0.1	06/09/2022	0.1
Information sheets	GAP study PIS version 0.1	06/09/2022	0.1
Project Summary	GAP study protocol version 0.1	06/09/2022	0.1
Recruitment advertisements	GAP study recruitment email version 0.1	09/09/2022	0.1
Further Information	GAP study Demographic data sheet Version 0.1 14th Oct	14/10/2022	0.1
Further Information	GAP study topic guide	14/10/2022	0.1

Yours sincerely,

Dr Simon White, Professor Peter Ogrodnik

Chair / Lead Reviewer

9.2 APPENDIX 2: TOPIC GUIDE FOR GENERAL PRACTITIONERS AND PRACTICE NURSES



Topic Guide for General Practitioners and Practice Nurses

Before the start of the interview:

- Introductions
- Check that the participant has read the patient information sheet and whether they have any questions.
- Check that the demographics questionnaire has been completed.
- Check the consent form has been signed.
- Check participant is happy for recording.

Current prescribing habits

Could you tell me a bit more about your role, in particular your contact with patients with asthma?

Could you talk me through how you decide which inhaler to prescribe for someone with asthma?

Thinking about step management, do you feel you have choice with which inhaler to use within each step?

Which type of inhaler would you prescribe for someone who has suspected asthma or newly diagnosed asthma?

What are the most common reasons that someone switches from one inhaler to another?

How commonly do you find patient's express a preference for one device over another?

What factors do you think influence your inhaler prescribing? (economic, patient-centered, safety concerns, social, environmental)

Do you have any concerns with prescribing dry powder inhalers?

Can you think of any reason in your practice where you might prescribe a DPI over an MDI? Can you think of a reason in your practice why you might prescribe an MDI over a DPI?

Environmental impact of inhalers

What is your understanding of the environmental impact of MDIs? If so, how have you become aware of this?

Have you attended any webinars or additional training to improve knowledge of the impact of inhalers?

How do you feel about the environmental impact of inhalers?

Are you aware of any initiatives aimed to reduce MDI prescribing? How do you feel about them? Have you used the NICE Decision-Making Tool for Inhalers?

Have you had discussions with patients about environmentally friendly asthma care?

If so, how did you do this? What reactions have you had from patients?

Environmentally-Friendly Prescribing decision-making

Do environmental concerns play a role in your prescribing process? Has it changed your practice?

Do you feel you need more training or education around the use of DPIs?

Would you feel confident switching someone from an MDI to a DPI for environmental reasons?

What concerns would you have about making this change?

What would help you feel more confident making this change?

9.3 APPENDIX 3: TOPIC GUIDE FOR CLINICAL PHARMACISTS



Greener Asthma Prescribing Topic Guide for Clinical Pharmacists

Before the start of the interview:

- Introductions
- Check that the participant has read the patient information sheet and whether they have any questions.
- Check that the demographics questionnaire has been completed.
- Check the consent form has been signed.
- Check participant is happy for recording.

Current prescribing habits

Could you tell me a bit more about your role, in particular relating to your contact with patients with asthma?

Could you talk me through your approach to reviewing inhaler prescriptions for patients with asthma?

What are the commonest things you come across that concern that you, or trigger you to suggest changes, when reviewing inhaler prescriptions for patients with asthma?

What are the most common reasons in your experience that someone switches from one inhaler to another?

What are the commonest concerns that patients raise about their asthma medications / inhaler use?

How commonly do you find patient's express a preference for one device over another? Can you share any examples of reasons given?

What factors do you think influence inhaler prescribing in your practice? (economic, patient-centred, safety concerns, social, environmental)

Do you have any concerns with prescribing dry powder inhalers?

Can you think of any situations where a DPI might be chosen over an MDI? Can you think of any situations where an MDI might be chosen over a DPI?

Environmental impact of inhalers

What is your understanding of the environmental impact of MDIs? If so, how have you become aware of this?

Have you attended any webinars or additional training to improve knowledge of the impact of inhalers?

How do you feel about the environmental impact of inhalers?

Are you aware of any initiatives aimed to reduce MDI prescribing? How do you feel about them? Have you used the NICE Decision-Making Tool for Inhalers?

Have you had discussions with patients about environmentally friendly asthma care? If so, how did you do this? What reactions have you had from patients?

Environmentally-Friendly Prescribing decision-making

Do environmental concerns play a role in your prescribing process? Has it changed your practice?

Do you feel you need more training or education around the use of DPIs?

Would you feel confident switching someone from an MDI to a DPI for environmental reasons?

What would help you feel more confident making this change? Do you have any ideas for initiatives or policies that would help you feel more confident in making this change?

Is there anything that motivates you to switch patients from an MDI to a DPI?

What concerns would you have about making this change?

9.4 APPENDIX 4: INVITATION TO PARTICIPATE EMAILS

Subject: Research Participants Needed for Greener Asthma Prescribing Study

You are invited to participate in a research study aimed at exploring how healthcare professionals make decisions about which inhalers to prescribe for asthma and whether environmental considerations play a role in the decision-making process.

The lead researcher, Lauren Franklin, is a medical student carrying out an MPhil and the research is being supervised by Dr Helen Twohig and Professor Christian Mallen who are both academic GPs at Keele University.

We are looking to speak to general practitioners, nurses and clinical pharmacists. Participation is entirely voluntary and would consist of an interview, either in-person or online. You will be compensated with a £50 voucher for your time.

For more information, please see the attached participant information sheet.

If you are interested in participating, please contact l.h.k.franklin@keele.ac.uk for further information.

We hope you consider taking part in our study,

Kind regards,

Lauren

PARTICIPANT INFORMATION SHEET

Version 0.2

Greener Asthma Prescribing: A qualitative study exploring health care professional perspectives on reducing the prescribing of metered dose inhalers for asthma, to reduce the carbon footprint of primary care

Lead Researcher: Lauren Franklin, l.h.k.franklin@keele.ac.uk

Research Supervisor: Dr Helen Twohig, h.j.twohig1@keele.ac.uk

Ethics Reference Number: 0380

Invitation

We would like to invite you to take part in our research study. Before you decide whether you wish to take part, it is important for you to understand why this research is being conducted and what it will involve. Please take time to read this information carefully and do ask a member of the research team if there is anything that is unclear.

The lead researcher, Lauren Franklin, is a medical student carrying out an MPhil and the research is being supervised by Dr Helen Twohig and Professor Christian Mallen who are both academic GPs at Keele University.

What is the purpose of the research?

Our study aims to explore how primary health care professionals (HCPs) make decisions about which inhalers to prescribe for people with asthma and what influences these decisions. This is important because the prescribing of metered dose inhalers (MDIs) constitutes 3-4% of the entire NHS carbon footprint and 13% of primary care's carbon footprint. Reduction in prescribing of these inhalers critical if the NHS is to reach its net zero target. There are incentives and tools to encourage practitioners to consider prescribing

other types of inhalers but there is little research into how primary care HCPs make inhaler choices in practice and whether environmental considerations are influencing their management decisions.

We would like to know more about what healthcare professionals (HCPs) think about reducing the use of MDIs for asthma and how this can be done safely.

We want to understand:

- How HCPs decide which asthma inhalers to prescribe
- What HCPs know about the environmental effects of MDIs and if/how this affects their choice of inhaler
- What HCPs think about switching to inhalers that cause less harm to the environment and any concerns they have

Why have I been invited?

We want to interview GPs, practice nurses and clinical pharmacists and are therefore inviting people who work in these roles. We aim to interview approximately 20 people for this study.

Do I have to take part?

You are free to decide whether you wish to take part or not. If you decide that you want to take part, please email [l.h.k.franklin@keele.ac.uk](mailto:l.h.k.franklin@ Keele.ac.uk) and we will arrange a time to for the interview to be conducted.

What will happen if I take part?

If you wish to take part, you will be asked to participate in an interview conducted either in person (at your place of work if you prefer and your location makes this feasible) or via Microsoft Teams. You will be sent a consent form and demographic survey via email and asked to complete this before the scheduled interview. Right before the interview commences, a member of the research team will check you have read the information sheet and will clearly state how and when you can withdraw. You will be offered the chance to clarify their understanding or ask further questions prior to the interview.

Interviews may last up to 1 hour but can be as short as 20 minutes and will be recorded. After the interview has finished, we will check if you agree for the data to be used in the study. All audio recordings will be transcribed verbatim and anonymised during this process. Once the transcription has been checked and anonymised, the recording of the interview will be deleted.

Once data has been anonymised it may not be possible to withdraw your data if you withdraw from the study.

What are the benefits of taking part?

You may find taking part interesting and derive satisfaction from contributing to research. You will be reimbursed with a £50 shopping voucher for your time in participating.

What are the risks of taking part?

We do not foresee any risks in taking part in this study.

At the start of the interview, you will be advised that you are free to withdraw at any point, without giving a reason. Any data that you provide will be anonymised during the transcription process and care will be taken during reporting to ensure that data presented does not identify anyone.

How will we use information about you?

We will need to use information from you for this research project. This information will include anything that you say within the interview and any answers you provide when completing the short demographic survey. People who do not need to know who you are will not be able to see your name or contact details. Your data will have a code number instead. We will keep all information about you safe and secure. Once we have finished the study, we will keep some of the data so we can check the results. We will write our reports in a way that no-one can work out that you took part in the study.

Audio data will be anonymised at the earliest possible opportunity. Transcripts and all other data will be labelled with unique identifiers which do not reveal your identity. All electronic data will be stored on Keele IT storage space, separate from any demographic information. The raw data, which could identify you, will not be passed to anyone outside the research team without your express written permission. The exception to this will be any regulatory authority which has the legal right to access the data for the purposes of conducting an inspection, audit or enquiry. These agencies treat your personal data in confidence.

Only *anonymous* data will be stored for 10 years and may be used in follow on research or requested by other researchers for scientific verification of the findings. When it is no longer required, the data will be disposed of securely.

How will we share our findings?

We will send you a summary of our findings.

We will also publish our results in an academic dissertation, academic journals and present them at conferences. We will also use social media to promote our findings, via Keele

Medical School's dedicated Twitter feed. In this way, we hope that the research results will be quickly available to the wider population.

What will happen if I don't want to carry on with the study?

You can stop being part of the study at any time, without giving a reason. If you withdraw from the study after the interview has been carried out, you will be asked if you are content for the data collected thus far to be retained and included in the study. If you prefer, the data collected can be destroyed and not included in the study. Once the research has been completed, and the data analysed, it will not be possible for you to withdraw your data from the study.

Who is funding and organising the research?

This study is part of an intercalated MPhil at Keele University for medical student, Lauren Franklin. The funding is coming from a research fellowship awarded to Professor Christian Mallen. None of the researchers will receive any financial reward by conducting this study, other than their normal salary / bursary as an employee / student of the University.

Who has reviewed the study?

Research involving human participants is reviewed by an ethics committee to ensure that the dignity and well-being of participants is respected. This study has been reviewed by the Keele University's Faculty of Medicine and Health Research Ethics Committee and been given favourable ethical opinion.

What if there is a problem?

If you have a query, concern or complaint about any aspect of this study, in the first instance you should contact the researchers if appropriate. If the researcher is a student, there will also be an academic member of staff listed as the supervisor whom you can contact. If there is a complaint please contact the supervisor with details of the complaint. The contact details for both the researcher and supervisor are detailed on page 1.

If your concern or complaint is not resolved by the researcher or their supervisor, you should contact the approving Research Ethics Committee Chair:

REC Name: Keele University's Faculty of Medicine and Health Research
Ethics Committee Email address: health.ethics@keele.ac.uk

Thank you for taking time to read this information sheet and for considering volunteering for this research.

9.6 APPENDIX 6: PARTICIPANT CONSENT FORM



Consent Form Version 0.1, dated 06/09/2022

Greener Asthma Prescribing: A qualitative study exploring health care professional perspectives on reducing the prescribing of metered dose inhalers for asthma, to reduce the carbon footprint of primary care

Lead Researcher: Lauren Franklin, l.h.k.franklin@keele.ac.uk

Research Supervisor: Dr Helen Twohig, h.j.twohig1@keele.ac.uk

REC Project Reference: 0380

Before you consent to participating in the research, please read the participant information sheet and then mark each box below with your initials if you agree. If you have any questions or queries before signing the consent form please contact Lauren Franklin on the email address above.

*Please initial
the boxes*

1. I have read and understood the research information sheet dated 06/09/2022 (version 0.1).
2. I have been given the opportunity to ask questions about the project, ask questions and have had these answered satisfactorily.
3. I understand that my taking part is voluntary. I also understand that I can discontinue participation at any point without having to give a reason.
4. I understand that data collected during this research will be processed in accordance with data protection law as explained in the Participant Information Sheet
5. I consent for my interview to be recorded. The audio recording will be transcribed and anonymised prior to analysis for the purposes of the research.
6. I understand and agree that parts of my interview may be used verbatim in publications or presentations but that such quotes will be anonymised
7. I agree to take part in the above research

Name of participant

Signature

Date

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Signature

Date

Name of person taking consent

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When completed, 1 copy for the participant, 1 copy for the research file

9.7 APPENDIX 7: PARTICIPANT DEMOGRAPHICS QUESTIONNAIRE



Participant ID:

Demographic data for Greener Asthma Prescribing Study (REC Project Reference 0380)

Version 0.1 (date 10/10/22)

Please answer the following questions, which will help us ensure that we include a diverse range of participants in our study.

Where there are several response options, please delete as appropriate.

1. What is your age? _____

2. What is your gender?

Female Male Non-binary Prefer not to say Other:_____

3. What is your profession?

GP Nurse Nurse practitioner Clinical Pharmacist

4. What is the postcode of the practice you work at? _____

5. How many years have you been qualified for your current role? _____

Please email this form to Lauren Franklin, l.h.k.franklin@keele.ac.uk along with your completed consent form.

9.8 APPENDIX 8: EXAMPLE TRANSCRIPT AND PERSONAL REFLECTION

9.8.1 Interview Transcript Excerpt

Below is an excerpt from the interview I had with PN03.

LF: *And so before this leaflet did you, were you having many conversations with patients about the environment and the sustainability of their treatment?*

PN03: *I have to say I'm not brilliant at it. It is something I really want to try and get better at. But like you know, I've been doing this for 18 years. It's really hard to, you know, get me to change old habits. But I'm sort of aware of it. Like I say, we've got a marker on our template, it literally is just a tick box, which doesn't mean anything other than just to remind us that we've had that conversation. And what I find tricky is that we...because we're desperately trying to get the best control for the patients, I find it really hard when somebody has a really good technique on something. And I work in a really, really deprived area, so you know, getting them to even have the money to be able to afford to take an inhaler, let alone then changing it and then having the, you know, the clarity of thoughts, to remember to take it and stuff like that is a lot more of what we're doing. So I do find it tricky, but and I know that there's various of the other nurses who are very good at it and very passionate about it.*

LF: *OK. And when either yourself or clinicians that you know have had these conversations about the environmental impact of inhalers, are these well received by patients?*

PN03: *Some and some. You get some who kind of haven't even thought about it. And the bottom of, I keep going on, of this leaflet just cause it's so fresh in my mind the bottom of the leaflet has kind of got that, you know, even if you don't want to change to a dry powder, taking it back to the pharmacy*

because your pharmacy can then dispose of it correctly. I think that's well received whether it's actually done I don't know but I think patients never know that they can. That's always helpful. In terms of whether or not they want to change it isn't well received with the majority of patients. I think, I think I would say, oh, I don't even want to guess at numbers of how many I've changed, but it yeah, it's not... It's that thing, isn't it? If something's working then they don't often want to change it? I suppose the next part of my thinking that I need to change is that if I'm changing treatment as in I'm stepping up or stepping down, it would be to then go oh let's think about it. It's like I had a perfect example the other day, actually I didn't because I did think of it with her, it was a lady and she wasn't controlled. Well, I knew we needed to do something, and I gave her, like, three options, one of which was a dry powder, and she just didn't want to go anywhere near it. So, yeah, it isn't always well received. So I don't really know how to make that better.

LF: OK. And for example, with this lady, was there a particular reason why she didn't want a dry powder?

PN03: She'd had one before. She'd had one before and she said that it stuck to the top of her mouth. She didn't like it, and there was just kind of like, you know, you start the maybe we could look at your technique, but she's just not interested at all. So yeah, that's...yeah you don't push it.

LF: And when other patients have come in and saying I don't want to try a dry powder or they've tried it and they want to change back, what they not liking?

PN03: And they're not liking sort of sensation. It's completely bizarre, isn't it? Cause some patients really like the fact that they can taste it and then other patients really, really hate the fact that they can taste it. And some people think that that means that they are getting it better and some people

think that they don't. And a lot of people complain of coughing. It's so often down to technique, it feels like, but lots of people say, oh yeah, it makes me cough. I don't like it. So yeah.

LF: And is there a specific patient group that you'd be more inclined to keep on an MDI rather than DPI?

PN03: And some of the older ones I think probably just because they can manage it a little bit better, they don't get confused to change it, you know. They can get ones where they don't need to think about it too hard. Yeah, but they tend to be the ones. And I guess, like I say, the chaotic patient who we have a lot of, who we just, you know, they just struggle to manage to be able to change it. And if I'm totally honest, which is probably wrong, but we have two sites. We have one which is very white working class and we have one which is massively ethnically diverse and we have to use interpreters all the time and totally honestly, I wouldn't even think about doing it there because the usually the interpreters are on the phone. We've got an issue where they're dropping out at 15 minutes and 50 seconds for some reason, which is hideous. And so you've got so much to try to cram into the 15 minutes. Otherwise, you got to phone them back again. So honestly, I don't even go near it on that just because I can't, I can't deal with that level of stress.

LF: OK. And what kind of people would you be more inclined to use DPI for or change over?

PN03: I guess a lot of the opposites of those really, so the younger people I tend to change over. For some reason, I've got it in my head, it's probably because it comes from Symbicort, I think probably patients that I'm switching to MART regimes. I may potentially think about it a bit more readily. Even though I'd potentially go for a Fostair, I'd potentially do a Fostair DPI rather than a Symbicort just out

of tradition, I suppose. And then also we use quite a lot of Ellipta devices, so anyone who we're trying to get compliance better with the once daily things I suppose so yeah.

9.8.2 Reflective Diary Excerpt

During/after the interview:

- Seems to be a desire to improve and be more sustainable. Making changes to prescribing however not across the board.
- Benefit of practice-made resource
- Patient reluctance and negative DPI views
- Concept of the chaotic patient?
- Deprivation again, 'clarity of thought'
- Practical barriers- translators? Is this a local or national thing?
- Good rapport building. Interview felt very participant-led and participant looked relaxed. Think due to quick chat at start about medical school.

Whilst analysing the interview:

- Is a tickbox exercise the best approach for integrating sustainable prescribing?
- Integrate DPIs into stepping up and stepping down- matches Greener Practice guidance
- Role of MART in sustainable prescribing
- Same views as previous interview on deprivation/ethnicity/age- trend? Prejudices? Very strong views. Both interviewees from similar demographic/job role- is this linked? Seemed to be looking at the effect providing inhaler education for these groups has on her?

9.9 APPENDIX 9: CONSOLIDATED CRITERIA FOR REPORTING QUALITATIVE RESEARCH (COREQ) CHECKLIST

No. Item	Guide questions/description	Reported on Page #
Domain 1: Research team and reflexivity		
<i>Personal Characteristics</i>		
1. Interviewer/facilitator	Which author/s conducted the interview or focus group?	Methods
2. Credentials	What were the researcher's credentials? E.g. PhD, MD	Preliminary pages
3. Occupation	What was their occupation at the time of the study?	Preliminary pages
4. Gender	Was the researcher male or female?	Preliminary pages
5. Experience and training	What experience or training did the researcher have?	Preliminary pages
<i>Relationship with participants</i>		
6. Relationship established	Was a relationship established prior to study commencement?	Methods
7. Participant knowledge of the interviewer	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	Appendix 5
8. Interviewer characteristics	What characteristics were reported about the interviewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	Methodology/Reflectivity

Domain 2: study design		
<i>Theoretical framework</i>		
9. Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	Methodology
<i>Participant selection</i>		
10. Sampling	How were participants selected? e.g. purposive, convenience, consecutive, snowball	Methods
11. Method of approach	How were participants approached? e.g. face-to-face, telephone, mail, email	Methods
12. Sample size	How many participants were in the study?	Results
13. Non-participation	How many people refused to participate or dropped out? Reasons?	Results
<i>Setting</i>		
14. Setting of data collection	Where was the data collected? e.g. home, clinic, workplace	Methods
15. Presence of non-participants	Was anyone else present besides the participants and researchers?	Methods
16. Description of sample	What are the important characteristics of the sample? e.g. demographic data, date	Results
<i>Data collection</i>		
17. Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	Appendix 2/3
18. Repeat interviews	Were repeat interviews carried out? If yes, how many?	Methods
19. Audio/visual recording	Did the research use audio or visual recording to collect the data?	Methods
20. Field notes	Were field notes made during and/or after the interview or focus group?	Methods
21. Duration	What was the duration of the interviews or focus group?	Results
22. Data saturation	Was data saturation discussed?	Methods
23. Transcripts returned	Were transcripts returned to participants for comment and/or correction?	Methods
Domain 3: analysis and findings		
<i>Data analysis</i>		

24. Number of data coders	How many data coders coded the data?	Methods
25. Description of the coding tree	Did authors provide a description of the coding tree?	Methods
26. Derivation of themes	Were themes identified in advance or derived from the data?	Methodology
27. Software	What software, if applicable, was used to manage the data?	Methods
28. Participant checking	Did participants provide feedback on the findings?	Methods
<i>Reporting</i>		
29. Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	Results
30. Data and findings consistent	Was there consistency between the data presented and the findings?	Results/Discussion
31. Clarity of major themes	Were major themes clearly presented in the findings?	Results
32. Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	Results/Discussion