

# Pharmacists as the delivery channel for adherence support in asthma

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*Applied Health Research*

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## Abstract

Non-adherence to inhaled corticosteroids remains a key challenge in asthma care in the United Kingdom (UK) – it increases healthcare costs, morbidity, and mortality. The growing pressure on UK primary care increased interest in pharmacists as a potential delivery channel for adherence support. However, research on UK pharmacist-led adherence support for asthma is limited.

This thesis addresses the gap in the literature by examining the effectiveness of previous pharmacist-led interventions in improving adherence in adults with asthma (systematic review/meta-analysis, 11 studies), exploring the perspectives of UK pharmacists (online questionnaire,  $n = 127$ ) and adults with asthma (qualitative study,  $n = 17$ ) on pharmacist-led adherence support for asthma, and assessing the feasibility and acceptability of a new pharmacist-led adherence support intervention delivered to adults with asthma in general practice (before-and-after study,  $n = 31$ ).

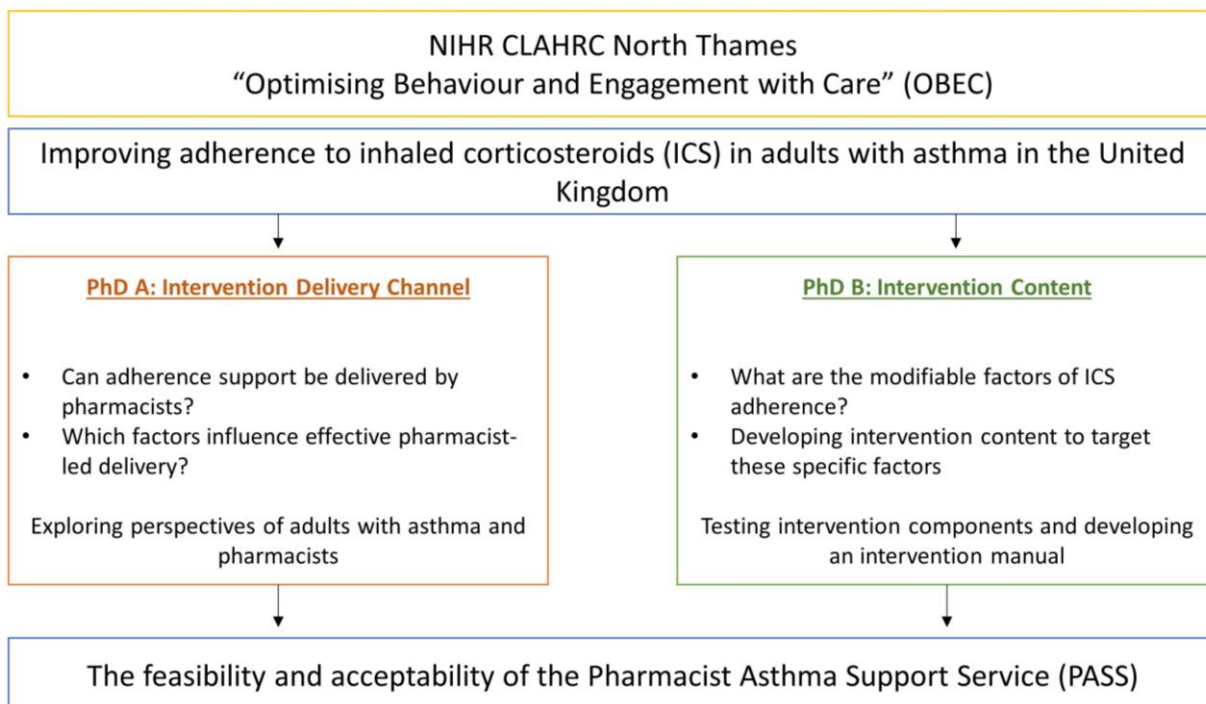
Previous pharmacist-led interventions significantly improved adherence in adults with asthma ( $d = 0.49$ , 95% CI 0.35 – 0.64,  $p < 0.0001$ ), with effective interventions addressing the ability *and* motivation to adhere to medication. UK pharmacists reported feeling most confident in and focusing mostly on patient education as adherence support (i.e. ability-related processes). Adults with asthma used their trust in other healthcare professionals (e.g. general practitioners) to gauge their trust in pharmacists. While they were open to pharmacist-led support due to gaps in existing asthma care, they were also concerned about pharmacist competency and role overlap with other healthcare professionals. The new pharmacist-led adherence intervention delivered in general practice demonstrated high acceptability among pharmacists and

adults with asthma, but further work is needed to improve the feasibility of the study design.

This research suggests that pharmacist-led adherence support is worth exploring further. With additional adherence-focused support/training for pharmacists and public awareness of pharmacist-led care, UK pharmacists may be able to make a valuable contribution to asthma care.

## PhD Structure

This PhD was part of a larger project under the National Institute for Health Research Collaboration for Leadership in Applied Health Research and Care (NIHRC CLAHRC) North Thames. The project was divided into two PhDs: PhD A (outlined in this thesis) focused on intervention delivery, and PhD B developed intervention content. PhD A had an Applied Health Research focus, examining the potential of UK pharmacists to deliver theory-based adherence support. PhD B (running in parallel) had a Health Psychology focus and centred on the development of the theory-based ICS adherence intervention. Both PhDs merged in a feasibility and acceptability study of the new intervention and its delivery by general practice pharmacists (see Figure 1).



*Figure 1.* PhD structure under the larger National Institute for Health Research Collaboration for Leadership in Applied Health Research and Care (NIHR CLAHRC) North Thames project

## Impact Statement

Tackling non-adherence to inhaled corticosteroids – a persistent and complex issue in asthma care – may reduce asthma-related healthcare costs, morbidity, and mortality in the United Kingdom (UK). In line with the recent call for increased pharmacist involvement in respiratory care within the National Health Service (NHS), this thesis outlines the first in-depth exploration of UK pharmacists as a potential delivery channel for adherence support for adults with asthma, offering unique contributions to both research and practice.

### *Research*

The systematic review/meta-analysis identifies detection bias and contamination bias as common limitations in the existing literature due to the use of self-report measures of adherence and randomisation at the participant level. This thesis also outlines the challenges associated with general practice-based research, including complex study approval processes, a lack of research infrastructure, and low recruitment and retention rates. It also identifies challenges in using research questionnaires in the general practice population with asthma, namely the need for extra assistance in completing questionnaires for older participants or participants whose first language was not English. These insights can improve future research and increase the feasibility of studies investigating pharmacist-led interventions delivered in general practice.

The research identifies potential barriers to pharmacist-led adherence support for asthma, such as pharmacists' lack of confidence in complex consultation-related skills, concerns from other healthcare professionals about role overlap, and people's doubts about pharmacist competency. While these findings are based on perceptions held by UK pharmacists and adults with asthma, they form a useful starting point for 1.) future

efforts aimed at identifying and addressing existing barriers to pharmacist-led adherence support in the UK, and 2.) research examining the perspectives of other stakeholders (e.g. general practitioners and nurses) on pharmacist-led adherence support.

### *Practice*

The research highlights existing gaps in the current skillset and confidence of UK pharmacists, namely in targeting motivation-related factors affecting adherence (e.g. beliefs about asthma and medicines). This suggests a need for additional training/support to develop pharmacists' counselling skillset beyond patient education and information provision, and towards targeted psychology-based approaches to shift beliefs and support adherence. Training in psychology-based intervention methods could be introduced as part of pharmacy degrees or continuing professional development modules.

The research also suggests that adults with asthma may have doubts about pharmacist competency and concerns about continuity of care, acting as potential barriers to initial engagement with pharmacist-led adherence support. While the general practice context may help overcome some of these barriers, increased public awareness of pharmacist-led services and pharmacy education may also facilitate the implementation of pharmacist-led adherence support.

On a larger scale, this research suggests that pharmacists may be an underutilised but valuable resource in asthma care. The research findings can help shape multidisciplinary approaches for adherence support, which are particularly important given the complexity of adherence behaviour and the growing pressure on UK primary care. The findings from the systematic review/meta-analysis in this thesis have also

been included in the Dutch pharmacy guidelines for asthma care, with publication expected in 2019.

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## List of Abbreviations

NIHR	National Institute for Health Research Collaboration for
CLAHRC	Leadership in Applied Health Research and Care
UK	United Kingdom
COPD	Chronic Obstructive Pulmonary Disease
FEV <sub>1</sub>	Forced Expiratory Volume
FVC	Forced Vital Capacity
FeNO	Fractional Exhaled Nitric Oxide
GP	General Practitioner
PEF	Peak Expiratory Flow
WHO	World Health Organization
SABA	Short-acting Beta-agonist
ICS	Inhaled Corticosteroid
LABA	Long-acting Beta-agonist
OCS	Oral Corticosteroid
MDI	Metered Dose Inhaler
DPI	Dry Powder Inhaler
WAAP	Written Asthma Action Plan
ACT	Asthma Control Test
ACQ	Asthma Control Questionnaire
HRQoL	Health-related Quality of Life
NRAD	National Review of Asthma Deaths
NICE	National Institute for Health and Care Excellence
DOT	Direct Observation of Treatment
MEMS	Medication Event Monitoring System
EMD	Electronic Monitoring Device
MMAS	Morisky Medication Adherence Scale
MARS	Medication Adherence Report Scale
INCA device	Inhaler Compliance Assessment device
HBM	Health Belief Model
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
PBC	Perceived Behavioural Control
CSM	Common Sense Model of Self-Regulation
e-CSM	Extended Common Sense Model
NCF	Necessity-Concerns Framework

PAPA	Perceptions and Practicalities Approach
COM-B	Capability, Opportunity, Motivation and Behaviour
BCW	Behaviour Change Wheel
3CBC	3 Components of Behaviour Change
MRCF	Medication-related Consultation Framework
MUR	Medicines Use Review and Prescription Intervention Service
NMS	New Medicine Service
CMS	Chronic Medication Service
MYMS	Managing Your Medicines Service
HSC board	Health and Social Care board
CPPE	Centre for Pharmacy Postgraduate Education
RCT	Randomised Controlled Trial
I-MUR	Italian Medicines Use Review
CPGP	Clinical Pharmacists in General Practice
QOF	Quality Outcomes Framework
OBEC	Optimising Behaviour and Engagement in Care
MRC	Medical Research Council
PROSPERO	International Prospective Register of Systematic Reviews
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-analyses
PICOS	Participants Intervention Comparison Outcome Study Design
DE	Design Effect
ICC	Intra-Cluster Correlation Coefficient
USA	United States of America
MALMAS	Malaysian Medication Adherence Scale
BMQ/BMQ-S	Beliefs about Medicines Questionnaire (Specific)
PCI	Pharmaceutical Care Issue
RPS	Royal Pharmaceutical Society
CP	Community Pharmacist
ICP	Integrated Care Pharmacist
AUKCAR	Asthma UK Centre for Applied Research
PASS	Pharmacist Asthma Support Service
TFA	Theoretical Framework of Acceptability
CCG	Clinical Commissioning Group
C&H	City and Hackney
EMIS	Egton Medical Information Systems
TAT	Think Aloud Task
Brief IPQ	Brief Illness Perceptions Questionnaire
JRO	Joint Research Office
PPI	Patient and Public Involvement

## Section A: Introduction and Background



# 1 Asthma

## 1.1 Defining asthma

Asthma is a heterogeneous long-term condition affecting the airways through chronic inflammation, reversible airflow obstruction (i.e. temporary/reversible impairment of airflow to the lungs), and/or enhanced bronchial reactivity (i.e. easily-triggered contractions in the airways) (The Global Asthma Network, 2018). It is characterised by periods of expiratory airway limitation, with symptoms such as wheeze, shortness of breath, cough, and/or chest tightness that vary in intensity (Global Initiative for Asthma, 2018; Pavord et al., 2018).

During an exacerbation (also known as an ‘asthma attack’), breathing becomes restricted due to constricted airway muscles, inflamed airway lining, and/or a build-up of sticky mucus and phlegm in the airways (Masoli, Fabian, Holt, & Beasley, 2004). This progressive or acute increase in asthma symptoms is often the result of external or internal factors known as triggers. Triggers vary between individuals and examples include cold weather, animal hair, pollen, or stress (Global Initiative for Asthma, 2018).

There are over 300 million people with asthma worldwide and this figure is set to increase by 100 million by 2025 (Global Burden of Disease Study Collaborators, 2015; Masoli et al., 2004). Asthma is the 16<sup>th</sup> leading cause of disease burden worldwide, based on years lived with disability (a measure of disease burden) (The Global Asthma Network, 2018). Asthma-related mortality rates have fallen to less than 1% in most countries due to advances in healthcare and asthma treatment. However, asthma-related mortality remains a global health issue because many asthma-related

deaths are actually preventable (Levy et al., 2014; The Global Asthma Network, 2018).

In the United Kingdom (UK), two clinical guidelines exist for asthma diagnosis and management: the guideline by the British Thoracic Society/Scottish Intercollegiate Guidelines Network (BTS/SIGN) (2016) and the guideline by the National Institute for Health and Care Excellence (NICE) (2017). The BTS/SIGN guidelines were derived from a multidisciplinary clinically-led process, combining a critical appraisal of the literature with evidence from clinical practice. The NICE guidelines were based on health economic modelling with input from a multidisciplinary guideline development group. As such, the guidelines differ in terms of their diagnosis and treatment recommendations (White, Paton, Niven, & Pinnock, 2018).

The biggest difference between the two guidelines is the recommended treatment approach for mild asthma, with the BTS/SIGN guidelines recommending a more updated treatment approach (White et al., 2018). As such, this chapter will focus on the recommendations outlined in the BTS/SIGN guidelines.

## 1.2 Diagnosing asthma

There is no definitive test to diagnose asthma, meaning that diagnoses are made based on a person's symptom history and a healthcare professional's clinical judgment. A diagnosis relies on two key components: respiratory symptoms and tests to demonstrate expiratory airflow limitation or airway inflammation (British Thoracic Society/Scottish Intercollegiate Guidelines Network, 2016). Both of these components should be used to rule out other conditions. However, asthma treatment can be administered in urgent cases (i.e. during an exacerbation) when an asthma diagnosis seems likely (Global Initiative for Asthma, 2018).

### 1.2.1 Respiratory symptoms

Common asthma symptoms (e.g. wheeze, chest tightness, cough, and shortness of breath) are non-specific respiratory symptoms that also point to other conditions, such as chronic obstructive pulmonary disorder (COPD), cystic fibrosis, congenital heart disease, or heart failure (British Thoracic Society/Scottish Intercollegiate Guidelines Network, 2016; Global Initiative for Asthma, 2018). A detailed individual symptom history helps discern certain characteristics of the symptoms that may point to asthma.

In asthma, more than one symptom is generally present from time to time with varying intensity (Global Initiative for Asthma, 2018). Symptoms may have specific triggers (e.g. exercise, pollen, or cold air), and may worsen at night, first thing in the morning, or with viral infections. The likelihood of an asthma diagnosis increases if the person has other allergic conditions (e.g. eczema), their family members have asthma and/or allergic conditions, and symptoms begin during childhood. Additional symptoms such as tingling or numbness in the extremities, chest pain, and dizziness are likely to point to non-respiratory conditions (e.g. a heart failure), ruling out an asthma diagnosis (Global Initiative for Asthma, 2018).

### 1.2.2 Expiratory airflow limitation

In addition to taking a symptom history, healthcare professionals can analyse characteristics of lung function to make an asthma diagnosis. Expiratory airflow limitation refers to a decrease in the maximum amount of air breathed out by the individual. It can be measured using a spirometer, which is a device that measures both the total amount of air exhaled per second (Forced Expiratory Volume per second, FEV<sub>1</sub>) and the total volume of air exhaled in a single breath (Forced Vital Capacity, FVC) (M. R. Miller et al., 2005). These values and their ratio (FEV<sub>1</sub>/FVC) are compared to normal predicted values based on an individual's age, gender, race,

height, and weight (Barreiro & Perillo, 2004). Spirometry results that fall consistently below the predicted values may be an indication of narrowed airways.

However, expiratory airflow limitation has to be variable and reversible to establish an asthma diagnosis. These characteristics differentiate asthma from other respiratory conditions with non-reversible airflow limitation (e.g. COPD). Variability and reversibility can be tested using reversibility tests, bronchoprovocation tests ('challenge tests'), and monitoring methods.

Reversibility tests use spirometry before and after a person takes bronchodilator medication, which opens up the airways (explained further in Section 1.3.1). Improved spirometry readings after the bronchodilator are an indicator that airflow limitation may be reversible (British Thoracic Society/Scottish Intercollegiate Guidelines Network, 2016). Bronchoprovocation tests introduce a potential asthma trigger (often exercise or a small dose of inhaled irritants) to measure airway hyperresponsiveness. Monitoring methods include asking a person to measure their lung function twice daily for two weeks to check for changes, or monitoring how people improve on anti-inflammatory asthma medication (British Thoracic Society/Scottish Intercollegiate Guidelines Network, 2016).

Additional tests can be used to establish whether people have airway inflammation or specific asthma triggers, such as testing for fractional exhaled nitric oxide (FeNO) or allergens (British Thoracic Society/Scottish Intercollegiate Guidelines Network, 2016; Global Initiative for Asthma, 2018).

### 1.2.3 Considerations for the current diagnostic approach

#### *Misdiagnosis*

Despite the guidelines outlined above, the lack of a definitive diagnostic test for asthma means that the condition is still misdiagnosed in practice. Heffler, Pizzimenti, Guida, Bucca, and Rolla (2015) reviewed bronchoprovocation tests for asthma conducted in an allergy outpatient clinic. Of the 226 cases referred for testing by their General Practitioners (GPs), only 99 (43.8%) had a positive result suggestive of asthma. However, more than half of the people with a negative result ( $n = 65$ , 51.2%) were already being treated for asthma. However, this study was a retrospective analysis of clinical records and there was no follow-up data for many of the individuals with negative test results because they were referred on to other specialists.

Scott, Currie, Albert, Calverley, and Wilding (2012) measured lung function (spirometry), airway hyperresponsiveness (bronchoprovocation tests), FeNO, and allergies (skin prick tests) in overweight individuals (Body Mass Index  $\geq 30$  kg/m<sup>2</sup>) with a prescription for asthma medication. Approximately one-third of these participants (36.3%) demonstrated good lung function and low levels of airway hyperresponsiveness, inflammation, and allergies, inconsistent with an asthma diagnosis (Scott et al., 2012). Although these findings were based on data taken from the screening process of an intervention study, they indicate that additional asthma-specific testing is important for overweight individuals because it may be difficult to differentiate asthma- and obesity-related respiratory symptoms based on a symptom history alone.

Asthma misdiagnosis is problematic for several reasons. Firstly, people are put on unnecessary medication. It may not relieve their symptoms and may give them side effects, and they may therefore require additional clinical appointments. Secondly, the

medication and healthcare utilisation costs related to asthma misdiagnoses are preventable. One Canadian study found that a secondary screening programme to double-check asthma diagnoses led to an average cost saving of \$35,141 (95% CI \$4,588 - 69,278) per 100 individuals screened, mainly due to the lifetime medication costs saved (Pakhale, Sumner, Coyle, Vandemheen, & Aaron, 2011).

### *Phenotypes and overlap syndromes*

The diagnosis process is further complicated by asthma phenotypes and overlap syndromes. Asthma phenotypes refer to recognisable patient clusters that differ based on the age of onset, pathophysiology, and aetiology of asthma (Bel, 2004; Fahy, 2009; Global Initiative for Asthma, 2018; Haldar et al., 2008). Several phenotypes have been identified, although disagreement still exists as to how many can be classified as true phenotypes and what the clinical utility of phenotypes will be (Bel, 2004; W. C. Moore et al., 2010; Wenzel, 2012).

Earlier research viewed asthma as a primarily allergy-related condition (Wenzel, 2012). Researchers established that asthma was connected to a subset of the immune system's helper T cells (T<sub>H</sub>2 response), which is linked to the hypersensitivity seen in atopy (a genetic tendency for allergies) and allergic conditions (A. Berger, 2000). Recent phenotype research suggests that a large proportion of people with asthma (approximately 70% in primary and secondary care) do fall under the allergic asthma phenotype, characterised by childhood onset, a family history of allergic conditions, airway inflammation, and good response to inhaled corticosteroids (Haldar et al., 2008; Wenzel, 2012).

However, some adult-onset phenotypes may have less to do with atopy and more with preventable lifestyle risk factors such as smoking, obesity, and occupational exposure

to sensitizing allergens (Baur et al., 2012; Global Initiative for Asthma, 2018; D. J. Tan et al., 2015; Wenzel, 2012). Furthermore, some phenotypes (e.g. late-onset eosinophilic asthma and neutrophilic asthma) have signs of airway inflammation but not of T<sub>H</sub>2-related atopy (Wenzel, 2012). Allergen and FeNO testing are crucial in differentiating these phenotypes based on their underlying physiological mechanisms.

Although controversial, Asthma-COPD overlap syndrome (ACOS) is sometimes discussed as an overlap between signs of COPD (persistent airflow limitation) and asthma (a history of asthma or airflow limitation reversibility) in people over the age of 40 (Leung & Sin, 2017). Passalacqua, Ciprandi, and Canonica (2000) as well as Giavina-Bianchi, Aun, Takejima, Kalil, and Agondi (2016) proposed that a combination of rhinitis and asthma should be termed “united airways disease” as it represents a syndrome of hypersensitivity and inflammation in the upper and lower airways. However, some pathophysiological components of both conditions remain unclear and require further rigorous research.

#### *Low-resource settings*

The majority of people with asthma are located in low- and middle-income countries, and these countries also report higher asthma-related mortality rates when compared to high-income countries (The Global Asthma Network, 2018). There may be limited access to diagnostic testing in low-resource settings, and healthcare professionals may have to rely on a symptom-based approach. It is important to remember that although low-resource settings are more common in low- and middle-income countries, they also exist in high-income countries (Global Initiative for Asthma, 2018).

Healthcare professionals can monitor the duration of symptoms and identify any symptoms discordant with an asthma diagnosis (e.g. weight loss, fevers, chills, or

sweating) (Global Initiative for Asthma, 2018). They can also monitor lung function before and after the introduction of asthma medication. A commonly used measure is Peak Expiratory Flow (PEF), which refers to the “maximum flow achieved during an expiration delivered with maximal force starting from the level of maximal lung inflation” (Quanjer, Lebowitz, Gregg, Miller, & Pedersen, 1997, p. 2s). PEF meters are inexpensive devices that are included in the World Health Organization (WHO) package of essential non-communicable disease interventions for primary care in low-resources settings (World Health Organization, 2010).

### 1.3 Managing asthma

Following a diagnosis, asthma management takes a control-based approach focusing on symptoms and the risk of future exacerbations. Both the healthcare professional and the person with asthma are involved in a continuous cycle of assessing current symptom control and future exacerbation risk, choosing an appropriate treatment, and reviewing the progress made on the treatment. It is important to consider both symptom control and future risk because asymptomatic individuals can still be at risk of an exacerbation (Global Initiative for Asthma, 2018). Both pharmacological/surgical and non-pharmacological approaches are used in asthma management.

#### 1.3.1 Pharmacological and surgical management

Asthma medications are prescribed in a stepped approach based on symptom control and overall response to medication (see Table 1). Initial treatment is based on a person’s clinical presentation, and treatment is ‘stepped up’ or ‘stepped down’ based on treatment response.



Table 1. Step-wise approach to asthma treatment. Adapted from “The British Guideline on the Management of Asthma” by the British Thoracic Society/Scottish Intercollegiate Guidelines Network (2016)

1	2	3	4	5
<u>Regular preventer</u>	<u>Initial add-on therapy</u>	<u>Additional add-on therapies</u>	<u>High dose therapies</u>	<u>Continuous or frequent use of oral steroids</u>
Low dose ICS	Low dose ICS and LABA	<i>No response to LABA:</i> Increased ICS, no LABA  <i>Benefit from LABA:</i> Medium-dose ICS and LABA  <i>Benefit from LABA and control still inadequate:</i> ICS and LABA, with potential LTRA, theophylline, LAMA	Increase ICS to high dose  Potential LTRA, theophylline, beta-agonist tablet, LAMA  <i>Refer patient for specialist care</i>	Daily steroid tablet in lowest dose providing adequate control  Maintain high dose ICS  Consider other treatments to minimise use of steroid tablets  <i>Refer patient for specialist care</i>
Short-acting beta-agonists as required – consider increasing dose if using $\geq 3$ doses/week				
*inhaled corticosteroid (ICS), long-acting beta-agonist (LABA), leukotriene receptor antagonists (LTRA), long-acting muscarinic antagonist (LAMA)				

### Inhalers

Inhaled asthma medication is broadly categorised into preventer medication (preventers) and reliever medication (relievers). Preventer medication is prescribed for continuous use to tackle the underlying inflammatory component of asthma. The most common example of this is the inhaled corticosteroid (ICS) (British Thoracic Society/Scottish Intercollegiate Guidelines Network, 2016). Reliever medication is prescribed for use only in the case of an exacerbation to provide immediate relief, and examples include short- and long-acting beta-agonists (SABA and LABA) that relax airway muscles. SABA is a reliever on its own and LABA must be combined with a preventer medication to be effective (British Thoracic Society/Scottish Intercollegiate Guidelines Network, 2016).

While previous guidelines suggested that mild asthma could be treated with a reliever medication alone, recent updates to treatment guidelines recommend prescribing both preventer and reliever medication for all people with asthma (British Thoracic Society/Scottish Intercollegiate Guidelines Network, 2016; Global Initiative for Asthma, 2019; Pavord et al., 2018)

There are many types of inhalers on the market that differ in terms of how medication is dispensed (e.g. propellant, mechanical, compressed air), drug formulation (e.g. dry powder), dose storage (e.g. single or multi-dose), and dose preparation (Price et al., 2013). Common examples include Metered Dose Inhalers (MDIs), Dry Powder Inhalers (DPIs), and Breath-Actuated Inhalers (BAIs) (Asthma UK, 2016b). Individuals with a MDI may also be given a spacer device, which has an aero chamber that catches medication to allow for easier administration through continuous breathing (Cochrane, Bala, Downs, Mausekopf, & Ben-Joseph, 2000).

#### *Additional treatments*

Additional treatments include anti-histamines or steroid nasal sprays, flu vaccines, theophylline, leukotriene receptor antagonists (LTRAs), and long-acting muscarinic antagonists (LAMAs) (British Thoracic Society/Scottish Intercollegiate Guidelines Network, 2016; Global Initiative for Asthma, 2019). Treatments targeting allergies in general (anti-histamines and steroid nasal sprays) are not specifically designed for asthma, but may help manage the allergic component of the condition. Similarly, flu vaccines are recommended for people with asthma as exacerbation risk may increase with viral infections (Global Initiative for Asthma, 2019).

Theophylline is a bronchodilator that was used for asthma more frequently in the 1960s and 70s before the widespread use of anti-inflammatory inhalers (Crompton,

2006; Miles Weinberger & Hendeles, 1996). Leukotriene receptor antagonists (LTRAs, e.g. Montelukast) block inflammatory chemicals called leukotrienes, providing both bronchodilator and anti-inflammatory benefits. They are used only as add-on medication if inhaled medication is not having the desired effect (British Thoracic Society/Scottish Intercollegiate Guidelines Network, 2016; Dempsey, 2000). LAMAs relax the muscles in the airway and have the additional benefit of inhibiting excess mucus production (Halpin, 2016; Tagaya et al., 2016).

### *Specialist treatments*

If combinations of the medications outlined above are unsuccessful (see Steps 4 or 5 in Table 1), people may be prescribed oral corticosteroids (OCS) and referred for specialist treatment. OCSs (e.g. Prednisolone) are only used if the asthma is not responding to inhaled medication. In the case of an exacerbation, systemic corticosteroids (affecting the whole body) may be injected or administered intravenously (British Thoracic Society/Scottish Intercollegiate Guidelines Network, 2016).

Specialist treatments include monoclonal antibody treatments and bronchial thermoplasty. Monoclonal antibody treatments (e.g. Omalizumab and Mepolizumab) work by blocking chemicals in the immune system that may be triggering inflammation in the airways, such as Immunoglobulin E (IgE) or Interleukin 5 (IL5) (Busse et al., 2001; Pavord et al., 2012). Bronchial thermoplasty is a bronchoscopic procedure carried out in hospital where thermal energy is applied to the airways to reduce any smooth-muscle mass that may be making it difficult to breathe (Cox, Miller, Mitzner, & Leff, 2004).

### 1.3.2 Non-pharmacological management

Although medication is an integral part of asthma care, both previous research and asthma guidelines stress the importance of asthma self-management to improve asthma outcomes (British Thoracic Society/Scottish Intercollegiate Guidelines Network, 2016; Gibson et al., 2003; Global Initiative for Asthma, 2018). Self-management refers to “...the tasks that individuals must undertake to live well with one or more chronic conditions. These tasks include having the confidence to deal with medical management, role management and emotional management of their conditions” (Institute of Medicine, 2004, p. 57). In the context of asthma, self-management entails taking medication, picking up or refilling prescriptions, managing and monitoring symptoms, avoiding triggers, adjusting treatment, and seeking professional help as needed, all within the demanding context of daily life (Pinnock, 2015). As such, many people with asthma may struggle with some elements of their self-management.

To support people with asthma, healthcare professionals are encouraged to incorporate regular reviews to support the development of the necessary skills, knowledge, and confidence to self-manage asthma (Global Initiative for Asthma, 2018; Institute of Medicine, 2004). Annual asthma reviews in primary care incorporate three main components: assessing asthma control, identifying and tackling any reasons for poor asthma control, and exploring people’s beliefs surrounding their condition and its management. They address topics such as inhaler technique, symptoms, lung function, medication management, triggers, smoking cessation, and self-management targets (Pinnock et al., 2010).

A useful tool for supported self-management is the Written Asthma Action Plan (WAAP). These plans, generated in collaboration with a healthcare professional,

provide instructions for three scenarios: everyday management, increased symptoms/deterioration of asthma control, and an exacerbation (Pinnock, 2015). The WAAP provides self-management instructions for each scenario, and outlines when to seek professional and/or emergency care. It often lists a person's prescribed medication and additional devices (e.g. spacers), along with instructions for use (e.g. dosage and timing). The WAAP is not a static document and should be regularly updated with a healthcare professional during an asthma review (Pinnock, 2015).

Tobacco has consistently been linked to respiratory disease, and smoking cessation should be considered an integral part of asthma care (Ferkol & Schraufnagel, 2014; Global Initiative for Asthma, 2018; Tonnesen et al., 2007). Reductions in tobacco consumption and second-hand smoke exposure are global targets set out in recent asthma care guidelines (Global Initiative for Asthma, 2018; The Global Asthma Network, 2018). Smoking cessation services can include behavioural support (e.g. one-on-one or group-based counselling), pharmacological treatment (e.g. nicotine replacement therapy), or a combination of the two. Healthcare professionals are encouraged to proactively engage smokers with asthma in smoking cessation services (Hiscock et al., 2013; Tonnesen et al., 2007).

#### 1.4 Asthma outcomes

As highlighted in Sections 1.1 to 1.3, asthma is a heterogeneous condition with multiple pathophysiological mechanisms, symptoms, and treatment approaches. As such, several methods for operationalising and evaluating the condition exist. The following section will briefly describe asthma outcomes commonly used within research: asthma control, exacerbations, lung function, biomarkers, and health-related quality of life.

#### 1.4.1 Asthma control

Asthma control refers to the “...extent to which the manifestations of asthma can be observed in the patient, or have been reduced or removed by treatment” (Global Initiative for Asthma, 2018, p. 26). It has two components: current symptoms and future risk. The impact of current symptoms is often operationalised through their effect on daytime functioning (e.g. walking), sleep (e.g. night-time awakening), and medication-taking behaviour (e.g. increased reliever inhaler use). The future risk component focuses on the presence of risk factors for future exacerbations, fixed airflow limitation, and medication side effects (Global Initiative for Asthma, 2018).

The most common measures of asthma control in both clinical practice and research are self-reported assessments. Within clinical practice, tools such as the Three Questions Tool from the Royal College of Physicians, (Pearson & Bucknall, 1999) and the Primary Care Asthma Control Screening Tool (PACS) (LeMay, Armour, & Reddel, 2014) are used for screening to quickly identify and prioritise individuals with poor asthma control.

Within research, validated questionnaires such as the patient self-reported Asthma Control Test (ACT) (Nathan et al., 2004) and Asthma Control Questionnaire (ACQ) (Juniper, O'Byrne, Guyatt, Ferrie, & King, 1999) are often used to quantify asthma control. Both questionnaires assess symptoms over the previous four weeks and provide a total numerical score with validated cut-off points. For example, a score of less than 20 on the ACT or higher than 1.5 on the ACQ indicates poorly-controlled asthma (Juniper et al., 1999; Schatz et al., 2009).

#### *Asthma severity*

Asthma severity is often categorised as low, mild, moderate, or severe based on the lowest level of treatment required to achieve optimal asthma control (D. R. Taylor et

al., 2008). For example, individuals with mild asthma may only need a SABA inhaler to maintain asthma control, whereas those with severe asthma may need high-intensity treatment such as OCS or high-dose ICS/LABA inhalers. In contrast to asthma control, asthma severity is a descriptor rather than an outcome. For example, it may be used to describe a participant sample in research or to identify individuals who need specialist referrals in practice (D. R. Taylor et al., 2008).

#### 1.4.2 Exacerbations

The American Thoracic Society and the European Respiratory Society define an exacerbation ('adverse event') as a significant change from a person's usual variations in symptoms, medication use, and/or lung function. Severe exacerbations require urgent action by both the person with asthma and their healthcare professional to prevent hospitalisations or death. They can be identified by major treatment changes (i.e. systemic corticosteroids or increased preventer treatment dose for at least three days) and/or hospitalizations/emergency department visits requiring systemic corticosteroids (Reddel et al., 2009).

Moderate exacerbations do not result in hospitalisations or death, but are significantly taxing on the person with asthma and require a change of treatment approach. They are characterised by a deterioration in symptoms and/or lung function and increased reliever medication use lasting at least two days. This includes visits to emergency care that do not result in the use of systemic corticosteroids (Reddel et al., 2009). Within research, administrative databases (e.g. hospital, pharmacy, or insurance claim records) are frequently used to identify the hospitalisations, emergency room visits, or medication changes indicative of exacerbations (Shen, Johnston, & Hays, 2011).

### 1.4.3 Lung function

Research shows that lung function does not correlate with asthma symptoms, and it should therefore always be assessed separately (Global Initiative for Asthma, 2018; Kerstjens, Brand, de Jong, Koeter, & Postma, 1994). Common outcomes for lung function include Peak Expiratory Flow, Forced Expiratory Volume per second (FEV<sub>1</sub>), Forced Vital Capacity (FVC), and the ratio of FEV<sub>1</sub> over FVC.

The spirometer is currently considered the ‘gold standard’ for lung function testing. Initial uptake of this method was slow due to the need for specialist training and the device’s price and lack of portability. However, recent technological advances have produced more portable and user-friendly spirometers that are reliable for clinical use (Petty, 2005; Schoh et al., 2002). The Welsh government recently invested considerable funding for spirometry training and equipment across primary care in Wales (Respiratory Health Implementation Group, 2018). PEF meters are often used when spirometry is unavailable because they are cheap, portable, and user-friendly devices that require no electronic power (Quanjer et al., 1997).

### 1.4.4 Biomarkers

Commonly measured biomarkers of asthma include Immunoglobulin E (IgE), eosinophils, neutrophils, and fractional exhaled nitric oxide (FeNO). IgE is an antibody in the immune system that is a marker for atopy, and therefore allergic asthma. Eosinophils and neutrophils are both white blood cells involved in the body’s inflammatory process, and their presence in the airways has been linked to severe asthma (de Groot et al., 2016; Fahy, 2009). FeNO (briefly mentioned in Section 1.2.2) is a marker of airway inflammation because cells in the airway increase nitric oxide production during the inflammatory process (Kim et al., 2017).



Asthma biomarkers can be found in blood (eosinophils), serum (IgE), sputum (eosinophils, neutrophils), and exhaled air (FeNO). Blood and serum can be collected through blood samples, while sputum can be coughed up or collected via bronchoscopy (Fahy, Wong, Liu, & Boushey, 1995; Kim et al., 2017). Samples of eosinophils and neutrophils can also be collected through bronchoalveolar lavage (BAL), a procedure that uses a bronchoscope to deliver a small amount of saline solution into the lung, which is then collected and analysed (Barber et al., 2016).

Although biomarkers provide evidence of inflammation and atopy, it is important to note that they are not direct measures of asthma severity or control. While FeNO measurements are non-invasive and suitable for people with limited lung capacity, other biomarkers may require invasive and/or costly data collection methods that may not be suitable for all studies (Kim et al., 2017; Szeffler et al., 2012).

#### 1.4.5 Quality of life

Health-related quality of life (HRQoL) takes a person-centred approach looking at the impact of asthma on daily functioning and well-being (Hays & Reeve, 2008). It covers domains such as physical and social functioning, emotional wellbeing, role limitations, and general or condition-specific symptoms (Ford, Mannino, Redd, Moriarty, & Mokdad, 2004; Hays & Reeve, 2008). Although HRQoL itself is not a clinical measure, it fits well with the Chronic Care Model (CCM) which posits that an improvement in both clinical *and* functional outcomes is the ultimate aim of healthcare for long-term conditions (Barr et al., 2003; E. H. Wagner, Austin, & Von Korff, 1996).

Self-report questionnaires are used to measure the construct given its person-centred nature (Hays & Reeve, 2008). Two examples, both called the Asthma Quality of Life Questionnaire, measure this construct specifically in people with asthma (Juniper, Guyatt, Ferrie, & Griffith, 1993; Marks, Dunn, & Woolcock, 1993). Juniper et al.

(1993) developed a 32-item questionnaire covering asthma symptoms, activity limitation, emotional function, and environmental stimuli. The questionnaire developed by Marks et al. (1993) assessed the impact of asthma over four weeks, covering domains such as breathlessness, mood, social disruption, and concerns for health.

In both of these questionnaires, results for asthma-specific HRQoL were well-aligned with clinical asthma measures (e.g. peak expiratory flow, airway hyperresponsiveness, or symptoms) and non-specific HRQoL measures (Juniper et al., 1993; Marks et al., 1993).

## 1.5 Asthma in the United Kingdom

Following the background information on asthma and asthma care given above, the next section will briefly outline asthma in the UK context to set the scene for this thesis.

The UK has among the highest prevalence rates of asthma and allergies in the world (Gupta, Sheikh, Strachan, & Anderson, 2004; The Global Asthma Network, 2018). Between 2011 and 2012, approximately 240,000 new diagnoses were made by GPs (3.8 per 1000 individuals). The prevalence rate was approximately 6 million people, although this may be a conservative estimate because it was based on patient-reported and clinician-diagnosed-and-treated asthma only (Mukherjee et al., 2016).

### 1.5.1 Asthma as a public health issue

The health outcomes for people with asthma in the UK are poor compared to other high-income countries (Bateman et al., 2008). The UK consistently ranks among the top ten high-income countries for asthma-related hospitalisations and mortality rates (The Global Asthma Network, 2018). In addition to the impact on people's health,

asthma has a direct effect on healthcare spending. The UK's high incidence and prevalence rates for asthma translate to approximately 2.7 million GP consultations, 3.7 million nurse consultations, 113,000 ambulance calls, 121,000 Accident and Emergency (A&E) visits, and 93,900 hospital in-patient treatments. Between 2011 and 2012, asthma care incurred over £1.1 billion worth of public sector costs (Mukherjee et al., 2016). Asthma also incurs indirect costs through productivity loss. Annually, approximately 4.1 million workdays (78.9 days/1000 adults) are lost due to asthma-related absenteeism. Furthermore, over 36,000 people claim Disability Living Allowances (DLAs) for the condition (Mukherjee et al., 2016).

Asthma has a serious negative impact on individual wellbeing, healthcare systems, and the economy in the UK, making it a real public health concern. In most cases, asthma-related morbidity and mortality are preventable with adequate care and support, accurate prescribing, and appropriate medication use (Levy et al., 2014; Mukherjee et al., 2016). As such, many of the direct and indirect costs associated with the condition can be reduced.

#### 1.5.2 Gaps in care and directions for research

The recommended components of asthma care, such as the WAAP and annual asthma review, have been shown to have a significant positive impact on asthma-related morbidity and mortality (Basheti, Reddel, Armour, & Bosnic-Anticevich, 2007; Gibson et al., 2003). An annual survey conducted by Asthma UK ( $n = 7611$ ) found that only 35% of people with asthma in the UK receive basic care, consisting of annual asthma reviews, WAAPs, and inhaler technique checks with a trained healthcare professional. There were notable differences between regions, with basic care provision ranging from 26.1% in Wales to 43.2% in Scotland (Cumella, 2017). The National Review of Asthma Deaths (NRAD) found that of the 195 people that died

from asthma in the UK in 2012, only 135 (69%) had records of a primary care asthma review in the previous year, only 44 (23%) owned a WAAP, and 19 (10%) died within 28 days after being treated in hospital for an exacerbation (Levy et al., 2014).

Improving performance on each of these care indicators will be crucial in reducing the direct and indirect costs associated with asthma. Furthermore, shifting asthma care from acute management to long-term supported self-management may lessen the burden on the healthcare system (Pinnock et al., 2010).

The Lancet Asthma Commission and European Asthma Research Innovation Partnership (EARIP) emphasize that while we await new developments in diagnostic testing and targeted asthma treatment, efforts to decrease asthma-related morbidity and mortality should focus on optimising current asthma care. This may involve improving patient-provider communication, implementing supported self-management initiatives, developing tools to assess and support self-management in primary care, and tackling modifiable behavioural factors that may improve asthma outcomes (Masefield et al., 2017; Pavord et al., 2018). An example of a modifiable behavioural factor, as mentioned by both the EARIP and Lancet commission, is medication adherence. This concept will be explored in detail in the next chapter.

## 2 Medication adherence

This chapter provides a broad overview of adherence definitions and methods for assessment, followed by a discussion of adherence in the context of asthma care. It will then evaluate relevant models and theories that have been used to examine adherence within health psychology research. Finally, this chapter will describe previous interventions targeting adherence in asthma and guidelines/frameworks for future intervention development.

### 2.1 Defining adherence

As outlined in the previous chapter, the self-management of long-term conditions is a complex process that includes managing medications and symptoms, adjusting treatment, and seeking professional help as needed (Pinnock, 2015). Medication adherence is a component of the self-management process, referring to an individual's interaction with medication (World Health Organization, 2003). The terms compliance, concordance, and adherence are often used interchangeably in the literature and it is important to understand the differences between these three terms. Although related, they capture the shift from the clinician- to person-centred care model over time (Horne et al., 2005; Vrijens et al., 2012).

#### 2.1.1 Compliance, concordance, and adherence

The earliest term, *compliance*, was defined as the extent to which a patient's behaviour aligned with clinical prescription (Sackett & Haynes, 1976). It is based on the biomedical model of illness, where the patient is a passive recipient of medical recommendations prescribed by their clinician. The definition reflects the one-way authoritative relationship between clinicians and patients at the time, and was therefore

commonly used in medical literature during this period (Horne et al., 2005; Leventhal & Cameron, 1987).

With increasing research interest in people's perspectives of their own care, perceptions of the clinician-patient relationship began to shift (Henbest & Stewart, 1990; McCracken, Stewart, Brown, & McWhinney, 1983; Weston, Brown, & Stewart, 1989). In response, the then Royal Pharmaceutical Society of Great Britain (1997) proposed the term *concordance*: a state of agreement reached through cooperation between a clinician and a patient about what constitutes optimal medication-taking behaviour. In contrast to *compliance*, *concordance* portrays the patient as an active participant in the decision-making process for their care. It acknowledges that patient and clinician perspectives can differ, and that shared agreement is crucial for effective clinical practice (Royal Pharmaceutical Society of Great Britain, 1997).

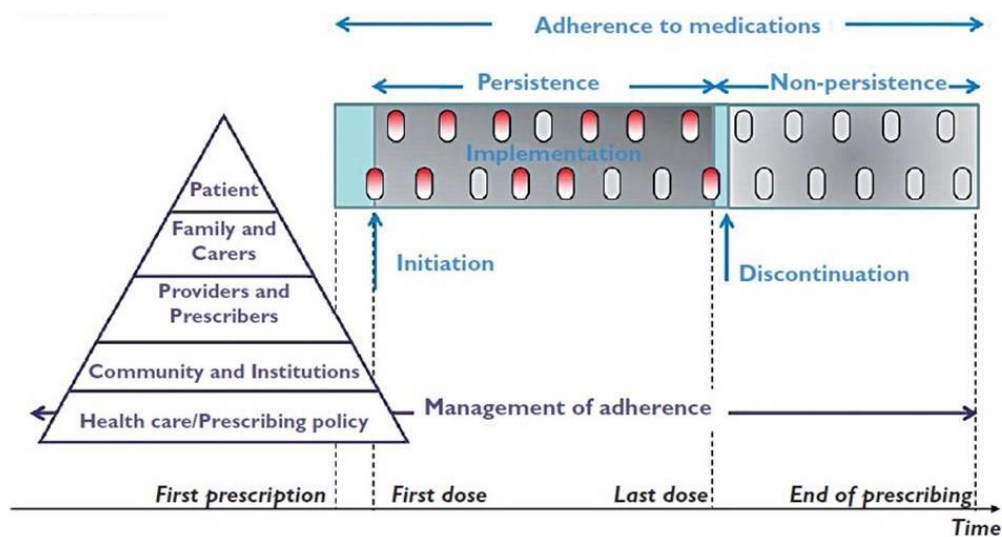
Next, the American Heart Association proposed that adherence was not a static construct, therefore identifying it as a behavioural *process* rather than a *state* (N. Miller, Hill, Kottke, & Ockene, 1997). The World Health Organization (WHO) recognises that adherence is influenced by changing person- and context-related factors. These include health care team/system factors (e.g. clinician competency or insurance coverage policies), social/economic factors (e.g. socioeconomic status or literacy rates), therapy-related factors (e.g. duration of treatment), patient-related factors (e.g. asthma knowledge), and condition-related factors (e.g. symptom severity), also known as the five interacting dimensions of adherence (World Health Organization, 2003).

The current WHO definition of *adherence* is “the extent to which a person's behaviour – taking medication, following a diet, and/or executing lifestyle changes,

corresponds with agreed recommendations from a healthcare provider” (World Health Organization, 2003, p. 17). This definition is most commonly used in health psychology and behavioural medicine literature because it recognizes the two-way relationship between patients and clinicians, as well as the dynamic and complex nature of adherence behaviour. As such, this definition will be used throughout this thesis.

### 2.1.2 Taxonomy of adherence

Vrijens et al. (2012) set out to capture the multiple definitions of adherence in behavioural and pharmacological literature to produce a quantifiable taxonomy of adherence. Through a consensus exercise, they produced a taxonomy outlining all stages of the adherence process (see Figure 2). In line with the WHO, the taxonomy defines adherence to medications as “the process by which patients take their medications as prescribed” (Vrijens et al., 2012, p. 696). This process can be further broken down into three components: initiation, implementation, and discontinuation (see Figure 2).



**Figure 2.** The Taxonomy of Adherence. From “A new taxonomy for describing and defining adherence to medications” by Vrijens et al. (2012), Br J Clin Pharmacol, 73(5), p. 697.

Initiation involves taking the first dose of medication as prescribed, and discontinuation refers to the stopping of the medication regimen, where no further doses are taken. Implementation reflects how well medication dosing in reality corresponds with the prescribed dosing regimen. Persistence refers to the length of time between initiation and discontinuation (Vrijens et al., 2012). Vrijens et al. (2012) emphasize that researchers must identify which component of medication adherence is being investigated (initiation, discontinuation, persistence, and/or implementation) as this influences how the construct can be measured and targeted in future interventions.

### 2.1.3 Medication non-adherence

Medication non-adherence, not taking medications as prescribed, can occur in any of the three taxonomy components outlined above. For example, it could entail failure to initiate treatment (initiation), over- or under-using medication (implementation), or discontinuing medication earlier or later than recommended (persistence) (Vrijens et al., 2012). Overall, approximately 50% of medication for long-term conditions is not taken as prescribed, with even higher rates of non-adherence in developing countries (World Health Organization, 2003). A review by DiMatteo (2004) found that adherence to medications for non-psychiatric conditions ranged from 4.6 to 100%, with a median of 76% and larger studies reporting lower adherence rates.

Non-adherence is an important moderator of health system effectiveness (World Health Organization, 2003). For example, advances in medical treatment will not produce maximum health-related impact if adherence rates are low (Burnier, 2006; Cutler & Everett, 2010). Furthermore, medication non-adherence equates to significant losses in healthcare spending (Bender & Rand, 2004; Sokol, McGuigan, Verbrugge, & Epstein, 2005; World Health Organization, 2003). As the global burden



of long-term conditions increases, addressing medication non-adherence will be a crucial step in ensuring the survival of current healthcare systems (World Health Organization, 2003). However, there are exceptions where medication adherence can be harmful, for example in trials where active drug therapy is linked to an increased mortality risk compared to a placebo. In these studies, higher levels of adherence to ‘harmful’ medication were in fact detrimental (Simpson et al., 2006).

Initial research into non-adherence looked at individual characteristics (e.g. personality traits or demographic characteristics) to try to identify the typical ‘non-adherent patient’. However, none of these static factors were accurate predictors of non-adherence (Horne, Cooper, Wileman, & Chan, 2019). As a result, research shifted its focus to potentially modifiable person-centred behavioural factors to tackle non-adherence.

#### *Motivation and ability*

Addressing non-adherence at the individual level involves identifying the unique drivers behind the behaviour (motivation and/or ability), recognising the types of non-adherence occurring (intentional and/or unintentional), and targeting these factors in a tailored and consistent manner that can account for changes over time (Horne et al., 2019; Nunes et al., 2009; World Health Organization, 2003).

Horne et al. (2005) proposed that variations in adherence at the level of the individual involve two broad interacting factors: motivation and ability. Motivation refers to whether or not the individual *wants* to take the medication based on beliefs and conscious or intuitive decision-making processes. Ability refers to whether or not an individual is *able* to take the medication, related to factors such as adequate knowledge, prescription affordability, and physical capability (Horne et al., 2019). A

combination of motivation and ability is needed for optimal adherence: being motivated and unable, or demotivated and able to take medication can result in non-adherence. There is considerable overlap between these categories, and they are driven by a combination of intentional and unintentional processes.

The effect of broad contextual factors on adherence are captured through their influence on individual motivation and ability. For example, a healthcare system that does not offer free prescriptions for long-term conditions may make people feel less motivated to buy their prescriptions or less able to afford them.

In line with this view of motivation and ability, non-adherence can be classed as intentional and/or unintentional. Intentional non-adherence (linked to motivation) occurs when a person actively chooses not to take their treatment, or takes it in a way that differs from proposed recommendations. Unintentional non-adherence (linked to ability) occurs when factors outside of a person's control keep them from following treatment recommendations (Nunes et al., 2009; World Health Organization, 2003). Both types of non-adherence can overlap and occur in a single person, and the drivers behind non-adherence can change over time within an individual (Horne et al., 2019).

#### *Informed adherence*

Given the effectiveness of modern-day medication, healthcare professionals may believe that optimal adherence is a necessary outcome for their patients and that it is their role to ensure that it occurs. However, efforts to tackle non-adherence should also recognise the importance of *informed* adherence, as recommended by both the WHO and the National Institute for Health and Care Excellence (NICE) (Nunes et al., 2009; World Health Organization, 2003).

Informed adherence implies that the individual ultimately has the right to choose to adhere to medication. Both the WHO and NICE guidelines recommend that healthcare professionals provide people with the necessary information, support, and opportunities to make informed decisions regarding their own healthcare (Nunes et al., 2009; World Health Organization, 2003). If a person chooses to adhere to treatment, healthcare professionals should monitor and facilitate this process. If they choose to forgo treatment, this decision should also be respected (Nunes et al., 2009).

Informed adherence is supported by ample evidence that suggests people want increased involvement in their own healthcare decisions, particularly for long-term conditions such as asthma (Caress, Beaver, Luker, Campbell, & Woodcock, 2005; Caress, Luker, Woodcock, & Beaver, 2002; Joseph-Williams, Elwyn, & Edwards, 2014). It mirrors the idea of informed consent in clinical practice: voluntary treatment decisions made by a patient following the adequate comprehension of information given by a healthcare professional (Appelbaum, Lidz, & Meisal, 1987). Both informed consent and adherence are based on the broader concept of patient autonomy: the patients' right to accurate and complete information regarding their health and care, and the subsequent right to make their own healthcare decisions based on that information (Blackhall, Murphy, Frank, Michel, & Azen, 1995).

## 2.2 Measuring adherence

As outlined in the previous sections, adherence is a complex behaviour. Operationalising and measuring adherence is a difficult task because it is a dynamic and multi-factorial construct (Lam & Fresco, 2015). There is no single unifying measurement across adherence research because measures are often treatment- and condition-specific (Lam & Fresco, 2015). Disagreement exists regarding the 'gold standard' method for assessing adherence, depending on the purpose and field of

research. A solution to this issue is to implement several measurement methods to triangulate adherence data, although this may not always be feasible (Lehmann et al., 2014; World Health Organization, 2003).

Another challenge is establishing when a person can be classified as adherent to medication. A common approach is to dichotomise this outcome (adherent versus non-adherent individuals) based on an arbitrary cut-off value, often 80% of doses taken as prescribed (Karve et al., 2009). Applying this arbitrary cut-off across conditions and medications is problematic because it is based on early research specifically for hypertensive medication (Haynes, 1976). In addition, optimal adherence cut-off values for therapeutic benefit are condition- and formulation-specific (Karve et al., 2009; Osterberg, Urquhart, & Blaschke, 2010). The clinical significance of non-adherence varies between medications due to differing levels of *drug forgiveness*: the difference between the "...postdose duration of beneficial action (D) and the prescribed dosing interval (I)" (Osterberg et al., 2010, p. 458). In other words, forgiveness refers to the threshold of doses that can be missed without losing the medication's therapeutic benefit. Medications with longer forgiveness have longer periods of drug action that can be sustained when a dose is missed (Osterberg et al., 2010).

Multiple methods for measuring adherence exist across a variety of adherence-related sciences that include, but are not limited to, medicine, pharmacy, nursing, sociology, health economics, and behavioural sciences (Vrijens et al., 2012). While accurately measuring adherence is important within research, it is also crucial within clinical practice. Without accurate adherence estimates, medications may be viewed as ineffective, doses may be unnecessarily increased, and expensive diagnostic testing may be ordered (Lam & Fresco, 2015).

Adherence measures have previously been classified as objective (i.e. relying on observable and measurable indicators of medication-taking behaviour) and subjective (i.e. relying on evaluations made by healthcare professionals, the individual, or their carers) (World Health Organization, 2003). However, some disagreement exists about whether measures of behaviour can be truly objective. As such, we will classify adherence measures as direct (i.e. observing the medication being taken or testing for its presence/effect in the body) or indirect (i.e. using proximal factors as representations of adherence behaviour) (Lam & Fresco, 2015).

### 2.2.1 Direct measures

#### *Direct observation*

Direct measures include observing the medication being taken and testing for its presence in the body. In cases where high adherence rates are important, perhaps due to significant public health risks, direct observation of treatment (DOT) protocols may be implemented. The WHO recommended DOT protocols to treat and prevent the spread of tuberculosis because DOT protocols were shown to reduce the risk of relapse and drug resistance (Frieden & Sbarbaro, 2007; Quy et al., 2006; Weis et al., 1994). DOT strategies are extremely labour-intensive and difficult to implement outside of controlled environments (e.g. hospitals or clinics) and single-dose medication (Vermeire, Hearnshaw, Van Royen, & Denekens, 2001). Furthermore, individuals can still fake adherence, for example by hiding medications under their tongue and spitting them back out later.

#### *Testing for the presence of medication*

There are two methods of testing for a medication in the body (often through blood or urine samples): identifying traces of the medication or its metabolites, or testing for a marker that is attached to the medication before it is taken (Lam & Fresco, 2015;

World Health Organization, 2003). For participants with certain conditions, this measurement approach may be less of a burden if blood or urine samples are already routinely collected. However, in most cases, direct testing is costly and invasive compared to other methods of adherence assessment (Vitolins, Rand, Rapp, Ribisl, & Sevick, 2000). Furthermore, the accuracy of direct testing is influenced by each individual's diet, rate of drug absorption/excretion, and additional medications in the body (Vitolins et al., 2000). Testing is unavailable for behavioural treatment recommendations (e.g. lifestyle changes) and a large number of medications, including inhaled treatment for asthma.

### 2.2.2 Indirect measures

Indirect measures use proximal factors as representations adherence and examples include electronic monitoring devices, remainder dose counting, secondary database analysis, validated questionnaires, medication diaries, and interviews.

#### *Electronic monitoring devices*

Electronic monitoring devices (e.g. MEMS<sup>®</sup> caps, Smart Inhalers) record the date and time when a medication is taken, for example when an inhaler is pressed or a bottle cap is opened. This approach uses inhaler depressions or bottle cap openings as a proxy measure of adherence, assuming that each recorded event actually represents medication being taken. A key strength of this approach is that it captures patterns of adherence over time rather than focusing on adherence at a single time point (Vrijens et al., 2012). Furthermore, it does not rely on recall by a patient, healthcare professional, or carer. This approach is limited by the fact that 'dose dumping' (actuating the device, but not taking the medication) can still occur in an attempt to conceal non-adherence (Charles et al., 2007). However, multiple successive device actuations (perhaps before a clinic appointment) can be identified as dose dumping

and therefore excluded from study data (Chan, Harrison, Black, Mitchell, & Foster, 2015). Although they were initially expensive, electronic monitoring devices (EMDs) are becoming more affordable (Chan et al., 2015). Unfortunately, available EMDs are incompatible with many medication types and polypharmacy management systems (e.g. Dossette boxes) (G. Wagner & Ghosh-Dastidar, 2002).

Disagreement exists about the Hawthorne effect in electronic monitoring, referring to changes in behaviour because people are aware that they are being observed (Franke & Kaul, 1978). Some research suggests that EMDs have an impact on adherence behaviour (Deschamps, van Wijngaerden, Denhaerynck, Geest, & Vandamme, 2006), whereas other studies found little or no such effect (Acosta et al., 2013; Sutton et al., 2014; G. Wagner & Ghosh-Dastidar, 2002). Although findings from EMDs are considered more robust because they do not rely on memory-based recall, they should still be interpreted with some caution.

#### *Remainder dose counting*

Whereas EMDs assess when a medication is taken, remainder dose counting assesses the quantity of leftover medication per person within a given time period to estimate adherence rates. Examples include counting leftover pills or weighing inhaler canisters to establish how many doses may have been missed (World Health Organization, 2003). Although dose counting is a straightforward procedure, it becomes labour intensive and prone to error with large participant samples (World Health Organization, 2003). Remainder dose counting is also limited by the risk of dose dumping. Furthermore, it relies on people to bring their medications to appointments if researchers are unable to complete home visits (Vitolins et al., 2000).

Unlike EMDs, dose counting does not capture adherence patterns and can only provide information about adherence over a specific time period (i.e. how much of the prescribed medication was taken this month?) (World Health Organization, 2003). Furthermore, previous research suggests that remainder dose counting overestimates adherence compared to EMDs or blood/urine testing (Bender et al., 2000; Pullar, Kumar, Tindall, & Feely, 1989; Rand et al., 1992; van Onzenoort et al., 2010).

### *Secondary database analysis*

Secondary database analysis uses medication-related information collected via healthcare, pharmacy, and insurance claim systems to estimate adherence (Lam & Fresco, 2015). A common method involves prescription refill data as a representation of adherence, with the assumption that refilled prescriptions indicate medication being taken. Although prescription refill rates are correlated with adherence, they remain a proxy measure of the behaviour (Grossberg, Zhang, & Gross, 2004; Grymonpre, Cheang, Fraser, Metge, & Sitar, 2006; Steiner & Prochazka, 1997).

For example, people may be picking up and ‘stock-piling’ their prescriptions rather than taking them (Greevy et al., 2011; Meyer, Van Kooten, Marsh, & Prochazka, 1991; Steiner, Koepsell, Fihn, & Inui, 1988). Furthermore, prescription refill rates offer no information about *how* a medication is taken (Lam & Fresco, 2015). For example, people may be halving pills, using inhalers incorrectly, or sharing medication. In contrast to EMDs and remainder dose counting, secondary database analysis may be less salient to research participants and therefore less likely to produce a Hawthorne effect (Franke & Kaul, 1978).



### *Recall-based methods*

Validated questionnaires, medication diaries, and interviews all rely on the recall of patients, healthcare professionals, or carers when it comes to evaluating adherence. People often overestimate their own rates of adherence, perhaps due to inaccurate recall or social desirability bias (Daniels et al., 2011; Krishnan et al., 2004; G. Wagner & Miller, 2004). Social desirability bias refers to an adjustment of responses to make them more socially acceptable (Spector, 2004). Healthcare professionals also tend to overestimate the adherence rates of their patients (Byerly et al., 2005; L. G. Miller et al., 2002). However, this also means that when non-adherence is reported, it is a more reliable account because people are less likely to misreport non-adherence.

### *Validated self-report questionnaires*

Validated self-report questionnaires are commonly used in adherence research because they are cheap and easy to implement in most research settings (Voils, Hoyle, Thorpe, Maciejewski, & Yancy, 2011). In addition, some are able to reveal potential modifiable factors that underpin non-adherent behaviour. Examples include the Brief Medication Questionnaire (Svarstad, Chewing, Sleath, & Claesson, 1999), four- or eight-item Morisky Adherence Scale (MMAS-4 and MMAS-8) (Morisky, Ang, Krousel-Wood, & Ward, 2008; Morisky, Green, & Levine, 1986), Medication Adherence Report Scale (MARS) (Horne & Hankins, 2004), and Self-Efficacy for Appropriate Medication Use Scale (SEAMS) (Risser, Jacobson, & Kripalani, 2007).

These questionnaires generally predict adherence better than other self-report measures because they are validated against other adherence measures (often EMDs) during their development to increase reliability (Garber, Nau, Erickson, Aikens, & Lawrence, 2004; Monnette, Zhang, Shao, & Shi, 2018). However, a questionnaire given at a specific time point is not representative of adherence over time (Jerant,

DiMatteo, Arnsten, Moore-Hill, & Franks, 2008). Furthermore, questionnaires are limited by language and literacy barriers (Risser et al., 2007; Wolf, Chang, Davis, & Makoul, 2005).

### Medication diaries

Medication diaries record how people take their medication. People are often asked to fill them in on a daily basis, and they are submitted to researchers for analysis. Disagreement exists as to whether medication diaries actually alter people's adherence behaviour, with some studies using them as a behaviour change technique rather than an adherence measure (Anhøj & Møldrup, 2004; Safren et al., 2001; G. Wagner & Ghosh-Dastidar, 2002). As with other recall-based methods, medication diaries are prone to an overestimation of adherence by approximately 30% (Farmer, 1999). Furthermore, completion and submission rates for medication adherence diaries are often low, possibly biasing results (Gordon, Prohaska, Gallant, & Siminoff, 2007).

### Interviews

Interviews can be conducted in person, online, or over the telephone. Whereas questionnaires and medication diaries can be completed confidentially, interviews require interaction with a researcher or clinician (Garber et al., 2004). They can be tailored to each individual, making them a useful tool to discern unique causes of non-adherence. However, interviews are significantly less concordant with non-self-report adherence measures (e.g. EMDs, pill counts, and drug level tests) when compared to questionnaires and medication diaries. This could be due to social desirability bias (Garber et al., 2004). Therefore, this method is more labour intensive and generally considered less reliable for measuring adherence compared to other self-report adherence measures.

Although their reliability within research may be limited, self-report adherence measures (questionnaires, diaries, and interviews) have been used successfully in clinical practice. For example, the results of self-report questionnaires can be used to identify unique medication-related concerns for each individual and to tailor subsequent support (García-Cárdenas et al., 2013; Svarstad et al., 1999). Adherence-focused interviews gather detailed information about adherence behaviour, which can form the basis of a motivational interviewing intervention (Young et al., 2012). Medication diaries can offer insight into patterns of adherence from the patient's perspective, identifying influential lifestyle factors and habits that can be targeted to improve adherence.

### 2.2.3 Choosing a suitable adherence measure

As outlined above, each adherence measure has its strengths and limitations. The most suitable measure for a study will depend on the study aims, resources available for research (e.g. time and funding), target population (e.g. literacy rates), and research setting (e.g. primary care) (Lam & Fresco, 2015). In an ideal situation, multiple methods for assessing adherence would be used to triangulate data (Lehmann et al., 2014; World Health Organization, 2003). Using that method, researchers can also assess any differences between adherence measures (Lehmann et al., 2014).

It is important to note that adherence remains a behavioural construct, regardless of how it is measured. Therefore, adherence measures only provide insights into people's medication-taking behaviour. As such, adherence measures should ideally be paired with a clinical outcome to demonstrate how a change in behaviour impacts health outcomes (World Health Organization, 2003). For example, adherence measures in asthma research are commonly combined with measures of healthcare utilisation

(Bender & Rand, 2004; Mäkelä, Backer, Hedegaard, & Larsson, 2013), asthma control (Armour et al., 2007; Wong, Chua, Husin, & Arshad, 2017), and asthma-related quality of life (Xaubet Olivera et al., 2016) to demonstrate the clinical impact of increased adherence.

## 2.3 Adherence in asthma

Following the general overview of adherence, this next section will introduce adherence in asthma as the specific subject of this thesis. As outlined in Chapter 1.3, inhaled corticosteroids (ICS), if used consistently, are a safe and effective treatment to control the underlying inflammation in asthma. They differ from short- and long-acting beta-agonists (i.e. reliever inhalers), which are used for immediate relief only in the case of an exacerbation. The discovery of new treatments for asthma and improvements in the global asthma-related mortality rate have slowed over the last decade. As such, targeting adherence to existing effective treatments will be essential in tackling the global disease burden of asthma (Pavord et al., 2018).

### 2.3.1 Why is adherence important for asthma?

The UK has one of the highest prevalence rates of asthma in the world, and its annual number of asthma-related deaths is one of the highest in Europe. Both the National Review of Asthma Deaths (NRAD) and Asthma UK highlight that non-adherence to medication and gaps in current asthma care may be contributing to these numbers (Cumella, 2017; Levy et al., 2014).

Considerable research has focused on the impact of adherence on asthma-related clinical outcomes. Sub-optimal ICS adherence has been linked to a decrease in lung function as measured by FEV<sub>1</sub> and an increase in airway inflammation as measured by sputum eosinophils (Murphy et al., 2012). Both of these indicators have been

linked to increased exacerbation risk, although it is important to note that an association does not specify causal direction (Green et al., 2002; O'Byrne, Pedersen, Lamm, Tan, & Busse, 2009). Furthermore, these findings were based on people with difficult asthma (i.e. poor response to treatment) in secondary care, possibly limiting the generalisability of results (Murphy et al., 2012).

People adherent to ICS are significantly less likely to experience an exacerbation compared to those who are non-adherent (Stern et al., 2006). However, Williams et al. (2011) found that ICS adherence only significantly reduced the risk of exacerbations when it fell above 75% of doses taken as prescribed. Interestingly, ICS adherence increased directly before and after an exacerbation, perhaps related to the experience of physical symptoms (Williams et al., 2011). Findings from both studies should be interpreted with some caution due to the use of prescription refill data, as there is a risk of dose-dumping and information about patterns of adherence may be lacking. Another study calculated that for every canister of ICS used in the previous 12 and 6 months, the rate of asthma-related deaths reduced by 21% and 54% respectively (Suissa, Ernst, Benayoun, Baltzan, & Cai, 2000). However, its non-randomised case-control design may have increased the risk of sampling bias, leading to a higher number of people with uncontrolled asthma in the study.

Increased exacerbation risk directly affects healthcare utilisation and expenditure. In the UK, at least £1.1 billion is spent on asthma care every year (Mukherjee et al., 2016). Regular ICS use has been linked to significant reductions in asthma-related hospital admissions, emergency department visits, and oral corticosteroid use (Suissa, Ernst, & Kezouh, 2002; Williams et al., 2004). In people with difficult asthma, ICS adherence significantly predicts previous ventilation events (i.e. breathing assistance

in intensive care) independent of demographic characteristics and asthma control (Murphy et al., 2012).

In addition to healthcare expenditure, ICS non-adherence may affect work absenteeism and productivity loss. One study found that adherent individuals had significantly fewer annual absenteeism days (26.9 days) compared to non-adherent individuals (29.7 days,  $p = 0.002$ ). However, this participant sample also included people with COPD and covered adherence to any preventive medication for daily use (e.g. ICS, leukotriene modifiers, methylxanthines) (Carls et al., 2012).

Research suggests that medication adherence in asthma is strongly linked to asthma-related health outcomes, healthcare utilisation, and economic outcomes. Therefore, improving adherence rates may have a beneficial impact across a spectrum of outcomes.

### 2.3.2 Adherence to inhaled corticosteroids

Previous research suggests that approximately 80% of ICS doses need to be taken as prescribed to maintain therapeutic benefit, although this may vary between individuals (Lasmar et al., 2009). In reality, ICS adherence consistently falls below that threshold.

Fischer et al. (2010) found that 11.4% of electronic asthma prescriptions were not picked up, a phenomenon known as primary non-adherence. However, paper-based prescriptions and prescriptions filled through other means (e.g. veteran healthcare or cash payments) were not captured in the data (Fischer et al., 2010). Cochrane et al. (2000) found that people were adherent to ICS between 20% and 73% of the time, translating to approximately 63% to 83% of doses taken as prescribed. Between 24% and 69% of participants underused their ICS, while 2% to 23% were overusing it (Cochrane et al., 2000). A strength of this systematic review was that it only included

studies using EMDs (Nebulizer Chronolog and Turbuhaler Inhalation Computer). However, the sample sizes of included studies were relatively small (8 to 102 participants).

In a similar review, Barnes and Ulrik (2015) found that ICS adherence measured using EMDs ranged from 22% to 63% of doses taken as prescribed. Adherence estimates may have varied due to the different cut-off values used to determine adherence in each of the included studies (ranged from 50% to 80%). In terms of implementation, ICS adherence can also fluctuate. Both Williams et al. (2011) and Barnes and Ulrik (2015) found that ICS adherence was higher directly before and after an asthma exacerbation, possibly due to the salience of symptoms.

Krishnan et al. (2004) measured adherence to ICS and oral corticosteroids with EMDs following hospital discharge. Within two weeks after discharge, ICS adherence fell to 48.1% of doses taken. Within one week after discharge, oral corticosteroid adherence fell to 52.2%. However, these estimates were based on people with a recent asthma hospitalisation, who may have lower rates of adherence to begin with (Krishnan et al., 2004).

Bender, Pedan, and Varasteh (2006) found that only 8.8% of participants with a prescription for combination therapy inhalers (proprionate/salmeterol) refilled their prescriptions within the 12 months following their first prescription. However, these estimates may not be fully indicative of non-adherence because participants may have been stepped down from combination therapy to other preventive medication (Bender et al., 2006).

To summarise, non-adherence to ICS occurs across all three components of the taxonomy of adherence: initiation, implementation, and discontinuation (see Section 2.1.2) (Vrijens et al., 2012).

### 2.3.3 Inhaler competence

Adherence to ICS is closely linked to inhaler competence. The combination of adherence rates and inhaler competence has been described as *true adherence* in the literature (D'Arcy et al., 2014; Nikander et al., 2011; Pritchard & Nicholls, 2015). There are many different inhaler types on the market, and each device differs in terms of how medication is dispensed (e.g. propellant, mechanical, compressed air), drug formulation (e.g. dry powder), dose storage (e.g. single or multi-dose), and dose preparation (Price et al., 2013). As such, each device has different requirements for a person's dexterity, strength, coordination, and lung capacity (Gray et al., 1996; Ruggins, Milner, & Swarbrick, 1993; Wieshammer & Dreyhaupt, 2008). With incorrect inhaler technique, the full dose of medication does not reach the lungs and it loses its therapeutic effect. Incorrect inhaler technique has a negative impact on asthma control, emergency healthcare utilisation, and oral corticosteroid use, possibly due to an increased risk of exacerbations (Giraud & Roche, 2002; Melani et al., 2011).

Inhaler technique errors occur in 14% to 90% of asthma cases due to a variety of reasons, including characteristics of the device (e.g. dexterity requirements), the person (e.g. their preferences and beliefs about inhalers), and their healthcare professional (e.g. ability to teach inhaler technique) (Cochrane et al., 2000; Giraud & Roche, 2002; Price et al., 2013). People may prefer a specific inhaler due to ease of use, convenience (e.g. size and durability), prescription cost, and oral sensation (e.g. dryness and taste) (Aït-Khaled et al., 2000; Price et al., 2013). When given an inhaler they prefer, people are more open to learning correct inhaler technique (Lenney, Innes,



& Crompton, 2000; Welch et al., 2004). Similarly, viewing the inhaler as an important component of asthma care increases people's interest in learning correct inhaler technique (De Blaquiére, Christensen, Carter, & Martin, 1989).

Correct inhaler technique should be learned at initiation and maintained over the course of the prescription. As such, healthcare professionals with frequent patient contact play a crucial role in teaching and maintaining inhaler technique. Even when inhaler technique is taught correctly at initiation, approximately 50% of people lose this technique over time (Bosnic-Anticevich, Sinha, So, & Reddel, 2010). A combination of verbal instructions and physical demonstrations at several time points increases the likelihood of correct technique demonstrated at follow-up (Basheti, Reddel, Armour, & Bosnic-Anticevich, 2005; Cordina, McElnay, & Hughes, 2001).

In reality, only a small proportion of people with asthma have their inhaler technique checked by a healthcare professional (Basheti et al., 2005; Cumella, 2017). In addition, only 15% to 69% of healthcare professionals (pharmacists, physicians, emergency healthcare professionals) are able to demonstrate correct inhaler technique (Adeniyi et al., 2018; Cain, Cable, & Oppenheimer, 2001; Jones, Holstege, Riekse, White, & Bergquist, 1995; Kelling, Strohl, Smith, & Altose, 1983; Leung et al., 2015).

A noteworthy development in the field of inhaler competence is the emergence of electronic feedback technology (Pritchard & Nicholls, 2015). Example devices that attach to inhalers include the MDILog II (Westmed, INC., Englewood, CO), SmartMist (Aradigm Corporation, Hayward, CA), and Inhaler Compliance Assessment (INCA) device (D'Arcy et al., 2014). In addition to measuring adherence rates (time and date of use), these devices also measure some aspect of inhaler competence. For example, the SmartMist evaluates competence based on the recorded

inspiratory flow and volume data, whereas the INCA assesses competence based on acoustic recordings of each inhalation event. These devices may become valuable feedback tools for inhaler competence training in the future (Pritchard & Nicholls, 2015)

## 2.4 Relevant models and theories to explain non-adherence

As demonstrated in the previous sections, the clinical relevance of ICS adherence is well-documented. In health psychology research, theories and models are commonly used to understand and predict health behaviour, as well as identify potentially modifiable determinants of health behaviour. Medication adherence is no exception, and the following section will provide an overview of common approaches taken to understand adherence behaviour.

It will begin with an overview of social cognition models – the Health Belief Model (Rosenstock, 1966) and Theory of Planned Behaviour (Ajzen, 1991) – followed by an overview of self-regulatory models, including the Common Sense Model of Self-Regulation (Leventhal, Leventhal, & Contrada, 1998) and the Extended Common Sense Model (Horne, Parham, Driscoll, & Robinson, 2009). Each model will be evaluated and adherence-related literature specific to each model will be discussed.

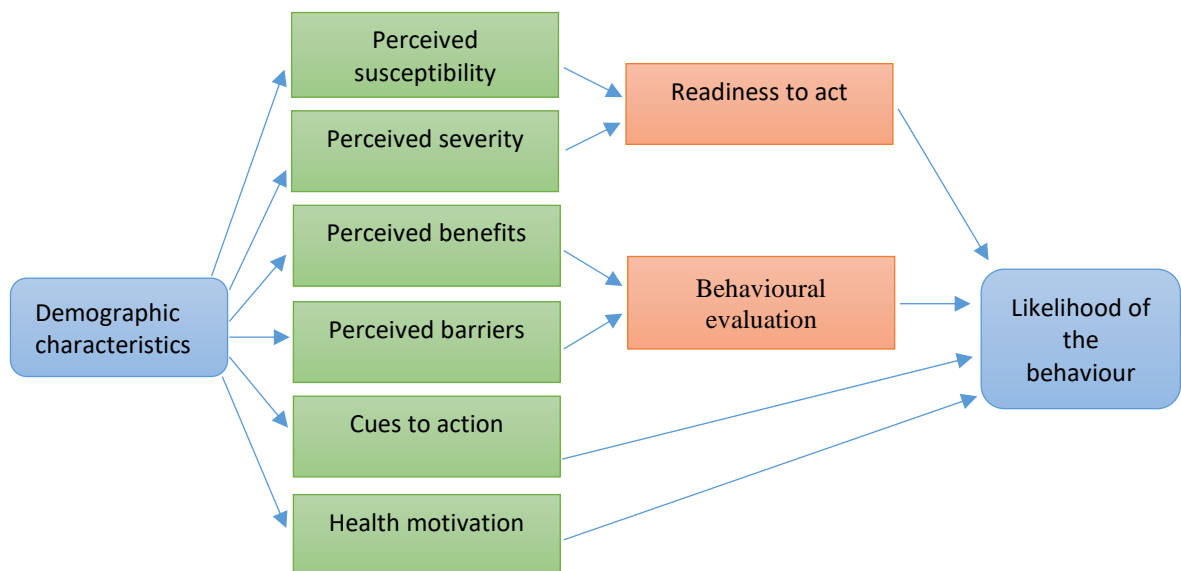
### 2.4.1 Social cognition models

At the basis of social cognition models is the assumption that individuals rationally process the costs and benefits of a behaviour. This process is informed by individual expectations, perceptions of the social environment (social cognitions), and incentives (Bandura, 1977, 1986; Edwards, 1954).

### The Health Belief Model

The Health Belief Model (HBM) (Rosenstock, 1966) was introduced to explain the uptake of free tuberculosis health screening, making it a model of preventive health behaviour (i.e. before any diagnosis takes place).

The HBM stipulates that in addition to an individual's demographic characteristics (e.g. age, social class, and gender), the likelihood of a preventive health behaviour occurring depends on two overarching dimensions: a psychological state of readiness to act and the belief that the course of action will be effective in reducing a health threat (Rosenstock, 1966). These two overarching dimensions are dependent on six health beliefs; perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and health motivation (see Figure 3) (Becker & Maiman, 1975; Rosenstock, 1966).



**Figure 3.** The Health Belief Model. Adapted from “*Introduction to Health Psychology*” by Morrison & Bennett (2012), Harlow: Pearson Education Limited, pg. 124.

Perceived susceptibility refers to how vulnerable a person feels to a health threat. Perceived severity refers to the perceived consequences of facing the health threat, both on an individual and social level (Rosenstock, 1966). These two constructs determine an individual's readiness to act. When ready, a course of action is chosen based on its perceived benefits and barriers. If the health behaviour is believed to effectively prevent negative health outcomes or reduce current health problems (perceived benefits), then the likelihood of the behaviour increases. In contrast, perceived barriers such as pain, treatment cost, or limited access to healthcare will reduce the likelihood of the health behaviour occurring (Rosenstock, 1966). Further influences include the cue to action (i.e. an external or internal trigger that pushes a person to address a health threat) and health motivation (i.e. being generally concerned about health) (Becker & Maiman, 1975; Rosenstock, 1966, 1974).

#### The Health Belief Model and adherence

Since its introduction to explain preventive health behaviour, the HBM has been adapted to explain behaviour after diagnoses, including medication adherence (Becker & Maiman, 1975).

Becker et al. (1978) interviewed mothers of asthmatic children who attended a paediatric emergency room. The interview focused on HBM components (health motivation, perceived susceptibility, perceived severity, perceived benefits, perceived barriers) and adherence was measured using self-report and blood tests. Results showed significant associations between each HBM component and theophylline adherence as measured through a blood test (Becker et al., 1978). However, these correlational findings do not establish a predictive relationship between HBM components and adherence.

Smith, Ley, Seale, and Shaw (1987) investigated whether HBM components (perceived susceptibility, severity, benefits, and barriers) could predict future adherence among children attending an outpatient asthma clinic. Although there were significant correlations between HBM components and adherence, the HBM components did not predict adherence at follow-up (Smith et al., 1987). A significant limitation of this study was the use of parental interviews to assess adherence, as parents may have overestimated adherence rates due to the pressure of the medical environment (Mules et al., 2012).

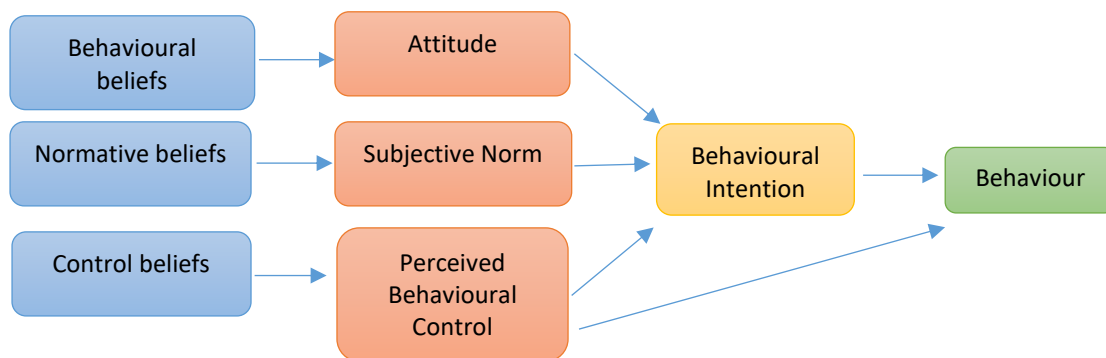
Findings by both Becker et al. (1978) and Smith et al. (1987) were limited by the fact that they used face-to-face interview methods to assess HBM components, mainly due to the absence of standardised measures. As such, comparison across studies is difficult. However, the biggest limitation of these studies is the fact that adherence research with theophylline and early preventive medication is outdated due to the emergence of new medications and delivery systems (Crompton, 2006; Price et al., 2013). ICS was first introduced to the market for adults in the early 1970s, but issues regarding dosing regimen (i.e. four or twice daily?) and accessibility for the public (i.e. who prescribes it?) were not refined until the early 1980s (Crompton, 2006).

#### *The Theory of Planned Behaviour*

Another commonly used social cognition model is the Theory of Planned Behaviour (TPB) (Ajzen, 1991), which is an extension of the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975). The TRA proposes that intentions to behave in a specific manner (behavioural intentions) can directly predict behaviour because behaviour is conscious, goal-oriented, and under volitional control (Fishbein & Ajzen, 1975). Behavioural intentions are informed by beliefs about the characteristics and

consequences of the behaviour (attitudes) and the perceived expectations of others (subjective norms) (Fishbein & Ajzen, 1975).

The TPB has one additional component, perceived behavioural control, to account for the perceived barriers and enablers of a behaviour (see Figure 4) (Ajzen, 1991). Perceived behavioural control (PBC) is based on beliefs about the ability to control and perform behaviour in various contexts (Ajzen, 1991). The three TPB components (attitude, subjective norm, and PBC) determine behavioural intention, an important prerequisite for behaviour. In contrast to attitude and subjective norm, PBC affects behaviour directly as well as indirectly through behavioural intention (see Figure 4) (Ajzen, 1991).



**Figure 4.** The Theory of Planned Behaviour. Adapted from “*The theory of planned behaviour*” by Azjen (1991), *Organ Behav Hum Decis Process.* 40:4, p. 472.

#### The Theory of Planned Behaviour and adherence

The TRA and TPB have been used to investigate adherence to a variety of medications, including prophylactic malaria medication (Abraham, Clift, & Grabowski, 1999), post-transplant immunosuppressant medication (Chisholm, Williamson, Lance, & Mulloy, 2007), insulin regimens for diabetes (Syrjala, Niskanen, & Knuutila, 2002), and highly active antiretroviral therapy (HAART) (Vissman et al., 2011).

However, research specifically on ICS adherence and the TRA/TPB is limited. van Es et al. (2002) found that attitudes, social influences, and self-efficacy (rather than PBC) accounted for 21% of the variance in self-reported adherence in adolescents with asthma. However, these findings were based on the attitudes/social influences/self-efficacy (ASE model), which is an adaptation of the original TRA (de Vries, Dijkstra, & Kuhlman, 1988).

In terms of adherence across long-term conditions, Rich, Brandes, Mullan, and Hagger (2015) conducted a meta-analysis of 11 studies and found that the TPB components had medium to large effect sizes for behavioural intention ( $r = 0.37 - 0.47$ ) and adherence behaviour itself ( $r = 0.26 - 0.39$ ). However, these estimates included adherence to behavioural recommendations as well as medication for long-term conditions (Rich et al., 2015). In addition, the TPB only accounted 32.9% of the variance in behavioural intention and 9.2% of the variance in adherence behaviour. The meta-analysis also demonstrated high levels of heterogeneity, suggesting that measurement error may have occurred in the adherence assessments (Rich et al., 2015).

#### *Limitations of social cognition models*

Both the HBM and TPB are static and linear models. They are unable to account for the dynamic and complex nature of adherence as a behavioural process (World Health Organization, 2003). For example, they do not explain how the consequences of adherence (or non-adherence) could influence beliefs and therefore future adherence behaviour. Second, both models were developed based on cross-sectional and correlational studies, making it difficult to infer the causal direction of the relationship between adherence and the theory components. (Armitage & Conner, 2001; Rosenstock, 1966).

Both models cannot account for the influence of contextual barriers, unconscious cognitive processes, past adherence behaviour, and emotional/mental health on adherence (Chisholm et al., 2007; Hunter et al., 2015; Munro, Lewin, Swart, & Volmink, 2007; L. A. Phillips, Cohen, Burns, Abrams, & Renninger, 2016; Uthman, Magidson, Safren, & Nachega, 2014). In general, social cognition models specify the prerequisites of behaviour at the process rather than content level. For example, the models may suggest that attitudes affect behaviour, but they do not specify which attitudes affect which behaviour and in what direction (Horne et al., 2019).

The HBM components are not clearly operationalized and quantified, making it difficult to employ a consistent assessment approach across studies. Cues to action and health motivation have been the most difficult to study empirically (Janz & Becker, 1984; Rosenstock, 1966, 1974; Zimmerman & Vernberg, 1994). Rosenstock (1966) suggested that HBM components could interact to influence behaviour, but provided no further clarification on how components are weighted against each other, or what the optimal thresholds for the components are. Furthermore, the HBM operates based on a 'health threat' premise, meaning that behaviour could not occur if there was no threat.

The most commonly cited limitation of the TPB is the intention-behaviour gap, referring to the model's decrease in predictive ability between behavioural intention and the execution of a behaviour (Sniehotta, Scholz, & Schwarzer, 2005). The TPB components account for a higher percentage of variance in intention than they do with actual behaviour (Rich et al., 2015). Furthermore, the magnitude of change in intention does not guarantee a change in behaviour of the same size ( $d = 0.66$  and  $d = 0.36$  respectively) (Webb & Sheeran, 2006).

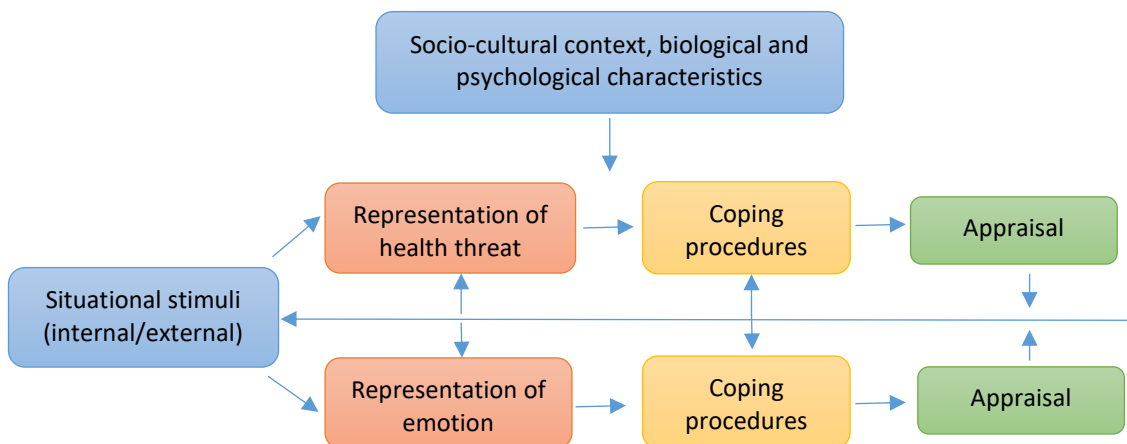


### 2.4.2 Self-regulatory models

Building on the limitations of the social cognition models, self-regulatory models were introduced. Unlike previous theories, self-regulatory models specify the prerequisites of adherence behaviour at both the process and content levels. At their core, they revolve around individuals striving to maintain ‘the self’ in its normal state through self-regulation. Illness is a disruptor of this normal state, and individuals will engage in three overlapping processes to return to optimal health: interpretation, coping, and appraisal (Leventhal et al., 1998).

#### *The Common-Sense Model of Self-regulation*

The Common-Sense Model of Self-Regulation (CSM) assumes that individuals actively engage in problem solving on both the cognitive and emotional level when faced with a health threat. (Leventhal, Brissette, & Leventhal, 2003; Leventhal et al., 1998). This process has three interacting components: cognitive and emotional responses, coping procedures, and appraisals of initiated actions (see Figure 5) (Leventhal et al., 1998).



**Figure 5.** The Common-Sense Model of Self-Regulation. Adapted from “*Illness cognition: Using common sense to understand treatment adherence and affect cognition*” by Leventhal & Diefenbach (1992), *Cognit Ther Res*, 16:2, p. 147.

### Parallel processing and self-regulation

Both the emotional and cognitive responses to a health threat are processed in parallel (Leventhal, 1970). The presenting health threat triggers an emotional response (e.g. fear or distress), as well as a cognitive response based on common-sense characterizations of the threat (i.e. illness representations) (Leventhal, 1970; Leventhal et al., 1998). Both responses inform subsequent efforts to manage the threat. These efforts, known as coping procedures, aim to protect health and prevent/treat illness. They are appraised based on their ability to reduce the health threat, and this appraisal re-informs the cognitive/emotional responses and subsequent coping procedures through a self-regulatory loop (see Figure 5) (Leventhal et al., 1998).

### Illness representations

In addition to the parallel *process* outlined above, the CSM also specifies the *content* of beliefs that guide the cognitive response. These common-sense characterizations of a health threat are known as illness representations (Leventhal et al., 1998). The content of these beliefs can be broadly categorised into identity, timeline, cause, consequences, and curability/control beliefs (see Table 2) (Leventhal et al., 1998).

*Table 2. The content of illness representations in the Common-Sense Model of Self-Regulation (Leventhal et al., 1998)*

<u>Illness representation</u>	<u>Content</u>
Identity	The actual diagnosis/label and its symptoms
Timeline	How the conditions develops, how long it lasts, and how long it takes to treat or recover from.
Cause	The source or trigger of the condition
Consequences	The real and imagined costs of the condition, which can be physiological, social, or psychological.
Curability/Control	Whether the condition can be prevented, controlled, and/or cured

Both episodic memories (i.e. previous experiences) and semantic memories (i.e. abstract and conceptual knowledge) help shape an individual's illness representations and coping/appraisal procedures (Leventhal & Cameron, 1987).

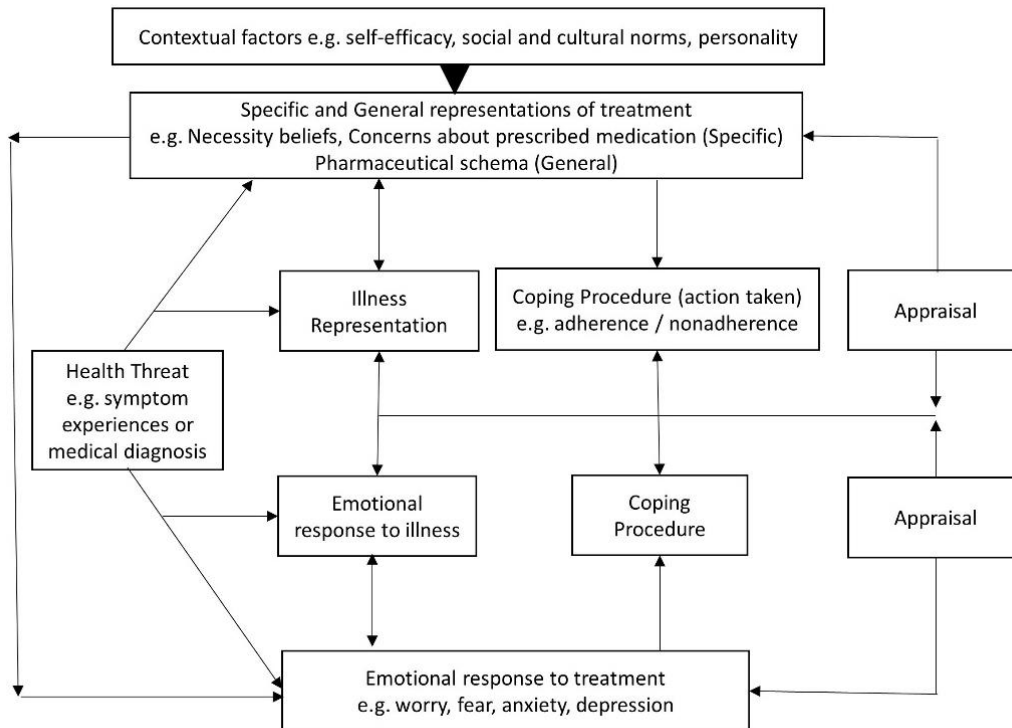
Each of illness representations can also change over time. For example, an individual may hold different beliefs when they first start experiencing unexplained symptoms (*self-evaluation* phase) compared to when they are diagnosed with a long-term condition (*diagnostic* phase) (Leventhal, Diefenbach, & Leventhal, 1992). As the perception of the health threat changes, the selection and implementation of suitable coping procedures adjusts (Leventhal et al., 1992). Stable self-regulatory loops are established when the coping and appraisal procedures align with the illness representations in a way that makes sense to the individual (Leventhal et al., 1992).

#### *The Extended Common-Sense Model*

According to the CSM, adherence (or non-adherence) would be viewed as a coping procedure for a specific health threat (e.g. an illness). In other words, people assess their need for treatment based on their illness representations. Horne (2003) proposed that in addition to illness beliefs, treatment beliefs may also be an important determinant of adherence. They determine whether or not a treatment is seen as useful in tackling a health threat (Horne & Weinman, 2002). Therefore, the decision to adhere to treatment has to align with a person's treatment and illness beliefs in a way that makes sense to the individual (a form of 'internal logic') (Horne, 2003).

The Extended Common-Sense Model (e-CSM) builds on the original CSM by adding general and specific treatment beliefs (see Figure 6). Similar to the original CSM, both cognitive and emotional responses to treatment are processed in a parallel self-regulatory loop (Horne, 2003; Leventhal et al., 1998). As shown in Figure 6, treatment

beliefs and components of the original CSM have a symbiotic relationship (Horne et al., 2019).



**Figure 6.** The Extended Common-Sense Model. From “Supporting adherence to medicines for long-term conditions: A Perceptions and Practicalities Approach based on an extended Common-Sense Model” by Horne et al. (2019), *European Psychologist*, 24:1.

### Treatment beliefs

#### *General treatment beliefs*

General treatment beliefs include beliefs about medications as an overarching class of treatment, and the self in relation to treatment (Horne & Weinman, 1999). They form part of a cognitive framework that holds and organizes information about treatment, also known as pharmaceutical schema (Horne, Weinman, & Hankins, 1999). Two examples of general treatment beliefs include general harm and perceived sensitivity to medication. General harm beliefs revolve around the potential risks of taking medication. For example, pharmaceutical medication may be perceived as unnatural

and therefore potentially harmful or addictive (Horne et al., 1999; Pound et al., 2005). Perceived sensitivity to medication refers to people's perceptions of how they respond to medication in general (Horne et al., 1999)

#### *Specific treatment beliefs*

Specific treatment beliefs focus on a particular treatment (e.g. ICS) rather than medications in general. They can be broadly categorised into necessity beliefs and concerns, an approach known as the Necessity-Concerns Framework (NCF) (Horne et al., 2013).

Necessity beliefs refer to the personal perceived need for treatment. These beliefs differ from efficacy beliefs because medication can be viewed as effective but unnecessary (Horne & Weinman, 1999). Concerns refer to the perceived negative effects of treatment. Common examples include worries about disruptions to daily life, dependence on medication, loss of medication effectiveness, and an accumulation of the medication in the body (Horne & Weinman, 1999). When considering a specific treatment, an individual will weigh the perceived need for treatment (necessity beliefs) with the potential for negative effects (concerns) (Horne et al., 2013).

#### *Self-regulatory models and adherence*

The effect of illness and treatment beliefs on adherence in asthma is well-documented. In a sample of adults with asthma, Halm, Mora, and Leventhal (2006) found that 53% of participants believed that they only had asthma when they had symptoms (the *no symptoms, no asthma* belief). Compared to those who believed they had asthma all or most of the time, the *no symptoms, no asthma* participants self-reported significantly lower rates of adherence to daily peak flow monitoring and to ICS at baseline and follow-up (one and six months) (Halm et al., 2006). Therefore, an acute and symptom-

based view of asthma (linked to timeline and identity beliefs) may have led to lower perceived need for treatment (necessity beliefs). However, these findings are limited by the use of self-reported adherence measures, which may have overestimated adherence rates. Furthermore, participants were recruited from a single centre and had a recent hospitalisation for asthma. As mentioned in Section 2.3.1, ICS adherence may be temporarily high following an exacerbation (Barnes & Ulrik, 2015; Williams et al., 2011)

Horne and Weinman (2002) found that self-reported adherence among adults in a community-based asthma clinic was significantly correlated with necessity beliefs ( $r = 0.32, p < 0.01$ ) and concerns ( $r = -0.43, p < 0.001$ ), suggesting that higher perceived necessity for treatment and fewer concerns were associated with better adherence. Furthermore, illness consequence and timeline representations and necessity beliefs were significantly correlated ( $r = 0.30, p < 0.01$  for both), indicating that the perceived seriousness of the condition and its need for treatment may be linked. Illness representations and treatment beliefs accounted for 13% and 17% of the variance in adherence respectively, over the variance explained by demographic and clinical factors (Horne & Weinman, 2002). In a structural equation modelling analysis, necessity beliefs, concerns, and illness consequence beliefs had a direct effect on adherence. Furthermore, illness consequence and timeline representations had an indirect effect on adherence through necessity beliefs (Horne & Weinman, 2002).

However, no conclusions about the direction of causality could be made due to the cross-sectional nature of the study. Furthermore, the use of self-report measures of adherence may have overestimated adherence rates. Adults presenting at non-urgent community-based clinics may have a greater interest in asthma self-management, and

may therefore have been more adherent at baseline (Mehuys et al., 2008; van Baar et al., 2006).

In a meta-analysis of 94 studies, Horne et al. (2013) found that adherence had a significant relationship with both necessity beliefs (OR = 1.74, 95% CI [1.57-1.93],  $p < 0.0001$ ) and concerns (OR = 0.50, 95% CI [0.45-0.56],  $p < 0.0001$ ) across all long-term conditions. With regards to asthma specifically, similar results emerged for adherence and necessity beliefs (OR = 2.61, 95% CI [1.80-3.78],  $p < 0.001$ ), and concerns (OR = 0.41, 95% CI [0.30-0.54],  $p < 0.001$ ). However these estimates were based on only seven studies for necessity beliefs and six studies for concerns. Furthermore, the confidence interval for necessity beliefs indicates that the estimate lacks precision. This is corroborated by the significant levels of heterogeneity amongst necessity belief and concerns studies, making them difficult to compare (Horne et al., 2013).

In contrast to Horne and Weinman (2002), Aujla et al. (2016) found that illness representations had a poor predictive relationship for adherence to self-management behaviours, with effect sizes ranging from 0.04 to 0.13. However, the analysis considered illness representations separately and did not account for their combined effect, in contrast to what is stipulated in the CSM (Aujla et al., 2016; Leventhal et al., 1998). Furthermore, the inclusion of treatment beliefs in the analysis may have improved the predictive relationship between beliefs and adherence to self-management behaviours (Aujla et al., 2016).

#### *Limitations of self-regulatory models*

Although the dynamic nature of self-regulatory models are well-suited to the complex and evolving nature of adherence, it may be difficult to capture these elements in an

intervention in practice. If CSM components change over time, then the structure and requirements of an intervention will need to continually change as well. Validated measures exist for illness representations (Moss-Morris et al., 2002; Weinman, Petrie, Moss-morris, & Horne, 1996) and treatment beliefs (Horne et al., 1999). However, quantifying and evaluating the coping procedures in the CSM and e-CSM is more difficult. Methods would differ greatly based on the behaviour of interest.

Both the CSM and e-CSM emphasize the reflective and problem-solving processes behind adherence behaviour. However, automatic repetitive behaviours triggered by conditioned contextual cues (i.e. habits) may also play an important role in supporting adherence (Wood & Neal, 2007). Bolman, Arwert, and Vollink (2011) found that both habit strength and concerns about ICS were strong predictors of ICS adherence. However, the generalisability of these findings is limited due to a low study response rate (34%) and the majority of participants being white educated women with mild asthma (Bolman et al., 2011).

Alison Phillips, Leventhal, and Leventhal (2013) investigated the relationship between illness representations, treatment beliefs, habit strength, and adherence to medication for hypertension. Results showed that habit strength explained an additional 27% of the variance in adherence, over and above the variance explained by illness representations and treatment beliefs. Habit strength was the strongest predictor of adherence regardless of how it was measured (validated self-report questionnaires and EMDs) (Alison Phillips et al., 2013). However, the generalisability of these findings is limited due to the fact that participants demonstrated high levels of adherence at baseline.



Despite limitations surrounding the generalisability of their findings, both Bolman et al. (2011) and Alison Phillips, Cohen, Burns, Abrams, and Renninger (2016) found that habit strength plays an important role in adherence behaviour. While the CSM and e-CSM are useful for understanding the initial components of adherence (e.g. initiation and short-term persistence), research suggests that behaviour initiation and maintenance have different driving factors (Rothman, 2000; Rothman, Sheeran, & Wood, 2009). Therefore, habit strength may play a larger role than patient beliefs when it comes to long-term persistence, which is important for long-term conditions (Alison Phillips et al., 2016).

## 2.5 Interventions targeting adherence

Health psychology theories and models map out the potentially modifiable determinants of adherence behaviour, and well-designed interventions apply these theoretical concepts in practice. The following section will briefly describe previous literature on adherence interventions, and outline the frameworks and recommendations for adherence intervention development that were used for this thesis.

### 2.5.1 Previous adherence interventions

Adherence interventions have been the subject of several Cochrane reviews. Haynes, Ackloo, Sahota, McDonald, and Yao (2008) looked at RCTs of interventions targeting adherence to any prescribed medication (including psychiatric conditions, excluding addiction). The 93 interventions included in the review varied greatly in terms of complexity, delivery, content, and length. Only 41 of the 93 interventions (44%) found a significant intervention effect on adherence, and only 29 of the 93 interventions (31%) found a significant improvement in treatment outcomes (Haynes et al., 2008).

Twelve included studies investigated adherence in asthma and COPD, with some studies finding a significant intervention effect on adherence and/or outcomes (Bailey et al., 1990; Farber & Oliveria, 2004; Hederos, Janson, & Hedlin, 2005; Levy et al., 2000; Schaffer & Tian, 2004) while most did not (Bailey et al., 1999; Cote et al., 2001; Cote et al., 1997; Gallefoss & Bakke, 1999; Morice & Wrench, 2001; van Es, Nagelkerke, Colland, Scholten, & Bouter, 2001; M. Weinberger et al., 2002). However, many of these asthma-specific studies had a small sample size and were therefore underpowered.

Of the interventions that were effective for long-term care overall, most employed a complex approach combining care accessibility and supportive care, reminders and telephone follow-ups, self-monitoring, family- and psychological therapy, and/or crisis intervention. Although the interventions were comprehensive, they were resource-intensive and only produced small improvements in adherence and treatment outcomes. Haynes et al. (2008) noted that interventions were commonly delivered by multidisciplinary or research teams, which may be contributing to intervention burden. They recommended exploring an expanded role for allied healthcare professionals (e.g. nurses and pharmacists) in medication adherence counselling to make interventions more feasible in practice. However, the quality of the evidence in the review was low, owing to imprecise adherence measures and small sample sizes (Haynes et al., 2008).

In an update of the review by Haynes et al. (2008), Nieuwlaat et al. (2014) included 182 RCTs of interventions targeting adherence, with 17 studies rated as having a low risk of bias. The interventions in the low-risk studies combined education, counselling, and/or daily support. They involved support from family members, peers, and/or allied healthcare professionals (often pharmacists). Five of the 17 studies (29%) found

significant improvements in adherence and clinical outcomes, four studies (24%) found a significant improvement in either adherence or clinical outcomes, and the remaining eight studies (47%) found no intervention effect (Nieuwlaat et al., 2014). None of the studies with a low risk of bias looked at adherence in asthma. As with the previous review, effective interventions were often complex and difficult to implement in practice. The authors noted an increase in mobile- and internet-based adherence interventions, as well as interventions delivered by allied healthcare professionals.

Normansell, Kew, and Stovold (2017) reviewed 39 RCTs of interventions specifically targeting ICS adherence. When combining all adherence interventions (education, electronic trackers, reminders, and simplifying regimens), there was a significant increase in adherence in the intervention groups compared to controls. However, there were limited improvements in clinical outcomes despite increased adherence. Overall, complex interventions with multiple components did not perform better than simpler interventions, with one exception: there was some evidence to suggest that complex interventions with reminders and feedback were more effective than simple interventions with reminders and feedback (Normansell et al., 2017). However, review findings were limited by a moderate risk of bias in the included RCTs (Normansell et al., 2017).

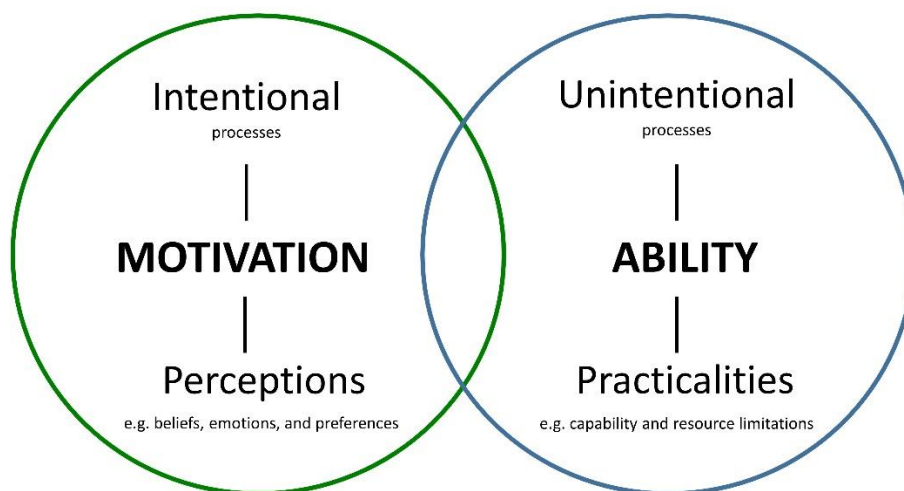
From these reviews, it is clear that there is a need for evidence-based adherence interventions that are pragmatic for implementation in clinical practice. Several intervention development frameworks have been proposed to meet that need, and these will be outlined briefly in the next section.

## 2.5.2 Developing adherence interventions

Sections 2.1.3 and 2.4 of this thesis outlined the evidence for potentially modifiable factors associated with adherence. To summarise, adherence is influenced by a person's motivation and ability to adhere. While several theories and models have been applied to the behaviour, self-regulatory models such as the CSM and e-CSM may be best-suited to capture the complex dynamic nature of adherence (see Section 2.4). Previous research has also established a link between components of these models, namely illness and treatment beliefs, and adherence (Halm et al., 2006; Horne & Weinman, 2002). A new adherence intervention would ideally target some, if not all, of these modifiable factors.

### *The Perceptions and Practicalities Approach*

The Perceptions and Practicalities Approach (PAPA) (see Figure 7), a pragmatic framework for adherence intervention development, may be able to guide that process (Horne, 2001, 2015).



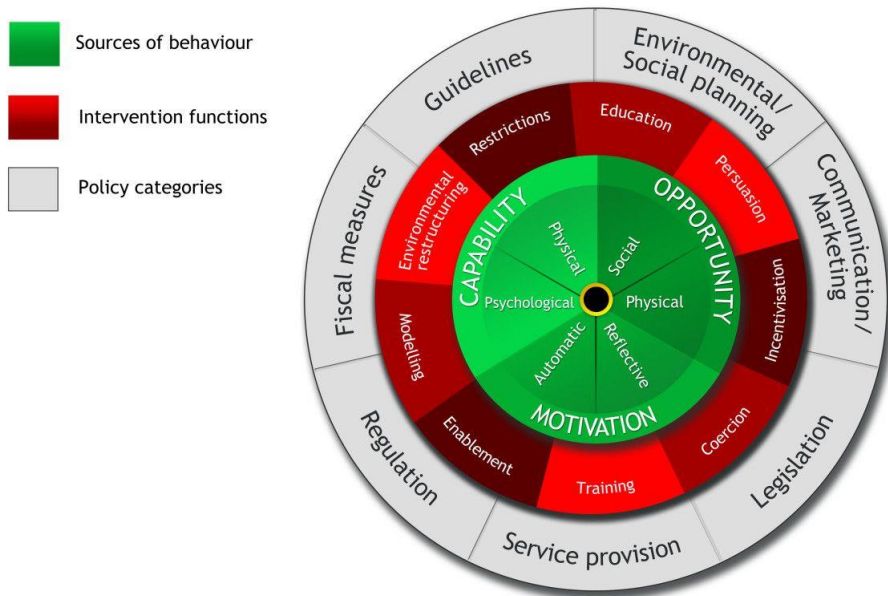
**Figure 7.** The Perceptions and Practicalities Approach. From “*Supporting adherence to medicines for long-term conditions: A Perceptions and Practicalities Approach based on an extended Common-Sense Model*” by Horne et al. (2019), *European Psychologist*, 24:1.

According to the PAPA, the motivation to adhere is established through intentional processes informed by beliefs, emotions, and preferences (i.e. perceptions). This aligns with the emotional response (e.g. fear and anxiety) and cognitive response (e.g. illness and treatment beliefs) to a health threat, as outlined by the CSM and e-CSM (see Section 2.4.2). The ability to adhere is established through unintentional processes influenced by capability and resource limitations (i.e. practicalities) (Horne, 2001, 2015). An example of a practical factor for adherence in asthma is inhaler competence, as outlined in Section 2.3.2.

There is considerable overlap between motivation- and ability-related factors, as shown in Figure 7. For example, non-adherence could be the result of people viewing their medication as unnecessary (perceptions) and forgoing prescriptions to cut monthly costs (practicalities). The factors also vary considerably between individuals. As such, the PAPA posits that intervention content should be tailored to each individual to address their specific motivation- and ability-related barriers to adherence (Horne, 2001, 2015).

#### *COM-B and the Behaviour Change Wheel*

An alternative framework for intervention development is the Capability, Opportunity, Motivation, and Behaviour (COM-B) system, which produced the Behaviour Change Wheel (BCW) (Michie, van Stralen, & West, 2011). The COM-B system posits that a person's capability, opportunity, and motivation need to be optimised for behaviour change to occur. The BCW has three matching layers outlining 1.) deficits in capability, opportunity, and motivation, 2.) suitable intervention functions to target these deficits, and 3.) policy initiatives that would enable interventions to occur (see Figure 8).



**Figure 8.** The Behaviour Change Wheel. From “*The behaviour change wheel: a new method for characterising and designing behaviour change interventions*” by Michie et al. (2011), *Implementation Science*. 6:1, p.42.

The COM-B/BCW approach explicitly includes the influence of contextual factors such as the physical environment and governmental policy (Michie et al., 2011). However, the PAPA posits that these broader contextual factors influence adherence behaviour via motivation, ability, or a combination of the two. For example, a lack of opportunity due to limitations in the physical environment or restrictions in governmental policy would have a direct effect the ability to adhere (Horne et al., 2019). Therefore, both frameworks are similar in their approach to behaviour change.

The PAPA was chosen as the basis of this thesis because it is reflected in the NICE guidelines for medicines adherence (Nunes et al., 2009). It is a simpler framework compared to the COM-B/BCW approach, and therefore more suited to the literature’s call for more pragmatic adherence interventions. Furthermore, the PAPA was

designed specifically for adherence interventions, whereas the COM-B/BCW approach was designed for behaviour change in general.

While pragmatic and evidence-based intervention *content* is important, the intervention *context* and *channel* are equally crucial in maximising intervention impact. This combination of content, context, and channel is captured in the 3 Components of Behaviour Change (3CBC) approach (Horne, 2012; Horne & Clatworthy, 2010). Intervention context encompasses the external factors that may affect how the intervention is put into practice (implementation) and how people interact with it in practice (engagement). The intervention channel refers to the mode of delivery (i.e. who/what delivers the content, and how?).

As highlighted by Nieuwlaat et al. (2014) and Haynes et al. (2008), adherence interventions were delivered through different channels and in a variety of contexts. However, one noteworthy finding from both reviews was an increasing interest in adherence support delivered by allied healthcare professionals, such as nurses and pharmacists. The next chapter in this thesis will explore pharmacists and the pharmacy setting as the potential delivery channel and context for adherence interventions.

### 3 Pharmacists and adherence

Healthcare recommendations for long-term conditions encourage a supported self-management approach: enabling people to treat and manage their own conditions, with and without assistance from the healthcare system (Department of Health and Social Care, 2010; World Health Organization, 2002). Long-term conditions are expected to account for 43% of global disease burden by 2020, and shifting the focus in healthcare from acute care to long-term management may help reduce the impact of these conditions on healthcare systems worldwide (Pinnock et al., 2010; Pruitt & Epping-Jordan, 2002; World Health Organization, 2005).

To cope with the demand on healthcare systems, there have been calls to diversify the global healthcare workforce and explore the roles of allied healthcare professionals in supporting people with long-term conditions (Bates, Meilanti, John, & Bader, 2018; Haynes et al., 2008; Nieuwlaat et al., 2014; World Health Organization, 2016). Pharmacists, as allied healthcare professionals, can play a significant role in patients' self-management of long-term conditions by supporting lifestyle changes, self-monitoring techniques, and optimal medication use (Wertheimer & Serradell, 2008).

Medication is one of the key healthcare interventions used to manage long-term conditions, and therefore optimal medication use is important in improving health outcomes, preventing medication wastage, and reducing healthcare costs (World Health Organization, 2003). However, as highlighted in Chapter 2, roughly 50% of medications for long-term conditions are not taken as prescribed, and this may indicate that people need additional support in maintaining adherence (World Health Organization, 2003). This chapter, in line with the subject of this thesis, will explore how pharmacists may be able to provide this type of support.



It is widely recognised that the traditional dispensing role does not make full use of pharmacists' knowledge and skillset (Edmunds & Calnan, 2001; Naik Panvelkar, Armour, & Saini, 2010; Royal Pharmaceutical Society of Great Britain, 1992; Tinelli, Ryan, & Bond, 2009; Turner, 1986). As medication experts, pharmacists are able to provide updated medication-related information and practical support to implement that information (e.g. inhaler technique demonstrations) (Abdel-Tawab et al., 2011; van Boven et al., 2016; van Wijk, Klungel, Heerdink, & De Boer, 2005). In addition, they are increasingly involved in prescribing as both supplementary and independent prescribers (Hughes & McCann, 2003). The accessibility of pharmacies compared to other medical settings is a big facilitator of pharmacist-led care in many countries, including the UK (Todd, Copeland, Husband, Kasim, & Bambra, 2014; van Boven et al., 2016).

When looking specifically at adherence, previous studies on pharmacist-led interventions have produced mixed results. Some studies found a significant effect of pharmacist-led interventions on adherence in heart disease (Ali, Laurin, Lariviere, Tremblay, & Cloutier, 2003; Bouvy et al., 2003), depression (Al-Jumah & Qureshi, 2012), asthma (Armour et al., 2007; García-Cárdenas et al., 2013), osteoporosis (van Boven, Stuurman-Bieze, Hiddink, Postma, & Vegter, 2014), and long-term conditions overall (Elliott et al., 2016; Pringle, Boyer, Conklin, McCullough, & Aldridge, 2014). However, these improvements in adherence were associated with improvements in clinical outcomes or reductions in healthcare costs in some studies (Ali et al., 2003; Armour et al., 2007; García-Cárdenas et al., 2013; Pringle et al., 2014), but not in others (Bouvy et al., 2003; Elliott et al., 2016). Furthermore, other studies on pharmacist-led interventions found no significant effect on adherence (Chabot, Moisan, Grégoire, & Milot, 2003; Charrois, Newman, Senthilselvan, & Tsuyuki,

2006; Cordina et al., 2001; Odegard et al., 2004; Wang, Chian, Lai, Tarn, & Wu, 2010; Young et al., 2012).

These mixed results could be due to the high heterogeneity in intervention content and participants. Furthermore, the quality of evidence on this topic is limited because many studies employ non-randomised designs, self-reported and non-validated adherence measures, small sample sizes, and non-blinded outcome assessors (van Wijk et al., 2005). As highlighted in the updated Cochrane review of adherence interventions by Nieuwlaat et al. (2014), pharmacist-led adherence interventions have potential, but require further high-quality research to build a reliable evidence base.

Given the complexity and variation in adherence behaviour, pharmacists have to be able to implement a person-centred approach to adherence in medication-related consultations. Abdel-Tawab et al. (2011) developed the Medication-related Consultation Framework (MRCF) to outline the skillset needed to deliver this type of service. The MRCF was designed to both assess practitioners' skills in person-centred consultations concerning medication, and facilitate the teaching and evaluation of these skills through structured feedback. The framework was adopted by the RPS to guide pharmacists' professional development.

The MRCF consists of five sections: scene setting, data collection and problem identification, actions and solutions, closing, and consultation behaviours. Each section outlines criteria that can be scored by an observer or used as a guide for structured consultation skills teaching (Abdel-Tawab et al., 2011). Scene setting engages the patient to establish a therapeutic relationship and facilitate data collection and problem identification, which involves identifying the pharmaceutical care needs of the patient through a collaborative discussion about their medication. Once these

needs have been identified, the pharmacist and patient discuss potential solutions and shared management strategies. Closing the consultation involves a discussion of contingency and follow-up plans. In addition to these consultation segments, the MRCF outlines 14 consultation behaviours that should be exhibited by the practitioner (e.g. effective time management) (Abdel-Tawab et al., 2011).

Based on the aforementioned research, this thesis will focus explore pharmacists as the potential delivery channel for adherence support for asthma, targeting adults in the UK. To set the scene for this topic, this chapter will 1.) evaluate previous pharmacist-led adherence support initiatives in the UK and 2.) discuss the specific contributions pharmacists could make to asthma-specific adherence support.

### 3.1 Pharmacist-led adherence support in the United Kingdom

#### *The community pharmacy context*

Community pharmacies can be categorised based on ownership: independents (one to five pharmacies), small multiples (six to 99 pharmacies), large multiples (more than 100 pharmacies, including supermarket pharmacies) (PricewaterhouseCoopers LLP, 2011). Pharmacists can own a community pharmacy, work in a salaried position, and/or carry out locum work (R. McDonald, Cheraghi-Sohi, Sanders, & Ashcroft, 2010).

In 2016, Great Britain had over 14,000 community pharmacies and the majority (49.2%) were large multiples (e.g. Boots and Lloyds Pharmacy). The remaining community pharmacies were independents (38.4%) and small multiples (12.4%) (Sukkar, 2016). Between 2011 and 2012, Northern Ireland had 535 operating community pharmacies: 232 independents (43.4%), 65 small chains (12.1%), and 238 multiples (44.5%) (PricewaterhouseCoopers LLP, 2017).

Community pharmacies are highly accessible ‘healthcare hubs’ (van Boven et al., 2016, p. 841). For example, 89.2% of the population in England have a community pharmacy within a 20-minute walk from their homes. These proportions are even higher in urban and deprived areas (98.3% and 90.2% respectively) (Todd et al., 2014; van Boven et al., 2016). Over 95% of community pharmacies in England are located within one kilometre of a general practice surgery (Office of Fair Trading, 2010).

Community pharmacy services vary across the UK, but most services involve one-to-one consultations with a community pharmacist to support optimal medication use. The services set out specific eligibility criteria (e.g. specific long-term conditions or a newly prescribed medication). People can request to access the service directly, or gain access through a referral from another healthcare professional (e.g. a GP) or an invitation from their community pharmacist.

The Community Pharmacy Contractual Framework (CPCF) outlines the services provided by community pharmacies on behalf of the NHS in England and Wales. The Medicines Use Review and Prescription Intervention Service (MUR) was introduced in both countries in 2005 (Department of Health and Social Care, 2005; NHS Prescription Services, 2018). An additional advanced service, the New Medicine Service (NMS), was introduced in England in 2011 (Department of Health and Social Care, 2013). In Scotland, the NHS contracts community pharmacies to deliver the Chronic Medication Service (CMS) (Wilson & Barber, 2013). In Northern Ireland, community pharmacies offer the Managing Your Medicines Service (MYMS) on behalf the Health and Social Care (HSC) Board (HSC Business Services Organisation, 2010a). Pharmacies can claim remuneration, from either the NHS or the HSC Board, based on the number of consultations performed (HSC Business Services Organisation, 2010b; R. McDonald et al., 2010; Wilson & Barber, 2013)

## The Medicines Use Review and Prescription Intervention Service (MUR)

The MUR is designed to explore people's adherence and treatment beliefs, identify and resolve causes of non-adherence, address side effects and/or interactions, and reduce medication wastage. The consultations, delivered face-to-face or over the telephone, are meant to be collaborative discussions between the pharmacist and patient (Department of Health and Social Care, 2005; Pharmaceutical Services Negotiating Committee, 2015). Pharmacies are required to conduct at least 70% of their MURs with people in the national target groups: people with high-risk medicines (e.g. anticoagulants), a recent hospital discharge and subsequent medication changes, respiratory conditions (including asthma), and/or cardiovascular disease with a regular prescription for four or more medications (NHS Digital, 2017).

Pharmacist training for the MUR is delivered through higher education institutions or standalone courses by the Centre for Pharmacy Postgraduate Education (CPPE, which supports pharmacists in England with their continuing professional development). It focuses on clinical and pharmaceutical knowledge, assessing and applying clinical information, and documentation/referrals. Pharmacists have to complete an assessment based on a national competency framework to deliver the service (Pharmaceutical Services Negotiating Committee, 2015). Pharmacies are required to have a private consultation area to provide MURs (NHS Employers, 2013a).

### *Service uptake*

In its first year, MUR uptake was low with only 38% of community pharmacies providing the service (Blenkinsopp, Celino, Bond, & Inch, 2009; Bradley, Wagner, Elvey, Noyce, & Ashcroft, 2008). In its second year, MUR uptake rose to 67% (Blenkinsopp, Bond, Celino, Inch, & Gray, 2008). The most recent estimate (2016 – 2017) suggests that MUR uptake has risen above 90% (NHS Digital, 2017).

Pharmacy ownership was an important determinant of MUR uptake, with large corporate multiples conducting most of the MURs (Blenkinsopp et al., 2009; Bradley, Wagner, et al., 2008). Being a store-based pharmacist (rather than locum), having a consultation area, and working more than 20 hours per week also increased the number of MURs performed per pharmacist (Latif & Boardman, 2008; R. McDonald et al., 2010). Pharmacist gender, years since qualification, clinical training, and pharmacy size did not affect MUR uptake (Latif & Boardman, 2008).

### *Service effectiveness*

There is a lack of randomised controlled trials (RCTs) investigating the effectiveness of MURs in improving adherence. Latif, Pollock, and Boardman (2011) interviewed MUR recipients and found that participants generally felt that their medication-related knowledge and medication-taking behaviour did not change as a result of the consultation. Another study found that people were most receptive to pharmacists' recommendations when they were convenient and/or in line with their own beliefs, highlighting the importance of a person-centred approach in medication consultations (Abdel-Tawab et al., 2011; Latif & Boardman, 2008).

Manfrin, Tinelli, Thomas, and Krska (2017) conducted a cluster-RCT of the Italian Medicines Use Review (I-MUR), which was based on the UK's MUR. It significantly increased adherence among people with asthma when compared to usual care, and was cost-effective (Manfrin et al., 2017). However, these findings may not be generalisable to the UK because the pharmacy context and patients may differ.

### *Service implementation*

In an interview study of pharmacists delivering the MUR, Latif and Boardman (2008) found that pharmacists generally welcomed the opportunity to expand beyond the

traditional dispensing role. However, they also felt it was difficult to deliver the MUR without additional support staff (e.g. pharmacy technicians). Consultations took pharmacists away from dispensing activity and could produce delays in delivering medications if tasks could not be delegated (Latif & Boardman, 2008; R. McDonald et al., 2010). However, some pharmacists felt hesitant about delegating the dispensing process due to doubts about pharmacist technician competency (R. McDonald et al., 2010).

The people receiving the MUR often misunderstood its purpose. They viewed it as a basic medication check without room for patient input, and some accepted the invitation for the service out of politeness and for the benefit of the pharmacist rather than themselves. They may have been expecting quick encounters at the pharmacy and/or viewed the pharmacist as a shopkeeper rather than a clinician (Latif, Boardman, & Pollock, 2013). Invitations to the MUR were primarily opportunistic and based on the national target groups. Pharmacists often failed to use pharmacy records as a source of information for MUR recruitment and consultation content (R. McDonald et al., 2010). Therefore, people with no previous record of medication-related problems (e.g. inappropriate prescriptions or non-adherence) may have had an MUR and felt it was unnecessary (Latif et al., 2013; R. McDonald et al., 2010).

Pharmacists worried that the quantity- and funding-driven motivations behind the MUR outweighed the motivation for patient benefit (Bradley, Wagner, et al., 2008; Harding & Wilcock, 2010; R. McDonald et al., 2010). Due to the pressure to meet MUR targets, some consultations became 'tick-box exercises': short consultations steered by the closed-ended questions on the MUR form, with limited patient input (Latif et al., 2011). These issues may explain why patients felt that their medication-

related knowledge and medication-taking behaviour did not change as a result of the consultation.

### *The New Medicines Service (NMS)*

The NMS, available in England, aims to improve adherence to newly prescribed medication for hypertension, cardiovascular disease, type 2 diabetes, and asthma/COPD. It consists of two consultations with a pharmacist: seven to 14 days after a new medication is prescribed, and 14 to 21 days after the first consultation (NHS Employers, 2013b). In these consultations, pharmacists and patients explore adherence, identify medication-related problems, and discuss information and support tailored to the patient to optimise adherence early in the medication-taking process.

Pharmacists delivering the NMS have to complete the MUR accreditation process and a NMS readiness self-assessment (NHS Employers, 2013b). The CPPE offers NMS training electronically and through local workshops (Centre for Pharmacy Postgraduate Education, 2011). Pharmacists delivering the service are given a semi-structured interview guide for their consultations. The guide consists of open-ended questions exploring motivation-related factors that may affect adherence: concerns about the medication and its effectiveness, the experience of any side effects, and the perceived necessity of the medication (NHS England, 2013).

### *Service uptake*

Uptake of the NMS was considerably higher than the MUR, with 82% of community pharmacies offering the service in its first year. The most recent estimate (2016 – 2017) suggests that upwards of 85% of community pharmacies now offer the service (NHS Digital, 2017). The earlier introduction of the MUR and the subsequent change in pharmacy culture may have facilitated the uptake of this new service. The self-



assessed accreditation process also removed delays associated with external accreditation. Furthermore, pharmacy income from the NMS consultations was viewed as “a bonus” at a time when income from dispensing was decreasing (Wells, Thornley, Boyd, & Boardman, 2014, p. 63).

### *Service effectiveness*

To date, there has only been one RCT looking at the effectiveness of the NMS in improving adherence, covering asthma/COPD, type 2 diabetes, hypertension, and antiplatelet/anticoagulant medications. Elliott et al. (2016) conducted a pragmatic randomised controlled trial of the NMS, measuring adherence using two self-report measures: a question from the NMS consultation (“Have you missed a dose in the previous seven days?”, categorising participants as adherent/non-adherent) and the eight-item Morisky Medication Adherence Scale (MMAS-8) (Morisky et al., 2008). The NMS produced significantly higher adherence than usual care at 10 weeks based on the NMS question (OR = 1.62, 95% CI [1.04 – 2.53],  $p = 0.03$ ). The MMAS-8 did not produce a significant intervention effect at 10 weeks (OR = 1.77, 95% CI [0.96 – 3.28],  $p = 0.07$ ). However, the MMAS-8 did find a significant intervention effect at 10 weeks when the analyses took account of participants who appropriately stopped or changed their medication (OR = 1.81, 95% CI [1.07 – 3.05],  $p = 0.03$ ). (Elliott et al., 2016). In terms of cost-effectiveness, the NMS saved £21 per person compared to usual care. However, this was not a significant difference (95% CI [£59 - £150],  $p = 0.13$ ) (Elliott et al., 2016).

Although these results are promising, the use of self-report adherence measures may have overestimated adherence. In addition, the NMS question was a non-validated method for measuring adherence and may have been affected by social desirability

bias (Elliott et al., 2016). The NMS only targets people with new prescriptions, therefore excluding non-adherence exhibited by people with other prescriptions.

When looking specifically at people with asthma/COPD ( $n = 117$ ), there was no significant intervention effect at 10 weeks based on the NMS question (OR = 1.22, 95% CI [0.49 – 0.31],  $p = 0.67$ ) and the adjusted MMAS-8 (OR = 5.26, 95% CI [0.93 – 29.56],  $p = 0.60$ ) (Boyd et al., 2014). Grouping the two conditions together may have diluted the effect of the intervention. Furthermore, the most common NMS prescription for asthma/COPD was salbutamol ( $n = 20$ , 30.8%), a reliever medication. Measuring adherence to salbutamol is not an accurate representation of adherence in asthma, which focuses primarily on preventive medication (e.g. inhaled corticosteroids, ICS) (see Section 1.3.1). The NMS adherence question (“Have you missed a dose in the previous seven days?”) was inappropriate for reliever medication such as Salbutamol, as its use should be minimal with adequate use of preventive medication. While the overall results of the trial are encouraging, the effectiveness of the NMS in improving adherence among people with asthma remains uncertain.

#### *Service implementation*

A qualitative evaluation of the NMS, combining both observational fieldwork and semi-structured interviews in 63 community pharmacies across the UK, found that pharmacists delivering the service felt that they were not given adequate notice to prepare for its introduction (Boyd et al., 2014). Although pharmacists generally heard about the NMS 12 to 18 months before its implementation, there were instances where pharmacists were informed with four months’ notice (Wells et al., 2014). However, most pharmacists felt prepared to deliver the NMS due to their previous MUR training (Boyd et al., 2014).

Pharmacists held different views on the main purpose of the service, including monitoring patients, reducing medication wastage, supporting adherence, reducing side effects, addressing questions, and providing general information (Boyd et al., 2014). Some pharmacists viewed the service as unnecessary when local GPs already conducted follow-up consultations for people with new prescriptions. As with the MUR, pharmacists were concerned about meeting NMS targets and the increased workload in community pharmacies (Boyd et al., 2014).

When the NMS was first introduced, most pharmacists adhered to the questions in the consultation interview guide. However, as they became more familiar with the service, pharmacists began changing the wording/structure of the guide and leaving out questions that they deemed irrelevant to tailor consultation content to individual patients (Boyd et al., 2014). However, despite pharmacists' decisions to tailor intervention content, researcher observations of the consultations noted limited patient input. Discussions between pharmacists and patients were confirmatory rather than exploratory. Furthermore, pharmacists often missed opportunities to address questions regarding other prescribed medications (non-NMS prescriptions) (Boyd et al., 2014).

Public awareness of the NMS was lacking. As such, pharmacists had to actively invite people for a consultation rather than rely on passive recruitment. Patients were often concerned about time commitment, and pharmacists tried to circumvent their initial hesitancy by using informal language (e.g. inviting them for a "quick chat") (Latif et al., 2016, p. 974). Although expectations were initially low, many people appreciated the reassurance they received from pharmacists about their new medications. However, people who felt that they could manage their new medication on their own viewed the service as unnecessary. Pharmacists' recommendations were well-received when they addressed a concern raised by the patient or when they aligned with the

patient's beliefs, as seen with the MUR (Boyd et al., 2014; Latif & Boardman, 2008). Patient feedback for future improvement included expanding the NMS eligibility criteria and encouraging patient input through additional open-ended questions (Boyd et al., 2014).

### The Chronic Medication Service (CMS)

The CMS is part of the NHS Community Pharmacy Contract in Scotland. It targets people with long-term conditions and encourages a collaborative care approach between GPs and community pharmacists. It aims to identify and prioritise medication-related risk, minimise adverse drug reactions, and address existing or potential medication-related issues (Community Pharmacy Scotland, 2018).

To receive the CMS, patients must register with a specific pharmacy. The pharmacist conducts a pharmaceutical assessment that produces an electronic patient profile (general health, medical conditions/allergies/sensitivities) and medication profile (identified pharmaceutical care issues) (NHS Education for Scotland, 2010). Based on these profiles, pharmacists assess whether patients need a pharmaceutical care plan. This plan outlines any medication-related issues identified by the pharmacist or patient, and the collaborative strategies and desired outcomes in tackling them. The CMS also encourages GP involvement by electronically notifying GPs when one of their patients registers for the service. GPs can then decide to issue an electronic serial prescription (24 or 48 weeks) to support the pharmaceutical care plan. This prescription is automatically sent to the pharmacy where the patient is registered (NHS Inform, 2012).

There is limited published research on the uptake, effectiveness, and implementation of the CMS. However, an independent review commissioned by the Scottish

government suggested that the broad approach to pharmacist-led support for long-term conditions in Scotland may tackle medication- and prescription-related risks more efficiently than the NMS/MUR service split in England (Wilson & Barber, 2013).

At the time of the review, the CMS had over 200,000 registered patients across its Early Adopter Sites. However, these sites were only just beginning to engage in the serial prescribing and dispensing phase of CMS, and some pharmacists expressed frustration at the slow progress towards full CMS implementation (e.g. full cooperation with GPs and service implementation across all community pharmacies). The review recommended additional research into the clinical impact/contributions of pharmacy services, therapeutic relationships between patients/GPs/pharmacists, and integration of information systems to facilitate the continued development of Scottish pharmacy services, such as the CMS (Wilson & Barber, 2013).

#### [The Managing Your Medicines Service \(MYMS\)](#)

The MYMS is a community pharmacy-based service commissioned by the HSC Board in Northern Ireland. It aims to optimise treatment and support appropriate medication use through clinical review, education, and collaboration between healthcare professionals (HSC Business Services Organisation, 2010a). Patients must be taking high-risk medications or upwards of four medications, and have sub-optimal adherence (as indicated by pharmacy or GP records), a recent hospital discharge with a subsequent medication change, or limited self-management support (e.g. living alone) to be eligible. Eligible patients are identified by the pharmacist, or referred by other healthcare professionals (e.g. GPs) (HSC Business Services Organisation, 2010a).

In the consultation, the pharmacist identifies any current and potential medication-related problems and outlines a collaborative plan of action to address them. A report of the consultation is forwarded to the patient's GP, and a follow-up consultation with the pharmacist is scheduled if deemed necessary (HSC Business Services Organisation, 2010a). As with the CMS, there is limited published research on the uptake, effectiveness, and implementation of the MYMS.

#### Limitations of the community pharmacy context

While the services outlined above have all been rolled out in practice, there are several limitations of the community pharmacy context that have been identified. These may be barriers to the delivery of pharmacist-led adherence support in community pharmacy settings. The room for clinical expansion in the pharmacist role may be limited by the views held by the general public and other healthcare professionals, who view community pharmacists as shopkeepers or specialist retailers due to the traditional dispensing role (Gidman, Ward, & McGregor, 2012; Hughes & McCann, 2003; Latif et al., 2013; Latif et al., 2016). Furthermore, the commercial interests associated with a retail environment have been perceived as conflicting with the principles of healthcare, particularly when it comes to prescribing (Gidman et al., 2012; Hughes & McCann, 2003).

As the community pharmacist role extended into medication reviews, other healthcare professionals (e.g. GPs and nurses) raised concerns about role overlap and possible professional boundary encroachment. This sentiment was also echoed by some pharmacists (Edmunds & Calnan, 2001; Hughes & McCann, 2003; Latif et al., 2016). Some patients were concerned about a lack of communication between community pharmacists and GPs, and that a conflict between these healthcare professionals might jeopardise the patient-GP relationship (Latif et al., 2013).

Another concern with the community pharmacy setting revolves around privacy, confidentiality, and data protection. People felt that community pharmacies lacked privacy, despite the introduction of private consultation rooms (Eades, Ferguson, & O'Carroll, 2011; Gidman et al., 2012). Some people even felt hesitant about using the consultation rooms because the rooms were associated with services such as methadone prescriptions, which carried a negative stigma (Gidman et al., 2012). GPs worried about potential breaches in patient confidentiality if medical records were shared with community pharmacists, perhaps due to the 'open' layout of pharmacies and the thoroughfare of locum staff (Edmunds & Calnan, 2001).

#### *The general practice context*

Given some of the limitations of the community pharmacy setting, other areas of primary care have been explored as potential settings for pharmacist-led adherence support. In their *Five Year Forward View* and *General Practice Forward View* documents, NHS England set out plans to expand the general practice workforce, reduce practice burden, and release GP time. Part of this process included integrating pharmacists into primary care teams to increase healthcare access and multidisciplinary support for people with long-term conditions (NHS England, 2016, 2017b).

#### *The Clinical Pharmacists in GP Practices Pilot*

Pharmacists recruited for the *Clinical Pharmacists in GP Practices* pilot in England were expected to use their medication expertise in consultation-based patient-facing work to improve patient care and safety, particularly for people with long-term conditions and/or multiple medications. Each participating practice was expected to recruit an experienced clinical pharmacist prescriber, with additional pharmacists as mentees. NHS England provided partial funding for the scheme: 60% in year one, 40%

in year two, and 20% in year three, with practices expected to meet the remaining costs (NHS England, 2015).

The CPPE offers training for this new role through three 18-month *Clinical Pharmacists in General Practice Education Pathways*. The pathways include training on clinical pharmacy, the general practice setting, leadership, and clinical assessment. Each pathway is tailored to a specific skill level based on whether or not pharmacists have a postgraduate clinical pharmacy degree, previous experience in general practice, and an independent prescribing qualification (Centre for Pharmacy Postgraduate Education, 2018).

During the pathway, pharmacists are supported by a CPPE education supervisor, a clinical mentor, a senior clinical pharmacist lead at their site, and a GP clinical supervisor. Pharmacists are assessed through workplace-based assessments, a portfolio, and a written statement of progression (Centre for Pharmacy Postgraduate Education, 2018).

#### *Service uptake*

The pilot study of the scheme was able to recruit 490 pharmacists for work across 650 practices, although not all of these pharmacists were experienced prescribers (Mann, Anderson, Avery, Waring, & Boyd, 2018; Sharma, 2018). Further funding was acquired to roll out the programme, with the aim of recruiting 2000 clinical pharmacists to general practice by 2020 (Mann et al., 2018).

#### *Service effectiveness and implementation*

The Clinical Pharmacists in General Practice (CPGP) scheme is currently being rolled out and an evaluation of its effectiveness is yet to be conducted. Mann et al. (2018)



offer some insight on the scheme's progress in their qualitatively focused service implementation analysis from Phase One of the pilot study.

The work of GP pharmacists varied considerably between sites. As such, it was difficult to measure the impact of the pharmacists in a uniform manner. Preliminary qualitative feedback from the pilot sites suggested that GP pharmacists increased patient access to appointments, medication safety (e.g. error minimisation and deprescribing), patient satisfaction, achievement of Quality Outcomes Framework (QOF) targets, and medication adherence for long-term conditions (Mann et al., 2018). This was achieved through patient-facing interactions with people with long-term conditions, including but not limited to medication reviews, deprescribing, hospital discharge support, mental health and substance abuse support, and lifestyle advice. A few pharmacists had limited patient contact and conducted medication-related audit work (Mann et al., 2018).

It was difficult to identify the unique contribution of pharmacists within the collaborative and multi-disciplinary general practice setting. Nonetheless, most GPs reported that they would continue to fund their GP pharmacist after the end of the pilot because they valued the pharmacist's medication expertise. However, the GPs recruited into the pilot may be 'innovators' with a greater inclination to try and support new care models (Mann et al., 2018).

GPs often expected pharmacists in the pilot study to be fully autonomous in patient-facing work. However, pharmacists required extensive training and clinical mentoring before reaching that stage, and the length of time required varied per pharmacist. Site leads highlighted that pharmacists should be working autonomously within 24 months for the scheme to be sustainable (Mann et al., 2018). Allowing pharmacists to shadow

key practice staff, work at reception, and attend local training on primary care structures helped them reach that autonomy. Funding for the scheme varied across sites, and practices' commitment to fund the GP pharmacist role and any additional external training was the most important facilitator of the CPGP scheme (Mann et al., 2018).

#### Limitations of the general practice context

As with community pharmacy-based services, the CPGP pilot study revealed some concerns from other allied healthcare professionals (e.g. nurses) about role overlap. Some practices viewed this overlap as beneficial because it meant that there were more healthcare professionals available (i.e. GPs, nurses, and pharmacists) to provide care for long-term conditions. However, Mann et al. (2018) recommend a clear job description and professional boundaries for the pharmacist role to facilitate collaborative working between healthcare professionals. In the pilot study, practices that adjusted the pharmacist role to local needs and the skillset of each pharmacist achieved better integration (Mann et al., 2018).

The clinical training and mentoring required for incoming pharmacists could pose a significant barrier to the implementation of the CPGP scheme because the costs of establishing this pharmacist role are initially quite high. Practices may not be able to sustain the funding needed to support the pharmacist role and the additional training required (Mann et al., 2018). Pharmacists hired for part-time posts (e.g. due to limited funding) may take longer to reach full autonomy. As such, smaller practices may be disadvantaged as the initial costs of the pharmacist role will remain high for longer. While pharmacist-led support delivered in general practice may address some of the concerns regarding commercial interests and confidentiality seen with community pharmacy, appointment-based services may decrease the accessibility of the service.

To summarise, pharmacist-led adherence support has been introduced in varying degrees across community pharmacy and general practice in the UK. Previous research has established the effectiveness of some of these services, and identified potential context-related barriers to service implementation (Boyd et al., 2014; Elliott et al., 2016; Latif & Boardman, 2008; Mann et al., 2018; Wilson & Barber, 2013). Although some of the findings are encouraging (e.g. the NMS evaluation), there is a need for further high-quality research with reliable adherence measures and randomised designs. Most of the aforementioned services targeted several long-term conditions, and most studies focused on the general benefit across all conditions. The next section of this thesis will explore how pharmacists may be able to support adherence specifically in people with asthma.

### 3.2 Pharmacists and adherence in asthma

As discussed in Chapter 2, employing a tailored approach targeting the unique motivation- and ability-related factors influencing adherence may make adherence support more effective (Horne, 2001, 2015; Nunes et al., 2009). Furthermore, *consistent* adherence support is crucial in asthma care because asthma symptoms are intermittent and adherence may therefore fluctuate (Chan, Watkins, & Schneider, 2019; Halm et al., 2006). The following section will outline how pharmacists may be able to fulfil these requirements for adherence support in asthma care (i.e. consistent support and tailored pharmaceutical care).

#### 3.2.1 Consistent adherence support

Routinely assessing and addressing non-adherence when medication is prescribed, dispensed, and reviewed is recommended in the NICE guidelines for medicines adherence (Nunes et al., 2009). Basic asthma care (i.e. annual asthma reviews, WAAPs, and inhaler technique checks) are generally delivered in general practice.

However, providing consistent adherence support through general practice may be difficult because only 35% of people with asthma in the UK engage with basic care (Cumella, 2017).

Community pharmacists may be able to increase engagement with asthma care (including adherence support) due to their accessibility: they have a drop-in appointment model, flexible opening hours (e.g. evenings and weekends), and convenient locations (e.g. commercial streets and/or city centres) (Saini et al., 2008; Todd et al., 2014; van Boven et al., 2016). Pharmacists may be the last point of contact that a patient has with the healthcare system before a medication is used, particularly for patients who do not attend annual asthma reviews. As such, these encounters may be valuable opportunities to provide adherence support to individuals who otherwise would not have input from a healthcare professional (Chan et al., 2019; Saini et al., 2011).

### 3.2.2 Pharmacists and patient motivation

Emotions, preferences, and beliefs about asthma and its treatment influence a person's motivation to adhere to medication. People may intentionally choose not to adhere to medication based on the treatment beliefs they hold (Horne, 2001, 2015). Beliefs about ICS may influence adherence in people with asthma. Previous research found that 23% of people with asthma have concerns about ICS, with concerns about dependence (37%) and long-term effects (48%) being the most common concerns. These concerns were significantly correlated with self-reported adherence ( $r = -0.43$ ,  $p < 0.001$ ) (Horne & Weinman, 2002).

In terms of beliefs about asthma itself, Halm et al. (2006) conducted an observational cohort study of inner-city adults with asthma and a recent asthma-related hospitalisation, and found that 53% of their participants believed they only had asthma

when they were symptomatic. These participants were significantly more likely to report non-adherence to ICS at baseline and both follow-up points (one and six months) compared to people who viewed their asthma as a long-term condition.

Pharmacists have the relevant knowledge to engage people in discussions about their asthma and ICS. Through tailored and collaborative discussions, they may be able to address people's asthma-related beliefs and concerns about ICS (Horne & Clatworthy, 2010). They may target these issues directly or provide referrals to another healthcare professional (e.g. for further psychological support) (Chan et al., 2019).

The mean length of GP consultations in the UK was only  $9.4 \pm 4.7$  minutes in 2002 (Deveugele, Derese, van den Brink-Muinen, Bensing, & De Maeseneer, 2002). Therefore, detailed discussions of asthma- and treatment-related beliefs in a single GP consultation may be unrealistic. Pharmacists may be able to offer slightly longer consultations focused specifically on treatment beliefs and medication, which may be useful for people with complex medication-related needs. For example, there is a high rate of comorbidities among people with asthma, and people on several medications may benefit from additional support (El Ferkh et al., 2017).

### 3.2.3 Pharmacists and patient ability

A person's capability and resources determine their ability to adhere to medication. In some cases, people may want to adhere but are unable to due to factors beyond their control (i.e. unintentional non-adherence) (Horne, 2001, 2015). Pharmacists may be able to improve the ability to adhere by targeting asthma knowledge, regimen complexity, financial and organisational factors, and inhaler competence (Chan et al., 2019).

### *Asthma knowledge*

Adherence is an informed choice and a key component of asthma care is ensuring that people have an accurate understanding of their asthma and medication (Nunes et al., 2009). This is particularly important because asthma requires a high level of self-management (Chan et al., 2019; Pinnock, 2015). Pharmacist-led educational interventions have been shown to significantly increase and sustain people's asthma knowledge (Armour et al., 2007; Saini et al., 2011; Wang et al., 2010; Xaubet Olivera et al., 2016). Furthermore, pharmacists can provide accurate and updated information on asthma medication with each patient encounter (van Boven et al., 2016).

Reinforcing information is crucial because people may not retain information provided in a consultation (e.g. due to stress), and memory of medical information declines with time and age (Kessels, 2003). Furthermore, people diagnosed at a young age, as is common with allergic asthma, may need additional information when they transition into adult care (Srof, Taboas, & Velsor-Friedrich, 2012). It is important to keep in mind that simply providing information is not sufficient to change health behaviour, and information should be provided in an accessible manner that makes sense to the individual (Horne et al., 2019; M. P. Kelly & Barker, 2016). As such, educational components of adherence support should be combined with a person-centred discussion of beliefs about asthma and its treatment (Abdel-Tawab et al., 2011).

### *Regimen complexity*

Medication regimen complexity has been linked with lower rates of adherence in asthma (Ponieman, Wisnivesky, Leventhal, Musumeci-Szabó, & Halm, 2009; Rand, 1998). Comorbidities and polypharmacy may be potential sources of regimen complexity. As mentioned previously, there is a high rate of comorbidities among people with asthma (El Ferkh et al., 2017). Using their knowledge of medications,

pharmacists may be able to simplify regimens by changing inhaler devices, offering combined formulations, deprescribing inappropriate medications, or switching to medications with a lower dosing frequency (Chan et al., 2019; Mann et al., 2018).

#### *Financial and organisational factors*

Asthma UK estimates that 64% of people with asthma feel that prescription costs negatively affect their finances (Cumella, 2017). In England, people with asthma have to pay for their inhalers unless they qualify for an exemption (NHS England, 2017a). The NHS no longer reimburses medications used to treat asthma triggers (e.g. hay fever), further exacerbating the financial burden on patients (Asthma UK, 2017).

Pharmacists may be able to guide people towards cost-exemption or prescription prepayment certificates (Chan et al., 2019). They can also recommend generic and one-a-day versions of medications for triggers to keep personal costs down and improve adherence (Asthma UK, 2017). If remembering to pick up and/or take medication is an issue, pharmacists are well-placed to recommend smart phone applications, electronic adherence monitoring, reminder messages (e.g. text), and online prescription ordering as potential adherence aids. However, these options may be limited by funding and availability, which varies by country and healthcare system (Chan et al., 2013; Tran, Coffman, Sumino, & Cabana, 2014).

#### *Inhaler competence*

There are many different types of inhaler devices on the market and inhaler competence is a crucial component of asthma management (see Sections 1.3.1 and 2.3.2). Pharmacists may be ideally placed to educate, correct, and support inhaler technique because they often see people shortly before they start using the inhaler. They could also optimise drug delivery by reviewing the appropriateness of inhaler

devices based on a person's dexterity and lung function, and recommending spacer devices where needed (Chan et al., 2019). Pharmacists' inhaler technique skillset needs to be maintained through regular training and application in practice, as previous research found that only 7% of healthcare professionals could demonstrate correct inhaler technique (Basheti, Armour, Reddel, & Bosnic-Anticevich, 2009; Baverstock, Woodhall, & Maarman, 2010).

#### 3.2.4 Pharmacists and monitoring adherence

Pharmacists have access to a person's prescription and dispensing data, which can be used to identify candidates for adherence support. van Boven et al. (2013) identified potentially sub-optimal asthma pharmacotherapy in a prescription database based on: frequent use of SABA, use of non-selective beta-blockers, use of ICS and/or OCS, and use of combined therapy (LABA/ICS). Using this method, the average Dutch community pharmacy (8,000 patients) would be able to identify approximately 400 people with asthma, with 33 eligible for intervention (van Boven et al., 2013). The Medication Monitoring and Optimisation (MeMO) programme automated these database searches to identify people with asthma for targeted adherence support, eventually leading to a significant improvement in adherence (van Boven et al., 2014). Pharmacists in the UK would be able to access similar information from their Electronic Prescription Service (EPS) records, although some pharmacies and general practices do not offer the EPS and these patients would therefore be missed in an electronic database search.

Pharmacists could support adherence indirectly by monitoring asthma control and/or asthma pharmacotherapy. They may be able to identify people with poor asthma control based on prescription data (e.g. frequent SABA use or prescriptions for OCS). Their frequent contact with patients may also offer insight into whether treatment



needs to be ‘stepped up’ or ‘stepped down’, thereby establishing the minimum medication dose needed to maintain asthma control and/or identifying patients who are at risk of future exacerbations (e.g. patients exhibiting SABA overuse) (Patel et al., 2015). In addition to reducing medication wastage, this approach also reduces the risk of unwanted side effects as a potential barrier to adherence (Chan et al., 2019; Watkins et al., 2016).

To summarise, interest in pharmacist-led care is growing in the UK, as demonstrated by all of the aforementioned care initiatives. The general public and other healthcare professionals are becoming more aware of the contributions pharmacists can make to healthcare for long-term conditions.

However, research on pharmacist-led adherence support in the UK highlighted significant issues with service implementation and intervention fidelity that will need to be addressed. The community pharmacy context demands a balance between dispensing and consultation-based activities. The perceived role of the pharmacist as a shopkeeper, the retail environment, and patient expectations for quick encounters at the pharmacy may hinder service implementation. Furthermore, pressure to meet consultation targets for funding had a negative effect on the intervention fidelity of adherence support.

While the general practice context was able to address some of these limitations, the costs of the GP pharmacist role and its required training were significant. Furthermore, the accessibility of appointments would be lower compared to community pharmacy. The extended pharmacist role raised concerns about potential role overlap with other healthcare professionals. Further research is needed to establish how best to facilitate collaboration between healthcare professionals in terms of job descriptions and

information technology systems, and how to best integrate pharmacists into the current primary care system.

When it comes to asthma, pharmacists may be an underutilised care resource. Their clinical knowledge and access to prescription information may help tackle the motivation- and ability-related adherence barriers identified in asthma research, as well as provide adherence support in a consistent manner. While some of the findings for pharmacist-led adherence support were promising, additional research is needed to establish the effectiveness of pharmacist-led adherence interventions specifically for asthma. The pharmacist delivery channel can be optimised with further input from UK pharmacists and people with asthma as the providers and recipients of pharmacist-led adherence support.

## 4 Rationale

Asthma produces significant direct and indirect costs in the UK, ranging from healthcare spending to productivity loss at work (Mukherjee et al., 2016). While we await new advances in diagnosis and treatment, attention should be paid to the potentially modifiable factors that may help improve asthma care.

As outlined in Chapter 2, medication adherence plays an important role in asthma-related health outcomes. Unfortunately, ICS adherence falls between 22% and 70%, with non-adherence linked to increased morbidity and mortality (Barnes & Ulrik, 2015; Murphy et al., 2012). Conversely, optimal ICS adherence has been linked with improvements in exacerbation risk, asthma-related mortality, healthcare utilisation, and asthma control (Stern et al., 2006; Suissa et al., 2000; Suissa et al., 2002; Williams et al., 2004). In addition to improvements in clinical outcomes, adherence helps reduce medication wastage and ensures that currently available treatments (e.g. ICS) are used to their maximum benefit.

Adherence is influenced by various motivation- and ability-related factors that are unique to each individual (see Section 2.1.3). In asthma, some examples include asthma beliefs, treatment beliefs, inhaler competence, and medication regimen complexity (Giraud & Roche, 2002; Halm et al., 2006; Horne & Weinman, 2002; Ponieman et al., 2009; Rand, 1998). Non-adherence to ICS is a complex issue encompassing many of these factors, therefore requiring multi-disciplinary collaboration to be tackled effectively (Pavord et al., 2018).

The growing pressure on primary care in the UK has led to increased interest in the role of allied healthcare professionals, a topic now being explored in both research and clinical practice (Baird, Charles, Honeyman, Maguire, & Das, 2016; Elliott et al.,

2016; Latif et al., 2011; Mann et al., 2018; NHS England, 2015, 2016). Pharmacists, as medication experts, may have the relevant knowledge and experience to target the motivation- and ability-related factors affecting adherence in asthma (see Section 3.2). The traditional dispensing role does not make full use of pharmacists' skillset, and their knowledge may be well-suited to target and address treatment beliefs as potential barriers to adherence in asthma (Chan et al., 2019; Edmunds & Calnan, 2001; Naik Panvelkar et al., 2010; Royal Pharmaceutical Society, 2014; Tinelli et al., 2009).

With the emergence of pharmacist-led services in both community pharmacy and general practice in the UK, further research is needed to establish whether the pharmacist delivery channel is a suitable avenue for asthma-specific adherence support. Current evidence on pharmacist-led services and their impact on adherence and clinical outcomes is conflicting, and further work is needed to explore the effect of these interventions among people with asthma.

## Section B: Empirical Studies

## 5 Aims and Objectives

The aim of this PhD is to examine UK pharmacists as a potential delivery channel for a theory-based intervention targeting adherence in adults with asthma. This is broken down into three objectives.

1. To assess the effectiveness of pharmacist-led interventions in improving medication adherence in adults with asthma, through a systematic review and meta-analysis (Chapter 6).
2. To explore the perspectives of UK pharmacists and adults with asthma on pharmacist-led adherence support (Chapters 7 and 8).
3. To investigate the feasibility and acceptability of pharmacists as a delivery channel for a theory-based adherence intervention delivered to adults with asthma in general practice (Chapter 9).

## 6 Pharmacists and medication adherence in asthma: a systematic review and meta-analysis

### 6.1 Introduction

When developing new complex health-related interventions, the Medical Research Council (MRC) recommends identifying relevant theory and existing evidence to establish whether the new intervention can be expected to have an effect (Craig et al., 2008). Therefore, understanding the potential of pharmacists as an adherence support delivery channel for asthma involved exploring the theory and evidence around adherence, pharmacist-led interventions, and asthma. Relevant theory previously applied to adherence behaviour was explored in Section 2.4 of this thesis, with the CSM/e-CSM and PAPA identified as potentially useful tools for adherence interventions in asthma (Horne, 2001, 2015; Horne & Weinman, 1999; Leventhal et al., 1998).

The MRC recommends using systematic reviews to identify existing evidence relevant to new interventions (Craig et al., 2008). A review on the effectiveness of pharmacist-led interventions in improving adherence in asthma was lacking, as previous reviews focused on adherence interventions across long-term conditions (Haynes et al., 2008; Nieuwlaat et al., 2014), adherence interventions for asthma (Normansell et al., 2017), and community pharmacist-led interventions across long-term conditions (van Wijk et al., 2005). Reviewing existing evidence on pharmacist-led interventions specifically for adherence in asthma was important to prevent the duplication of previous research and to establish the overall effectiveness of these interventions. Furthermore, reviewing the evidence base would provide insight on potential intervention content, influential contextual factors, and research study design.

## 6.2 Aim and objectives

The aim of this study was to review existing evidence on the effectiveness of pharmacist-led interventions in improving adherence among adults with asthma. This aim was broken down into two objectives:

1. To estimate how effective these interventions are in improving adherence among adults with asthma.
2. To identify the research design, location, sample, outcome, and intervention characteristics that moderate the effectiveness of these interventions.

## 6.3 Methods

This study was a systematic review and meta-analysis. The review protocol is registered on the International Prospective Register of Systematic Reviews (<http://www.crd.york.ac.uk/PROSPERO>) under registration ID CRD42016035657. This chapter is written in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher, Liberati, Tetzlaff, Altman, & The PRISMA Group, 2009).

### 6.3.1 Systematic search strategy

Systematic searches were conducted on four databases with relevance to the pharmacy field; Excerpta Medica Database (EMBASE, Elsevier B.V.), Medical Literature Analysis and Retrieval Systems Online (MEDLINE, U.S. National Library of Medicine®), Web of Science (all databases, Institute for Scientific Information), and the Cochrane Central Register of Controlled Trials (CENTRAL, Cochrane). Additional studies were identified from the reference lists of included studies and review articles retrieved during the search. The search ran from 5<sup>th</sup> May 2016 to 15<sup>th</sup>



June 2017, with weekly database alerts installed for new publications during this period.

The search strategies (see Appendix A) included controlled database-specific vocabulary (e.g. Medical Subject Headings) and free text searches based on two key terms: pharmacy and asthma. Adherence was not included as a key term to capture studies where improving medication adherence was not the primary objective, but adherence may still have been included as an outcome.

Pharmacy-related terms branched out from:

*Pharmacist, pharmacy, pharmaceutical services, pharmaceutical care, and medication therapy management.*

Asthma-related terms branched out from:

*Wheezing and asthma.*

Previously validated filters for identifying RCTs were used to narrow down the searches on MEDLINE and EMBASE (Higgins & Green, 2011; Lefebvre, Eisinga, McDonald, & Paul, 2008). The sensitivity-maximising filter was used on MEDLINE. However, the sensitivity-maximising filter produced 451,008 records on EMBASE (June 2017). As such, the sensitivity-and-precision maximising filter was used to narrow down the search (Higgins & Green, 2011; Lefebvre et al., 2008). Web of Science had a built-in RCT search filter. All entries on CENTRAL are controlled trials (randomised and quasi-randomised).

No further filters were needed to narrow down the search. Search strategies were constructed with guidance from two experts in systematic review methodology.

### 6.3.2 Inclusion and exclusion criteria

The review included published literature in English, Dutch, Spanish, and German (the languages spoken by the research team). Unpublished literature and publications in other languages were excluded because they would extend the review beyond the time and resources available for this PhD. There were no restrictions on publication date. The inclusion criteria were established according to the PICOS framework; participants, intervention, comparisons, outcomes, and study design (Centre for Reviews and Dissemination, 2008).

#### *Participants*

Participants were adults with asthma and no other respiratory conditions, with a prescription for asthma medication. There were no restrictions on how asthma was diagnosed (e.g. doctor-diagnosed only). Participants with additional respiratory conditions (e.g. COPD) were excluded because their medication and adherence behaviour was theorised to be different from participants with only an asthma diagnosis. Initial scoping searches revealed that many RCTs recruited a mixture of adults (18 years and over) and children (17 years and younger). Separate data for each group was often unavailable. We included studies if the majority of participants were adults. The effect of mixed age samples on review outcomes was explored during analysis.

#### *Intervention*

Pharmacists were the primary delivery channel for intervention content (i.e. pharmacist-led interventions). Collaborative care interventions with other healthcare professionals (e.g. GPs or nurses) were included only if the pharmacist was directly involved in delivering intervention content. Studies where pharmacists only completed research tasks (e.g. screening or recruitment) were excluded. Interventions delivered

in in-patient facilities or nursing homes were excluded because patients in these settings may not administer their own medication. Interventions were delivered face-to-face, over the telephone, digitally, or through e-mail/postal correspondence. Interventions were delivered in individual sessions or in group sessions with other people with asthma.

### *Comparisons*

Studies compared usual pharmacist care (control group) with a pharmacist-led intervention group. Usual pharmacist care was defined as dispensing medication and providing basic information about asthma and its treatment. If participants received multiple interventions within the same time period (e.g. a pharmacist-led intervention and psychotherapy) or were enrolled in multiple trials at once, the study was excluded. This was done to isolate the effect of a single intervention.

### *Outcomes*

Studies included adherence as a primary or secondary outcome. The review focused on summary- rather than participant-level data. Eligible adherence measures included (from most to least reliable method): electronic adherence monitoring devices (e.g. Doser™, Smartinhaler™), pharmacy-based data (e.g. prescription refill data), patient self-report measures (e.g. questionnaires or interviews), and reports from healthcare professionals or carers. If multiple adherence measures were used in a single study, the most reliable measure was chosen for inclusion. When studies employed multiple measures within the same category (e.g. pharmacy-based data), a mean effect size across measures was included in the analysis.

## *Study Design*

Only RCTs with randomisation at the cluster or participant level were included to narrow down the scope of the review and to compare data of a similar methodological standard.

### 6.3.3 Study selection

All records retrieved from the databases were imported into EndNote (Version X7; Clarivate Analytics, 2014) to remove duplicates. A study screening form (see Appendix B) was developed using the aforementioned inclusion criteria and piloted by two researchers across 12 unrelated papers. Once finalised, this form was used by the research team to screen studies.

The author of this thesis screened all records based on titles, abstracts, and key words using the screening form. The records were also divided between three other researchers for independent screening. All inclusion decisions were cross-checked and all inconsistent inclusion decisions were resolved through consensus. Two researchers independently screened the full-text versions of eligible studies. If there was insufficient information in the publication to make a decision, study authors were contacted for clarification. Authors were given two weeks to respond (with a follow-up e-mail halfway through), before the study was excluded. Multiple publications from the same RCT were considered a single study.

### 6.3.4 Data extraction

Authors of included studies were asked to provide additional information about study design and intervention content. Other published resources (e.g. study protocols or doctoral theses) were consulted where possible.

### *Risk of bias*

The Cochrane Collaboration's Risk of Bias tool was used to assess the risk of selection, performance, attrition, detection, and reporting bias for each included study (Higgins et al., 2011). Assessments for each study were made based on sequence generation procedures, allocation concealment, blinding of participants/personnel/outcome assessors, completeness of outcome data and reporting, and any additional sources of bias (Higgins & Green, 2011).

Allocation concealment and blinded outcome assessors were chosen as the most important risk domains for this review. Allocation concealment was important because assigning people with uncontrolled asthma to the intervention group would inflate the intervention effect (selection bias). Blinded outcome assessors were necessary to reduce detection bias: pharmacists who deliver the intervention or researchers who develop the intervention may overestimate its effect. Less weight was assigned to the performance bias domain because this type of bias is difficult to prevent in behavioural intervention trials. Unlike pharmaceutical trials with visually identical active and placebo medication, blinding participants and personnel in behavioural trials is difficult because the intervention and control conditions are noticeably different (McCambridge, Kypri, & Elbourne, 2014). Furthermore, blinding the personnel delivering the intervention is not possible when the study is randomised at the participant level.

An overall risk of bias was calculated, taking into account the relative importance of each domain. For the random sequence generation, blinding participants/personnel, incomplete outcome data, and selective reporting domains, studies were awarded one point per domain where bias was present. For the more important domains, allocation concealment and blinded outcome assessment, studies were awarded two points per

domain where bias was present. Half a point was awarded per domain where the risk of bias was uncertain. Finally, studies were awarded an additional point for each source of potential bias identified under the ‘other bias’ domain (i.e. several points were often awarded under this domain). This was done to ensure that all sources of bias were accounted for in the total risk of bias score. A total score was then calculated as follows: 1 – 3 points (low risk of bias), 4 – 6 points (moderate risk of bias) and 7 points and over (high risk of bias). Another researcher independently conducted risk of bias assessments across 25% of the included studies for crosschecking.

#### *Study, sample, and intervention characteristics*

Information about research design, study location and context, participants, outcome measures, intervention delivery, and intervention content was extracted from the studies (see Table 3).

Table 3. Data extracted from the studies included in the systematic review on pharmacist-led interventions and adherence in asthma

<u>Characteristics</u>	<u>Information Extracted</u>
Research Design	Study design Unit of randomisation (participant or cluster) Number of intervention and control groups/clusters Nature of control group Length of follow-up (months)
Location and Context	Study location (country) Healthcare setting (e.g. community pharmacy or hospitals)
Participants	Age (years) Sex (% male participants) Sample size ( <i>n</i> - total, intervention group, control group) Study uptake (% invitations accepted) Attrition rate (% baseline sample lost) Baseline differences between intervention and control group Asthma control (controlled, partly controlled, uncontrolled)
Outcome measures	Adherence as primary outcome measure (yes/no) Adherence measures used Other study outcomes (e.g. asthma control)
Intervention delivery	Pharmacist training and support Method of delivery (pharmacist only or collaborative care, face-to-face sessions, group or individual sessions)
Intervention content	Perceptions and Practicalities Approach Behaviour Change Techniques Taxonomy

The nature of the control group was explored because definitions of usual care varied in other reviews of medication adherence literature (Nieuwlaat et al., 2014; Normansell et al., 2017). We took note of how pharmacists were trained to deliver the intervention wherever possible. Intervention content was coded based on 1) the Perceptions and Practicalities Approach (PAPA) (Horne, 2001, 2015) and 2) the Behaviour Change Technique (BCT) Taxonomy (Michie et al., 2013). These two approaches were chosen to assess which aspects of adherence were being targeted (PAPA), and how interventions were trying to change adherence behaviour (BCT Taxonomy).

Interventions were categorised as full PAPA (tailored approach targeting motivation and ability to adhere), partial PAPA (targeting motivation and ability), or non-PAPA interventions (targeting only motivation or ability). Partial PAPA interventions can also be defined as tailored interventions targeting either motivation *or* ability (Horne, 2001, 2015). However, we were unable to use this alternative definition because the level of detail on intervention tailoring in the included studies was insufficient. The BCT Taxonomy outlines standardised techniques that can change behaviour when applied in a suitable context (e.g. ‘behavioural practice/rehearsal’ to teach inhaler technique) (Michie et al., 2013). We chose this approach because it is widely used across health psychology research and therefore enables comparisons across behavioural interventions in a standardised manner. Intervention content data was independently extracted by another researcher across 25% of the included studies for cross-checking.

#### 6.3.5 Data synthesis

Summary data across the review (e.g. age or sample size across all included studies) was calculated. Normally distributed data were presented in means and standard deviations (SDs). Skewed data or data with extreme outliers were presented as medians and interquartile ranges (IQRs). A meta-analysis was used to summarise adherence data where possible and sensible. The remaining data was synthesized narratively.

#### *Meta-analysis*

The meta-analysis assessed the overall effectiveness of pharmacist-led interventions in improving medication adherence. The Review Manager (RevMan) (Version 5.3, The Nordic Cochrane Centre - Cochrane Collaboration, 2014) and Comprehensive Meta-Analysis (CMA) software (Version 3.0, Biostat Inc., 2014) were used.



The standardised mean difference ( $d$ ) was used to summarise adherence data. This effect size was chosen because we assumed that adherence has an underlying continuous distribution, even when it is operationalised as a dichotomous variable (Lam & Fresco, 2015; Lipsey & Wilson, 2001). In addition, adherence is measured in a variety of ways and the standardised mean difference produces adjusted effect sizes on a uniform scale (Higgins & Green, 2011).

A random effects model was used to account for the expected heterogeneity of participants and interventions. Heterogeneity was assessed using the chi-squared test, with  $p = 0.10$  as the cut-off value for significance because chi-squared tests can be underpowered in smaller meta-analyses. The  $I^2$  statistic and a forest plot were used as additional indicators for heterogeneity (Higgins & Green, 2011). A funnel plot and Orwin's fail-safe N (1983) were chosen to assess publication bias.

#### Cluster-randomised trials

Cluster-randomised trials that did not account for clustering in their analyses were adjusted by inflating standard errors (SEs) according to recommendations by Higgins and Green (2011). This method calculates a design effect (DE) based on average cluster size ( $M$ ) and an intraclass correlation coefficient (ICC).

The DE is then used to inflate the SE of an effect estimate:

$$DE = 1 + [ICC(M - 1)]$$

$$SE_{adjusted} = SE_{original} \times \sqrt{DE}$$

The original effect size estimate can then be used with the adjusted SE to account for clustering. An ICC of 0.05 was chosen based on previous research. Campbell, Grimshaw, and Steen (2000) found that ICCs for outcome variables within primary

care were generally less than 0.05. The Health Services Research Unit (2004) found that asthma studies had ICCs between 0.03 and 0.08. Studies with continuous outcome measures had ICCs ranging from 0.00 to 0.08 (Health Services Research Unit, 2004). Both Wong et al. (2017) and García-Cárdenas et al. (2013) cited an ICC of 0.05 for studies on pharmacist-led interventions for asthma.

### *Sensitivity-analyses*

Sensitivity analyses were conducted based on ICCs (0.01, 0.05, 0.07, 0.10), risk of bias ratings (high risk studies excluded), mixed age participant samples (studies with participants under the age of 18 excluded), and meta-analysis model (fixed versus random effects). This was done to demonstrate that results of the meta-analysis were not dependent on the research decisions made for the review (Higgins & Green, 2011).

### *Narrative synthesis*

Data that was not captured in the meta-analysis was analysed in a narrative synthesis. Studies that found an intervention effect (positive studies) were compared with studies that did not (negative studies) based on risk of bias, study characteristics (research design, location and healthcare setting, and outcome measures), sample characteristics, and intervention characteristics (delivery and content).

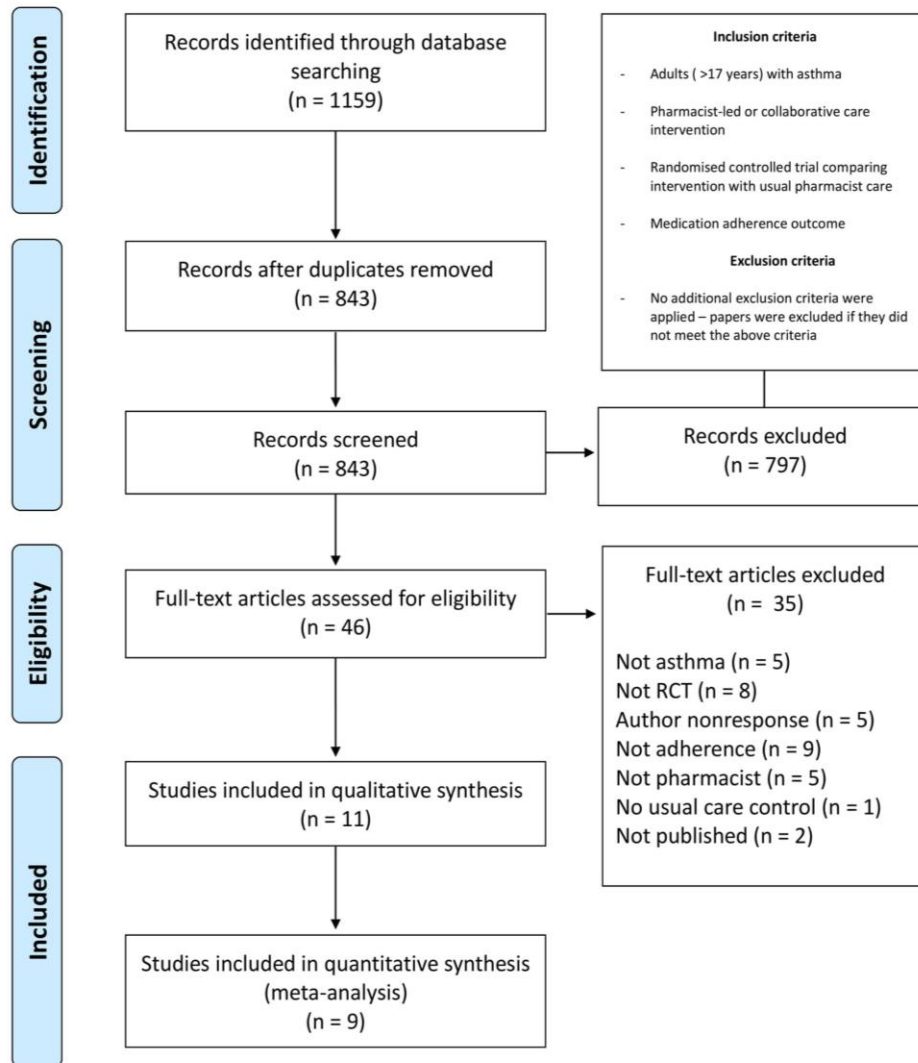
Intervention content was analysed last to rule out findings due to other factors (e.g. high risk of bias). The BCT and PAPA codes were used to categorise and analyse intervention content. A preliminary synthesis of findings to identify potentially effective intervention components was generated. The robustness of this synthesis was then tested by reflecting critically on the review process and applying it across different interventions with members of the research team (Popay et al., 2006).

## 6.4 Results

### 6.4.1 Study selection

The database search retrieved 1159 records, with 843 remaining after duplicates were removed. There were 20 inconsistent inclusion decisions between researchers during title, abstract, and key word screening. There was confusion about what constituted an adequate randomisation method, and whether a ratio of preventer to reliever inhalers was considered an adherence measure. The issue regarding randomisation was resolved using examples from Higgins and Green (2011). Through discussion with the research team, preventer-reliever inhaler ratios were categorised as a proxy measure of asthma control, rather than a direct adherence measure. All inconsistent inclusion decisions were resolved through consensus, 797 records were excluded and 46 records were selected for full-text review (see Figure 9).

There were six inconsistent inclusion decisions during full-text screening concerning randomisation, publication status, and suitable adherence outcome measures. These were all resolved through consensus, and 35 records were excluded at this stage. Five studies were excluded because they had mixed participant samples (asthma/COPD or all long-term conditions) and separate data for asthma was not available. Eight studies were excluded because they did not meet the criteria for a RCT. Five studies did not publish enough information to make an inclusion decision and authors did not respond when contacted for further information. Nine studies did not measure adherence, and five studies had interventions delivered by someone other than a pharmacist (pharmacy students, researchers, hospital staff, and psychologists). One study was excluded because it compared two types of interventions and lacked a usual care control group. Finally, two papers (one DPharm thesis and one study protocol) were excluded because results were not published yet (see Figure 9).



**Figure 9.** PRISMA flowchart for the inclusion of studies in the systematic review of pharmacist-led interventions and adherence in asthma.

Following study selection and the resulting 11 studies eligible for inclusion in the review, the research team discussed potentially revisiting and expanding the inclusion criteria to 1.) increase the number of included studies and 2.) include studies from the United Kingdom. Expanding the criteria to include other study designs, ages and conditions (e.g. asthma and COPD combined) was discussed.

We felt that expanding the review to include other study designs would have increased the risk of bias across the review. Focusing on adherence in other age groups, such as

children and adolescents, was beyond the scope of this PhD and previous research suggests that factors affecting adherence differ in children and adolescents compared to adults (Pearce et al., 2018). Therefore, grouping all age groups together may have hindered the identification of effective intervention components for our target group (adults with asthma).

We theorised that factors affecting adherence in people with asthma and people with COPD were different. For example, while asthma and COPD symptoms are similar, people with asthma experience variable symptoms (i.e. exacerbations) while those with COPD may experience constant symptoms, and this may affect their perceived need for treatment (Halm et al., 2006; Horne, 2003). Therefore, including studies that combined people with asthma or COPD into one group, as was the case with the evaluation of the New Medicine Service in the UK (Elliott et al., 2016), may have decreased the generalisability of review findings to the population with asthma alone. Given the discussions outlined above, the original inclusion criteria were maintained for the review.

Four studies had a small percentage of participants under the age of 18 years. Two studies (Charrois et al., 2006; Mehuys et al., 2008) included 17-year-old participants. Cordina et al. (2001) included participants between the ages of 14 and 82 years. Munzenberger and Hill (2007) included participants between the ages of four and 70 years. However, participant samples consisted primarily of adults and the majority of under-aged participants were old enough to administer their own medication. Eleven studies (Armour et al., 2007; Charrois et al., 2006; Cordina et al., 2001; García-Cárdenas et al., 2013; Manfrin et al., 2017; Mehuys et al., 2008; Munzenberger & Hill, 2007; Wang et al., 2010; Wong et al., 2017; Xaubet Olivera et al., 2016; Young et al., 2012) were eventually included in the review.

The authors of eight studies (Armour et al., 2007; Charrois et al., 2006; Cordina et al., 2001; Mehuys et al., 2008; Munzenberger & Hill, 2007; Wong et al., 2017; Xaubet Olivera et al., 2016; Young et al., 2012) were able to provide additional information about their interventions and study design. Wang et al. (2010) and García-Cárdenas et al. (2013) did not respond to attempts for contact. Manfrin et al. (2017) could only provide basic information about the Italian Medicines Use Review (I-MUR) content due to intellectual property restrictions after the success of the trial. They recommended using the English MUR as a reference because it was the original basis for the I-MUR.

#### 6.4.2 Study characteristics

Study characteristics are outlined in Table 4.

Table 4. Research design, location, and outcome characteristics of the studies included in the systematic review on pharmacist-led interventions and adherence in asthma

Study	Randomised	<i>n</i>		Follow-up (months)	Country	Healthcare Setting <sup>a</sup>	Adherence Measure <sup>b</sup>	<i>p</i> < 0.05? <sup>c</sup>
		IG	CG					
Armour et al. (2007)	Cluster	165	186	6	Australia	Community	Brief Medication Questionnaire (BMQ)	Yes
Charrois et al. (2006)	Patient	36	34	6	Canada	Community	Prescription refill rates	No
Cordina et al. (2001)	Cluster	64	55	12	Malta	Community	Self-reported rates of forgetting per day	No
García-Cárdenas et al. (2013)	Cluster	186	150	6	Spain	Community	MMAS-4	Yes
Manfrin et al. (2017)	Cluster	400	416	9	Italy	Community	2 items from MMAS-8	Yes
Mehuys et al. (2008)	Patient	80	70	6	Belgium	Community	Prescription refill and Self-report: “How often do you not take your controller as prescribed?”	Yes
Munzenberger & Hill (2007)	Patient	31	29	5.3	USA	Community	Self-report, appropriate use of inhaled steroid: “How often do you take your controller medication?”	No
Wang et al. (2010)	Patient	29	32	6	Taiwan	Outpatient	MMAS-4	No
Wong et al. (2017)	Cluster	80	77	6	Malaysia	Outpatient and Telepharmacy	MALMAS	Yes
Xaubet Olivera et al. (2016)	Patient	52	53	4	Brazil	Outpatient	MMAS-4 and prescription refill rates	Yes
Young et al. (2012)	Patient	41	42	6	USA	Telepharmacy	MMAS-8	No

<sup>a</sup>Community pharmacy (community), ambulatory care/outpatient clinics (outpatient), telephone-based (telepharmacy); <sup>b</sup>Morisky Medication Adherence Scale (MMAS, 4 and 8 items), Malaysian Medication Adherence Scale (MALMAS); <sup>c</sup>Yes (significant intervention effect, *p* < 0.05) and No (no significant intervention effect, *p* ≥ 0.05)

### *Randomisation*

All included studies were RCTs. Five studies (Armour et al., 2007; Cordina et al., 2001; García-Cárdenas et al., 2013; Manfrin et al., 2017; Wong et al., 2017) were cluster-randomised at the pharmacy or clinic level. Manfrin et al. (2017) cluster-randomised pharmacists to either immediately deliver the intervention or to deliver the intervention three months after baseline (phased intervention method). The remaining studies (Charrois et al., 2006; Mehuys et al., 2008; Munzenberger & Hill, 2007; Xaubet Olivera et al., 2016; Young et al., 2012) were randomised at the participant level with one intervention and one control group. Wang et al. (2010) randomised at the participant level with two intervention groups (a nurse-led intervention with and without pharmacist counselling) and one control group. The nurse-led intervention group without the added pharmacist counselling was excluded from the review.

### *Nature of control group*

All studies met the criteria for a usual pharmacist care control group. However, there may have been subtle differences between control groups. For example, three interventions (Wang et al., 2010; Wong et al., 2017; Young et al., 2012) were delivered in clinical settings (hospitals or federal health clinics). The quality of care for the usual care group in these studies may have been higher than in a community pharmacy. In addition, control participants in two studies received asthma and medication information in the form of an educational asthma booklet (Charrois et al., 2006) or inhaler technique checks (Xaubet Olivera et al., 2016).

### *Length of follow-up*

Seven studies (Armour et al., 2007; Charrois et al., 2006; García-Cárdenas et al., 2013; Mehuys et al., 2008; Wang et al., 2010; Wong et al., 2017; Young et al., 2012) had a



follow-up period of six months. Cordina et al. (2001) had the longest follow-up period with 12 months, followed by Manfrin et al. (2017) with nine months. Xaubet Olivera et al. (2016) had a follow-up period of 4 months. The intervention by Munzenberger and Hill (2007) was delivered during participants' routine pharmacy visits. The average time taken from baseline to completion was 5.3 months (Munzenberger & Hill, 2007).

#### *Location and context*

Studies were conducted in Australia (Armour et al., 2007), Canada (Charrois et al., 2006), Malta (Cordina et al., 2001), Spain (García-Cárdenas et al., 2013), Belgium (Mehuys et al., 2008), Taiwan (Wang et al., 2010), Italy (Manfrin et al., 2017), Malaysia (Wong et al., 2017), Brazil (Xaubet Olivera et al., 2016), and the United States of America (USA) (Munzenberger & Hill, 2007; Young et al., 2012). Xaubet Olivera et al. (2016) and Wang et al. (2010) delivered their interventions in a hospital-based asthma outpatient clinic. Pharmacists working with Wong et al. (2017) delivered face-to-face sessions in government health clinics, with an additional telephone-based session. The intervention by Young et al. (2012) was completely telephone-based. The remaining seven studies (see Table 4) were delivered in a community pharmacy setting.

#### *Study outcomes*

Five studies (Cordina et al., 2001; Wang et al., 2010; Wong et al., 2017; Xaubet Olivera et al., 2016; Young et al., 2012) listed medication adherence as a primary outcome measure. The most common primary outcome was asthma control. Other outcome measures included asthma knowledge, inhaler technique, pulmonary function, quality of life, patient satisfaction, patient activation, and cost-effectiveness.

Adherence as a behavioural outcome was commonly paired with clinical outcomes such as asthma control to assess intervention effectiveness.

Six studies (Armour et al., 2007; García-Cárdenas et al., 2013; Wang et al., 2010; Wong et al., 2017; Xaubet Olivera et al., 2016; Young et al., 2012) used validated self-report scales to measure adherence. These included the Brief Medication Questionnaire (Svarstad et al., 1999), Malaysian Medication Adherence Scale (MALMAS) (Chung, Chua, Lai, & Morisky, 2015), and Morisky Medication Adherence Scale with four items (MMAS-4) (Morisky et al., 1986) or eight items (MMAS-8) (Morisky et al., 2008).

Manfrin et al. (2017) used two items from the MMAS-8 (Morisky et al., 2008) in the interest of brevity. Cordina et al. (2001) used a questionnaire and patient interviews to assess how often participants forgot to take their ICS. Munzenberger and Hill (2007) used one item on a questionnaire to determine whether ICS was being used as prescribed: “How often is the medication you checked in question 8 above taken by you/your child? – only as needed, once a day, 2 times a day, 3 times a day, 4 or more times a day, or every other day” (Munzenberger & Hill, 2007, p. 155). Mehuys et al. (2008) used a single item to assess adherence; “how often do you not take your controller medication as prescribed?” with five response categories (never, 1 to 2 times per year, 1 to 2 times per month, 1 to 2 times per week, and daily) (p. 792). Xaubet Olivera et al. (2016), Mehuys et al. (2008), and Charrois et al. (2006) used prescription refill data to calculate adherence rates (see Table 5).

Table 5. Studies included in the systematic review using pharmacy-based data to calculate adherence

<u>Study</u>	<u>Adherence Measure</u>	<u>Calculated as</u>
Charrois et al. (2006)	Inhaled corticosteroid use	Prescriptions refilled at baseline and at 6 months
Mehuys et al. (2008)	Adherence rate (%)	$\frac{(total\ number - number\ of\ days\ last\ supplied)}{(last - first\ claim\ date)} \times 100$
Xaubet Olivera et al. (2016)	Mean percentage of drugs dispensed	$\frac{number\ of\ months\ of\ dispensing}{total\ number\ of\ months} \times 100$

#### 6.4.3 Participant characteristics

Participant characteristics are outlined in Table 6.

Table 6. Participant characteristics of studies included in the systematic review on pharmacist-led interventions and adherence in asthma

<u>Study</u>	<u>Age (years)</u>	<u>Gender (% male)</u>	<u>Uptake</u>	<u>Attrition</u>	<u>Asthma Control<sup>a</sup></u>
Armour et al. (2007)	50.2 ± 16.4	35.0%	-	11.4%	Mixed
Charrois et al. (2006)	37.2 ± 10.5	47.2%	77.4%	1.4%	Uncontrolled only
Cordina et al. (2001)	43.2 ± 18.3	50.6%	-	21.7%	Mixed
García-Cárdenas et al. (2013)	55.8 ± 19.1	46.1%	97.1%	9.9%	Mixed
Manfrin et al. (2017)	54.1 ± 17.2	41.2%	-	35.4%	Mixed
Mehuys et al. (2008)	35.7 ± 5.5	46.9%	72.8%	25.4%	Mixed
Munzenberger & Hill (2007)	36.1 ± 14.5	23.3%	100%	26.8%	Uncontrolled only
Wang et al. (2010)	28.2 ± 10.9	72.1%	-	11.6%	Mixed
Wong et al. (2017)	55.2 ± 13.3	46.5%	79.5%	8.2%	Mixed
Xaubet Olivera et al. (2016)	52.0 ± 10.2	27.6%	-	11.8%	Mixed
Young et al. (2012)	44.6 ± 15.8	23.5%	77.8%	15.3%	Mixed
Overall	50.2 ± 16.0	41.8% ± 14.2%	84.1% ± 11.5%	16.3% ± 9.9%	-

Values expressed as means ± standard deviations and percentages (%)  
<sup>a</sup>Mixed levels of controlled, partly controlled, and uncontrolled asthma (Mixed)

### *Age*

The mean participant age across the review was  $50.2 \pm 16.0$  years, ranging from  $28.2 \pm 10.9$  years (Wang et al., 2010) to  $55.8 \pm 19.1$  (García-Cárdenas et al., 2013). Seven studies (Armour et al., 2007; García-Cárdenas et al., 2013; Manfrin et al., 2017; Wang et al., 2010; Wong et al., 2017; Xaubet Olivera et al., 2016; Young et al., 2012) had adult participants (18 years and over). Despite the inclusion of four studies with some participants under the age of 18 (Charrois et al., 2006; Cordina et al., 2001; Mehuys et al., 2008; Munzenberger & Hill, 2007), the mean age across all studies fell above 18 years. The maximum percentage of participants in any study under the age of 18 was 23%.

### *Gender*

The mean percentage of male participants was  $41.8\% \pm 14.2\%$ . Five studies (Armour et al., 2007; Munzenberger & Hill, 2007; Wang et al., 2010; Xaubet Olivera et al., 2016; Young et al., 2012) had an uneven proportion of male and female participants. The remaining six studies (Charrois et al., 2006; Cordina et al., 2001; García-Cárdenas et al., 2013; Manfrin et al., 2017; Mehuys et al., 2008; Wong et al., 2017) had an equal distribution of male and female participants.

### *Asthma Control*

Nine studies (Armour et al., 2007; Cordina et al., 2001; García-Cárdenas et al., 2013; Manfrin et al., 2017; Mehuys et al., 2008; Wang et al., 2010; Wong et al., 2017; Xaubet Olivera et al., 2016; Young et al., 2012) had a mixture of controlled, partly controlled, and uncontrolled asthma. Cordina et al. (2001), Wang et al. (2010), Wong et al. (2017), and Young et al. (2012) had equal proportions of each control category in their samples. Armour et al. (2007), García-Cárdenas et al. (2013), and Xaubet Olivera et al. (2016) had a higher proportion of uncontrolled asthma in their samples. Manfrin et

al. (2017) and Mehuys et al. (2008) had a higher proportion of participants with controlled and partly controlled asthma. Two studies (Charrois et al., 2006; Munzenberger & Hill, 2007) focused solely on participants with uncontrolled ('high risk' or 'persistent') asthma.

#### *Uptake and attrition*

The total number of participants across the studies was  $N = 2,308$ , with a total of 1,164 and 1,144 participants in the intervention and control groups respectively. The median sample size across studies was 119 (IQR = 77 – 247). The median sample size was 64 (IQR = 39 – 123) for the intervention groups and 55 (IQR = 38 – 114) for the control groups. The mean rate of study uptake was high ( $84.1\% \pm 11.5\%$ ) for the six studies that reported this data (Charrois et al., 2006; García-Cárdenas et al., 2013; Mehuys et al., 2008; Munzenberger & Hill, 2007; Wong et al., 2017; Young et al., 2012). The mean attrition rate across the review was  $16.3\% \pm 9.9\%$ , ranging from 1.4% (Charrois et al., 2006) to 35.4% (Manfrin et al., 2017).

#### 6.4.4 Risk of bias assessments

Assessments for each risk of bias domain are outlined per study in Figure 10.

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Armour et al. 2007	+	+	-	-	+	+	?
Charrois et al. 2006	+	+	-	+	-	+	-
Cordina et al. 2001	+	+	-	-	-	+	-
Garcia Cardenas et al. 2013	+	+	-	-	+	+	-
Manfrin et al. 2017	+	+	-	-	+	+	-
Mehuys et al. 2008	+	+	-	+	+	+	-
Munzenberger et al. 2007	+	-	-	-	+	+	-
Wang et al. 2010	?	-	-	-	-	+	+
Wong et al. 2017	+	+	-	-	+	+	+
Xaubet Olivera et al. 2016	+	+	-	+	+	+	+
Young et al. 2012	+	+	-	-	+	+	-

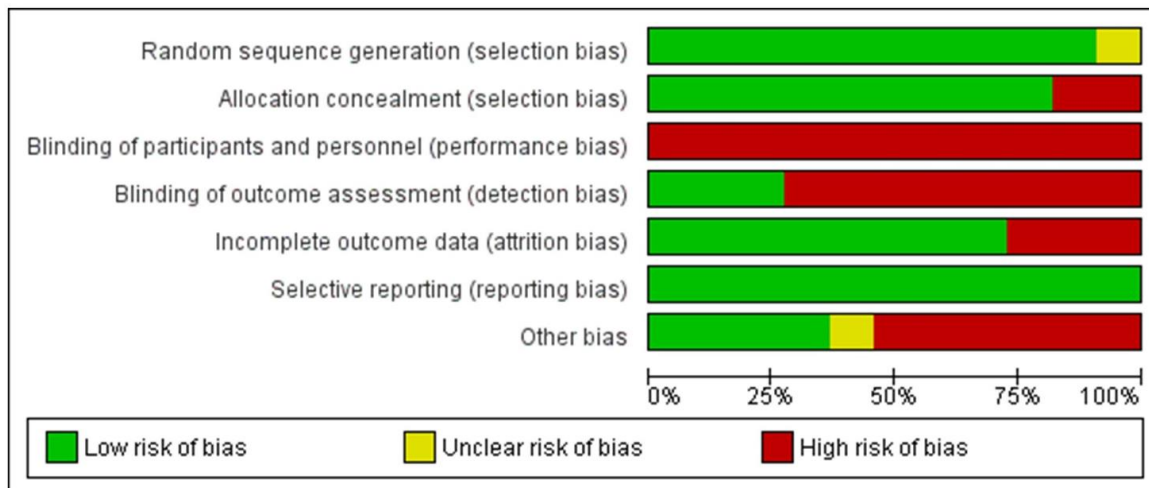
**Figure 10.** Risk of bias summary for included studies. Review authors' judgments about the risk of bias domains for each included study.

Based on these domains, each study was given an overall low, moderate, or high risk of bias rating (see Table 7).

Table 7. Overall risk of bias ratings for studies included in the systematic review on pharmacist-led interventions and adherence in asthma

<u>Study</u>	<u>Overall risk of bias</u>	<u>Explanation</u>
Armour et al. (2007)	Moderate	High risk of performance, detection, and other bias.
Charrois et al. (2006)	High	High risk of performance, attrition and other bias.
Cordina et al. (2001)	High	High risk of performance, detection, attrition, and other bias.
García-Cárdenas et al. (2013)	Low	High risk of performance, detection and other bias
Manfrin et al. (2017)	High	High risk of performance, detection, and other bias.
Mehuys et al. (2008)	Moderate	High risk of performance and other bias.
Munzenberger et al. (2007)	High	High risk of selection, performance, detection, and other bias.
Wang et al. (2010)	High	High risk of selection, performance, detection and attrition bias.
Wong et al. (2017)	Low	Low risk of bias across all domains, except for performance and detection bias.
Xaubet Olivera et al. (2016)	Low	High risk of performance bias. Low risk of bias across the remaining domains.
Young et al. (2012)	Moderate	High risk of performance, detection, and other bias.

Five studies (Charrois et al., 2006; Cordina et al., 2001; Manfrin et al., 2017; Munzenberger & Hill, 2007; Wang et al., 2010) were categorised as having a high risk of bias. Only two studies (Wong et al., 2017; Xaubet Olivera et al., 2016) could be categorised as having a low risk of bias. The risk of bias across all studies is summarised in Figure 11.



**Figure 11.** Risk of bias graph. Review authors' judgment on the types of bias present across the review

As shown above, all studies had a high risk of performance bias. However, as previously mentioned, reducing performance bias in behavioural intervention studies is difficult because the control and intervention conditions are noticeably different for participants. The risk of selection bias was low as most studies adequately addressed random sequence generation (91% of studies) and allocation concealment (82% of studies). Armour et al. (2007), Charrois et al. (2006), Cordina et al. (2001), García-Cárdenas et al. (2013), Manfrin et al. (2017), Xaubet Olivera et al. (2016), and Wong et al. (2017) used computer- or Internet-based randomisation services. Mehuys et al. (2008) used a randomisation table and Young et al. (2012) used a block randomisation scheme. Munzenberger and Hill (2007) asked pharmacists to blindly pick a number (odd or even) from an envelope. One study (Wang et al., 2010) did not outline their method of randomisation.

The risk of detection bias for the adherence outcome was high in eight studies because self-report measures were used (Armour et al., 2007; Cordina et al., 2001; García-Cárdenas et al., 2013; Manfrin et al., 2017; Munzenberger & Hill, 2007; Wang et al., 2010; Wong et al., 2017; Young et al., 2012). Self-report measures are prone to



detection bias when participants are not blinded to their allocation, as is mostly the case with behavioural intervention trials. The studies with a low risk of detection bias used pharmacy-based data to measure medication adherence (Charrois et al., 2006; Mehuys et al., 2008; Xaubet Olivera et al., 2016).

Other sources of bias were present in more than half of the included studies (see Figure 11). For example, four studies (Charrois et al., 2006; Mehuys et al., 2008; Munzenberger & Hill, 2007; Young et al., 2012) had a high risk of other bias because they were randomised at the participant level and contamination of the control group was likely. Xaubet Olivera et al. (2016) randomised at the participant level, but the intervention was delivered in groups and this made separating control and intervention participants easier. Manfrin et al. (2017), Cordina et al. (2001), and Munzenberger and Hill (2007) used non-validated self-report measures to measure adherence. Young et al. (2012) asked participants to answer questionnaires over the telephone. This may have introduced social desirability bias: when participants alter their responses to appear more socially acceptable or desirable (DeMaio, 1984; Feveile, Olsen, & Hogh, 2007).

#### 6.4.5 Meta-analysis

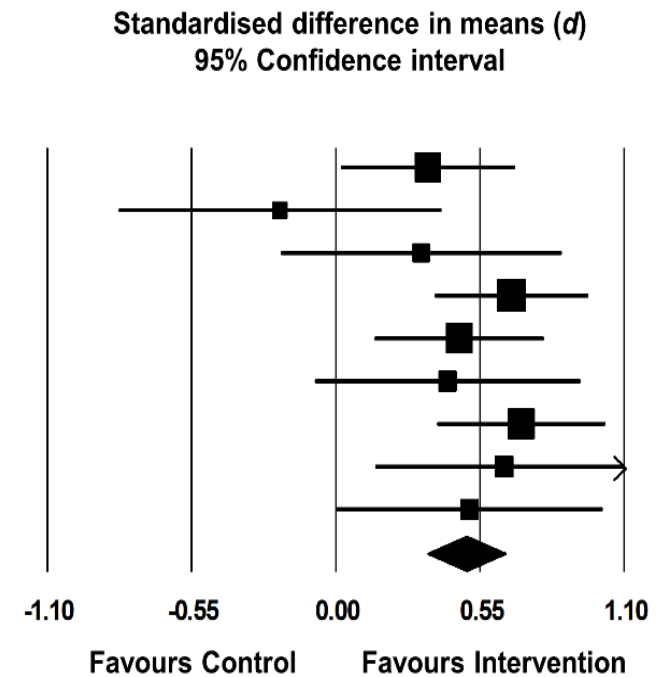
Munzenberger and Hill (2007) and Manfrin et al. (2017) were excluded from the meta-analysis due to insufficient quantitative data on adherence. The remaining nine studies were included. Six studies (Charrois et al., 2006; Mehuys et al., 2008; Wang et al., 2010; Wong et al., 2017; Xaubet Olivera et al., 2016; Young et al., 2012) had data that could be inputted into CMA without adjustment. Adherence data from three cluster-randomised trials (Armour et al., 2007; Cordina et al., 2001; García-Cárdenas et al., 2013) were adjusted by inflating SEs.

The meta-analysis produced a medium effect size for pharmacist-led interventions and medication adherence,  $d = 0.49$  (SE = 0.08, 95% CI 0.35 – 0.64,  $p < 0.0001$ ). The width of the confidence interval (0.29) suggests that the estimate is moderately precise. The chi-squared statistic indicated that there was low statistical heterogeneity in the analysis ( $\chi^2 = 9.84$ , df = 8,  $p = 0.28$ ). With the exception of three studies (Charrois et al., 2006; García-Cárdenas et al., 2013; Wong et al., 2017), the included studies had confidence intervals (CIs) with good overlap on the forest plot (see Figure 12). The  $I^2$  statistic indicated a low percentage of variability in the effect estimates ( $I^2 = 16.4\%$ ), according to guidelines by Higgins and Green (2011). Based on these findings, there was not enough evidence of statistical heterogeneity to justify moderator analyses. Publication bias analyses could not be conducted due to the small number of included studies (Macaskill, Walter, & Irwig, 2001).

#### *Sensitivity analyses*

All sensitivity analyses are outlined in Table 8. Findings were consistent across ICCs, with high risk studies removed, with mixed participant sample studies removed, and across meta-analysis models.

Study name	Statistics for each study						
	Std diff in means	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Amour et al. 2007	0.35	0.17	0.03	0.02	0.69	2.05	0.04
Charrois et al. 2006	-0.21	0.31	0.10	-0.83	0.40	-0.68	0.50
Cordina et al. 2001	0.33	0.27	0.08	-0.21	0.86	1.19	0.24
Garcia Cardenas et al. 2013	0.67	0.15	0.02	0.37	0.97	4.44	0.00
Mehuys et al. 2008	0.47	0.17	0.03	0.15	0.80	2.84	0.00
Wang et al. 2010	0.43	0.26	0.07	-0.08	0.93	1.64	0.10
Wong et al. 2017	0.71	0.16	0.03	0.38	1.03	4.30	0.00
Xaubet Clivera et al. 2016	0.64	0.25	0.06	0.15	1.14	2.54	0.01
Young et al. 2012	0.51	0.26	0.07	0.00	1.02	1.96	0.05
	0.49	0.08	0.01	0.35	0.64	6.57	0.00



**Figure 12.** Forest plot for the meta-analysis. The effect of pharmacist-led interventions on adherence expressed as the standardised mean difference (*d*).

Table 8. Sensitivity analyses for the systematic review examining the effect of intraclass correlation coefficients (ICCs), risk of bias, mixed participant age, and meta-analysis model on the overall weighted effect size.

<b>Intraclass correlation coefficients (ICCs)</b>					
<u>ICC</u>	<u>d</u>	<u>Lower limit</u> <u>95% CI</u>	<u>Upper limit</u> <u>95% CI</u>	<u>Overall effect</u>	<u>Heterogeneity</u>
0.01	0.49	0.35	0.64	Z = 6.59 p < 0.0001	$\chi^2 = 10.00$ , df = 8 (p = 0.26) I <sup>2</sup> = 20.05%
0.05	0.49	0.35	0.64	Z = 6.57 p < 0.0001	$\chi^2 = 9.84$ , df = 8 (p = 0.28) I <sup>2</sup> = 16.42%
0.07	0.50	0.35	0.64	Z = 6.55 p < 0.0001	$\chi^2 = 9.38$ , df = 8 (p = 0.31) I <sup>2</sup> = 14.76%
0.10	0.50	0.35	0.64	Z = 6.53 p < 0.0001	$\chi^2 = 9.15$ , df = 8 (p = 0.33) I <sup>2</sup> = 12.72%
<b>Studies with a high risk of bias excluded</b>					
None excluded	0.49	0.35	0.64	Z = 6.57 p < 0.0001	$\chi^2 = 9.84$ , df = 8 (p = 0.28) I <sup>2</sup> = 16.42%
Charrois et al. (2006)	0.54	0.40	0.67	Z = 7.78 p < 0.0001	$\chi^2 = 4.14$ , df = 7 (p = 0.76) I <sup>2</sup> = 0%
Cordina et al. (2001)	0.50	0.34	0.66	Z = 6.18 p < 0.0001	$\chi^2 = 9.11$ , df = 7 (p = 0.24) I <sup>2</sup> = 23%
Wang et al. (2010)	0.49	0.33	0.66	Z = 5.91 p < 0.0001	$\chi^2 = 9.46$ , df = 7 (p = 0.22) I <sup>2</sup> = 26%
Charrois and Cordina	0.55	0.41	0.69	Z = 7.73 p < 0.0001	$\chi^2 = 3.51$ , df = 6 (p = 0.74) I <sup>2</sup> = 0%
Cordina and Wang	0.51	0.33	0.68	Z = 5.54 p < 0.0001	$\chi^2 = 8.99$ , df = 6 (p = 0.17) I <sup>2</sup> = 33%
Charrois and Wang	0.55	0.41	0.69	Z = 7.62 p < 0.0001	$\chi^2 = 3.94$ , df = 6 (p = 0.68) I <sup>2</sup> = 0%
Three studies removed	0.56	0.42	0.71	Z = 7.57 p < 0.0001	$\chi^2 = 3.25$ , df = 5 (p = 0.66) I <sup>2</sup> = 0%
<b>Studies with mixed age participant samples excluded</b>					
None excluded	0.49	0.35	0.64	Z = 6.57 p < 0.0001	$\chi^2 = 9.84$ , df = 8 (p = 0.28) I <sup>2</sup> = 16.42%
Charrois et al. (2006)	0.54	0.40	0.67	Z = 7.78 p < 0.0001	$\chi^2 = 4.14$ , df = 7 (p = 0.76) I <sup>2</sup> = 0%
Mehuys et al. (2008)	0.49	0.32	0.66	Z = 5.51 p < 0.0001	$\chi^2 = 9.51$ , df = 7 (p = 0.22) I <sup>2</sup> = 26%
Charrois and Mehuys	0.55	0.40	0.70	Z = 7.26 p < 0.0001	$\chi^2 = 3.95$ , df = 6 (p = 0.68) I <sup>2</sup> = 0%
Cordina et al. (2001)	0.50	0.34	0.66	Z = 6.18 p < 0.0001	$\chi^2 = 9.11$ , df = 7 (p = 0.24) I <sup>2</sup> = 23%
Cordina and Mehuys	0.50	0.31	0.69	Z = 5.14 p < 0.0001	$\chi^2 = 9.03$ , df = 6 (p = 0.17) I <sup>2</sup> = 34%
Cordina and Charrois	0.55	0.41	0.69	Z = 7.73 p < 0.0001	$\chi^2 = 3.51$ , df = 6 (p = 0.74) I <sup>2</sup> = 0%
Three studies removed	0.57	0.42	0.73	Z = 7.22 p < 0.0001	$\chi^2 = 3.21$ , df = 5 (p = 0.67) I <sup>2</sup> = 0%
<b>Meta-analysis model used</b>					
Random	0.49	0.35	0.64	Z = 6.57 p < 0.0001	$\chi^2 = 9.84$ , df = 8 (p = 0.28) I <sup>2</sup> = 16.42%
Fixed	0.50	0.37	0.64	Z = 7.47 p < 0.0001	$\chi^2 = 9.56$ , df = 8 (p = 0.30) I <sup>2</sup> = 16.42%

#### 6.4.6 Narrative synthesis

The following section will summarise the remaining data on intervention delivery and content. It will also compare studies that found a significant intervention effect (positive studies) with those that did not (negative studies) in terms of risk of bias, study characteristics (research design, location and healthcare setting, and outcome measures), sample characteristics, and intervention characteristics (delivery and content).

##### *Intervention delivery*

Intervention delivery involved two components: pharmacist training/support and the method of delivery.

##### *Pharmacist training and support*

Two studies (Wong et al., 2017; Xaubet Olivera et al., 2016) provided minimal training to intervention pharmacists. The pharmacist working with Wong et al. (2017) was recently trained as part of the Malaysian government's Respiratory Medication Therapy Adherence Clinic programme, a pharmacist-led ambulatory health service offering medication support for asthma and/or COPD (Clinical Pharmacy Committee - Respiratory Subspecialty, 2010). The pharmacist in the other study (Caroline Xaubet Olivera) was a pharmacist who developed the intervention as part of her PhD (Xaubet Olivera, 2013). With her previous pharmacy training and her involvement in the development of the programme, only updated inhaler technique training was needed.

Nine studies (Armour et al., 2007; Charrois et al., 2006; Cordina et al., 2001; García-Cárdenas et al., 2013; Manfrin et al., 2017; Mehuys et al., 2008; Munzenberger & Hill, 2007; Wang et al., 2010; Young et al., 2012) gave intervention pharmacists updated background information on asthma and its management. Four studies (Armour et al.,

2007; Cordina et al., 2001; Munzenberger & Hill, 2007; Wang et al., 2010) used a combination of self-study materials and face-to-face training sessions. Five studies (Charrois et al., 2006; García-Cárdenas et al., 2013; Manfrin et al., 2017; Mehuys et al., 2008; Young et al., 2012) provided only face-to-face training sessions.

Six studies used interactive training techniques such as role play and feedback (Armour et al., 2007; Manfrin et al., 2017; Young et al., 2012), patient actors (Charrois et al., 2006), group discussions of case studies (Armour et al., 2007; Charrois et al., 2006; Cordina et al., 2001), and question-and-answer sessions (Manfrin et al., 2017; Munzenberger & Hill, 2007). Pharmacists were trained in effective patient-provider communication by trained communication reviewers (Charrois et al., 2006; Young et al., 2012), researchers (Armour et al., 2007; Cordina et al., 2001; Munzenberger & Hill, 2007), and previously trained pharmacists (Manfrin et al., 2017).

Charrois et al. (2006) and Armour et al. (2007) sent pharmacists regular updates through a trial newsletter. García-Cárdenas et al. (2013) gave pharmacists a copy of the Spanish national asthma guidelines and had a facilitator visit pharmacists regularly. Furthermore, pharmacists could contact the researchers with any additional queries (García-Cárdenas et al., 2013).

#### Method of delivery

Nine interventions (Armour et al., 2007; Cordina et al., 2001; García-Cárdenas et al., 2013; Manfrin et al., 2017; Mehuys et al., 2008; Munzenberger & Hill, 2007; Wong et al., 2017; Xaubet Olivera et al., 2016; Young et al., 2012) were delivered exclusively by pharmacists. Charrois et al. (2006) used a collaborative intervention approach with pharmacists, respiratory therapists, and physicians. Wang et al. (2010) combined nurse-led asthma education with pharmacist-led medication support.

Pharmacists working with Young et al. (2012) delivered a telephone-based intervention. The intervention by Wong et al. (2017) included a face-to-face consultation with a telephone-based follow-up. The remaining nine interventions (Armour et al., 2007; Charrois et al., 2006; Cordina et al., 2001; García-Cárdenas et al., 2013; Manfrin et al., 2017; Mehuys et al., 2008; Munzenberger & Hill, 2007; Wang et al., 2010; Xaubet Olivera et al., 2016) were delivered face-to-face. Xaubet Olivera et al. (2016) delivered the intervention in group sessions, with a maximum of 10 participants per group. The remaining 10 interventions (Armour et al., 2007; Charrois et al., 2006; Cordina et al., 2001; García-Cárdenas et al., 2013; Manfrin et al., 2017; Mehuys et al., 2008; Munzenberger & Hill, 2007; Wang et al., 2010; Wong et al., 2017; Young et al., 2012) were delivered individually.

#### *Intervention content*

All BCT- and PAPA-based coding is outlined in Table 9.

#### *Perceptions and Practicalities Approach (PAPA)*

All interventions included an educational component about asthma. Common topics included asthma physiology (i.e. definitions, aetiology, disease progress, and complications), inhaler technique, self-management strategies (e.g. peak flow monitoring, symptom tracking), triggers and avoidance strategies, asthma treatment (i.e. medications, usage instructions, side effects, and treatment plans), and asthma control. Five interventions (Charrois et al., 2006; Cordina et al., 2001; Mehuys et al., 2008; Munzenberger & Hill, 2007; Wang et al., 2010) did not go beyond these educational components. They were categorised as non-PAPA interventions because they only addressed ability-related factors influencing adherence (Horne, 2001, 2015).

One intervention (Xaubet Olivera et al., 2016) was categorised as a partial PAPA intervention. Although it focused primarily on education, it included open and interactive group discussions about asthma- and medication-related concerns. The group component helped address both ability- and motivation-related barriers to adherence. However, the intervention could not be tailored to each individual participant because it took place in a group setting. Five studies (Armour et al., 2007; García-Cárdenas et al., 2013; Manfrin et al., 2017; Wong et al., 2017; Young et al., 2012) were categorised as full PAPA interventions. These interventions addressed both motivation- and ability-related factors in a tailored manner (Horne, 2001, 2015).

Pharmacists working with Armour et al. (2007) targeted participants' beliefs about their medication and their ability to remember to take their medication. They tailored the intervention using participants' responses on the Brief Medication Questionnaire (Svarstad et al., 1999). García-Cárdenas et al. (2013) targeted inhaler technique and participants' necessity beliefs and concerns about their medication. The Beliefs about Medicines Questionnaire (BMQ) (Horne et al., 1999) was used to identify the most salient causes of intentional non-adherence for each participant. Pharmacists working with Manfrin et al. (2017) were trained to use a consultation topic guide to identify individual issues with medication use, medication knowledge, and expectations for and beliefs about treatment. In addition, they learned to identify Pharmaceutical Care Issues (PCIs) using medication records and structured participant interviews. PCIs referred to any medication-related issues that could impact optimal medication use and asthma control (Krska, Cromarty, Arris, Jamieson, & Hansford, 2000).

The pharmacists working with Wong et al. (2017) used the MALMAS (Chung et al., 2015) in their consultations to identify whether non-adherence was intentional or unintentional. Each MALMAS item referred to a different domain of non-adherence



(e.g. forgetting or stopping due to side effects) and the study pharmacists used participant responses in combination with medication records to tailor counselling.

Young et al. (2012) trained intervention pharmacists to use a communication guide to identify and address three types of adherence barriers over the telephone; knowledge barriers (e.g. misconceptions about medication), practical barriers (e.g. resource constraints or regimen complexity), and motivation/efficacy barriers (e.g. medication-related concerns or low self-efficacy). Adherence support was tailored based on the type of barrier identified (Young et al., 2012).

### The Behaviour Change Techniques Taxonomy

The included studies implemented BCTs across eight categories; goals and planning, feedback and monitoring, shaping knowledge, comparison of behaviour, repetition and substitution, natural consequences, self-belief, and associations (Michie et al., 2013). The number of BCTs implemented ranged from one (Munzenberger & Hill, 2007) to nine techniques (Armour et al., 2007).

#### *Goal and planning*

Five BCTs were coded under this category: *1.1 Goal setting (behaviour)*, *1.3 Goal setting (outcome)*, *1.4 Action planning*, *1.5 Review behaviour goals*, and *1.7 Review outcome goals*. Goal setting involves setting a target in terms of the intended behaviour (behavioural goal) or an outcome of the intended behaviour (outcome goal) (Michie et al., 2013). Reviewing goals (outcome or behavioural) involves modifying behaviour change strategies and/or goals based on participants' progress (Michie et al., 2013). Action planning refers to the detailed planning of behaviour based on context, frequency, duration, and intensity (Michie et al., 2013).

Pharmacists working with Armour et al. (2007) set and reviewed goals with participants regarding their adherence (behaviour) and/or asthma control (outcome). These goals guided each consultation. In the intervention by García-Cárdenas et al. (2013), pharmacists helped participants set self-management goals, but the target of these goals (behaviour or outcome) was unclear from the publication.

Action planning was coded in five studies (Armour et al., 2007; Charrois et al., 2006; Munzenberger & Hill, 2007; Wong et al., 2017; Young et al., 2012) because they explicitly mentioned a Written Asthma Action Plan (WAAP). WAAPs can be viewed as action planning because they include instructions for daily management, personal triggers and warning signs before an exacerbation, patient-initiated treatment to tackle exacerbations, and seeking medical help when self-management is insufficient (Rank, Volcheck, Li, Patel, & Lim, 2008). Detailed descriptions of WAAPs can be found in Section 1.3.2 of this thesis.

#### *Feedback and monitoring*

Interventions included 2.2 *Feedback on behaviour*, 2.4 *Self-monitoring of outcomes of behaviour*, and 2.7 *Feedback on outcomes of behaviour*. Feedback entails monitoring and providing feedback on the performance of the behaviour or related outcomes (Michie et al., 2013). Self-monitoring refers to the people's efforts to monitor and record outcomes of their own behaviour as part of the behaviour change strategy (Michie et al., 2013).

Pharmacists working with Cordina et al. (2001) gave participants feedback on their PEF measurements (outcome of adherence behaviour), while those working with Manfrin et al. (2017) gave feedback using the PCIs identified in the consultation (adherence behaviour). Pharmacists working with Mehuys et al. (2008) used the

Asthma Control Test (ACT) (Nathan et al., 2004; Schatz et al., 2006) to give feedback about asthma control (outcome of behaviour). In terms of self-monitoring, participants in two studies (Cordina et al., 2001; Wang et al., 2010) were taught how to use a peak flow meter to monitor their PEF (outcome of behaviour).

Table 9. Intervention content coding for the systematic review using the Perceptions and Practicalities Approach (Horne et al., 2001; 2015) and the Behaviour Change Techniques Taxonomy (Michie et al., 2013).

Intervention Content Coding	<u>Armour et al. (2007)</u>	<u>Charrois et al. (2006)</u>	<u>Cordina et al. (2001)</u>	<u>Garcia-Cardenas et al. (2013)</u>	<u>Manfrin et al. (2017)</u>	<u>Mehuys et al. (2008)</u>	<u>Munzenberger &amp; Hill (2007)</u>	<u>Wang et al. (2010)</u>	<u>Wong et al. (2017)</u>	<u>Xaubet Olivera et al. (2016)</u>	<u>Young et al. (2012)</u>
<b>Perceptions and Practicalities Approach (PAPA)</b>											
Non-PAPA		✓	✓			✓	✓	✓			
Partial PAPA										✓	
Full PAPA	✓			✓	✓				✓		✓
<b>The Behaviour Change Techniques Taxonomy</b>											
Goal setting (behaviour)	✓										
Goal setting (outcome)	✓			✓							
Instructions on performing a behaviour	✓	✓	✓	✓		✓			✓	✓	✓
Demonstration of the behaviour	✓	✓	✓	✓					✓		
Review (behaviour goals)	✓										
Review (outcome goals)	✓										
Action planning	✓	✓					✓		✓		✓
Remove aversive stimulus	✓	✓	✓		✓						
Information about health consequences	✓		✓					✓	✓		
Self-monitoring of outcome of behaviour			✓					✓			
Feedback (on behaviour)			✓		✓						
Feedback (on outcomes of behaviour)			✓			✓					
Behavioural practice/rehearsal						✓					
Information of antecedents				✓						✓	
Verbal persuasion about capability											✓

### *Shaping knowledge*

Shaping knowledge included *4.1 Instruction on how to perform the behaviour* and *4.2 Information about antecedents*. Instructions on performing the behaviour was the most commonly used BCT across the review. It was coded in eight studies (Armour et al., 2007; Charrois et al., 2006; Cordina et al., 2001; García-Cárdenas et al., 2013; Mehuys et al., 2008; Wong et al., 2017; Xaubet Olivera et al., 2016; Young et al., 2012) as part of inhaler technique checks.

Providing information about antecedents refers to informing participants about which factors (e.g. situations, events, emotions, or cognitions) are known to reliably predict the target behaviour (Michie et al., 2013). Pharmacists working with García-Cárdenas et al. (2013) used participants' responses on the BMQ to discuss necessity beliefs and concerns as potential antecedents of intentional non-adherence (García-Cárdenas et al., 2013). Similarly, the intervention by Xaubet Olivera et al. (2016) included an educational session specifically about the common causes of non-adherence (Xaubet Olivera, 2013).

### *Comparison of behaviour & repetition and substitution*

Inhaler technique checks often involved *6.1 Demonstration of the behaviour* and *8.1 Behavioural practice and rehearsal* (Michie et al., 2013). Pharmacists in five interventions (Armour et al., 2007; Charrois et al., 2006; Cordina et al., 2001; García-Cárdenas et al., 2013; Wong et al., 2017) provided an observable example of correct inhaler technique in person or through visual aids. Pharmacists in the study by Mehuys et al. (2008) asked participants to demonstrate and practice inhaler technique several times after correction (Michie et al., 2013).

### *Natural consequences*

Four interventions (Armour et al., 2007; Cordina et al., 2001; Wang et al., 2010; Wong et al., 2017) implemented *5.1 Information about health consequences*: giving participants information about the health-related effects of performing the target behaviour (Michie et al., 2013). This involved pharmacists explaining the link between adherence and asthma control, followed by an explanation of the health consequences of uncontrolled asthma.

### *Self-belief associations*

Young et al. (2012) trained pharmacists in motivational interviewing to address motivation-related barriers to adherence. The communication guide given to pharmacists implemented *15.1 Verbal persuasion about capability*, which involves arguing against a participant's self-doubts and re-affirming their ability to adhere to medication (target behaviour) (Michie et al., 2013). Other interventions used *7.5 Remove aversive stimulus*, targeting any factors that might impede adherence behaviour (Michie et al., 2013). Pharmacists working with Manfrin et al. (2017), Armour et al. (2007), Charrois et al. (2006), and Cordina et al. (2001) reviewed participants' medication regimen to identify medication-related issues (e.g. side effects or contraindications) that may influence adherence behaviour.

### *Comparing interventions*

Six studies (Armour et al., 2007; García-Cárdenas et al., 2013; Manfrin et al., 2017; Mehuys et al., 2008; Wong et al., 2017; Xaubet Olivera et al., 2016) found that pharmacist-led interventions significantly improved adherence (positive studies). The remaining studies did not find a significant improvement in adherence (negative studies). The positive studies had a lower overall risk of bias than the negative studies. All cluster-randomised trials were powered to detect an effect, and found a significant

intervention effect (Armour et al., 2007; García-Cárdenas et al., 2013; Manfrin et al., 2017; Wong et al., 2017). These studies reduced the risk of contamination between groups.

In terms of location and context, four positive studies were conducted in community pharmacies in Australia (Armour et al., 2007), Spain (García-Cárdenas et al., 2013), Italy (Manfrin et al., 2017), and Belgium (Mehuys et al., 2008). Australia actively integrates pharmacists into public health policy. Furthermore, adequate training and remuneration (for pharmacists and referring physicians) is in place for delivering these services (Benrimoj & Frommer, 2004). While training for pharmacist-led care in Italy, Spain, and Belgium lags behind Australia, it is on the rise (Elsen & Libert, 2001; Gastelurrutia, Faus, & Fernández-Llimós, 2005; Manfrin et al., 2017). All three countries have a high number of pharmacists per 100,000 people (Eurostat, 2017). Furthermore, having a consistent relationship with a ‘family pharmacist’ is common in Belgium (Elsen & Libert, 2001). We concluded that these contextual factors may have contributed to intervention effectiveness.

Three negative studies were conducted in community pharmacies in Malta (Cordina et al., 2001), Canada (Charrois et al., 2006), and the USA (Munzenberger & Hill, 2007). In Canada, there are less pharmacists per 100,000 people, with greater geographic dispersion (Karim & Noott, 2011). This may have affected outcomes, especially since the Canadian study was conducted in a rural setting (Charrois et al., 2006). Characteristics of the healthcare systems in Malta and the USA may have prevented community pharmacists from taking on a more clinical role. At the time of the study in Malta, asthma was treated only through secondary and state healthcare (Cordina et al., 2001). Private health insurance policies in the USA often only covered

the cost of dispensing medication, and therefore did not cover the costs of additional pharmacist-led services (Christensen & Farris, 2006).

For intervention content, we found no differences in terms of the types and number of BCTs coded. According to the PAPA, five out of the six positive studies targeted both intentional and unintentional non-adherence by addressing both the motivation and ability to adhere (Armour et al., 2007; García-Cárdenas et al., 2013; Manfrin et al., 2017; Wong et al., 2017; Xaubet Olivera et al., 2016). The other positive study only targeted ability-related factors affecting adherence. However, this study recruited only regular visitors of the pharmacy. A higher interest in self-management and a good relationship with the pharmacist could have made these participants more responsive to the intervention (Mehuys et al., 2008). One negative study ( $p = 0.07$ ) also targeted both motivation and ability (Young et al., 2012). However, this intervention was delivered over the telephone to controlled and partly controlled asthma patients, possibly limiting its effect (McLean et al., 2010). There were no further differences between positive and negative studies in terms of risk of bias, research design, location and context, participants, outcome measures, intervention delivery, and intervention content.

## 6.5 Overview of findings

The meta-analysis found that pharmacist-led interventions can significantly improve adherence in adults with asthma, with a moderate effect size ( $d = 0.49$ ,  $SE = 0.08$ , 95% CI [0.35 – 0.64],  $p < 0.0001$ ). The narrative synthesis suggested that effective interventions employed a tailored approach targeting both the motivation and ability to adhere to medication, in line with the PAPA (Horne, 2001, 2015). Furthermore, where the intervention is delivered (country and healthcare setting) influences its effectiveness due to differences in pharmacy accessibility, healthcare and health



insurance infrastructure, pharmacist training, service funding, and pharmacist integration into healthcare policy. Five of the included interventions (45%) focused solely on asthma education. Most of the interventions (64%) were delivered in the community pharmacy context.

## 6.6 Discussion

### 6.6.1 Strengths and limitations

This review analysed potential factors affecting intervention effectiveness at several levels. We considered the influence of both patient characteristics (e.g. asthma control, age, gender) and pharmacist characteristics (e.g. pharmacist training) on study outcomes. On the contextual level, we went beyond looking at study location (country) and explored national healthcare policies, pharmacy guidelines, and pharmacy literature. In terms of the interventions themselves, we looked at both intervention content and delivery. When analysing content, we took a two-tiered analysis approach exploring what the interventions were trying to change (PAPA) and how they tried to achieve this change (BCT Taxonomy) (Horne, 2001; Michie et al., 2013).

All reviews are subject to the limitations of primary studies. None of the included studies were able to blind their participants to allocation. Participants may have had a preference for allocation and previous research shows that this can significantly affect study outcomes (Preference Collaborative Review Group, 2009). In addition, studies that used self-report measures of adherence with non-blinded participants were subject to detection bias. Contamination between the intervention and control groups may have been an issue in the studies randomised at the participant level.

Most studies had a follow-up period of six months, which limits our knowledge about the sustainability of intervention effects. With regards to measuring adherence, self-

report measures are pragmatic in application. However, there is a risk of participants not being truthful (Lam & Fresco, 2015). Furthermore, the act of filling in a questionnaire itself can affect participant behaviour in a behavioural trial (McCambridge et al., 2014). Only two studies had measures in place to ensure that the intervention was being delivered as intended (i.e. intervention fidelity) (Armour et al., 2007; García-Cárdenas et al., 2013).

We included a small number of studies and found low levels of heterogeneity in our analysis. As a result, we were unable to conduct moderator and publication bias analyses. Furthermore, the generalisability of our findings was limited. The cross-cultural applicability of our findings is unknown because most studies were conducted in Western cultures (Armour et al., 2007; Charrois et al., 2006; Cordina et al., 2001; García-Cárdenas et al., 2013; Manfrin et al., 2017; Mehuys et al., 2008; Munzenberger & Hill, 2007; Young et al., 2012). The guidelines for a small, medium, and large effect size ( $d$ ) do not translate directly into the healthcare realm. A small effect size for one condition may have a larger clinical impact than a large effect size for another condition (McGough & Faraone, 2009).

The moderate to high risk of bias across the review reduces the reliability of our findings. However, removing high-risk studies from the meta-analysis slightly increased the overall effect estimate ( $d = 0.49$  to  $d = 0.56$ ). We chose to retain these studies to avoid overestimating the intervention effect based on a smaller pool of data. Furthermore, behavioural intervention trials often cannot meet the criteria of the Cochrane Collaboration's risk of bias tool because it was based on clinical RCTs (Higgins et al., 2011). Medication adherence was mostly a secondary outcome and we did not analyse data for asthma control (the most common primary outcome). Data on adherence and subsequent asthma control was covered in a recent Cochrane review

(Normansell et al., 2017). We lacked sufficient detail to accurately code BCTs for each intervention and were unable to draw a conclusion about effective intervention components (Michie et al., 2013).

#### 6.6.2 Comparisons with existing literature

Hughes et al. (2010) also found significant differences between European countries in terms of pharmacy resources and care activities using a modified version of the Behavioural Pharmaceutical Care Scale (BPCS). For example, pharmacist-led care was affected by staffing differences. Community pharmacies in the United Kingdom, Malta, and Iceland often only had one full-time pharmacist, assisted by pharmacy technicians. In contrast, community pharmacies in Denmark, Germany, Switzerland, and Portugal often employed two or more full-time pharmacists (Hughes et al., 2010).

Most of the interventions included in the review were delivered in community pharmacies, suggesting that this may be a suitable context for pharmacist-led adherence support in the UK. Pharmacy accessibility was a key facilitator for these interventions, and the accessibility of UK community pharmacies is high (Todd et al., 2014; van Boven et al., 2016).

However, evaluations of previous community pharmacy interventions (see Section 3.1) highlighted several barriers to adherence support in the UK context. Firstly, remuneration schemes based on the number of consultations delivered put pressure on pharmacists to reach their targets, thereby making consultations a quick ‘tick-box exercise’ (Boyd et al., 2014; Latif et al., 2011). Secondly, public perception of community pharmacy hindered pharmacist-led care because people expected quick encounters at their pharmacies, and viewed their pharmacists as specialist shopkeepers rather than competent healthcare professionals (Latif et al., 2013). Finally, pharmacists in understaffed environments found it difficult to step away from other responsibilities

(e.g. overseeing prescriptions and dispensing) to conduct medication-related consultations (Boyd et al., 2014; Latif & Boardman, 2008; R. McDonald et al., 2010). This may have been exacerbated by the fact that UK community pharmacies often only employ one full-time pharmacist (Hughes et al., 2010).

In terms of intervention content, our findings regarding the PAPA align with previous studies that found significant relationships between adherence and ability-related factors such as inhaler technique, regimen complexity, asthma knowledge, forgetting, and socioeconomic status (AL-Jahdali et al., 2013; Barnes & Ulrik, 2015; Beasley, Weatherall, Shirtcliffe, Hancox, & Reddel, 2014; Koster, Philbert, de Vries, van Dijk, & Bouvy, 2015; Uphoff et al., 2015), as well as motivation-related factors such as beliefs about asthma and asthma treatment (Foot, La Caze, Gujral, & Cottrell, 2016; Horne et al., 2013; Horne & Weinman, 2002). However, additional factors should be considered when looking at maintaining adherence long-term (also known as persistence). These include habit formation (i.e. did taking the medication become a recurring habit?) and experiences of the treatment (i.e. does it do what the patient expected it to do?) (Alison Phillips et al., 2013).

The findings from our meta-analysis are in line with a recent Cochrane review of interventions targeting adherence to ICS, which found a significant intervention effect overall when compared to usual care groups (Normansell et al., 2017). In contrast, a broader Cochrane review of interventions targeting adherence to prescribed medication (including psychiatric conditions, excluding addiction) found insufficient evidence of an intervention effect in low risk studies. However, the heterogeneity of interventions, participants, and medications in this review made it difficult to synthesize data (Nieuwlaat et al., 2014). In line with our findings, both preceding reviews found a moderate to high risk of bias in included studies. Both reviews also

noted that the inconsistency in adherence measures across studies was an issue (Nieuwlaat et al., 2014; Normansell et al., 2017).

### 6.6.3 Implications for research and practice

Future research should aim to use validated adherence measures wherever possible. Since it is difficult to blind participants in behavioural intervention trials, researchers could use blinded outcome assessors and adherence measures that do not rely on self-report (e.g. refill data or electronic monitoring devices) to reduce the risk of detection bias. Furthermore, measures to maintain intervention fidelity should be in place. Where possible, longer follow-up periods will help researchers establish the sustainability of intervention effects.

When developing new pharmacist-led interventions, researchers could consult the BCT Taxonomy to structure and accurately report their intervention content (Michie et al., 2013). This will increase the replicability of research. As noted by Normansell et al. (2017), establishing an optimal threshold for adherence to maintain the effect of ICS may be useful for future asthma care guidelines. Previous research estimated this at 80%, but optimal levels can vary between individuals (Lasmar et al., 2009).

## 6.7 Conclusion

This systematic review and meta-analysis found that pharmacist-led interventions can significantly improve adherence in adults with asthma, suggesting that this new delivery channel can be reasonably expected to have an effect. However, the review highlighted several factors that can influence the effectiveness of pharmacist-led interventions.

Intervention content is important, and simply providing information is not sufficient to guarantee behaviour change (M. P. Kelly & Barker, 2016). Therefore, pharmacist-

led care has to move beyond patient education and towards PAPA-based interventions that not only elicit adherence barriers, but also actively address them through engaging and consistent pharmacist-led support. Striving for these targets in the UK will make interventions more effective, and align pharmacist-led care with national recommendations made in the NICE guidelines for medicines adherence (Nunes et al., 2009). However, a better understanding of UK pharmacists' current skillset and experience is necessary to determine their ability to deliver PAPA-based adherence support and any associated professional development needs.

Even if intervention content is optimised, interventions will be ineffective if delivered in contexts that hinder pharmacist involvement. Review findings were based on studies conducted in multiple countries, and further work is needed to understand pharmacist-led adherence interventions for asthma delivered specifically in the UK context. The extended role for UK pharmacists in healthcare is increasingly recognised and integrated into healthcare policy (NHS England, 2014, 2016, 2017b). However, some uncertainty remains about *where* pharmacist-led support is best delivered in the UK. While community pharmacy (home to the New Medicine Service and Medicines Use Review) is a potential option, other settings should also be explored to establish whether the barriers to adherence support identified in community pharmacy research can be avoided.

## 7 Pharmacist perspectives on medication adherence support for people with asthma in the United Kingdom

### 7.1 Introduction

Incorporating the perspectives of important stakeholders (e.g. patients and healthcare professionals) into the development of new healthcare services is crucial, as these insights can improve the structure and content of new services and highlight factors that may affect service implementation and delivery (Curry, Stark, & Summerhill, 1999; Mohammad Mosadeghrad, 2013). The perspectives of both pharmacists and adults with asthma on pharmacist-led adherence support for asthma in the UK were explored in this thesis.

Previous studies exploring UK pharmacist perspectives on adherence interventions found that community pharmacists delivering the New Medicine Service (NMS) and Medicines Use Review (MUR) were concerned about encroaching on the responsibilities of other healthcare professionals, such as GPs. (Boyd et al., 2014; Latif et al., 2016). Pharmacists frequently cited their lack of time at work and a lack of funding as potential barriers to adherence support services (Boyd et al., 2014; Latif et al., 2011).

Research exploring UK pharmacist perspectives on adherence support specifically for asthma is currently lacking. Kritikos, Reddel, and Bosnic-Anticevich (2010) conducted a questionnaire study exploring the perspectives of Australian community pharmacists on their role in asthma care. The pharmacist respondents felt that their role in asthma care involved facilitating optimal self-management, asthma control, and medication use. They noted that patient-related factors (e.g. patients' lack of asthma knowledge) and resource-related factors (e.g. pharmacists' lack of time) were

significant barriers to pharmacist involvement in asthma care. Interestingly, concerns regarding funding and encroaching on the responsibilities of other healthcare professionals were not as relevant. In fact, close to 70% of the respondents wanted more inter-professional contact within asthma care (Kritikos et al., 2010).

Given the aforementioned gap in the literature, an exploration of UK pharmacist perspectives on adherence support specifically for asthma was needed to understand how a pharmacist-led adherence intervention would fit into current UK pharmacy practice. Previous research identified barriers to pharmacist-led adherence support in the community pharmacy setting, and alternative settings (e.g. hospitals) needed to be explored to determine whether they were more suitable for service delivery (Boyd et al., 2014; Latif et al., 2011; Latif et al., 2016).

The findings in Chapter 6 highlighted the benefit of adherence support interventions based on the Perceptions and Practicalities Approach (PAPA) (Horne, 2001, 2015), and an exploration of UK pharmacist perspectives would identify the current support needs of pharmacists in achieving the delivery of PAPA-based care. Furthermore, pharmacists would be able to identify factors that may hinder effective service implementation and delivery.

## 7.2 Aims and objectives

The aim of this chapter was to explore the perspectives of UK pharmacists on providing PAPA-based adherence support for people with asthma. This was further broken down into four objectives:

1. To establish which components of PAPA-based adherence support are currently being delivered by pharmacists to people with asthma in the UK.



2. To evaluate how confident pharmacists feel in delivering these adherence support services.
3. To identify potential barriers to service delivery from the UK pharmacist perspective.
4. To explore how pharmacist perspectives differ between different pharmacy settings.

The patient perspective on pharmacist-led adherence support will be discussed in the next chapter (Chapter 8).

### 7.3 Methods

An online questionnaire was distributed to UK pharmacists between October 2016 and August 2017 (cross-section study design). The online questionnaire method was chosen based on feedback from Rachel Joynes, the Head of Research and Evaluation at the Royal Pharmaceutical Society (RPS) in 2017. She recommended using a method that was easy to distribute and access (particularly on smartphones) to match the time constraints of most working pharmacists and maximise response rates. Ethical approval for the study was obtained from the UCL Research Ethics Committee (20<sup>th</sup> October 2016, Ref: 9409/001).

#### 7.3.1 Developing the questionnaire

We developed a new questionnaire based on the *Pharmacists' Role in Asthma Management Questionnaire*, designed by Kritikos et al. (2010) for the Australian community pharmacy setting. The questionnaire had 38 items and it explored pharmacists' perspectives on their role, potential barriers, confidence, and level of inter-professional contact in asthma care. The questionnaire demonstrated high internal consistency (Cronbach's  $\alpha = 0.84$ ).

We adapted the questionnaire for application across UK pharmacy settings using the PAPA (Horne, 2001, 2015), input from subject matter experts (i.e. clinical pharmacy and behavioural medicine experts), and previous literature on UK pharmacist perspectives and service delivery. The PAPA was applied to ensure that questionnaire content aligned with the recommendations made in the NICE guidelines for medicines adherence (Nunes et al., 2009). Items from the questionnaire by Kritikos et al. (2010) were expanded and replaced based on the motivation (perceptions) and ability (practicalities) components of the PAPA. The questionnaire was drafted through discussions with a subject matter expert in behavioural medicine and another PhD researcher.

The questionnaire draft was then given to a clinical respiratory pharmacist working in general practice, who had extensive experience in asthma-specific adherence support, prescribing, and training pharmacists in respiratory care. She added items to the questionnaire based on her clinical experience in asthma care. These included items about pharmacists' confidence in supporting self-management, interpreting medical information, and asking patients about their tobacco and illicit drug use. She reviewed the face validity of items and edited item wording to increase their relevance and clarity to a pharmacist audience. The resulting questionnaire had 50 items and three subsections: Delivered Services, Confidence, and Potential Barriers (see Appendix C for full questionnaire). Additional collected data included respondents' age (years), gender, years since registration as a pharmacist, hours worked per week, and pharmacy setting. The questionnaire was hosted on the Qualtrics online platform (Qualtrics, Provo, UT).

### *Delivered Services*

To establish whether current UK pharmacy practice could accommodate a PAPA-based intervention, the first questionnaire section (Delivered Services) investigated which elements of PAPA-based adherence support pharmacists were already delivering. A list of 19 care activities related to perceptions (e.g. necessity beliefs and concerns about medication), practicalities (e.g. asthma education or inhaler technique), tailoring care to the patient, and standard asthma care (e.g. peak flow measurements) were presented to respondents (see Appendix C). Items were dichotomous, asking respondents to indicate whether or not they currently conducted each of the listed care activities.

### *Confidence*

To identify potential pharmacist support needs, the second section (Confidence) asked pharmacists how confident they felt delivering various elements of PAPA-based adherence support for asthma. The questionnaire by Kritikos et al. (2010) focused on six categories of support: medications, adherence, self-management, triggers, asthma control, and monitoring. These categories were expanded using the PAPA, generating 17 new items (see Appendix C). For example, the original item about confidence in “asthma adherence counselling” was expanded and replaced with items such as “I am confident that I can communicate the necessity of ICS to a patient” (perceptions) and “I am confident in demonstrating and teaching the use of Metered Dose Inhalers” (practicalities). Respondents rated their agreement with each item on a Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree), with higher scores indicating higher levels of confidence.

### *Potential Barriers*

The final section (Potential Barriers) asked pharmacists about potential barriers to pharmacist-led adherence support for asthma. A list of 14 barriers were generated based on the original Australian questionnaire (Kritikos et al., 2010), previous evaluations of the NMS and MUR (Boyd et al., 2014; Latif & Boardman, 2008; Latif et al., 2011), and input from the clinical respiratory pharmacist. For example, “patient health beliefs are a barrier” (Kritikos et al., 2010) was expanded into “most patients do not view asthma as a chronic problem” and “most patients feel that their symptoms are not severe enough to justify further care”. As with the Confidence items, respondents rated their agreement on a Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). Higher scores indicated higher barrier importance.

To reduce the risk of social desirability bias, respondents were told that the Confidence and Potential Barrier items were based on previous statements by other pharmacists.

#### 7.3.2 Recruitment

Respondents were UK pharmacists who worked in either community pharmacies or integrated care settings (hospital and primary care). These settings were chosen because direct patient contact is a core part of these pharmacist roles. Respondents were categorised as community pharmacists (CPs) or integrated care pharmacists (ICPs, hospital and primary care pharmacists) to reflect differences in work environment. CPs are primarily based in a community setting with a retail component, working collaboratively with other pharmacists and/or pharmacy technicians. ICPs work in multidisciplinary settings, such as hospitals and general practice.

A link to the questionnaire was distributed through the RPS and Boots Pharmacy mailing lists, social media (Facebook and Twitter), and UK Master of Pharmacy (MPharm) degree courses. Respondents gave informed consent on the Qualtrics

platform before completing the questionnaire, and could enter a prize draw for £25, £100, and £200 online shopping vouchers upon completion.

### 7.3.3 Analysis

*A priori* power calculations were conducted on G\*Power (Faul, Erdfelder, Buchner, & Lang, 2009) and statistical analyses were conducted using SPSS (Version 22.0, IBM Corporation).

#### *Respondent characteristics*

Means and standard deviations (SDs) were used to summarise age, years since registration, and hours worked per week. Frequencies (*n*) and percentages were used to summarise gender and pharmacy setting (CP or ICP). Independent samples t-tests or chi-squared tests were used to explore any baseline differences between CPs and ICPs in terms of characteristics.

#### *Study outcomes*

Dichotomous data (Delivered Services) was summarised using frequencies (*n*) and percentages. For example, the number and percentage of respondents that currently “discuss the chronic nature of asthma with the patient” was calculated. Likert-type items (Confidence and Potential Barrier items) were presented using means and SDs. Differences between CPs and ICPs for each questionnaire item were explored using chi-squared tests (Delivered Services items) and independent samples t-tests (Confidence and Potential Barrier items) (Norman, 2010).

The Benjamini-Hochberg procedure was used to control the false discovery rate from multiple comparisons. This procedure ranks *p*-values produced by multiple tests from smallest to largest. It then compares them to their Benjamini-Hochberg critical value:  $(i/m)Q$ , where *i* = the rank of the *p*-value, *m* = the total number of tests run, and *Q* =

the selected false discovery rate. The largest  $p$ -value where  $p < (i/m)Q$  is considered significant, as are all the  $p$ -values that are smaller than that cut-off point (Benjamini & Hochberg, 1995). A false discovery rate of 0.05 was selected for our analysis. The Benjamini-Hochberg procedure was chosen over the Bonferonni correction because the Bonferonni correction produces a higher rate of false negatives when applied to a large number of multiple comparisons (J. H. McDonald, 2014).

A Cronbach's alpha ( $\alpha$ ) was used to calculate the internal consistency between all 17 Confidence items and a mean Confidence score was calculated for each respondent. The mean Confidence scores were analysed using an ANCOVA to assess the effect of pharmacy setting (CP versus ICP) on Confidence while controlling for age, years since registration, and hours worked per week.

The Likert-type Potential Barrier items were also dichotomised into positive agreement and neutral/disagreement. Responses of "4 – Agree" and "5 – Strongly Agree" on the Likert-type scale were coded as positive agreement and scores of "3 – Neither Agree nor Disagree" and below were coded as neutral/disagreement. This was done to calculate the proportion of respondents that identified each item as a potential barrier to pharmacist-led adherence support for asthma. We chose this dichotomised approach to align with the previous work by Kritikos et al. (2010), and because we felt it would clearly identify potential barriers to the service (compared to means and SDs).

#### *Power calculation*

The *a priori* power calculation suggested that for an ANCOVA with a dichotomous predictor and three covariates, a sample size of 128 respondents would be needed to detect a medium effect size ( $f = 0.25$ ) with 95% confidence.

## 7.4 Results

The questionnaire was distributed to 2535 pharmacists and accessed by 205 pharmacists (8%). Of those that accessed the questionnaire, 127 (62%) completed it. There were no significant differences between those who accessed the questionnaire and did not complete it (non-completers,  $n = 78$ ) and those who completed the questionnaire (completers,  $n = 127$ ) in terms of age, hours worked per week, years since registration, and pharmacy setting (CP or ICP). However, significantly more female than male respondents completed the questionnaire ( $p = 0.02$ ) (see Table 10). Respondents were based in Scotland (Edinburgh and Glasgow), Wales (North and South), and England (North East, North West, Midlands, South East, and South West).

*Table 10. Differences in age, years since registration, hours worked per week, gender, and pharmacy setting between pharmacists who did and did not complete the online questionnaire (completers and non-completers)*

	Non-Completers <sup>a</sup>		Completers <sup>a</sup>		<u>Mean difference,</u> <u>p-value</u>
	<u>n</u>	<u>mean ± SD</u>	<u>n</u>	<u>mean ± SD</u>	
Age (years)	19	35.0 ± 10.1	124	37.1 ± 10.5	-2.1, $p = 0.42$
Hours worked per week	19	37.7 ± 9.0	127	35.6 ± 9.4	2.1, $p = 0.37$
Years since registration	18	12.1 ± 10.8	121	14.0 ± 10.6	-1.94, $p = 0.47$
Gender	<u>Male (n)</u>	<u>Female (n)</u>	<u>Male (n)</u>	<u>Female (n)</u>	<u>p-value</u>
	9	9	51	76	0.02*
Pharmacy setting	<u>CP (n)</u>	<u>ICP (n)</u>	<u>CP (n)</u>	<u>ICP (n)</u>	<u>p-value</u>
	9	11	61	66	0.80
<sup>a</sup> Based on non-completers and completers where demographic and work-related was not missing. * $p < 0.05$					

#### 7.4.1 Respondent characteristics

There were 51 male and 76 female respondents, with 61 CPs and 66 ICPs (see Table 11). Respondents had a mean age of  $37.1 \pm 10.5$  years, and CPs were significantly older than ICPs ( $41.6 \pm 11.4$  versus  $33.2 \pm 7.9$ ,  $p < 0.001$ ). Respondents worked a mean of  $35.5 \pm 9.4$  hours per week, with male respondents working more hours per week than female respondents ( $39.8 \pm 6.4$  versus  $32.6 \pm 10.0$ ,  $p < 0.001$ ). The sample had a mean of  $14.0 \pm 10.6$  years since registration and CPs had significantly more years since registration when compared to ICPs ( $17.6 \pm 11.8$  versus  $10.6 \pm 8.1$ ,  $p < 0.001$ ) (see Table 11).



Table 11. Respondent characteristics and differences between groups based on pharmacy setting and gender

	<u>Overall Sample</u>	<u>Pharmacy setting</u>		<u>Mean difference &amp; p-value<sup>a</sup></u>	<u>Gender</u>		<u>Mean difference, p-value<sup>a</sup></u>
		<u>CP</u>	<u>ICP</u>		<u>Male</u>	<u>Female</u>	
<i>n</i>	127	61	66	-	51	76	-
Age (years)	37.1 ± 10.5 (23 – 65)	41.6 ± 11.4 (23 - 65)	33.2 ± 7.9 (23 - 57)	8.4 [4.9 – 11.9] <i>p</i> < 0.001**	37.3 ± 10.4 (24 - 61)	37.0 ± 10.7 (23 - 65)	0.3 [-3.5 – 4.2], <i>p</i> = 0.87
Hours worked per week	35.5 ± 9.4 (2 – 60)	36.5 ± 10.8 (8 - 60)	34.6 ± 7.9 (5 - 45)	1.9 [-1.4 – 5.3] <i>p</i> = 0.25	39.8 ± 6.4 (23 - 60)	32.6 ± 10.0 (5 - 50)	7.2 [4.3 – 10.1], <i>p</i> < 0.001***
Years since registration	14.0 ± 10.6 (1 – 42)	17.6 ± 11.8 (1 - 42)	10.6 ± 8.1 (1 - 36)	7.0 [3.3 – 10.6] <i>p</i> < 0.001***	14.1 ± 10.5 (1 - 39)	14.0 ± 10.8 (1 - 42)	0.1 [-3.8 – 4.1], <i>p</i> = 0.94
Values expressed as means ± standard deviations (minimum – maximum) <sup>a</sup> Independent samples t-test *** <i>p</i> < 0.001							

### *Representativeness of the respondent sample*

Our findings regarding respondents' hours worked per week were representative of the pharmacist population in the UK, based on the 2008 Pharmacy Workforce Census ( $n = 30,517$ ). The census reported that pharmacists worked  $35.3 \pm 12.4$  hours per week, with a mean of 32.5 hours for female respondents and 39.7 hours for male respondents. The mean age of this study was slightly lower than that found in the 2008 census ( $44.0 \pm 14.3$  years). However, pharmacists aged 22 to 39 were under-represented in the census, and this may have driven the mean age up (Seston & Hassell, 2009). Years since registration were not included in the census data.

#### 7.4.2 Study outcomes

##### *Delivered Services*

Education about asthma and its treatment was the most commonly delivered service. For example, 98% of respondents explained the differences between ICS and reliever medication to people, and 88% discussed the importance of ICS even in the absence of symptoms. Respondents also communicated to people that well-controlled asthma is mostly asymptomatic (85%) and discussed people's concerns regarding medication side effects (85%) (see Table 12).

Complex consultation-based services were less common: 40% discussed Written Asthma Action Plans with people, and 39% checked peak flow readings. Another noteworthy finding was that only 47% of respondents reported checking patients' inhaler technique on a regular basis. CPs "discussed the chronic nature of asthma with a patient" more frequently than ICPs (87.9% versus 65.0%,  $p = 0.03$ ), and ICPs "checked patients' peak flow readings" more often than CPs (56.0% versus 22.0%,  $p < 0.001$ ) (see Table 12).

Table 12 Delivered Services items: proportion of respondents completing specific adherence-related care activities and differences between groups based on pharmacy setting

<u>Delivered Services</u>	<u>n</u>	<u>Overall</u>		<u>Community Pharmacists</u>		<u>Integrated Care Pharmacists</u>		<u>p-value<sup>a</sup></u>
		Delivered	Not Delivered	Delivered	Not Delivered	Delivered	Not Delivered	
Discussing the chronic nature of asthma with the patient	118	90 (76.3%)	28 (23.7%)	51 (87.9%)	7 (12.1%)	39 (65.0%)	21 (35.0%)	0.03*
Communicating that well-controlled asthma is mostly asymptomatic	123	104 (84.6%)	19 (15.4%)	55 (91.7%)	5 (8.3%)	49 (77.8%)	14 (22.2%)	0.16
Eliciting patients' beliefs about how necessary they believe their ICS are for their asthma management	124	94 (75.8%)	30 (23.6%)	48 (80.0%)	12 (20.0%)	46 (71.9%)	18 (28.1%)	0.39
Discussing the necessity of ICS even in the absence of symptoms	126	111 (88.1%)	15 (11.9%)	56 (91.8%)	5 (8.2%)	55 (84.6%)	10 (15.4%)	0.35
Discussing patients' concerns regarding side effects attributed to their medication	127	108 (85.0%)	19 (15.0%)	56 (91.8%)	5 (8.2%)	52 (78.2%)	14 (21.2%)	0.16
Discussing patients' concerns about developing long-term dependence on their ICS	116	76 (65.5%)	40 (34.5%)	40 (70.2%)	17 (29.8%)	36 (61.0%)	23 (39.0%)	0.39
Discussing patients' concerns about the long-term use of ICS and its potential side effects (e.g. beliefs about weight gain)	122	86 (70.5%)	36 (29.5%)	48 (78.7%)	13 (21.3%)	38 (62.3%)	23 (37.7%)	0.16
Educating the patient about the physiological mechanisms of asthma	119	69 (58.0%)	50 (42.0%)	40 (66.7%)	20 (33.3%)	29 (49.2%)	30 (50.8%)	0.16
Inhaler technique lessons when first prescribed a new inhaler	122	110 (90.2%)	12 (9.8%)	55 (91.7%)	5 (8.3%)	55 (88.7%)	7 (11.3%)	0.66
Inhaler technique checks on a regular basis	119	56 (47.1%)	63 (52.9%)	31 (52.5%)	28 (47.5)	25 (41.7%)	35 (58.3%)	0.35
Developing strategies to help patients remind themselves to take their ICS	117	63 (53.8%)	54 (46.2%)	33 (56.9%)	25 (43.1%)	30 (50.8%)	29 (49.2%)	0.61

<b>Table 12 continued</b>								
Tailoring the provided information to the patient's individual needs.	123	88 (71.5%)	35 (28.5%)	46 (76.7%)	14 (23.3%)	42 (66.7%)	21 (33.3%)	0.35
Reviewing the appropriateness of the patient's current prescriptions	119	84 (70.6%)	35 (29.4%)	37 (63.8%)	21 (36.2%)	47 (77.0%)	14 (23.0%)	0.29
Explaining the difference between preventer and reliever medication	123	121 (98.4%)	2 (1.6%)	60 (100%)	0 (0%)	61 (96.8%)	2 (3.2%)	0.35
Teaching the patient self-monitoring techniques for asthma control (e.g. symptom tracking or peak flow measurements)	113	60 (53.1%)	53 (46.9%)	31 (54.4%)	26 (45.6%)	29 (51.8%)	27 (48.2%)	0.78
Teaching the patient self-managements techniques (e.g. recognising when and knowing how to take action if asthma gets worse)	118	71 (60.2%)	47 (39.8%)	37 (61.7%)	23 (38.3%)	34 (58.6%)	24 (41.4%)	0.78
Discussing the Asthma Action Plan	109	44 (40.4%)	65 (59.6%)	19 (34.5%)	36 (65.5%)	25 (46.3%)	29 (53.7%)	0.35
Checking the patient's peak flow readings	100	39 (39.0 %)	61 (61.0%)	11 (22.0%)	39 (78.0%)	28 (56.0%)	22 (44.0%)	< 0.001***
Discussing individual trigger factors and avoidance strategies	116	70 (60.3%)	46 (39.7%)	35 (60.3%)	23 (39.7%)	35 (60.3%)	23 (39.7%)	- <sup>b</sup>
Values expressed as frequencies and percentages – <i>n</i> (%)								
ICS = inhaled corticosteroid								
<sup>a</sup> Chi-squared tests for association, <i>p</i> -values adjusted with the Benjamini-Hochberg procedure (false discovery rate = 0.05)								
<sup>b</sup> No difference in count between groups ( <i>p</i> = 1.00)								
* <i>p</i> < 0.05, *** <i>p</i> < 0.001								

## Confidence

### Distribution of responses

Overall, confidence in providing adherence support for asthma was high. Most Confidence items had a mean of 4 or above, indicating high levels of agreement with statements such as “I am confident that I can communicate the necessity of inhaled corticosteroids to a patient” and therefore high levels of confidence with most activities (see Table 13).

Respondents felt most confident in educational activities, such as explaining the difference between ICS and reliever medication ( $4.7 \pm 0.7$ ), communicating the necessity of ICS ( $4.5 \pm 0.8$ ), and demonstrating the use of various inhalers (metredose inhaler,  $4.5 \pm 0.8$ ; Accuhaler<sup>®</sup> and Turbohaler<sup>®</sup>, both  $4.4 \pm 0.9$ ). In addition, they felt confident with the basic components of adherence support consultations, such as taking a medication history ( $4.3 \pm 1.1$ ), interpreting sources of medical information ( $4.3 \pm 1.1$ ), eliciting people’s medication-related beliefs ( $4.3 \pm 0.9$ ), and discussing a patient’s adherence with another healthcare professional ( $4.3 \pm 1.0$ ) (see Table 13).

Confidence scores were slightly lower for complex consultation-based activities such as understanding and discussing the Asthma Action Plan ( $3.6 \pm 1.2$ ), taking and interpreting peak flow measurements ( $3.5 \pm 1.2$ ), and tailoring adherence support to each individual ( $3.9 \pm 1.1$ ). Respondents also reported lower confidence in providing appropriate self-management advice to people with asthma, and asking patients about their illicit drug use ( $3.9 \pm 1.1$  and  $3.7 \pm 1.1$  respectively).

Table 13. Confidence items - respondents' confidence in specific adherence-related care activities and differences between groups based on pharmacy setting

<u>Item</u>	<u>Overall</u>	<u>Community Pharmacists</u>	<u>Integrated Care Pharmacists</u>	<u>p-value<sup>a</sup></u>
I feel confident discussing a patient's medication adherence with another healthcare professional (e.g. a specialist consultant or a general practitioner)	4.3 ± 1.0	4.0 ± 1.0	4.5 ± 1.0	0.07
I understand the clinical management of asthma and I feel confident explaining this to a patient	4.2 ± 1.0	4.1 ± 1.0	4.3 ± 1.1	0.50
I feel confident tailoring adherence support to meet the individual needs of a patient	3.9 ± 1.1	3.8 ± 1.1	4.0 ± 1.1	0.50
I am confident that I can provide patients with appropriate self-management advice for asthma	3.9 ± 1.1	3.9 ± 1.1	4.0 ± 1.1	0.97
I know how to take a medication history	4.3 ± 1.1	4.1 ± 1.1	4.6 ± 1.0	0.02*
I can interpret and understand sources of medical information (e.g. Personal Medical Records or medical notes)	4.3 ± 1.1	4.0 ± 1.2	4.6 ± 1.0	0.01*
I am able to take and interpret peak flow measurements	3.5 ± 1.2	3.5 ± 1.1	3.6 ± 1.3	0.97
I can understand and discuss a patient's Asthma Action Plan in detail	3.6 ± 1.2	3.4 ± 1.2	3.8 ± 1.2	0.22
I can identify patients' individual concerns about inhaled corticosteroids (ICS) such as worries about side effects, long-term-effectiveness, or dependence	4.1 ± 0.9	4.0 ± 0.9	4.1 ± 0.9	0.97
I can explain the difference between ICS (preventer) and reliever inhalers	4.7 ± 0.7	4.7 ± 0.7	4.7 ± 0.8	0.97
I am confident that I can communicate the necessity of ICS to a patient	4.5 ± 0.8	4.5 ± 0.8	4.5 ± 0.8	0.97
I am confident that I can elicit a patient's beliefs about how necessary they believe ICS are in their treatment	4.3 ± 0.9	4.3 ± 0.8	4.3 ± 0.9	0.97
I am confident in demonstrating and teaching the use of Metered-Dose Inhalers	4.5 ± 0.8	4.5 ± 0.7	4.5 ± 0.9	0.97
I am confident in demonstrating and teaching the use of Accuhalers	4.4 ± 0.9	4.4 ± 0.9	4.4 ± 1.0	0.97
I am confident in demonstrating and teaching the use of Turbohaler	4.4 ± 0.9	4.4 ± 0.8	4.4 ± 1.0	1.00
I feel comfortable asking patients about their smoking status	4.5 ± 0.8	4.5 ± 0.8	4.5 ± 0.8	0.97
I feel comfortable asking patients about their illicit drug use	3.7 ± 1.1	3.4 ± 1.1	4.1 ± 1.0	0.01*
Values expressed as means ± standard deviations				
ICS = inhaled corticosteroid				
<sup>a</sup> Independent samples t-tests comparing community and integrated care pharmacists, <i>p</i> -values adjusted with the Benjamini-Hochberg procedure (false discovery rate = 0.05)				
* <i>p</i> < 0.05				

### Differences between pharmacists

A mean Confidence score was calculated across all 17 items (Cronbach's alpha = 0.96). There was no significant effect of pharmacy setting on mean Confidence when controlling for age, years since registration, and hours worked per week ( $F(1, 105) = 0.57$ ,  $p = 0.45$ , partial  $\eta^2 = 0.01$ ). However, when analysing Confidence items separately, ICPs were significantly more confident than CPs when it came to taking a medication history ( $4.6 \pm 1.0$  versus  $4.1 \pm 1.1$ ,  $p = 0.02$ ), interpreting and understanding sources of medical information ( $4.6 \pm 1.0$  versus  $4.0 \pm 1.2$ ,  $p = 0.01$ ), and asking a patient about their illicit drug use ( $4.0 \pm 1.0$  versus  $3.4 \pm 1.1$ ,  $p = 0.01$ ) (see Table 13).

### *Potential Barriers*

#### Distribution of responses

Based on agreement (Likert-type scale responses  $\geq 4$ ), pharmacist respondents rated patient-related factors as the most influential barriers to adherence support. These included patients lacking knowledge about asthma (73% of respondents agreed), patients feeling that their symptoms were not severe enough for further care (63% agreed), and patients not viewing their asthma as a chronic problem (62% agreed). Patients having difficulty speaking or understanding English and not wanting help from pharmacists were not viewed as significant barriers (23% and 21% agreed respectively).

Resource-related factors such as pharmacists lacking time in their working day (56% agreed) and insufficient funding for adherence support (51% agreed) were also identified as potential barriers. Respondents were less concerned about adherence support falling beyond the scope of their role (15% agreed), encroaching on the

responsibilities of patients' doctors (16% agreed), and the suitability of their work premises to provide adherence support (20% agreed) (see Table 14).



Table 14. Potential barrier items – Proportion of respondents in agreement with each barrier item and differences between groups based on pharmacy setting

Item	Respondents in agreement <sup>a</sup>		Overall <sup>b</sup>	Community Pharmacists <sup>b</sup>	Integrated Care Pharmacists <sup>b</sup>	p-value <sup>c</sup>
	Yes	No				
I do not have enough time in a working day to provide pharmaceutical care consultations to asthma patients	71 (55.9%)	56 (44.1%)	3.3 ± 1.3	3.1 ± 1.2	3.5 ± 1.4	0.21
Most patients do not have enough time to receive a pharmaceutical care consultation	51 (40.2%)	76 (59.8%)	3.0 ± 1.1	3.1 ± 1.0	2.8 ± 1.1	0.21
Most patients believe that they already receive sufficient care from their doctors	54 (42.5%)	73 (57.5%)	3.1 ± 1.1	3.3 ± 1.1	2.9 ± 1.0	0.21
Most patients do not have enough knowledge about asthma	93 (73.2%)	34 (26.8%)	3.8 ± 0.8	3.8 ± 0.9	3.9 ± 0.7	0.60
Most patients do not view their asthma as a chronic problem	79 (62.2%)	48 (37.8%)	3.6 ± 0.9	3.6 ± 0.9	3.5 ± 0.9	0.51
Most patients feel that their symptoms are not severe enough to justify further care	80 (63.0%)	47 (37.0%)	3.6 ± 0.9	3.5 ± 0.9	3.6 ± 0.9	0.60
Most patients do not want help from their pharmacist	26 (20.5%)	101 (79.5%)	2.4 ± 1.0	2.4 ± 1.0	2.3 ± 0.9	0.60
My work premises are not suitable for private consultations	26 (20.5%)	101 (79.5%)	1.9 ± 1.1	1.6 ± 0.9	2.3 ± 1.2	0.01*
Most patients do not visit the same pharmacy repeatedly	20 (15.7%)	107 (84.3%)	2.3 ± 0.8	2.2 ± 0.8	2.5 ± 0.8	0.21
I do not think it is my role to provide this type of service to asthma patients	19 (15.0%)	108 (85.0%)	1.7 ± 0.9	1.5 ± 0.8	1.8 ± 1.0	0.28
I have not received sufficient training to provide pharmaceutical care to asthma patients	21 (24.4%)	96 (75.6%)	2.2 ± 1.1	2.3 ± 1.2	2.1 ± 1.0	0.33
I do not receive sufficient financial compensation for providing this service	65 (51.2%)	62 (48.8%)	3.3 ± 1.2	3.7 ± 1.1	2.9 ± 1.3	0.001***
Many of my patients have difficulty speaking or understanding English	29 (22.8%)	98 (77.2%)	2.3 ± 1.0	2.2 ± 0.9	2.5 ± 1.0	0.33
I do not want to encroach on the responsibilities of the patient's doctor or consultant	20 (15.7%)	107 (84.3%)	2.1 ± 0.9	2.2 ± 1.0	2.0 ± 0.9	0.28

<sup>a</sup>Frequency (*n*) and proportion (%) of respondents in agreement with the item (Likert-type scale response ≥ 4)  
<sup>b</sup>Means ± standard deviations  
<sup>c</sup>Independent samples t-tests comparing community and integrated care pharmacists, *p*-values adjusted using the Benjamini-Hochberg procedure (rate = 0.05)  
\**p* < 0.05, \*\*\**p* < 0.001

### Differences between pharmacists

Compared to CPs, ICPs rated the suitability of their work premises as a more influential barrier ( $1.6 \pm 0.9$  versus  $2.3 \pm 1.2$ ,  $p = 0.01$ ). CPs rated insufficient financial compensation as a more influential barrier when compared to ICPs ( $3.7 \pm 1.1$  versus  $2.9 \pm 1.3$ ,  $p < 0.001$ ) (see Table 14). There were no further differences between CPs and ICPs.

### 7.5 Overview of findings

This study found that respondents focused heavily on education when providing adherence support for asthma. Furthermore, respondents felt most confident in their ability to provide education compared to other elements of an adherence support consultation. Encouragingly, respondents also felt confident with basic clinical activities, such as collaborating with other healthcare professionals and interpreting medical records.

However, confidence dropped slightly for complex consultation-related activities such as tailoring advice for individual patients and using asthma-related tools (e.g. asthma action plans and peak flow meters). There was no effect of pharmacy setting on Confidence overall, but ICPs felt more confident than CPs when specific items were compared.

Respondents viewed adherence support for asthma as part of their role and were not concerned about encroaching on the responsibilities of other healthcare professionals. From the perspective of the pharmacist respondents, patient-related factors (e.g. patients' beliefs about asthma) and resource-related factors (e.g. time and funding) were the most influential barriers to service delivery. ICPs were concerned about the

suitability of their work premises to deliver adherence support, while CPs identified insufficient funding as a potential service delivery barrier.

## 7.6 Discussion

### 7.6.1 Strengths and limitations

This study employed a novel questionnaire. Its content was designed in line with the NICE guidelines for medicines adherence to ensure it was relevant for the UK context (Nunes et al., 2009). Questionnaire items were chosen based on the PAPA, incorporating a novel health psychology approach to adherence support for asthma (Horne, 2001, 2015). The questionnaire was reviewed by a clinical respiratory pharmacist with experience in adherence support, prescribing, and pharmacist training for asthma to ensure the clinical relevance and face validity of questionnaire items. Respondents were recruited from different care settings (community pharmacy and integrated care) to explore the most suitable setting for pharmacist-led adherence support for asthma in the UK.

The final respondent sample was representative of UK pharmacists in terms of demographic characteristics and work-related data according to the 2008 Pharmacy Workforce Census (Seston & Hassell, 2009). However, we were unable to recruit respondents from Northern Ireland. Furthermore, the questionnaire response rate was low and findings may have been affected by non-response bias, meaning that the attitudes of this pharmacist sample may not be fully representative of UK pharmacists. Pharmacists who responded to this questionnaire may have been more interested in adherence, and hence more motivated to take part in the study. Respondents with an existing interest in adherence may take more initiative and invest more time/effort into developing their adherence support skillset. This may mean that the pharmacist

support needs identified in this study (among a sample of motivated respondents) may be even greater in a sample of pharmacists with less interest in adherence support.

The nature of study findings remains exploratory due to the use of a non-validated questionnaire. The questionnaire items themselves may also have affected the reliability of study findings. Some of the items were double-barrelled and this may have confused respondents (Olson, 2011). For example, the item “I understand the clinical management of asthma and I feel confident explaining this to a patient” asked respondents about their clinical knowledge of asthma *and* their ability to explain information to a patient in a single question. Item wording for the Confidence items may have also elicited responses regarding other constructs (e.g. knowledge and competency) rather than confidence. For example, the item “I know how to take a medication history” asked respondents if they had the relevant knowledge to take medication histories, rather than the necessary confidence to do so. Questionnaire length may have hindered recruitment, although the response rate was typical of recruitment through the RPS newsletter (5 – 10% of recipients click on included links).

#### 7.6.2 Comparison with existing literature

In line with findings from the NMS evaluation (Boyd et al., 2014), respondents felt most confident with and focused heavily on providing education as adherence support for asthma. They perceived a lack of asthma knowledge among patients as an influential barrier to service delivery, and these findings may thus be related. Respondents may have felt that imparting knowledge through education was the best support they could provide to their patients.

While confidence was high for educational and basic clinical activities, it dropped slightly for complex consultation-related activities (e.g. making clinical decisions based on medical information or tailoring consultations to the patient). Gregory and

Martin (2007) found a similar trend in their interviews with Canadian pharmacists who had become physicians: the pharmacists initially struggled with clinical decision-making during their medical training, particularly in situations of informational ambiguity. In their medical degrees, they had to learn a new level of professional self-confidence that was not part of their training as a pharmacist (Gregory & Martin, 2007). Similarly, Rosenthal, Austin, and Tsuyuki (2010) cited a lack of confidence and difficulties with ambiguity as significant barriers to pharmacists' expansion into a consultation-based patient-centred role.

Respondents cited a lack of time and funding as potential barriers to pharmacist-led adherence support for asthma, as previously noted in the NMS and MUR evaluations (Boyd et al., 2014; Latif et al., 2016). In contrast to previous research, respondents were not concerned about encroaching on the responsibilities of other healthcare professionals (Boyd et al., 2014; Latif et al., 2016). This is an encouraging finding, although it may be the result of non-response bias.

### 7.6.3 Implications for research and practice

Future research could revise and strengthen the study questionnaire based on the limitations outlined in Section 7.6.1. Item wording and questionnaire length could be revised using Think Aloud Tasks (TATs) and further input from UK pharmacists (Willis, 2005). Additional work could then be done to examine the reliability and validity of the questionnaire as an assessment tool, with a focus on internal consistency, test-retest reliability, face validity, concurrent validity, construct validity, discriminant validity, and predictive validity (Rattray & Jones, 2007).

Given the cross-sectional nature of the study, further longitudinal research with a larger sample size is needed to establish how confidence and perceptions of barriers change over time and in response to training/professional development support. Future

research could also explore the influence of other factors on pharmacists' confidence and perceptions of barriers, such as pharmacy infrastructure (e.g. pharmacy ownership, electronic records), patient contact (e.g. previous consultation experience, patient characteristics), pharmacy education (e.g. clinical training), and pharmacy culture (e.g. difficulty with ambiguity, need for approval/risk aversion) (Edmunds & Calnan, 2001; Mil, Boer, & Tromp, 2001; Moczygemba, Barner, & Roberson, 2008; Rosenthal, Austin, et al., 2010). Additional work could investigate whether pharmacists' confidence and perceptions of barriers are similar in care for other long-term conditions (e.g. COPD).

Pharmacists may benefit from further support and training to move beyond information provision, perhaps with a focus on how to address patients' beliefs about ICS and asthma as barriers to adherence (Horne, 2006). Simply providing information is not sufficient to change adherence-related beliefs or behaviour, and pharmacists should focus on eliciting people's beliefs and re-framing them using a narrative that is tailored and logical to the individual (Horne et al., 2019; M. P. Kelly & Barker, 2016; Leventhal et al., 1992).

The disparity in patient contact hours between medical and pharmacy degrees suggests that additional patient-facing training may be needed for pharmacists to expand effectively into consultation-based roles (Hopayian, Howe, & Dagley, 2007; Howe, Champion, Searle, & Smith, 2004; C. Langley, Wilson, & Jesson, 2015; C. A. Langley & Aheer, 2015). Additional training in health psychology and health psychology-based interventions may be beneficial, similar to previous work with nurses (Chapman et al., 2015), clinicians (Dimeff et al., 2009; Sholomskas et al., 2005), and physiotherapists (Godfrey et al., 2016). Our findings also suggest that further training

in asthma-specific tools (e.g. Written Asthma Action Plan and peak flow metres) may also be needed.

ICPs scored slightly higher than CPs on most confidence items, with significantly higher confidence in taking a medication history, interpreting sources of medical information, and asking patients about illicit drug use. This suggests that pharmacists working in different pharmacy settings may have different professional development needs and adherence support interventions may not transfer between settings without adjustments to pharmacist training. CPs were significantly more concerned about funding as a potential barrier to service delivery compared to ICPs, perhaps due to the increasing corporatisation of UK community pharmacies. This corporatisation process may mean that community pharmacist-led care will increasingly consist of routine retail-based care activities, limiting the expansion of the pharmacist role into complex patient-centred work (Bush, Langley, & Wilson, 2009; K. M. G. Taylor & Harding, 2003).

## 7.7 Conclusion

This study gave an exploratory overview of the professional development and training needs of UK pharmacists as the potential delivery channel for PAPA-based adherence support for asthma. We found that current pharmacist-led asthma care focused heavily on addressing ability-related factors influencing adherence, specifically increasing patient knowledge about asthma through educational activities. While respondents felt that adherence support was part of their role, additional training and support will be needed to ensure that pharmacists can tackle the motivation-related factors affecting adherence, namely patients' beliefs about asthma and its treatment.

Our findings suggested that integrated care settings may be more suitable for pharmacist-led adherence support for asthma. ICPs reported feeling significantly more confident than CPs in consultation-based activities (e.g. interpreting and understanding sources of medical information). Furthermore, significant service delivery barriers (e.g. lack of time and insufficient funding) were reported by CPs, in line with findings from previous community pharmacy studies and concerns about corporatisation (Boyd et al., 2014; Bush et al., 2009; Latif et al., 2011; Latif et al., 2016). As these barriers were difficult to address without significant pharmacy and healthcare policy changes, integrated care settings were chosen as a potential alternative for pharmacist-led adherence support.

We chose to explore general practice as an alternative setting to community pharmacy, as it was an integrated care setting that would keep pharmacist-led adherence support within primary care, where most UK asthma cases are currently managed (British Thoracic Society/Scottish Intercollegiate Guidelines Network, 2016). Investigating this potential setting also aligned with the increasing interest in general practice pharmacists following the introduction of the NHS Clinical Pharmacists in General Practice (CPGP) scheme in England. Given the novelty of general practice pharmacist-led adherence support for asthma, it was important to explore the perspectives of adults with asthma as the potential recipients of the service.



## 8 Pharmacist-led adherence support in general practice: a qualitative interview study with adults with asthma

### 8.1 Introduction

Due to the recent introduction of general practice pharmacists, research on patient perspectives of this role is limited. Previous research on patient perspectives centred on community pharmacists, and this chapter will begin with an overview of this literature. Patient perspectives of community pharmacists were based on trust, service expectations, and service characteristics.

Trust refers to the optimistic acceptance of being in a vulnerable situation, knowing that one's interests will be cared for. Within healthcare, trust can be interpersonal (i.e. trust in a healthcare professional as a person) and institutional (i.e. trust in a healthcare institution, such as pharmacy) (Hall, Dugan, Zheng, & Mishra, 2001). In focus groups with members of the public, Gidman et al. (2012) found that interpersonal trust in community pharmacists was limited due to people's lack of familiarity with their pharmacist, particularly in comparison to the familiarity they experienced with their GP. When other trusted healthcare professionals (e.g. GPs) did not endorse community pharmacist-led care, interpersonal trust in pharmacists was low (Bradley, Wagner, et al., 2008; Latif et al., 2016).

Institutional trust in community pharmacy was affected by people's perceptions of pharmacy funding. Gidman et al. (2012) found that the general public were sceptical of community pharmacists' motivations in healthcare due to the commercial components of traditional retail pharmacies. Community pharmacy was also evaluated in comparison to other healthcare fields such as medicine. Latif et al. (2013) conducted an ethnographic study of community pharmacist-led consultations paired with patient

interviews, and found that people viewed pharmacy as a supplementary (or perhaps subordinate) healthcare profession to medicine. They viewed GPs as their primary healthcare provider, and were only willing to trust pharmacists with minor health concerns (e.g. common colds). Gidman et al. (2012) found that this high institutional trust in GPs stemmed from public awareness and trust in the medical education system. In contrast, the general public were hesitant about trusting pharmacists because they were unaware of the pharmacy education system (Gidman et al., 2012).

Expectations of community-pharmacist-led services were informed by patients' perceptions of large pharmacy corporations (e.g. Boots), the pharmacist role, and asthma. The general public were sceptical about community pharmacist-led care because of the increasing corporatisation of community pharmacies. They were concerned that large corporations involved in healthcare would value profit over patient wellbeing (Gidman et al., 2012). Many patients viewed the pharmacist role as prescription dispensing and basic information provision, with some people viewing community pharmacists as specialist shopkeepers rather than clinicians (Bereznicki et al., 2011; Latif et al., 2013).

However, in a qualitative interview study with people with asthma, Naik Panvelkar et al. (2010) found that participants with previous experiences of community pharmacist-led asthma services held higher expectations for community pharmacists compared to participants with no previous experience. Participants with previous experience expected pharmacists to contribute to their care through information provision, lung function testing, inhaler technique checks, and asthma management (Naik Panvelkar et al., 2010). Patient-held beliefs about asthma affected the perceived necessity of pharmacist-led support. Many people with asthma believed that daily asthma symptoms were an inevitable part of having asthma, and they subsequently

overestimated their asthma control. People who perceived their asthma as well-controlled doubted the necessity of pharmacist-led support (Bereznicki et al., 2011).

Service characteristics that affected people's perceptions of community pharmacist-led care included consultation length, consultation topic guides, service accessibility, and confidentiality/privacy. Previous qualitative evaluations of community pharmacist-led services in the UK found that consultation length was a concern for patients. This was because people expected community pharmacy-based interactions to be quick (e.g. picking up medication on the way to work) (Latif et al., 2013; Latif et al., 2016). In terms of the consultation topic guides, recipients of the Medicines Use Review (MUR) reported that the service employed closed-ended questions and therefore limited opportunities for patient input during the consultation (Latif et al., 2013). While patients felt that the accessibility of community pharmacies was a key strength of pharmacist-led care, they also reported concerns about the lack of confidentiality and privacy in community pharmacies (Latif et al., 2013; Latif et al., 2016; Todd et al., 2014).

Building on the research outlined above, the purpose of this chapter was to explore the perspectives of adults with asthma on a new healthcare model: general practice pharmacist-led support. We wanted to understand whether this new model could overcome some of the aforementioned barriers identified in the community pharmacy context, and whether this type of care was of interest to our target group (adults with asthma).

## 8.2 Aim

This chapter aimed to explore the perspectives of adults with asthma on a new service (pharmacist-led adherence support delivered in general practice), with a focus on how these perspectives are formed.

## 8.3 Methods

This chapter is reported in accordance with the Consolidated Criteria for Reporting Qualitative Research (COREQ) checklist (Tong, Craig, & Sainsbury, 2007). It describes a telephone-based semi-structured interview study with adults with asthma. Ethical approval for the study was obtained from the NHS London-Harrow Research Ethics Committee (October 12<sup>th</sup> 2017, Ref: 17/LO/1565) and Cwm Taf University Health Board (November 17<sup>th</sup> 2017, Ref: CT/831/205928/17).

### 8.3.1 Study Design

Qualitative methodology was chosen for this study because asthma is a long-term condition that requires a high level of self-management, and therefore understanding the lived experiences of people with asthma is an important step in optimising asthma care (Pinnock, 2015). A telephone-based method was chosen to enable recruitment across the UK despite limited researcher funding for travel. Furthermore, the telephone-based method increased study accessibility for people with severe asthma with potential travel limitations. While common concerns about telephone-based interviewing methods include difficulties in establishing rapport and reading non-verbal cues, previous research also suggests that telephone-based interviews can produce higher data quality compared to face-to-face interviews when sensitive topics (e.g. long-term conditions) are discussed (Drabble, Trocki, Salcedo, Walker, & Korcha, 2016; Novick, 2008; Sturges & Hanrahan, 2004).

In semi-structured interviews, researchers ask a set of predetermined open-ended questions. While researchers have some control over the topics discussed in the interview, participants have the room to speak and explore through their responses (Ayres, 2012). Our interviews employed a semi-structured approach to explore a specific topic (i.e. adherence support in general practice) while allowing for variation in participant perspectives.

#### *Methodological orientation and theoretical framework*

Given the novelty of general practice pharmacist role, we did not set out to prove/disprove existing theory. The study took a phenomenology-informed approach to explore people's lived experiences of asthma care and pharmacists, and to understand how perspectives of general practice pharmacists were formed based on these experiences. As such, multiple constructed realities existed based on people's lived experiences, and each perspective was inherently valid (P. L. Berger & Luckmann, 1991).

#### 8.3.2 Recruitment

Participants were adults ( $\geq 18$  years old) living in the UK and proficient in English, with a self-reported asthma diagnosis, a prescription for ICS, and access to a telephone and e-mail account. People with respiratory comorbidities (e.g. COPD) and/or those who were currently hospitalised or resident in care homes were excluded, as the adherence behaviour and support needs of these individuals were theorised to be different. Recruitment was set for 30 participants or thematic saturation, whichever was attained first. The recruitment target of 30 participants was set to ensure sufficiently rich data (Morse, 2000). Thematic saturation was defined as the point at which no new themes/sub-themes could be identified in the dataset (Glaser & Strauss, 2017).

A recruitment flyer with a brief study overview and researcher contact details (see Appendix D) and a participant information sheet containing a detailed explanation of the study (see Appendix E) were developed for the study. They were reviewed by the Asthma UK Centre for Applied Research (AUKCAR) Patient Advisory Group: a group of people with asthma who help researchers incorporate the patient perspective into all stages of research. Feedback on both documents primarily concerned wording and text length, and adjustments were made accordingly. The Patient Advisory Group reviewed the revised documents and had no further comments.

Recruitment aimed to generate a participant sample with variation in age, gender, and self-reported asthma severity to capture a variation in patient perspectives (i.e. purposive sampling). Recruitment targets are outlined in the sampling matrix below (Table 15), with the intended recruitment target of 30 participants. The matrix was designed based on data from a national asthma survey (Asthma UK, 2016a) and a community-based asthma morbidity study, both carried out in the UK (Walsh et al., 1999).

*Table 15 Sampling matrix for qualitative study with adults with asthma based on gender, age and self-reported asthma severity (n = 30 potential participants)*

	Male <i>n</i> (%)	Female <i>n</i> (%)
Gender	13 (45%)	17 (55%)
Age		
18 – 29	2 (6%)	2 (7%)
30 – 39	2 (7%)	2 (8%)
40 – 49	3 (10%)	4 (13%)
50 – 59	3 (11%)	4 (12%)
60 – 69	2 (8%)	3 (10%)
70+	1 (3%)	2 (5%)
Self-reported asthma severity		
Mild	8 (29%)	11 (36%)
Moderate	4 (15%)	5 (18%)
Severe	1 (1%)	1 (1%)

Several recruitment channels were employed: social media, electronic newsletters, and clinical settings. The study recruitment flyer was circulated via social media (Facebook and/or Twitter) by the researchers, AUKCAR, and NIHR CLAHN North Thames, and re-posted/re-tweeted by members of these networks. The study was advertised in two electronic newsletters: once in the Asthma UK volunteer bulletin, and twice in the University College London (UCL) student newsletter. Printed study flyers were handed directly to potential participants by a respiratory consultant at a hospital in London, and hospital pharmacists at two hospitals in Wales.

People who were interested in participating were asked to contact the research team via e-mail or telephone. Researchers e-mailed them the participant information sheet, consent form, and study eligibility criteria to review. If they were eligible and willing to participate, they were booked in for a one-hour telephone interview. Before the call, participants were asked to read a description of a general practice pharmacist-led adherence support consultation, sent to them via e-mail (see Appendix F). This description was based on the work of a clinical respiratory pharmacist working in general practice in London. Participants gave verbal consent over the telephone before the interview began.

The characteristics of recruited participants were continuously reviewed by the research team, and recruitment efforts were targeted accordingly. For example, the first round of advertisements recruited mostly female participants. Therefore, recruitment efforts towards the end of the study focused on recruiting male participants. All participants received a £20 online shopping voucher to thank them for their time.

### 8.3.3 Data collection

#### *The interview topic guide*

The interview topic guide had two sections. The first section (background/previous experience) focused on participants' experiences of asthma, asthma care, and pharmacists. The second section focused on how these lived experiences informed participants' perceptions of the new general practice pharmacist service (see Appendix G). Questions in this second section were based on the literature outlined in Section 8.1 to explore whether the new service could overcome the barriers identified in the community pharmacy context.

Questions were open-ended, and they were adapted and/or employed based on the course of each individual interview. While the topic guide was not pilot tested, it was reviewed by the AUKCAR Patient Advisory Group. They refined it by improving word choice and recommending relevant topics and/or prompts that they felt were missing. For example, they suggested adding a question about privacy in pharmacy settings, and recommended using the phrase "fatal asthma attack" over "asthma-related death".

#### *Data collection and storage*

Researchers called the participants for their pre-booked timeslots. The telephone call (including the verbal consent procedure and interview) was audio-recorded with participants' permission. After the interview, participants were asked to complete a short online questionnaire about demographic details and asthma history (see Appendix H). This questionnaire was also reviewed and refined with feedback from the AUKCAR Patient Advisory Group.



Demographic details included participants' age, gender, ethnicity, and region of residence (as indicated by the first portion of their home postcode). The asthma history section included self-reported asthma severity and healthcare utilisation in the previous 12 months. Self-reported asthma severity was based on the presence and frequency of asthma symptoms, as outlined by Janson (1998) in the National Asthma Education and Prevention programme – mild (symptoms only appear from time to time), moderate (daily symptoms), and severe (daily symptoms with frequent exacerbations). Self-reported healthcare utilisation included asthma-related GP visits and hospital admissions in the previous 12 months.

The self-report method was chosen because the AUKCAR Patient Advisory group viewed the collection of electronic medical data (e.g. requesting access to medical records) as a potential barrier to recruitment due to its invasive nature. Online questionnaires were used to collect this data because participants may have felt uncomfortable disclosing personal information (e.g. gender, age, ethnicity, previous hospitalisations) directly to the researcher during the telephone call. The online questionnaire was created and managed using the Research Electronic Data Capture (REDCap) platform hosted at UCL, a secure platform for questionnaires involving sensitive personal data (Harris et al., 2009).

All interviews were transcribed verbatim by a professional transcription service (Way with Words Ltd., UK). A transcription service was utilised due to time restraints related to the duration of the PhD. All transcripts were checked and corrected by a researcher, and participants were not asked to comment on/correct their own transcripts. All study data (audio-recordings of interviews, transcripts, and online questionnaire data) was stored on the UCL Data Safe Haven, a secure storage facility aligned with the requirements set out in the Data Protection Act (2018).

#### 8.3.4 Data analysis

All transcripts were imported into the NVivo software (QSR, Version 11) for analysis. Data was analysed using thematic analysis, which identifies, analyses, and reports patterns (i.e. themes) within data. This method was chosen over other theory-bound analysis methods (e.g. content analysis or grounded theory) because its flexibility matched the exploratory nature of the study (Braun & Clarke, 2006).

Participants' experiences with asthma, asthma medication, and pharmacists (covered in the first section of the topic guide) have been explored in previous research (Boyd et al., 2014; Halm et al., 2006; Horne & Weinman, 2002; Latif et al., 2013; Naik Panvelkar et al., 2010). We focused on how these lived experiences informed people's perspectives of the new general practice pharmacist-led model, taking an inductive approach in our analysis. Therefore, our analysis aimed to generate a detailed understanding of a particular aspect of the dataset (i.e. the formation of perspectives), rather than generate a rich description of the full dataset. We conducted iterative analyses as the study progressed to determine when thematic saturation had been reached.

After the first 10 interviews, researchers began familiarising themselves with the data by reading and re-reading the transcripts, and taking notes on potential patterns and notable topics. Brief summaries of each interview were written to aid analysis. During this first round of coding, all features of data that were of interest to the research aim were coded. This included notable patterns across transcripts, as well as unique experiences reported by single participants. After coding these first 10 transcripts, researchers reviewed the codes and merged any codes with considerable overlap (e.g. "the expert patient" and "self-management expertise").

Mind-maps were used to explore the relationships between these initial codes, and these mind-maps were used to generate initial themes and sub-themes. We identified themes based on their relevance to the study aim, rather than quantifiable criteria (e.g. the highest number of mentions within a dataset). Themes were identified at the latent level, examining the underlying perceptions and processes informing the semantic content of the data (i.e. what participants said) (Braun & Clarke, 2006).

The initial themes and sub-themes were reviewed based on their internal homogeneity (i.e. do they cohere meaningfully?) and external heterogeneity (i.e. do they describe separate concepts?), as recommended by Patton (1990). First, researchers reviewed the data extracts in each theme to determine whether they grouped together coherently, making adjustments where necessary (e.g. merging/splitting themes, generating new themes). Following these revisions, an initial thematic map was produced.

This thematic map was used as the reference point for incoming data during the iterative analysis process. Researchers re-read and re-coded their transcripts, and adjustments were made to the thematic map whenever new themes/sub-themes were identified. Thematic saturation was reached when the incoming data no longer produced changes to the thematic map. At this point, researchers reviewed the data once more to determine whether the proposed thematic map was representative of the dataset as a whole. Data extracts that were missed in the initial coding round were added at this stage. Researchers also reviewed the themes in relation to the written summaries of the participant interviews, and adjustments to the thematic map were made where necessary.

Once the final thematic map was achieved, detailed descriptions of each individual theme, its role in the overall thematic map, and its relationship to the research question

were written. This process was repeated for the identified sub-themes (Braun & Clarke, 2006).

#### 8.3.5 Research team and reflexivity

All interviews were conducted by the author of this thesis. Her previous experience in qualitative research include her MSc Health Psychology dissertation employing thematic analysis, and her research placement at the Health Experiences Research Group at the University of Oxford, where she shadowed face-to-face interviews and reviewed interview transcripts. Additional training was obtained through the *In-Depth Interviewing* and *Mixed Method Approach in the Social Sciences* courses at the UCL Doctoral School. There was no existing relationship between the author and the study participants prior to study commencement. Participants were informed of the study's research aims and the author's academic background (e.g. previous degrees, ongoing PhD). The author disclosed that she did not have asthma and emphasized that the purpose of the interviews was to gain a deeper understanding of the lived experiences of people with asthma.

The second-coding of transcripts was completed by another researcher with a background in Health Psychology and an ongoing PhD in Behavioural Medicine. She previously conducted focus groups with adults with asthma and had experience with thematic analysis. She independently coded 25% of the interviews, randomly selected as the study progressed. The codes were discussed and finalised through two discussion meetings, with inconsistent coding resolved through consensus (with input from PhD supervisors where needed).

The final findings were discussed and refined with a Professor in Public Health and Primary Care with extensive experience and published work in qualitative research,

and an interest in complex healthcare interventions, and the clinical management and self-management of long-term conditions.

## 8.4 Results

### 8.4.1 Participant characteristics

Thematic saturation was attained after 17 participants had been interviewed (see Table 16). The mean interview length was 39 minutes (ranging from 30 to 58 minutes). The participant sample was mostly female (59%), aged 30 to 39 years (41%), and White-British (70%). Most participants (41%) were recruited through the Asthma UK newsletter, and were living in Scotland (35%) and South England (41%).

*Table 16. Demographic details and recruitment channels used for adults with asthma recruited into the qualitative study*

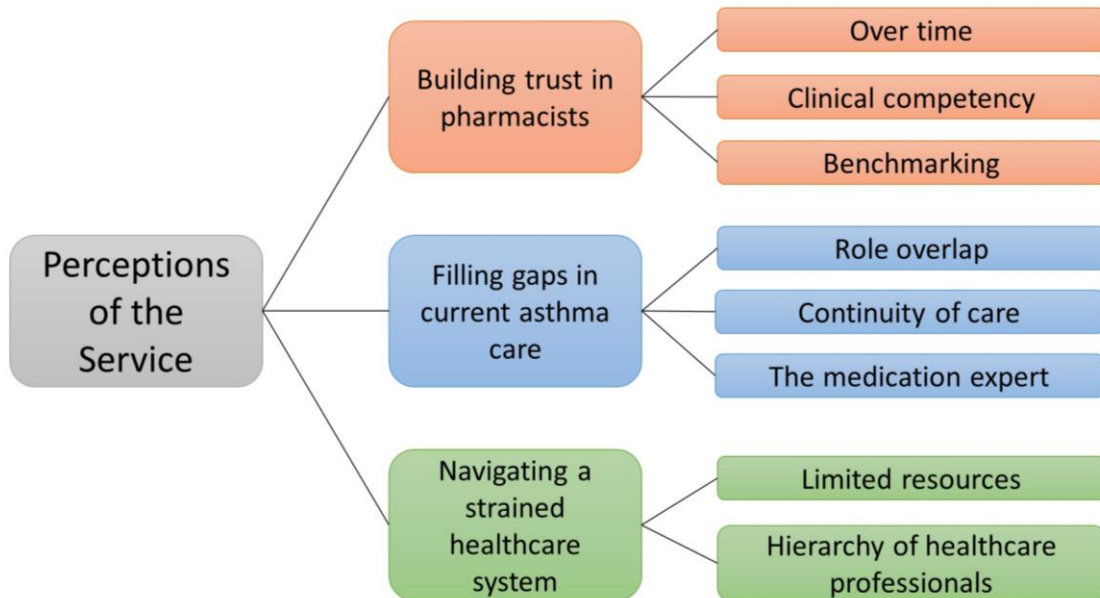
<u>Demographics</u> ( <i>n</i> = 17)	<u>Frequency</u> <i>n</i> (%)
<b>Gender</b>	-
<b>Age in years</b>	
18 – 29	5 (29%)
30 – 39	7 (41%)
40 – 49	2 (12%)
50 - 59	-
60 – 69	2 (12%)
70 +	1 (6%)
<b>Ethnicity</b>	
White – British	12 (70%)
White – Irish	1 (6%)
White – Any other background	2 (12%)
Black or Black British	1 (6%)
Mixed – White and Black African	1 (6%)
<b>Location of residence</b>	
Scotland	6 (35%)
Northern Ireland	1 (6%)
England – South	7 (41%)
England – North	1 (6%)
England - Midlands	2 (12%)
<b>Recruitment channel</b>	
Asthma UK newsletter	7 (41%)
Social media	3 (18%)
University College London newsletter	3 (18%)
Word of Mouth	3 (17%)
Hospital	1 (6%)

The sample included participants with self-reported mild (53%), moderate (24%), and severe asthma (17%) (see Table 17). Most participants (65%) reported no hospitalisations for asthma in the previous 12 months. The remaining participants reported between one and four (17%), or five and ten hospitalisations (17%). Two participants (12%) reported not seeing a GP for asthma in the last 12 months, despite national recommendations for annual asthma reviews (British Thoracic Society/Scottish Intercollegiate Guidelines Network, 2016). Two participants (12%) reported seeing their GP for their asthma between 10 and 20 times in the previous 12 months.

*Table 17. Self-reported asthma severity and asthma-related healthcare utilisation for participants in the qualitative study*

<u>Demographics</u> <i>(n = 17)</i>	<u>Frequency</u> <i>n (%)</i>
<b>Self-reported asthma severity</b>	
Mild	9 (53%)
Moderate	4 (24%)
Severe	3 (17%)
Prefer not to disclose	1 (6%)
<b>Self-reported hospitalisations for asthma (previous 12 months)</b>	
0	11 (65%)
1 – 4	3 (17%)
5 – 10	3 (17%)
<b>Self-reported GP visits for asthma (previous 12 months)</b>	
0	2 (12%)
1 – 10	13 (76%)
11 – 20	2 (12%)

Three overarching themes were identified in the data: building trust in pharmacists, filling gaps in current asthma care, and navigating a strained healthcare system (see Figure 13). They represented three influential inter-related processes that determined participants' perspectives of general practice pharmacists.



**Figure 13.** Thematic map for the qualitative study with adults with asthma. Themes and sub-themes identified in the data capturing participants' perceptions of pharmacist-led adherence support in general practice.

#### 8.4.2 Building trust in pharmacists

Opinions of general practice pharmacists were based on the level of trust participants were willing to place in pharmacists. The process of building trust occurred over time, and was based on participants' perceptions of pharmacists' clinical competency. Many participants engaged in a comparative benchmarking process, where they used other trusted healthcare professionals (e.g. GPs or nurses) as benchmarks for how much they were willing to trust a pharmacist.

##### *Building trust over time*

Participants highlighted that interpersonal trust in any healthcare professional builds through consistent contact over time, and some participants experienced this trust with

their asthma nurse or GP. They felt hesitant about the new pharmacist-led service because it meant deviating from their usual trusted healthcare professional. Their preference for usual care over new initiatives was a protective mechanism (“playing it safe”), and was not necessarily linked to doubts about pharmacists. However, some participants did worry that building a consistent relationship with pharmacists would be difficult, mainly due to their previous experiences with the high staff turnover rates in community pharmacies.

*“I don’t know really know [if I’d want a pharmacist], I think I’d prefer a doctor [to talk to about my asthma]. It’s the way it’s always been.”*

– P15, male, 30 – 39 years, mild asthma

*“[Community pharmacy chains have] got that many staff everywhere that they just get anybody in, work anywhere. So it’s harder because [those pharmacists] don’t seem to know the patients anymore.”*

-P02, female, 30 – 39 years, severe asthma

#### *Building trust based on perceived clinical competency*

When asked about specific criteria for trust, participants mostly discussed pharmacists’ clinical competency. From the perspective of the participants, knowledge about asthma was an important component of competency. Participants felt they could sense when a healthcare professional had adequate knowledge about asthma, and highlighted previous experiences where this was not the case. Participants who believed that pharmacists had sufficient asthma knowledge were more likely to support the new service.

*“I’ve had a few paramedics when I’ve been at the doctor’s and the nurses have sent for the ambulance, that they’ve had to ask the nurse what my [brittle] asthma is and what treatment I should be having which is quite frightening really because they should know what they’re doing....I think you can tell when somebody knows what they’re talking about.”*

– P02 female, 30 – 39 years, severe asthma



*“So I know that in the pharmacy role they’re very knowledgeable. So if [adherence support for asthma] is something they want to do then why not? I have a lot of faith in somebody who’s got a lot of knowledge in something.”*

– P08, female, 30 – 39 years, severe asthma

In addition to asthma knowledge, participants talked about training and broad clinical knowledge as important components of competency. Some participants believed that pharmacists would need extensive additional training to acquire the necessary skillset for the new service. They felt that pharmacists lacked broad clinical knowledge and were too medication-focused, with some participants worrying that pharmacists would misinterpret symptoms of undiagnosed health conditions as medication-related side effects.

*“...the training required to give the pharmacist, all this knowledge to make sure that us patients were confident in a pharmacist would cost [the NHS] an awful lot of money.”*

– P09, male, 60 – 69 years, undisclosed asthma severity

*“...it could be that the [medication] side-effects are something else entirely. So [pharmacists] would be kind of completely thinking down the asthma route, ‘it might just be that you’re taking an inhaler that you feel side-effects’ ...but what if it turns out you actually have cancer?”*

– P17, male, 18 – 29 years, mild asthma

Many participants mentioned that public awareness of pharmacists’ skillset is limited, and that this would hinder the new service. They felt that without adequate background information on pharmacists’ education and training, people would not be able to judge the new service accurately. As such, implementing the new service would require a shift in the public perception of pharmacists. They felt optimistic that public opinion could change, albeit slowly.

*“I think it’s all about making aware of what pharmacists can actually do and how clever they actually are.”*

– P02, female, 30 – 39 years, severe asthma

*“It’s going to be a slow process anyway because you’re changing the nature of the [pharmacist] job. You’re making them a hybrid, almost nurse...you’ve got to change the whole perception of what a pharmacist is.”*

– P14, male, 18 – 29 years, mild asthma

### *Building trust through benchmarking*

Although all participants had certain criteria for establishing trust, none of them had previous experience with general practice pharmacists. As such, many participants engaged in a process we labelled as *benchmarking*: using their trust and previous experiences with other healthcare professionals to gauge how much they would trust a general practice pharmacist. Common reference points included community pharmacists, respiratory consultants, nurses, GPs, and paramedics.

*“...I know [pharmacist support] is there but I still don’t understand it with [brittle] asthma because I still get wary. If paramedics have never heard of it and don’t know what they’re doing, how’s a pharmacist going to hear of it?”*

– P02, female, 30 – 39 years, severe asthma

*“I would much rather go to a pharmacist than to a nurse to discuss the medication issues that I was having... I can see an asthma nurse to discuss medication, and I was like ‘Really? What do nurses know about...not to be rude, but what do they know about medication more than my specialist who prescribed it?’”*

– P04, female, 30 – 39 years, mild asthma

Participants did not delineate between pharmacy sectors, using previous experiences with community or hospital pharmacists to inform their trust in the new general practice pharmacists.

*“I’m just lucky that I’ve got a really good [community] pharmacist...it’s a luxury that I’ve got but it would be really good for everyone to have it.”*

–P06, female, 30 – 39 years, severe asthma

*“I work with a pharmacist at work and she’s one of the most brilliant people I’ve ever met, so I already could fit that standard in my head that pharmacists are wonderful.”*

–P11, female, 40 – 49 years, moderate asthma (works as a nurse)

### 8.4.3 Filling gaps in current asthma care

Participants formed their perspectives of the new service based on their lived experiences of asthma care. Those who felt that general practice pharmacists would fill existing gaps in current asthma care were more enthusiastic about the new service. The potential place for general practice pharmacists in asthma care was assessed based on potential role overlap with other healthcare professionals (e.g. asthma nurses), continuity of care, and medication-specific support.

#### *Role overlap*

In addition to the trust-related benchmarking process outlined in Section 8.4.2, participants weighed the added value of the pharmacist-led service against the perceived roles of GPs and nurses. Participants that saw potential role overlap were more sceptical of the new service. However, other participants clearly delineated between the roles of pharmacists and GPs/nurses, and these participants often recommended ways to integrate pharmacists into their care.

*“I think if I was having an annual asthma review [with a nurse or GP] I wouldn’t need to use the pharmacist’s service as well, but it might be an alternative to the annual asthma review...”*

– P03, male, 70+ years, mild asthma

*“If you’re asking a GP [about your asthma], you’ve got maybe five, ten minutes... with the GP you can concentrate on the problem and get that sorted, and then go see the pharmacist and discuss the medication.”*

– P05, female, 60 – 69 years, moderate asthma

#### *Continuity of care*

Participants with self-reported severe asthma often had multiple healthcare professionals involved in their care (e.g. respiratory consultants, GPs, and asthma nurses). When asked about the new service, some of these participants felt concerned about involving an additional healthcare professional in their care. This was unrelated to their views on pharmacist competency, and usually informed by previous

experiences with inadequate continuity of care due to a lack of communication between healthcare professionals.

*“[Pharmacists] always say speak to your GP but then the GP tells you to speak to the pharmacist because they’re supposed to know more about drugs than what they are...and then you’re somewhere in the middle...”*

– P02, female, 30 – 39 years, severe asthma

### *The medication expert*

Other participants with severe asthma on multiple medications and/or with other health concerns welcomed the service. This enthusiasm came from the fact that they identified gaps in their current care which they believed could be filled by pharmacists as medication experts.

*“...just having contact with someone who actually...knows about the medication, like they know how they work and what the potential side effects are going to be and interactions...it’s that knowledge that a GP wouldn’t necessarily have time to tell you all about...”*

– P06, female, 30 – 39 years, severe asthma

*“...I’m trying to conceive at the moment so...and I thought I don’t want to be taking anything that’s unnatural or steroid-y...I did ask the respiratory consultant [about asthma medications and In Vitro Fertilisation] but he didn’t know...”*

–P08, female, 30 – 39 years, severe asthma

Another participant highlighted that pharmacists could make medication information more accessible for people with disabilities.

*“It’s frustrating when stuff isn’t accessible [for people with visual impairments]. I mean, like the leaflets inside the box, right? There’s a number you can phone and get a braille version of that but it takes a few days. By then, you’ve taken the medication, had a reaction to it...you could talk to the pharmacist and he could tell you these things.”*

–P05, female, 60 – 69 years, moderate asthma (visually impaired)

Some participants felt that general practice pharmacists should have an independent prescribing qualification to fulfil their role as medication experts. They worried that the new service might contribute to the burden on patients and/or the healthcare

system, and that independent pharmacist prescribers would minimise the risk of this happening.

*“For me, it would just be down to whether or not [pharmacists] are able to prescribe. I don’t imagine that they wouldn’t have the knowledge that was required...It’s just if I had to then see a doctor to be prescribed a different medication, I’d rather just go to see the doctor instead.”*

– P10, female, 40 – 49 years, mild asthma

Some participants felt they did not need additional medication-specific support because they were diagnosed earlier in life, and therefore gained knowledge and experience with their medications over time. However, they thought the service would be useful for newly diagnosed individuals with less asthma experience, particularly if initial medication information provided by other healthcare professionals was inadequate.

*“I think it would be very useful for a [newly diagnosed person] to have somebody who can explain to them a lot of stuff about using the medication. [Doctors] might not do, the doctor would prescribe the medication, then you’d have to read the label.”*

–P03, male, 70+ years, mild asthma

#### 8.4.4 Navigating a strained healthcare system

Participants were acutely aware of the strain on the NHS, and this informed their interactions with the healthcare system. How they navigated their asthma care, and therefore how they perceived the new service, was influenced by two perceptions: the limited resources in the NHS and a hierarchy of healthcare professionals.

##### *Limited resources*

Participants often expressed guilt and frustration about booking appointments for asthma in general practice because they felt they were taking up limited resources.

*“...come Monday morning I wouldn’t want to call the GP because I know on Monday morning they’re very, very busy...I’ll just sort of crack on at home, multi-dosing salbutamol and seeing what happens.”*

– P08, female, 30 – 39 years, severe asthma

*“...to be honest, GPs have bigger problems to deal with...[they’re] dealing with people with, you know, life threatening illnesses, then actually seeing the standard case of asthma or an asthma check-up isn’t the best use of [their] time.”*

– P16, male, 18 – 29 years, moderate asthma

Participants never booked appointments just for medication-related questions, and their concerns were frequently left unaddressed because other topics took priority in a consultation, particularly if the participant had multiple comorbidities. The pharmacist-led service was welcomed by these participants because they felt pharmacists would have more time to focus on their medication.

*“[GPs] just want you in and out... ‘oh yes, I wanted to ask you something else’ but too late now, you’re away. That’s how you feel.”*

–P01, female, 30 – 39 years, mild asthma

*“...my opinion is that [pharmacists] seem to have a bit more time to do [medication-specific support] and they’ve got the skills and they’ve got the understanding [of medication]...”*

–P06, female, 30 – 39 years, severe asthma

However, pharmacists themselves were also viewed as a limited healthcare resource. Many participants supported moving pharmacists from community pharmacies to general practice because they experienced inadequate care in busy community pharmacies. Others were concerned that pharmacist-led adherence support with a wide scope (i.e. for multiple long-term conditions) would limit access for people with asthma.

*“If [pharmacists] weren’t running a community pharmacy, if they were linked in, if they worked within the GP surgery with a lot of time, then yes, I don’t see how [a lack of time] would be an issue.”*

– P12, female, 30 – 39 years, mild asthma

*“...my worry is if a pharmacist has to do [adherence support in general practice] for asthma, what other long-term conditions will they have to do it for?”*

– P06, female, 30 – 39 years, severe asthma

### *The hierarchy of healthcare professionals*

Participants' views of the new service were influenced by a perceived hierarchy of healthcare professionals with GPs at the top, followed by nurses and finally pharmacists. The hierarchy determined the importance of each healthcare professional's time. Participants felt that GP appointments should be reserved for severe health concerns, while less urgent concerns could be managed by nurses or pharmacists.

The hierarchy of healthcare professionals influenced perceptions of the new service in both directions. Some participants were enthusiastic about the new service because they believed it would reduce the workload of GPs and nurses. For these participants, seeing a pharmacist (the healthcare professional further down the hierarchy) felt less intimidating and formal, slightly easing concerns about taking up valuable appointment time.

*"I think [the pharmacist-led service] takes some of the pressure off GPs, the nurses...having a regular check with the pharmacist is a much better solution for both us as the patient point of view, and from you know, healthcare professionals' point of view..."*

–P16, male, 18 – 29 years, moderate asthma

*"It feels less formal, I think, when you're with a pharmacist than when you're in the doctor's, and it doesn't feel like...sometimes when you go to the doctor's, you're kind of clock watching..."*

– P10, female, 40 – 49 years, mild asthma

Other participants were sceptical of the new service because they felt pharmacists could not extend into a clinical role similar to GPs and nurses. They felt that general practice pharmacists could fulfil a triage-like function to safeguard GP time, reflecting the relative importance of pharmacist to GP time.

*“I never feel as though a pharmacist is a nurse, if you see what I mean. A nurse has practical hands-on experience of trying to make people better. The pharmacist is one who deals with the theory of medication.”*

–P09, male, 60 – 69 years, undisclosed asthma severity

*“... the pharmacist has seen you and if there’s communication between the pharmacist and the GP, so that I guess it would help the GPs prioritise who they saw...”*

–P11, female, 40 – 49 years, moderate asthma

There were some concerns about extending the pharmacist role and how this would affect the existing hierarchy. Participants were worried about potential conflicts between GPs and pharmacists concerning inconsistent recommendations.

*“The only [drawback of the service] that I could think of is if [the pharmacist’s] recommendations were...if they disagreed with GPs, if they were in opposition to them then there might be a little bit of a power struggle.”*

–P04, female, 30 – 39 years, mild asthma

## 8.5 Overview of findings

Perceptions of the new service were based on people’s trust in pharmacists, perceived gaps in current asthma care, and the perceived strain on the NHS. Participants based trust on perceptions of pharmacists’ asthma knowledge and clinical competency. Without prior experience of the service, trust in general practice pharmacists was established through a *benchmarking* process that used other trusted healthcare professionals as reference points. Community pharmacists were commonly referenced in this process, suggesting that participants did not delineate between pharmacy sectors.

Participants contemplated whether the new service added value to their asthma care based on potential role overlap with other healthcare professionals (e.g. GPs or nurses). They weighed the potential risk of adding another healthcare professional to their care based on concerns about continuity of care. People who viewed pharmacists



as medication experts and people who wanted additional medication-related support were more supportive of the service.

Participants were aware of the limited resources in the healthcare system, and this affected their views of the new service and their interaction with the healthcare system in general. They navigated the strained healthcare system based on a hierarchy of healthcare professionals, with GPs at the top, followed by nurses, and finally pharmacists. When it came to the new service, the hierarchy worked both ways. For some participants, the hierarchy categorised pharmacist consultations as informal and accessible sources of support. For others, it prevented pharmacists from extending into consultation-based roles. Some participants were concerned about how the extended pharmacist role would affect the hierarchy and whether this would produce conflicts between healthcare professionals.

## 8.6 Discussion

### 8.6.1 Strengths and limitations

The qualitative method in this study captured the complex processes behind people's perceptions of the new service. The combination of recruitment channels produced variation in the sample in terms of age, self-reported asthma severity, healthcare utilisation, and participants' place of residence. Telephone-based interviews enabled recruitment across the UK without increasing participant burden, thus increasing study accessibility for participants with severe asthma and limited travel capacity. In addition, previous research suggests that telephone-based interviews can produce higher data quality compared to face-to-face interviews when sensitive topics (e.g. long-term conditions) are discussed (Sturges & Hanrahan, 2004).

Despite three rounds of recruitment and the use of several recruitment channels, the study sample did not match the proportions outlined in the sampling matrix (see Table 15). While the overall proportion of male and female participants was aligned (41% and 59% in the sample versus 45% and 55% in the sampling matrix), we were unable to recruit male participants aged 40 – 49 and 50 – 59, as well as male participants with self-reported severe asthma. We were also unable to recruit female participants aged 50 – 59 and 70+. As such, the study sample may not have captured the full diversity of the general population with asthma in terms of age, gender and self-reported asthma severity.

Furthermore, people recruited through the Asthma UK newsletter may have been more engaged in asthma research and care, and may therefore have been more open to new asthma care models. However, these participants may also have had more experience with asthma-specific healthcare services (e.g. annual asthma reviews) to inform their perceptions of the new service. If scepticism of the new service exists among people who are engaged in their asthma care, then these views may be amplified in the general population with asthma.

A major drawback of the study is that none of the participants had experienced a general practice pharmacist consultation directly, with some participants recruited from Scotland and Northern Ireland where this healthcare model is yet to be introduced. While the consultation description participants were asked to read was based on real work by a clinical respiratory pharmacist working in general practice, the study findings only represent patients' initial views of the new service. Therefore, the participants represented the general population with asthma who would initially need to be convinced to engage with the new service, with the understanding that their views may change over time or with exposure to the service.

### 8.6.2 Comparison with existing literature

There is limited research on patient perspectives of general practice pharmacists because the care model is relatively new. However, findings from this study align with those from community pharmacy-based research, suggesting that people with asthma may not differentiate between pharmacy sectors.

Findings align with work by Gidman et al. (2012), who found that people were hesitant about deviating from their usual trusted care model (often a GP). People trusted GPs over community pharmacists because they had developed a trusting relationship with their GPs over time. Both the general public and people with asthma have been found to use other trusted healthcare professionals (e.g. GPs and nurses) as benchmarks for trust when asked about a community pharmacist-led service (Gidman et al., 2012; Naik Panvelkar et al., 2010). Similarly, Naik Panvelkar et al. (2010) found that people's previous positive experiences with community pharmacists raised expectations for other pharmacist-led services.

Participants were interested in pharmacists' clinical competency. In the medical literature, clinical competency consists of accurate clinical knowledge (*know*), an understanding of how to apply that knowledge in practice (*know how*), accurately applying that knowledge in practice (*show how*), and continuing to do so as an independent clinician (*does*) (G. E. Miller, 1990). Participants in this study primarily looked for the *know*, *know how*, and *show how* components of competency when discussing general practice pharmacists.

Perceived gaps in current asthma care shaped perceptions of the new service. Similarly, Boyd et al. (2014) found that recipients of the New Medicine Service welcomed pharmacists' recommendations if they addressed a concern directly raised by the patient. While asthma care guidelines recommend a multidisciplinary approach

in treating difficult asthma, the present study suggests that some people with self-reported severe asthma were hesitant about the inclusion of another healthcare professional because it may affect continuity of care (British Thoracic Society/Scottish Intercollegiate Guidelines Network, 2016).

In line with previous research, the hierarchy of healthcare professionals was identified as a barrier to pharmacist-led care because it limited the expansion of the pharmacist role (Gidman et al., 2012; Latif et al., 2013). However, it also worked in favour of the new service because people viewed pharmacist consultations as less intimidating and formal, and this eased concerns about taking up healthcare resources.

### 8.6.3 Implications for research and practice

Our findings highlighted several challenges to the uptake of the general practice pharmacist-led healthcare model. Firstly, while there was support for the new service among adults with asthma, there were concerns regarding role overlap with other healthcare professionals. Given the *benchmarking* process used to establish trust in pharmacists, comparisons between general practice pharmacists and other healthcare professionals (e.g. GPs) could be used to increase service uptake by informing and engaging the public. For example, public campaigns highlighting the differences and similarities between GPs and general practice pharmacists may help the public differentiate the pharmacist role and understand the added value of the new service within asthma care.

In terms of competency, participants wanted pharmacists to have broad clinical skills and a prescribing qualification. The general practice context may align well with these expectations, as these skills were included in the general practice pharmacist training pathways developed by the Centre for Pharmacy Postgraduate Education (Centre for Pharmacy Postgraduate Education, 2018). The general practice context may also

facilitate trust between adults with asthma and pharmacists. While people in the UK are not asked to register with a specific community pharmacy, they are asked to register with a GP surgery. As such, consistent contact with the same pharmacist may be more likely in general practice, thereby facilitating the process of building trust over time.

Although the hierarchy of healthcare professionals acted as a barrier to the extended pharmacist role, it also made pharmacist consultations appear less formal and intimidating to access. Compared to appointments with a GP, participants felt more comfortable making an appointment with a pharmacist for medication-related questions. This is encouraging because the new service may encourage people with asthma to address medication-related concerns that may be barriers to adherence. However, participants did not delineate between pharmacy sectors and changing the public perception of pharmacists (e.g. community pharmacists as ‘shopkeepers’) will take time. Endorsements of pharmacist-led by other trusted members of the general practice team (e.g. GPs or nurses) may encourage people with asthma to engage with pharmacist-led services (Bradley, Elvey, et al., 2008; Gidman et al., 2012).

Future studies could conduct in-depth interviews with people with asthma after they experience a general practice pharmacist-led consultation. These interviews could establish if interpersonal factors (i.e. rapport with the pharmacist) have an impact on patient perspectives. Ethnographic observations of pharmacist-led consultations and the general practice team will help assess pharmacists’ integration and its effect on continuity of care for asthma patients. Future participant recruitment should aim for greater variation in the sample in terms of ethnicity and age, with additional efforts to look for discordant voices when thematic saturation is reached. Recruitment to the study through hospital settings was difficult, and future studies may benefit from

conducting face-to-face interviews in the clinics themselves, rather than over the telephone at a later date.

## 8.7 Conclusion

This chapter explored the perspectives of adults with asthma regarding general practice pharmacist-led adherence support, with a specific focus on how these perspectives were formed. Adults with asthma focused on trust, gaps in current asthma care, and the perceived strain on the healthcare system to inform their perspectives of the new service.

Chapters 6 and 7 of this thesis highlighted that pharmacist-led adherence support for adults with asthma should employ a PAPA with additional training for pharmacists to tackle the motivation-related factors affecting adherence (e.g. beliefs about asthma and its treatment) (Horne, 2001, 2015). Chapters 7 and 8 suggested that this type of adherence support may be best delivered in an integrated care setting, such as general practice, to overcome some of the barriers identified in the community pharmacy context (e.g. retail activities, lack of privacy, pharmacists and patients lacking time for consultations). However, these findings were based on past experiences of asthma care and adherence support, rather than direct experiences with general practice pharmacist-led adherence support. Therefore, to fully understand the potential of this type of intervention, additional work needed to be done to investigate its performance in clinical practice.

A feasibility and acceptability study of a general practice pharmacist-led adherence support intervention was designed in cooperation with another PhD researcher (see *PhD Structure* for cooperation details). This study, described in the next chapter of

this thesis, explored the perspectives of both UK pharmacists and adults with asthma on the Pharmacist Asthma Support Service (PASS).

## 9 The feasibility and acceptability of the Pharmacist Asthma Support Service (PASS): a UK general practice study

### 9.1 Introduction

This chapter links to the final objective of this PhD: to investigate the feasibility and acceptability of UK pharmacists as the delivery channel for an asthma-specific adherence intervention delivered in general practice. Feasibility studies investigate whether a study can be conducted in practice, with a focus on recruitment, retention, intervention fidelity (i.e. is the intervention delivered as it was intended?), and research procedures (Craig et al., 2008; Orsmond & Cohn, 2015). If a study is considered feasible, research can progress to pilot studies examining the initial effects of the intervention on outcome variables in a small participant sample (National Institute for Health Research, 2012).

Acceptability is the extent to which the implementers (e.g. healthcare professionals) and recipients (e.g. patients) of a healthcare intervention find the intervention appropriate based on expected and/or experienced responses to it (Sekhon, Cartwright, & Francis, 2017). The acceptability of a new healthcare intervention can influence its implementation and effectiveness, and acceptability research was recently included in the MRC guidelines for the process evaluation of complex interventions (G. F. Moore et al., 2015). As such, funders of healthcare research are increasingly asking for acceptability data for new healthcare interventions.

In their Theoretical Framework of Acceptability (TFA), Sekhon et al. (2017) proposed that the acceptability of healthcare interventions has seven components: affective attitude, burden, ethicality, intervention coherence, opportunity costs, perceived effectiveness, and self-efficacy (see Table 18). These components can guide



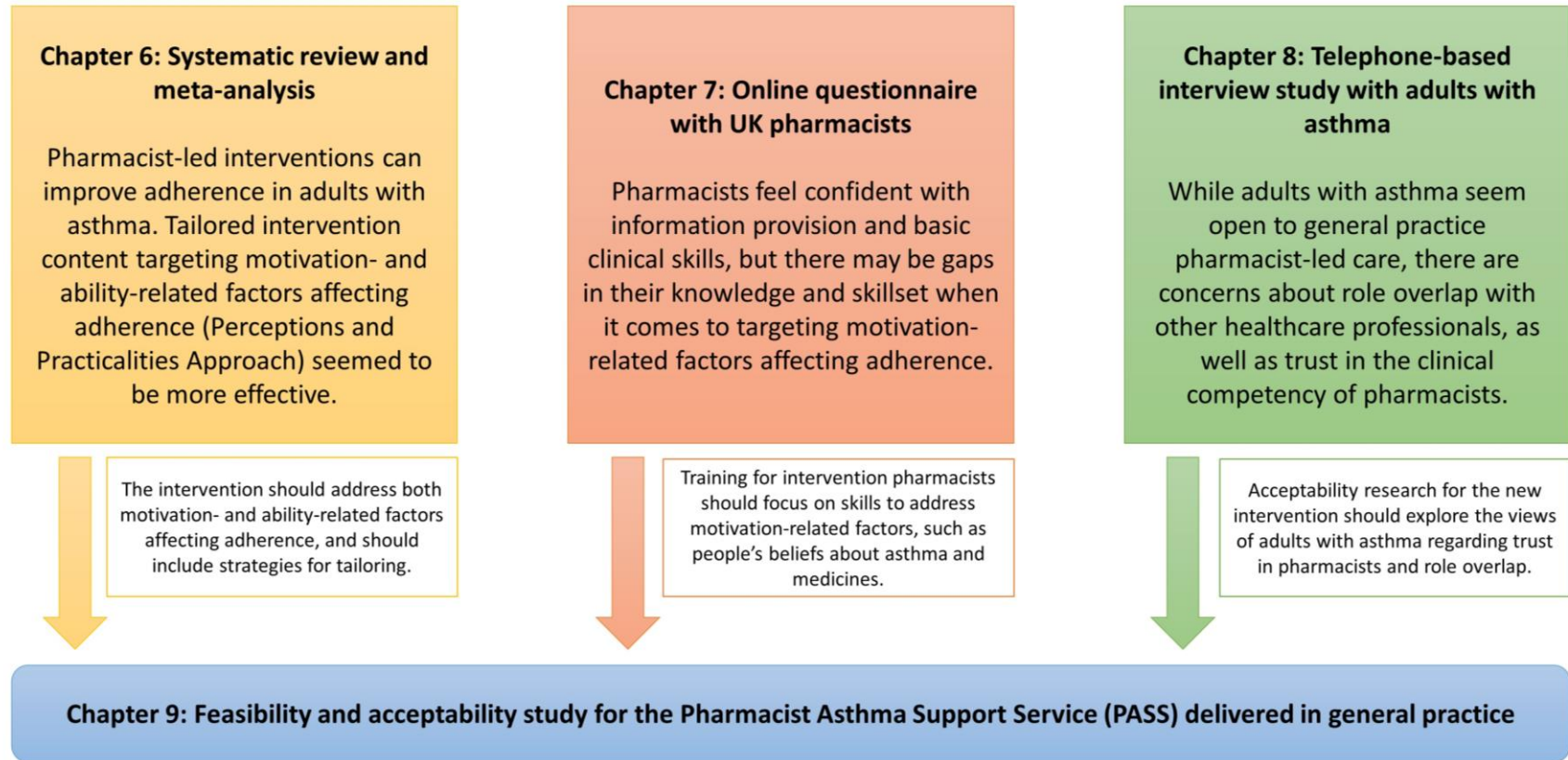
intervention design (i.e. ensuring the intervention addresses these factors) or can be used to assess the acceptability of healthcare interventions from both the implementer and recipient perspective (Sekhon et al., 2017).

*Table 18. Components of the Theoretical Framework of Acceptability (TFA). Adapted from “Acceptability of healthcare interventions: an overview of reviews and development of theoretical framework” by Sekhon et al. (2017), BMC Health Services Research 17:88.*

<u>TFA Component</u>	<u>Definition</u>
Affective attitude	How an individual feels about the intervention
Burden	The perceived amount of effort needed to receive/deliver the intervention
Ethicality	The extent to which the intervention fits with an individual’s value system
Intervention Coherence	The extent to which the individual understands the intervention and how it works
Opportunity Costs	The extent to which benefits, profits, or values must be given up to engage with the intervention
Perceived Effectiveness	The extent to which the intervention is perceived as likely to achieve its purpose
Self-efficacy	The individual’s confidence that they can perform the behaviours required for the intervention

Initial feasibility and acceptability research is crucial when developing new healthcare services because it identifies potential research design and intervention-related issues that would otherwise be encountered during costly large-scale randomised evaluations (Craig et al., 2008; Orsmond & Cohn, 2015). Therefore, the final step for this PhD was to conduct the initial feasibility and acceptability research to identify any potential issues for future evaluations of pharmacist-led adherence support for adults with asthma delivered in general practice.

Findings from Chapters 6, 7 and 8 were carried forward into this feasibility acceptability work (see **Figure 14** for further details). In summary, findings from the previous chapters informed intervention content (tailoring strategies and intervention targets), pharmacist training (targeting potential gaps in their existing knowledge and skillset), and topics of interest in assessing the acceptability of the new intervention.



**Figure 14** Flowchart of findings throughout the PhD

## 9.2 Aim and objectives

The aim of the study was to assess the feasibility and acceptability of the Pharmacist Asthma Support Service (PASS), a pharmacist-led adherence intervention based on the PAPA (Horne, 2001, 2015) and delivered in general practice. This aim was divided into several objectives:

1. To assess the feasibility of the PASS study in terms of recruitment, retention, data collection procedures, and intervention fidelity.
2. To assess the acceptability of intervention *content* from the perspectives of adults with asthma and pharmacists.
3. To assess the acceptability of the intervention delivery *channel* from the perspectives of adults with asthma and pharmacists.

The study's secondary objectives focused on process variables associated with the PAPA (beliefs about medicines, perceptions of asthma, and inhaler technique) and potential outcome variables for future evaluations of the intervention (adherence, peak expiratory flow, and asthma control):

4. To explore the change in process variables relevant to the PAPA over the course of the study.
5. To explore the change in outcome variables over the course of the study.

The sole aim of analysing the process and outcome variables was to establish whether the intervention showed promise within the intended population, thereby informing the possibility of pilot studies and RCTs in the future (Orsmond & Cohn, 2015). The analyses were exploratory and not intended to establish the intervention's effectiveness, as this was not the aim of the feasibility/acceptability study.

### 9.3 Methods

We conducted a before-and-after feasibility and acceptability study. There was no randomised control group or parallel comparator group because the primary aim was to establish whether the intervention and study design could work in practice, instead of exploring the effect of the intervention on outcome variables. The latter will have to be studied in subsequent pilot studies and RCTs (Orsmond & Cohn, 2015).

#### 9.3.1 The intervention

The PASS was an intervention targeting adherence to ICS among adults with asthma. It was delivered by pharmacists in general practice through individual face-to-face consultations. Consultations followed the standard asthma review structure outlined by the British Thoracic Society/Scottish Intercollegiate Guidelines Network (2016), covering symptoms, asthma control, medication, lung function, inhaler technique, and smoking cessation, with the additional adherence intervention component embedded into the consultation.

#### *Intervention development*

The content of the PASS was designed by another researcher as part of her PhD (see PhD structure). Her work will be briefly described in this section.

The intervention followed the PAPA (see Section 2.5.2): a tailored approach to address people's motivation and ability to adhere to ICS. Motivation- and ability-related factors affecting ICS adherence (see Table 19) were identified from previous research (Chapman et al., 2015; Horne, 2006; Horne et al., 2007; Horne & Weinman, 2002) and refined through three focus groups with adults with asthma.

Initial intervention components targeting these factors were tested in an online RCT with 1,457 adults with asthma, with promising outcomes (Katzner, Wileman, Chan,

Taylor, & Horne, 2018). CK also shadowed a clinical respiratory pharmacist working in general practice to inform the structure of the PASS consultation.

*Table 19. Targets of the Pharmacist Asthma Support Service (PASS) - motivation- and ability-related factors affecting adherence to inhaled corticosteroids (ICS).*

<u>Motivation-related factors</u>	<u>Ability-related factors</u>
<ul style="list-style-type: none"> <li>- Necessity beliefs about ICS</li> <li>- Concerns about ICS:               <ul style="list-style-type: none"> <li>• Side effects</li> <li>• Steroids</li> <li>• Long-term effects</li> <li>• Dependence</li> <li>• ICS building up in the body</li> <li>• Loss of effectiveness over time</li> <li>• Strength of ICS</li> </ul> </li> <li>- Beliefs about asthma (illness representations)               <ul style="list-style-type: none"> <li>• Timeline</li> <li>• Curability/control</li> <li>• Consequences</li> <li>• Identity</li> <li>• Cause</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>- Forgetfulness</li> <li>- Asthma knowledge</li> <li>- Inhaler technique</li> </ul>

### *Intervention tailoring*

The content of the pharmacist-led consultations was tailored based on a profiling questionnaire given to study participants before their first appointment with the intervention pharmacist (see Appendix I). The questionnaire was designed to identify necessity beliefs and concerns affecting ICS adherence, and intervention pharmacists used the completed questionnaires and additional information from the participant and their healthcare records to guide the consultation towards the most salient adherence barriers.

### *Intervention content*

Pharmacists began each consultation with a non-judgmental normalisation statement outlining the purpose of the consultation and common reasons for ICS non-adherence. The normalisation statement was designed to encourage participants to be open and

honest in their consultations, as some people may feel hesitant about discussing non-adherence with a healthcare professional (Horne, 2012).

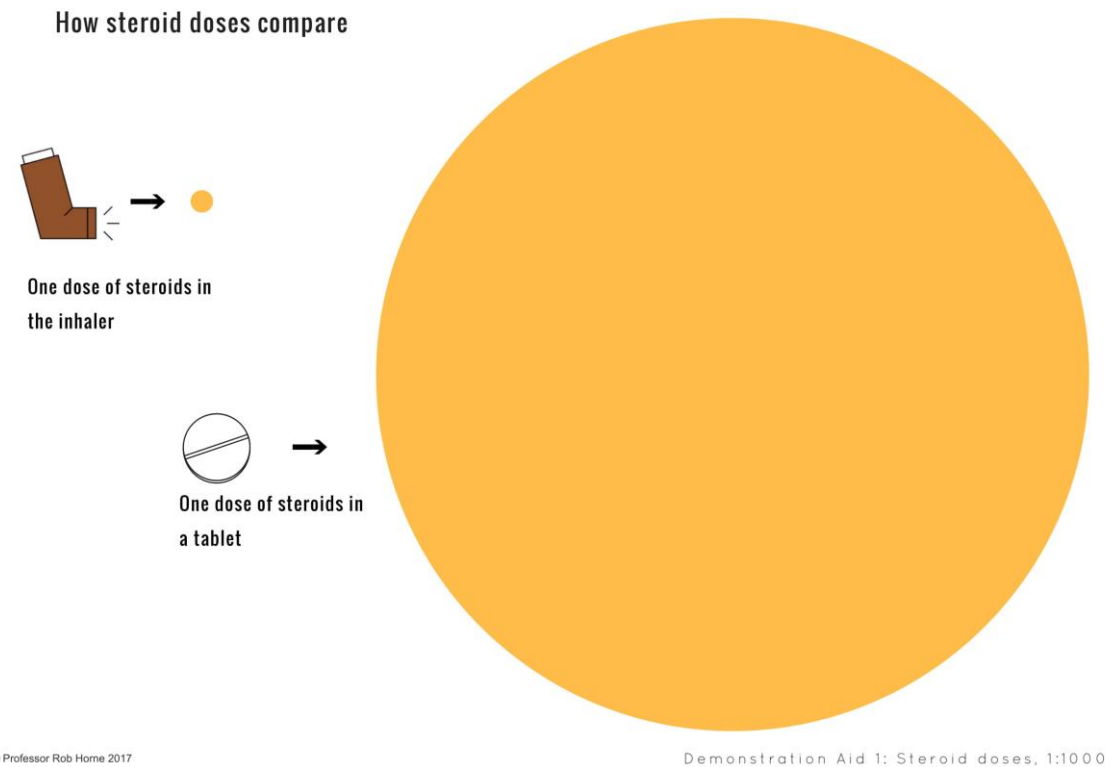
Pharmacists had an intervention manual to guide their consultations. It included pre-written scripts and demonstration aids that corresponded to specific items in the profiling questionnaire to allow for easier consultation tailoring. Pre-written scripts were intended as guidelines and did not need to be followed word-for-word. Pharmacists had access to four printed/laminated demonstration aids and one video for use during their consultations. The scripts and demonstration aids were developed by CK based on behaviour change and health psychology theory (Leventhal et al., 1992; Michie et al., 2013). An example (pre-written script and accompanying demonstration aid, Figure 15) is outlined below:

A participant indicates on their profiling questionnaire that they are **concerned about getting side effects** from their ICS. The pharmacist asks the participant to elaborate on their concerns, and they reveal that they are worried about **the side effects of steroids**. They may have had previous **difficult experiences with oral corticosteroids** (e.g. during hospitalisation).

**Pre-written script included in the intervention manual:** “Steroids are the active ingredient in your preventer inhaler and it is important that you are aware that steroids are actually natural substances produced by our own bodies...The medical steroids in the preventer are similar to our body’s natural steroids, and the dose is very small.”

## Suitable demonstration aid included in the intervention manual:

### *Intervention structure*



**Figure 15.** An example demonstration aid from the Pharmacist Asthma Support Service (PASS). Reframing the dose of steroids in oral and inhaled steroids.

The PASS consisted of two individual consultations with a pharmacist based in general practice. The first consultation lasted approximately 20 minutes, and the adherence intervention was delivered during this session. At the end of the consultation, the pharmacist and participant agreed on a set of asthma-specific goals (e.g. setting reminders to take ICS or giving up smoking). One month later, participants attended a follow-up consultation lasting approximately 10 minutes. Pharmacists reviewed participants' progress with their goals and reinforced intervention components as needed.

### *Intervention context and channel*

The PASS was delivered in two Clinical Commissioning Groups (CCGs) in London: City and Hackney CCG (C&H) and Haringey CCG. Ethical approval for the study was

obtained from the Camden & King’s Cross Research Ethics Committee (December 11<sup>th</sup> 2017, Ref: 17/LO/1965). Two pharmacists (one per CCG) were asked to deliver the intervention. The pharmacists differed in terms of previous clinical experience, job structures, and target patient groups (see Table 20). We recruited pharmacists with different clinical backgrounds to identify potential differences in training needs and service delivery. The different job structures helped us explore how the PASS would fit into existing pharmacist practice.

*Table 20. Characteristics of the intervention pharmacists delivering the Pharmacist Asthma Support Service (PASS) in each Clinical Commissioning Group (CCG)*

<u>Pharmacist 1</u>	<u>Pharmacist 2</u>
<ul style="list-style-type: none"> <li>- City and Hackney CCG, existing respiratory support service</li> <li>- Specialist clinical respiratory pharmacist.</li> <li>- Independent prescriber.</li> <li>- Extensive experience in providing adherence support for people with asthma.</li> <li>- Working across 42 practices in a CCG, providing consultations to people with asthma/COPD/respiratory difficulties.</li> <li>- Her work informed the structure of the PASS.</li> </ul>	<ul style="list-style-type: none"> <li>- Haringey CCG, no existing service specifically for asthma</li> <li>- Clinical pharmacist with previous hospital experience, recruited for work in general practice.</li> <li>- Independent prescriber.</li> <li>- Limited experience in providing adherence support for people with asthma.</li> <li>- Working at one practice, providing consultations to people with long-term conditions.</li> </ul>

Pharmacist One was a specialist respiratory pharmacist working in an existing respiratory support service in C&H. She worked across the CCG, spending one weekday every two weeks at each practice. She focused solely on people with asthma, COPD, and respiratory difficulties across a mixture of privatised and NHS practices. The PASS study linked onto her existing service.

Pharmacist Two worked full-time at a privatised practice in the Haringey CCG. She held consultations for long-term conditions, including but not limited to asthma. She



had previous hospital experience, but was not specialised in respiratory care. Her practice did not have a pre-existing asthma service. She conducted most of her PASS consultations on Saturdays to maintain her regular workload on weekdays.

### *Pharmacist training*

Both pharmacists were e-mailed a copy of the intervention manual to review ahead of time. We produced training binders containing the printed intervention manual and laminated demonstration aids, a list of intervention ‘do’s and don’ts’, examples of filled-in profiling questionnaires, and case studies based on real people with asthma seen in general practice.

Pharmacists completed one training session each with the author of this thesis approximately three weeks before the study commenced. These sessions lasted one to two hours, depending on the training needs and availability of each pharmacist. Each training session began with an overview of the research behind the intervention (i.e. the PAPA), and a discussion of the intervention manual and demonstration aids.

This was followed by a section on the intervention’s structure and tailoring methods. Pharmacists were reminded of the importance of the normalisation statement and shown how consultation content (e.g. pre-written scripts, demonstration aids, or video) could be selected based on the profiling questionnaire and participants’ input. Guidelines for the ideal PASS consultation were explained using a list of consultation ‘do’s and don’ts’ (see Appendix J).

Once the pharmacists were familiar with the intervention’s structure and materials, they were introduced to consultation scenarios. First, they were given completed profiling questionnaires and asked to describe how they would tailor consultation content based on each questionnaire. The first example was discussed in collaboration

with the researcher providing the training, but pharmacists were given minimal guidance in subsequent examples.

Next, pharmacists were given written case studies based on real people with asthma seen in general practice (see Appendix K). The case studies consisted of nine short descriptions of potential patients, accompanied by suggestions on how to structure each consultation. Pharmacists could opt to role-play a consultation (with the researcher as the patient) or to describe their consultation plan using the intervention materials. Pharmacists were given the training binder to take home. They were encouraged to review additional case studies before the study commenced and to contact the researchers with any questions.

### 9.3.2 Recruitment

Based on the timelines for the PhD, the availability of the pharmacists, and feedback from the pharmacists, a recruitment period of four weeks was deemed sufficient to gauge recruitment potential in each CCG. Sim and Lewis (2012) recommend a sample of 50 participants for pilot or feasibility studies. As such, we set a recruitment target of 100 participants (50 per CCG).

Inclusion and exclusion criteria are outlined in Table 21. Participants were adults with asthma ( $\geq 18$  years) with an asthma diagnosis and prescription for ICS, and no respiratory comorbidities. People with respiratory comorbidities (e.g. COPD) were excluded because their medication regimen and adherence support needs were theorised to be different.

People with limited English proficiency were excluded because the consent and intervention materials were in English. Translators could not be used due to limitations in study funding. In addition, interventions are culturally sensitive and therefore may

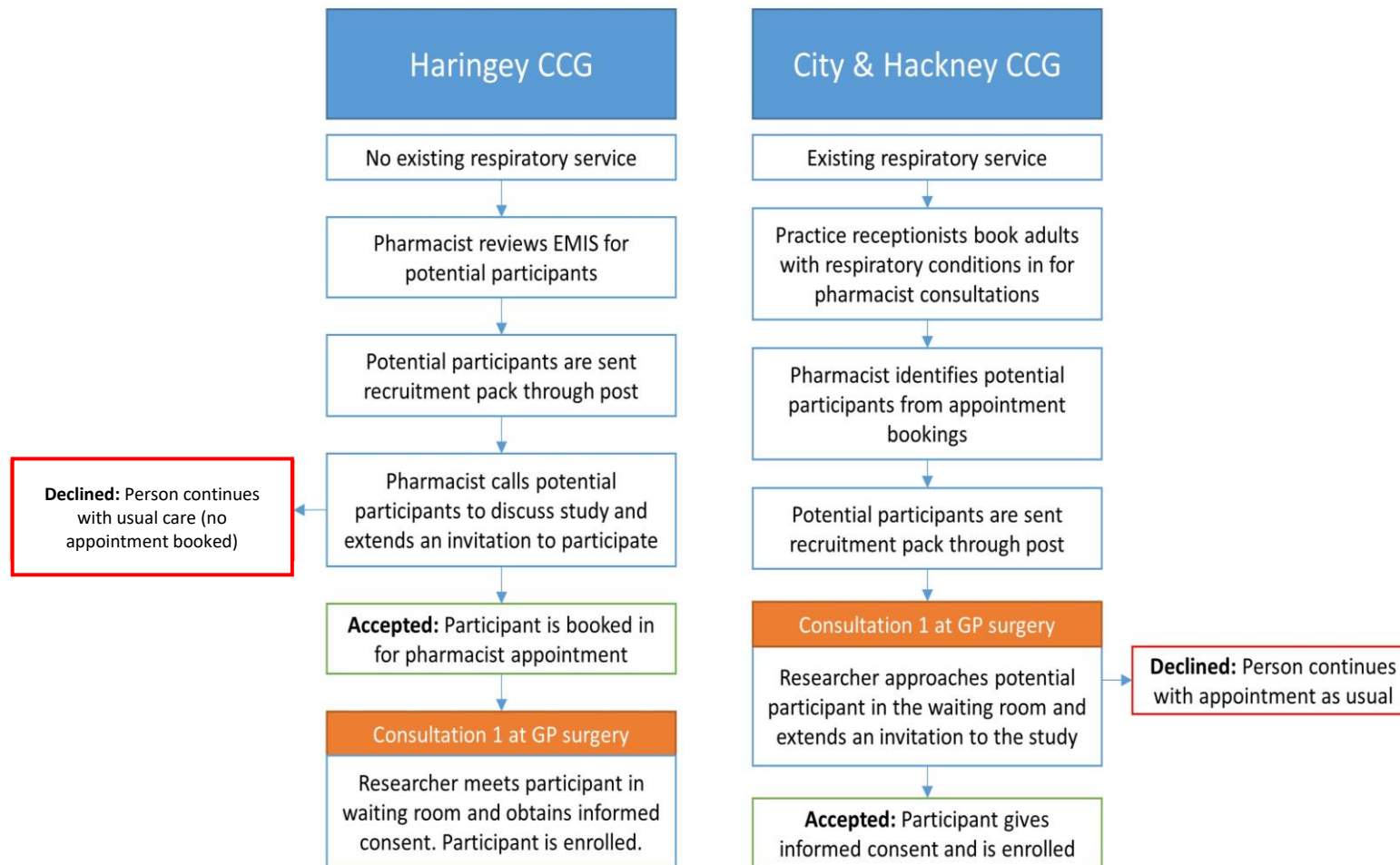
not be effective when translated from one language to another (Ahmed, Steed, Harris, Taylor, & Pinnock, 2018). People who previously saw the intervention pharmacist were excluded because we wanted to isolate the effect of the PASS.

*Table 21. Participant inclusion and exclusion criteria for the feasibility and acceptability study of the Pharmacist Asthma Support Service (PASS)*

<u>Inclusion criteria</u>	<u>Exclusion criteria</u>
- Adults ( $\geq$ 18 years).	- 17 years old or younger.
- Asthma diagnosis with no respiratory comorbidities.	- Respiratory comorbidities (e.g. COPD).
- Prescription for ICS.	- No prescription for ICS.
- Proficient in English.	- Difficulties with English.
- Administering their own medication.	- Not able to administer own medication (e.g. administered by nurse or carer).
	- Previously seen by the pharmacist.

Participants were not paid for the study. Different recruitment strategies were employed in each CCG because C&H had a pre-existing pharmacist-led respiratory service and Haringey did not (see Figure 16)

.



**Figure 16.** Recruitment methods for the feasibility and acceptability study. Outlining different recruitment strategies in the Haringey and City & Hackney Clinical Commissioning Groups.

### *City and Hackney CCG*

As part of the pre-existing service, practice receptionists booked adults with respiratory conditions in to see Pharmacist One. These people were identified as 'high risk' based on the following criteria set by the CCG: exacerbation in the previous 12 months, 12 or more salbutamol inhalers in the previous 12 months, or a prescription for a high-dose ICS ( $\geq 1000$  mcg beclomethasone dipropionate).

Pharmacist One reviewed the appointment bookings for potential participants based on the study inclusion criteria. Potential participants were sent a study information pack via the post, reaching them at least 24 hours before their consultation. It contained an introductory letter from the research team, a participant information sheet, and a consent form (see Appendix L). The documents asked people to come 15 minutes early for their appointment if they were interested in participating.

Two researchers (CK and the author) were present in the practice waiting room when people arrived for their appointments. We checked whether people had received their study information packs, described the study once more, answered any questions, and extended an invitation to participate. People were assured that they could decline participation without it impacting their ongoing care. Those who agreed to participate signed the consent forms and were enrolled into the study, while those who refused continued with their pharmacist-led consultation as usual (see Figure 16). This procedure was applied across all six practices in C&H.

### *Haringey CCG*

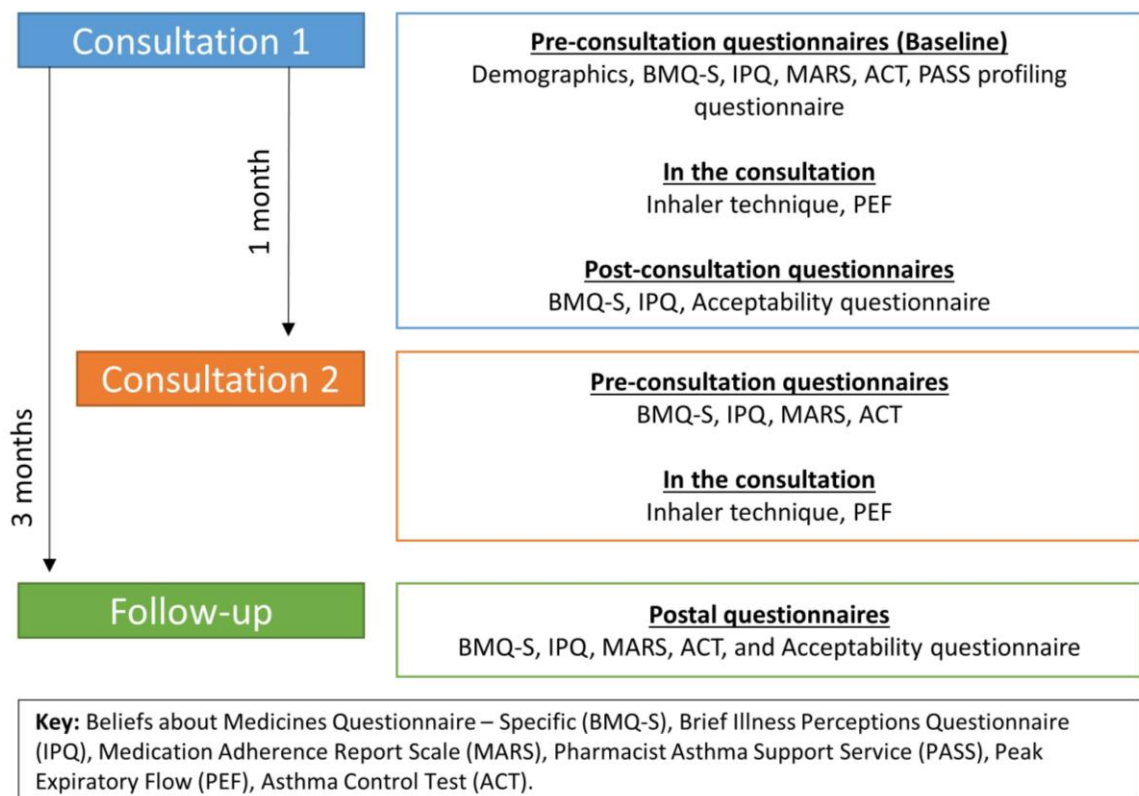
As there was no pre-existing respiratory service in Haringey, Pharmacist Two used the Egton Medical Information Systems (EMIS) database to identify potential participants based on study inclusion criteria. These people were sent the

aforementioned study information pack via the post. After a cooling-down period (approximately 24 hours after the packs were received, as advised by the UCL Joint Research Office), Pharmacist Two called potential participants to discuss the study and review their eligibility. People were assured that they could decline participation without it impacting their ongoing care. Participants who were willing and eligible to participate were booked in for a PASS consultation and asked to come 15 minutes early to complete study enrolment. Those who were ineligible or refused to participate continued with care as usual (i.e. not booked in for an appointment).

As with C&H, researchers met people in the practice waiting room when they arrived for their appointment. The study was described and additional questions were answered before people gave written informed consent and were enrolled into the study.

### 9.3.3 Data collection

Data was collected using paper-based questionnaires around the two pharmacist-led consultations and at three months (see Figure 17). For the two consultations, researchers sat with participants in the general practice waiting rooms to provide assistance with the questionnaires as needed. The pharmacists also collected data during the consultations themselves. At the three-month follow-up, participants received the questionnaires at their home address with a pre-paid envelope to return their responses to the research team.



**Figure 17.** Data collection in the feasibility and acceptability study of the Pharmacist Asthma Support Service (PASS).

### *Demographic characteristics*

The following demographic characteristics were collected at baseline: gender, age (years), ethnicity, highest level of education attained, and employment status.

### *Feasibility*

#### *Recruitment and retention*

The following recruitment indicators were used: the number of recruitment packs sent out, PASS appointment bookings made, appointments attended, and participants recruited into the study. Reasons for exclusion and additional contextual barriers to

recruitment were also recorded by the researchers. Retention was assessed based on the number of participants at baseline and the one- and three-month follow-ups.

#### Data collection procedures and outcome measures

Researchers were present when participants completed questionnaires at baseline and the one-month follow-up. Issues with the questionnaires and the data collection procedures were noted down in a shared document.

#### Intervention fidelity

On their consent forms, participants could opt to have a researcher observe their consultation. During these observations, we used an intervention fidelity checklist (designed by CK, see Appendix M) outlining the most important components of the PASS. Each component was marked as fully completed, partially completed, or not completed. Researchers could also make notes regarding the intervention video, goals set with the patient, notable events during the consultation, and exclusion of intervention components. While the presence of a researcher may affect patient and healthcare professional behaviour in a consultation, this method for checking intervention fidelity was favoured by the NHS Research Ethics Committee and the CCGs because it did not require audio/video-recordings of the consultations.

#### Acceptability

The 3 Components of Behaviour Change (3CBC) approach (see Section 2.5.2) proposes that effective behaviour change interventions optimise intervention content, context, and delivery channel (Horne, 2012; Horne & Clatworthy, 2010). We assessed the acceptability of both the intervention's content and delivery channel, as the impact of the intervention context was captured in the feasibility measures. The perspectives



of adults with asthma (i.e. study participants) and intervention pharmacists were considered.

#### *Adults with asthma*

Acceptability was measured directly after the first consultation and at the three-month follow-up. We developed a questionnaire (see Appendix N) based on the components of the TFA: affective attitude, burden, ethicality, intervention coherence, opportunity costs, perceived effectiveness, and self-efficacy (Sekhon et al., 2017). The ethicality component (i.e. the extent to which the intervention aligns with a person's value system) is particularly relevant for healthcare interventions linked to morality-related discussions, such as abortion or euthanasia. The research team decided that this was not the case for adherence support in asthma, and ethicality was excluded from the acceptability questionnaire.

#### *Designing the acceptability questionnaire*

The first draft of the questionnaire was developed through discussions with the research team. The draft was refined with feedback from four adults with asthma, who were members of the AUKCAR Patient Advisory Group. Although the feedback from the patient advisory group was crucial for questionnaire development, it is also important to remember that patient advisory group members may not be fully representative of the general asthma population due to their higher levels of engagement in asthma care and research. We collected feedback using Think Aloud Tasks (TATs) and open feedback sessions (Mes et al., 2019).

In TATs, people are asked to continuously verbalise their thought process as they work through a questionnaire. This helps researchers understand how people interpret, process, and respond to questionnaires, thereby identifying potential sources of

response error (van Someren, Barnard, & Sandberg, 1994; Willis, 2005). The open feedback sessions covered questionnaire length, content, and relevance. Based on patient feedback, we refined the questionnaire's wording and added illustrations to its instructions to provide more information in a single glance (Mes et al., 2019).

The questionnaire was split into two sections: content and delivery channel. Questionnaire items were statements based on the TFA components, and participants were asked to rate their agreement on a five-point Likert-type scale (1 – strongly disagree, 2 – disagree, 3 – uncertain, 4 – agree, 5 – strongly agree). For example: “I really liked having a pharmacist provide this type of asthma service” (delivery channel, affective attitude). Items alternated between positive phrasing (e.g. “I really liked...”) and negative phrasing (e.g. “I did not like...”) to maintain participant attention and reduce the risk of acquiescence bias (the tendency to agree with all items) (Hurd & Kapteyn, 1999). The questionnaire also included a comment section where participants could provide written feedback.

#### Intervention pharmacists

The acceptability and usability of the intervention from the pharmacist perspective was explored through structured feedback sessions. Feedback sessions were chosen over in-depth qualitative interviews because we viewed the pharmacists as research collaborators rather than study participants.

To encourage honest and open responses from the pharmacists, we asked another researcher to lead the feedback sessions because she was not directly involved in the daily running of the PASS study and therefore had no previous contact with the intervention pharmacists. The feedback sessions covered intervention training, intervention content, research design issues, intervention delivery, and future

intervention implementation (see Appendix O). The sessions were audio-recorded for our records, with the pharmacists' permission.

### *Process variables*

The study's process variables represented the motivation- and ability-related factors affecting adherence, as outlined in the PAPA (Horne, 2001, 2015). They included participants' beliefs about medicines, perceptions about asthma, and inhaler technique.

#### *Beliefs about Medicines*

Beliefs about medicines were measured using the Beliefs about Medicines Questionnaire Specific (BMQ-S) (Horne et al., 1999) before and after the first consultation, directly before the one-month follow-up consultation, and at three months. The BMQ-S is a validated questionnaire measuring people's necessity beliefs and concerns about a specific medication (see Appendix P). Five items measure necessity beliefs (e.g. "my health at present depends on my preventer inhaler") and six items measure concerns (e.g. "I sometimes worry about the long-term effects of my preventer inhaler") (Horne & Weinman, 1999; Horne et al., 1999).

Participants were asked to rate their level of agreement with each item on a five-point Likert-type scale: 1 – strongly disagree, 2 – disagree, 3 – neither agree nor disagree, 4 – agree, 5 – strongly agree. Higher scores represent stronger necessity beliefs and concerns (Horne & Weinman, 1999; Horne et al., 1999). The BMQ-S was chosen because the PASS was specifically designed to target necessity beliefs and concerns about ICS.

### *Perceptions of asthma*

Participants' perceptions of asthma were measured directly before and after the first consultation, directly before the one-month follow-up consultation, and at three months using the brief Illness Perceptions Questionnaire (brief IPQ) (Broadbent, Petrie, Main, & Weinman, 2006). It is a validated questionnaire with eight statements rated on a scale from 0 to 10 (see Appendix P).

Each statement captures an illness representation or emotional response outlined in the CSM (Leventhal et al., 1998). Participants were also asked to name and rank the three most important causes of their asthma (Broadbent et al., 2006). The brief IPQ was chosen because the PASS was designed to target the illness representations outlined in the CSM. The brief version of the questionnaire also reduced the risk of questionnaire fatigue among participants.

### *Inhaler technique*

Participants were asked to demonstrate their inhaler technique to the pharmacists during their consultations, both at baseline and one month. Pharmacist One designed device-specific inhaler technique checklists based on guidelines by the UK Inhaler Group (Scullion & Fletcher, 2016). The checklists outlined correct inhaler technique in steps, and pharmacists marked down whether each step had been completed successfully by the participant. An example checklist for a Turbohaler is included in Appendix P.

### *Outcome variables*

The intended outcome variable for the intervention was medication adherence, a behavioural outcome. Additional outcome variables, namely peak expiratory flow

(PEF) and asthma control, were included as clinical indicators for potential behaviour change.

#### *Medication adherence*

Medication adherence was measured at baseline, directly before the one-month follow-up consultation, and at three months using the validated Medication Adherence Report Scale (MARS) (Horne & Hankins, 2004). We tailored the items to refer specifically to preventer inhalers, as done by Chapman et al. (2015) in their study of a nurse-led intervention targeting ICS adherence.

The MARS includes 11 statements describing various types of non-adherence (e.g. “I only use my preventer inhaler when I need it”) (see Appendix P). Participants were asked to rate how often they engaged in each non-adherent behaviour on a five-point Likert-type scale: 1 – very often, 2 – often, 3 – sometimes, 4 – rarely, and 5 – never. Higher MARS scores correspond with higher adherence levels.

The MARS was chosen because it is a validated measure with adequate validity and reliability, used in previous asthma research (Clatworthy, Price, Ryan, Haughney, & Horne, 2009; Cohen et al., 2009; Horne & Hankins, 2004). While a self-report measure was the most pragmatic option for this study, we recognise the limitations of self-report in measuring adherence (outlined in Section 2.2.2).

#### *Clinical indicators*

Intervention pharmacists measured PEF during both consultations (baseline and one month). We chose PEF as a potential outcome variable because it was already built into the PASS consultations, and because it is commonly used to monitor lung function (see Section 1.4.3). Asthma control was measured at baseline, one month, and three months using the validated Asthma Control Test (ACT) (Nathan et al., 2004). The

ACT measures asthma control based on productivity at work/school/home, shortness of breath, night time awakening, and perceived control over the preceding four weeks (see Appendix P).

Participants were asked to indicate how often they experience specific symptoms on a five-point Likert-type scale (e.g. “How often have you had shortness of breath?”). Higher scores indicated higher asthma control, and participants were categorised as having well-controlled (ACT scores  $\geq 25$ ), controlled (ACT scores 20 – 24), and poorly controlled asthma (ACT scores  $< 20$ ) (Nathan et al., 2004). The ACT was chosen because it is a reliable measure for identifying people with poorly controlled asthma both in research and clinical practice (Manfrin et al., 2017; Schatz et al., 2009; Schatz et al., 2006).

#### 9.3.4 Data analysis

##### *Participant characteristics*

We summarised participant characteristics using means and standard deviations (SDs) or frequencies ( $n$ ) and percentages. Participant characteristics in C&H and Haringey were compared using independent samples t-tests and chi-squared tests.

##### *Feasibility*

We summarised the recruitment and retention indicators using frequencies ( $n$ ) and percentages. Participants who did and did not complete follow-up (completers and drop-outs) were compared based on demographic characteristics, beliefs about asthma, PEF, asthma control, and adherence using independent samples t-tests or chi-squared tests. Data collection issues and contextual factors affecting recruitment/retention identified by the researchers were discussed as a team and summarised.

Researchers marked each item on the intervention fidelity checklist as ‘completed’ or ‘not completed’. However, the intervention was tailored and therefore certain items were intentionally omitted from each consultation in line with the needs of the participant. This was the case for intervention components related to necessity beliefs and concerns, and the use of the intervention video. For these items, an additional code of ‘appropriate’ versus ‘inappropriate’ was added to the fidelity data to indicate whether the tailoring choices made by the pharmacist (i.e. completed or not completed) were in line with the needs of the participant. For each item in the fidelity checklist, we calculated the percentage of consultations where the intervention component had been completed. For the tailored portion of the intervention, we also calculated the percentage of consultations where the tailoring choice made by the pharmacist did not align with the needs of the participant (e.g. ‘inappropriate’).

### *Acceptability*

#### *Adults with asthma*

Negatively-phrased questionnaire items were reverse-coded for analysis. Mean acceptability scores (with SDs) were calculated for the intervention overall, its content, its delivery channel, and for each TFA component (split by content and delivery channel). The means and SDs of specific items were reviewed to establish whether participants liked and trusted their pharmacist. Acceptability scores for the two intervention pharmacists, and participants who completed or missed follow-up were compared using independent sample t-tests. Written feedback from participants was reviewed with the research team and summarised.

### *Intervention pharmacists*

The pharmacist feedback sessions were transcribed and reviewed by two researchers (VW and the author). Feedback was summarised by topic based on the interview guide (intervention training, intervention content, research design issues, intervention delivery, and the potential for future implementation). The summaries and any additional findings were discussed in a research team meeting.

### *Exploratory analyses*

The exploratory analyses concerned the process and outcome variables proposed for the study, namely the BMQ-S, brief IPQ, inhaler technique, MARS, PEF, and ACT. The analyses focused on whether data changed in the expected direction, and whether there were any significant changes in the variables over the course of the study.

For the BMQ-S, the Necessity-Concerns Differential (NCD = necessity belief score – concerns score) was calculated as a crude indicator of the relative value of necessity beliefs against concerns (Horne et al., 2013). A common criticism of the NCD is that it is an overly simplistic indicator, particularly because necessity beliefs and concerns are not complete opposites (L. Alison Phillips, Diefenbach, Kronish, Negron, & Horowitz, 2014). However, a meta-analysis by Foot et al. (2016) found that the NCD had a stronger correlation to adherence than necessity beliefs or concerns considered separately.

Means and SDs were calculated for each questionnaire item in the BMQ-S, IPQ, MARS, and ACT. Overall scores for necessity beliefs (BMQ-S), concerns (BMQ-S), the NCD (BMQ-S), the ACT, PEF, and the MARS were calculated as means and SDs. For inhaler technique, the number and percentage of correctly demonstrated inhaler technique steps was calculated. Paired samples t-tests were used to explore changes in



these measures between baseline and final follow-up (either one or three months, depending on the outcome).

## 9.4 Results

The study began on 23<sup>rd</sup> February 2018, with follow-up consultations running in March and April, and postal follow-up questionnaires being sent out in May and June.

### 9.4.1 Participant characteristics

During the four-week recruitment period, we recruited 31 participants across the two CCGs (see Table 22). The mean age of the sample was  $48.6 \pm 14.1$  years, with a minimum of 24 years and a maximum of 76 years. There were 12 male (39%) and 19 female participants (61%). In terms of ethnicity, most participants identified as Black ( $n = 12, 39\%$ ) or White ( $n = 13, 42\%$ ).

Table 22. Demographic characteristics of the participants in the feasibility and acceptability study for the Pharmacist Asthma Support Service (PASS)

<u>Demographic characteristics</u>	<u>Total</u> <i>n</i> = 31	<u>Haringey</u> <i>n</i> = 13	<u>C&amp;H</u> <i>n</i> = 18
<b>Age</b>	48.6 ± 14.1	56.4 ± 12.4	42.6 ± 12.4
<b>Gender</b>			
Male	12 (39%)	6 (46%)	6 (33%)
Female	19 (61%)	7 (54%)	12 (67%)
<b>Ethnicity</b>			
Asian	3 (10%)	2 (15%)	1 (6%)
Black	12 (39%)	6 (46%)	6 (33%)
White – British	8 (26%)	2 (15%)	6 (33%)
White – Other	5 (16%)	2 (15%)	3 (17%)
Mixed/multiple heritage	2 (6%)	0 (0%)	2 (11%)
Other	1 (3%)	1 (9%)	0 (0%)
<b>Highest level of education attained</b>			
No formal qualifications	2 (7%)	1 (8%)	1 (5%)
Secondary/high school	8 (26%)	3 (23%)	5 (28%)
Diplomas	3 (10%)	2 (15%)	1 (5%)
Undergraduate degree (BSc/BA)	9 (29%)	4 (31%)	5 (28%)
Postgraduate diploma	1 (3%)	0 (0%)	1 (5%)
Postgraduate degree (MA/MSc/MRes)	6 (19%)	2 (15%)	4 (22%)
Rather not say	1 (3%)	1 (8%)	0 (0%)
Other	1 (3%)	0 (0%)	1 (5%)
<b>Employment status</b>			
Full-time employment	8 (26%)	3 (24%)	5 (28%)
Part-time employment	4 (13%)	1 (8%)	3 (17%)
Self-employed	4 (13%)	2 (15%)	2 (11%)
Unemployed	1 (3%)	1 (8%)	0 (0%)
Retired	4 (13%)	2 (15%)	2 (11%)
Unable to work	8 (26%)	2 (15%)	6 (33%)
Rather not say	2 (6%)	2 (15%)	0 (0%)
<b>Asthma control<sup>a</sup></b>			
Uncontrolled	16 (52%)	5 (39%)	11 (61%)
Controlled	14 (45%)	8 (61%)	6 (33%)
Well-controlled	1 (3%)	0 (0%)	1 (6%)

Values expressed as means ± standard deviations or frequencies and percentages (*n*, %).

<sup>a</sup>According to the Asthma Control Test (ACT) (Nathan et al., 2004) – uncontrolled (ACT < 20), controlled (ACT = 20 – 24) and well-controlled (ACT = 25).

Participants varied in terms of educational background. Two participants (6%) had no formal qualifications and eight participants (26%) finished secondary school, while 16 participants (52%) attained some form of a university degree. We recruited equal numbers of people in full-time employment and people unable to work (*n* = 8, 26%), with other participants divided between unemployment (*n* = 1, 3%), self-employment

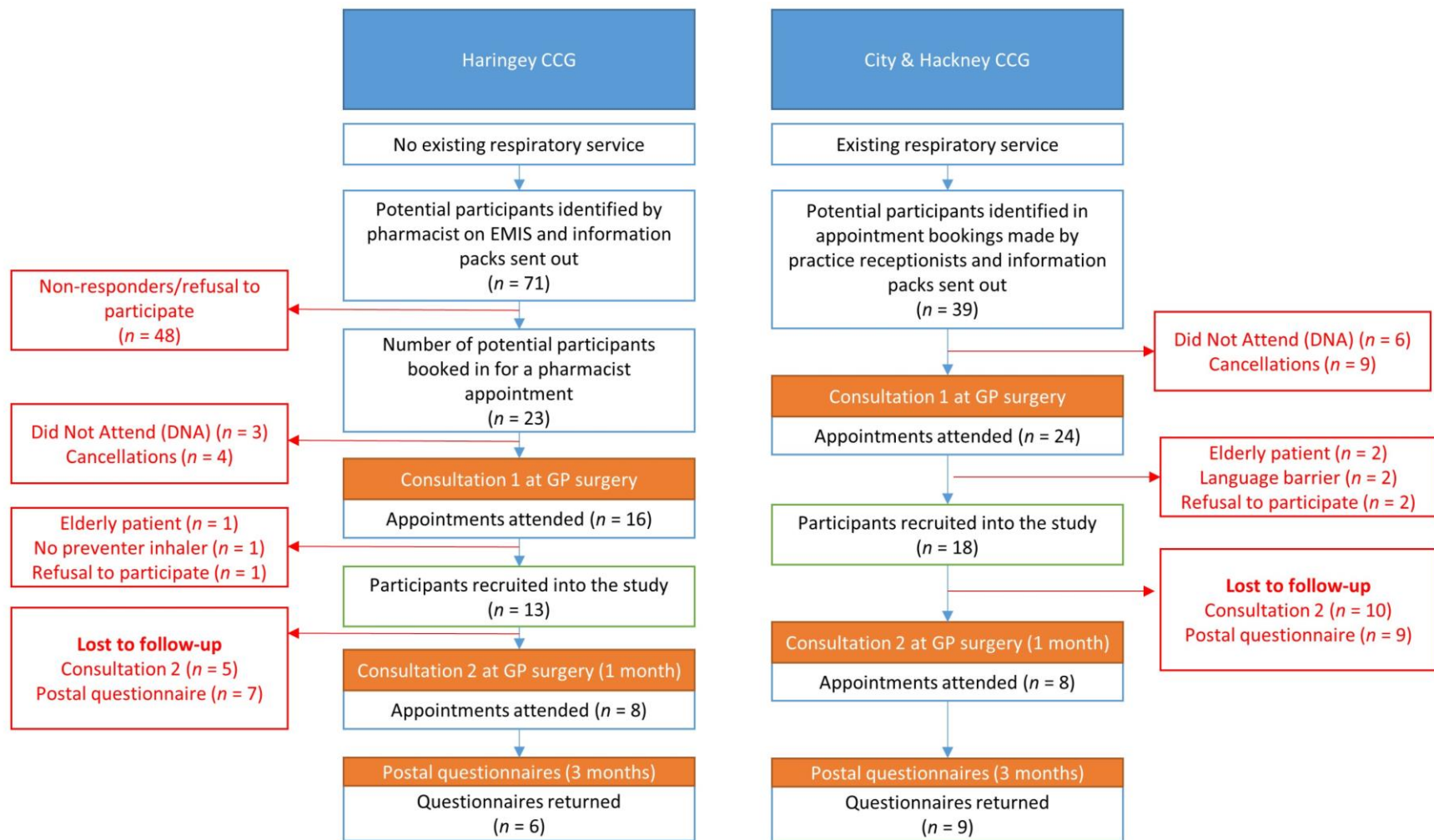
( $n = 4$ , 13%), and part-time employment ( $n = 4$ , 13%). Based on their ACT scores, participants generally had uncontrolled ( $n = 16$ , 52%) or controlled asthma ( $n = 14$ , 45%).

Most of the participants from Haringey reported having controlled asthma ( $n = 8$ , 61%), while many participants from C&H had uncontrolled asthma ( $n = 11$ , 61%). The participants in Haringey were significantly older ( $56.4 \pm 12.4$ ) compared to those in C&H ( $42.6 \pm 12.4$ ,  $p < 0.01$ ). There were no further differences between the CCGs in terms of demographic characteristics and asthma control.

#### 9.4.2 Feasibility

##### *Recruitment*

Recruitment was difficult in both CCGs – 31 participants were initially recruited into the study (see Figure 18). During the four-week recruitment period in C&H, 39 potential participants were identified through the CCG's existing respiratory service and sent study information packs. There was an appointment attendance rate of 66% ( $n = 24$ ) across the CCG. Of these people, 18 (75%) were recruited into the study. For Haringey, 71 study information packs were sent out to potential participants identified on EMIS by Pharmacist Two (see Figure 18). Of these individuals, only 23 people (32%) agreed to take part and were booked in for an appointment. The attendance rate for appointments was 70% ( $n = 16$ ), and 13 of these individuals (81%) were recruited into the study.



**Figure 18.** Recruitment and retention in the PASS study. A flowchart outlining the initial recruitment and retention at the one- and three-month follow-up points.

### Barriers and enablers of recruitment

In C&H, appointment bookings were made by practice receptionists due to the existing respiratory service. This made the initial steps in the recruitment process easier for the research team. However, the biggest barrier to recruitment in C&H was the low appointment attendance rate. Appointment bookings, attendance rates, and recruitment success varied across C&H practices (see Table 23).

Table 23. Recruitment indicators across practices in the City and Hackney Clinical Commissioning Group (CCG)

Practice	Appointments booked	Appointments	Recruited
		attended n (%)	n (%)
Total (City & Hackney)	39	24 (61%)	18 (75%)
Richmond Road	9	7 (78%)	5 (71%)
Sorsby	4	2 (50%)	1 (50%)
Hoxton	6	4 (67%)	2 (50%)
Gadhvi	4	3 (75%)	3 (100%)
Cedar	15	7 (47%)	6 (86%)
Sandringham	1	1 (100%)	1 (100%)

The biggest challenge for recruitment in Haringey was the initial booking of appointments. Contacting potential participants by telephone was difficult, possibly because people refused to answer calls from an unknown number. Pharmacist Two also suspected that many elderly asthma patients of Afro-Caribbean descent were abroad during this period to visit family and avoid the colder months (November – March). When potential participants did answer the telephone calls, many of them declined participation because the additional pharmacist consultation was not required for their asthma care.

### Reasons for difficult recruitment

Across both CCGs, there were 62 appointment bookings, 40 initial appointments attended (65%), and 31 recruited participants (78%). The primary reasons for

recruitment failure were Did Not Attend (DNA) cases ( $n = 9$ ) and appointment cancellations ( $n = 13$ ). Additional reasons for exclusion included people being too old/frail ( $n = 3$ ), having difficulty with English ( $n = 2$ ), lacking an ICS prescription ( $n = 1$ ), and refusing to take part ( $n = 3$ ) (see Figure 18).

#### Contextual factors affecting recruitment

Contextual factors affecting recruitment were the Quality Outcomes Framework (QOF), the study approvals process, and unfavourable weather conditions.

#### *The Quality Outcomes Framework*

The QOF is a performance and payment scheme that funds general practices based on specific care criteria (e.g. the percentage of people attending asthma reviews). Practices are awarded QOF points when they fulfil these criteria, and QOF points are converted into funding at the end of the NHS year (running from April to March) (NHS Employers, 2018).

Recruitment for the PASS study began at the end of the NHS year, meaning that many asthma reviews had already been conducted as part of the QOF targets. Potential participants in Haringey may have declined the PASS consultation because they felt it was redundant, and potential participants in C&H had to be excluded because they had already seen the pharmacist for their asthma review. People engaged in their asthma care were probably seen earlier in the NHS year (i.e. as soon as they were invited). As a result, we may have been trying to recruit from the remaining hard-to-reach patients. These patients were much less likely to engage with healthcare and research, although they may have had a greater need for adherence support.

Meeting the QOF criteria was an important priority for all practices. Therefore, practice staff had limited capacity for research support during this time period.

Furthermore, our recruitment period coincided with Pharmacist One starting at a new group of practices in her CCG. Without an existing professional relationship with practice staff, the appointment booking process for her service became less efficient.

#### *Study approvals processes*

The study encountered significant delays during the study approvals process. The initial ethics application was submitted to the UCL Joint Research Office (JRO) in June 2017, and final approval was not obtained until February 2018. Unfortunately, Pharmacist Two's contract with the Haringey practice ended at the end of the NHS year (late March 2018). As a result, recruitment *and* one-month follow-up consultations at the Haringey practice had to be completed between February and March (instead of the intended recruitment period of four weeks). Five recruitment days were scheduled between February 17<sup>th</sup> and March 3<sup>rd</sup>, and follow-up consultations were held at the end of March. We chose to proceed with the site because it was important to have both pharmacists deliver the intervention to establish the potential training needs of pharmacists from different clinical backgrounds.

An additional approvals-related barrier to recruitment was the fact that separate research approval was needed for every practice in C&H. Pharmacist One notified researchers about an eligible practice as soon as she saw potential study participants in her appointment bookings. However, appointment bookings were often only finalised one to two days before the appointments. Furthermore, study information packs had to be received by potential participants at least 24 hours before their appointment. Therefore, researchers often had less than a day to obtain site-specific approval from both the lead GP/practice manager and JRO coordinator, and send out the study information packs. For two practices, researchers hand-delivered the study

information packs directly to potential participants (rather than relying on the postal service) to meet the 24-hour requirement.

#### *Unfavourable weather conditions*

Finally, unfavourable weather conditions (Storm Emma – snow and freezing temperatures) appeared during three recruitment days. Patients and NHS staff had difficulty reaching the practices due to severe delays in public transport. Potential participants may have chosen to stay home if the cold affected their asthma. Two of the nine DNAs (22%) and four of the 13 cancellations (31%) occurred during this period.

#### *Retention*

Overall retention rates were low. They were similar for the one-month follow-up consultation ( $n = 16, 52\%$ ) and three-month postal follow-up ( $n = 15, 48\%$ ) (see Table 24). The retention rate in Haringey was slightly higher at the one-month follow-up (62%) compared to the three-month follow-up (46%). In contrast, the retention rate in C&H was higher at the three-month follow-up (50% versus 44%). Retention rates for the different practices ranged from 33% to 100% at the one-month follow-up, and 0% to 100% at the three-month follow-up.

*Table 24. Participant retention at the one- and three-month follow-up points in the feasibility and acceptability study of the Pharmacist Asthma Support Service (PASS)*

<u>Location</u>	<u>Baseline</u> ( <i>n</i> )	<u>1-month follow-up</u> (consultation) <i>n</i> (%)	<u>3-month follow-up</u> (postal) <i>n</i> (%)
Total	31	16 (52%)	15 (48%)
Haringey CCG	13	8 (62%)	6 (46%)
City & Hackney CCG	18	8 (44%)	9 (50%)
Richmond Road	5	2 (40%)	2 (40%)
Sorsby	1	1 (100%)	0 (0%)
Hoxton	2	1 (50%)	0 (0%)
Gadhvi	3	1 (33%)	1 (33%)
Cedar	6	2 (33%)	5 (83%)
Sandringham	1	1 (100%)	1 (100%)



### *Completers versus drop-outs*

Comparisons between those who did and did not complete each follow-up point (completers and drop-outs) are outlined in Table 25. At the one-month follow-up, completers were significantly older ( $54.13 \pm 13.88$ ) than drop-outs ( $43.00 \pm 12.23$ ,  $p = 0.03$ ). They also had a significantly lower baseline PEF ( $316.25 \pm 413.33$ ) compared to drop-outs ( $413.33 \pm 133.88$ ,  $p = 0.03$ ). Compared to the completers group, the drop-out group had significantly more people in full-time employment ( $n = 0$  versus  $n = 8$ ,  $p < 0.01$ ).

At the three-month follow-up, completers were significantly older ( $55.67 \pm 13.67$ ) than drop-outs ( $41.47 \pm 10.67$ ,  $p < 0.01$ ). Interestingly, completers reported significantly higher adherence at baseline ( $4.11 \pm 0.60$ ) compared to drop-outs ( $3.42 \pm 1.02$ ,  $p = 0.03$ ). There were no further differences between completers and dropouts at each follow-up point.

Table 25. Comparing the baseline characteristics of participants who completed and missed the one- and three-month follow-up points in the feasibility and acceptability study of the Pharmacist Asthma Support Service (PASS)

<b>One-month follow-up consultation</b>						
	<u>Completed</u>		<u>Drop-out</u>		<u>Mean Difference</u>	<u>p-value</u>
	n	Mean ± SD	n	Mean ± SD		
Age	15	54.13 ± 13.88	15	43.00 ± 12.23	11.13 [1.35 – 20.92]	0.03*
Necessity beliefs	16	3.61 ± 0.93	15	3.36 ± 1.04	0.25 [-0.48 – 0.98]	0.48
Concerns	16	2.60 ± 0.85	15	2.41 ± 0.94	0.19 [-0.47 – 0.85]	0.57
NCD	16	1.01 ± 1.29	15	0.95 ± 1.49	0.06 [-0.96 – 1.08]	0.90
Adherence	16	3.82 ± 0.52	15	3.69 ± 1.20	0.13 [-0.57 – 0.83]	0.70
PEF	16	316.25 ± 413.33	15	413.33 ± 133.88	-97.08 [-183.42 – -10.74]	0.03*
Asthma Control	16	15.25 ± 6.69	15	17.73 ± 5.75	-2.48 [-7.08 – 2.11]	0.23
<b>Three-month postal follow-up</b>						
	<u>Completed</u>		<u>Drop-out</u>		<u>Mean Difference</u>	<u>p-value</u>
	n	Mean ± SD	n	Mean ± SD		
Age	15	55.67 ± 13.67	15	41.47 ± 10.67	14.20 [5.03 – 23.37]	0.01**
Necessity beliefs	15	3.52 ± 0.81	16	3.46 ± 1.14	0.54 [-0.68 – 0.79]	0.88
Concerns	15	2.66 ± 0.85	16	2.36 ± 0.93	0.29 [-0.36 – 0.95]	0.36
NCD	15	0.86 ± 1.08	16	1.10 ± 1.62	-0.24 [-1.26 – 0.78]	0.63
Adherence	15	4.11 ± 0.60	16	3.42 ± 1.02	0.69 [0.07 – 1.31]	0.03*
PEF	15	319.33 ± 130.68	16	404.38 ± 108.93	-85.04 [-173.19 – 3.11]	0.06
Asthma Control	15	17.87 ± 6.95	16	15.13 ± 5.46	2.74 [-1.83 – 7.32]	0.23

\* $p < 0.05$ , \*\* $p < 0.01$

### Contextual factors affecting retention

Retention at the one-month follow-up may have been affected by appointment availability. Pharmacist One spent one day every two weeks at each of her practices, while Pharmacist Two was based at one practice and held most of her PASS consultations on Fridays and Saturdays. Therefore, appointment availability was limited to one or two days a week. Participants who were unable to attend the designated time slots for their one-month follow-up were given other appointments, either lengthening or shortening the follow-up period (e.g. five weeks or three weeks). The three-month postal follow-up may have been affected by issues with the postal service. However, we did not use tracked mail and could not confirm whether the questionnaires had reached participants and/or been posted back to us.

### *Data collection procedures and outcome measures*

Younger participants were often able to complete the study questionnaires in the allocated time (15 minutes) with minimal assistance. Older participants and/or participants whose first language was not English needed frequent assistance from researchers. Delays in questionnaire completion led to participants being late for their pharmacist appointments.

During their first visit to the practice, participants were asked to fill in the same study questionnaires directly before and after the consultation. They were also asked to fill in the PASS profiling questionnaire before their consultation (see Section 9.3.1). Many participants reported that the questionnaires felt repetitive and therefore unnecessary. Although researchers reassured participants that data collection at the follow-up points was less intensive, participants' initial experiences of the questionnaires may have reduced retention rates.

#### *The Beliefs about Medicines Questionnaire (BMQ-S)*

Response error may have occurred in the BMQ-S, MARS, and acceptability questionnaire. Participants found two BMQ-S items unclear (“My preventer inhaler is a mystery to me” and “My preventer inhaler disrupts my life”) because they were unsure about the terms “mystery” and “disrupts”.

#### *The Medication Adherence Report Scale (MARS)*

Participants felt that item wording in the MARS did not correspond logically with its scoring: 1 – very often, 2 – often, 3 – sometimes, 4 – rarely, 5 – never. This was particularly the case for the first two items (“I only use my preventer inhaler when I need it” and “I only use it when I feel breathless”), where a higher score (e.g. 5 – never) is indicative of higher adherence. As each item referred to inhaler *use*, many

participants interpreted a score of “5 – never” as lower inhaler use and therefore lower adherence. To them, a score of “1 – very often” was indicative of frequent inhaler use, and therefore higher adherence.

#### *The acceptability questionnaire*

Participants felt that the acceptability questionnaire was too long, especially compared to the other outcome measures. Alternating items (positive and negative phrasing) also contributed to questionnaire fatigue. While most participants were able to differentiate between the two questionnaire sections (intervention content and delivery channel), participants that were unable to make that distinction found the items repetitive.

#### *Inhaler technique checklists*

Finally, the intervention pharmacists found the inhaler technique checklists impractical for data collection during their consultations. They reported that filling in paper-based checklists during their consultations hindered their rapport with participants. Pharmacist One resorted to filling in checklists from memory directly after each consultation, and Pharmacist Two often forgot to fill in the checklist or left it incomplete. As a result, the inhaler technique data was deemed unsuitable for analysis.

#### *Intervention fidelity*

Of the 31 participants, 21 (68%) agreed to let researchers observe their first consultation. Intervention fidelity for the standardised components of the intervention (i.e. completed in every consultation) was relatively high, with most items completed in more than 80% of the consultations (see Table 26). However, the collaborative goalsetting component was completed in only 33% of the consultations ( $n = 7$ ). Pharmacists may have had limited experience with goalsetting, while they may have

completed the other activities (e.g. using information from EMIS or checking inhaler technique) in their clinical practice previously.

Table 26. Intervention fidelity for the Pharmacist Asthma Support Service (PASS) - standardised and tailored intervention components

<u>Intervention Component</u>	<u>Completed n (%)<sup>a</sup></u>
<b>Standardised components</b>	
Used the profiling questionnaire	21 (100%)
Conducted an asthma impact assessment	21 (100%)
Used information from EMIS	20 (85%)
Checked inhaler technique	18 (86%)
Set goals for the next consultation	7 (33%)
<b>Tailored components</b>	
Reinforced necessity beliefs	12 (57%)
Addressed concerns	16 (76%)
Showed the intervention video	11 (52%)
<sup>a</sup> Based on 21 consultations shadowed by researchers	

Pharmacists addressed participants' concerns in 76% of consultations. Necessity beliefs were reinforced and the intervention video was shown in 57% and 52% of the consultations respectively (see Table 26). However, pharmacists made inappropriate tailoring decisions in two consultations (10%) where concerns should have been addressed, one consultation (5%) where necessity beliefs should have been reinforced, and two consultations (10%) where the intervention video should have been shown.

### 9.4.3 Acceptability

#### *Adults with asthma*

From the perspective of the participants, the acceptability of the PASS was high, both directly after the first consultation ( $3.94 \pm 0.43$ ) and at the three-month follow-up ( $4.06 \pm 0.62$ ).

#### Content

The acceptability of the intervention content was high directly after the first consultation ( $3.93 \pm 0.49$ ) and at the three-month follow-up ( $4.05 \pm 0.64$ ). Mean scores

for each TFA component are outlined in Table 27, with higher scores indicating higher acceptability.

*Table 27. Acceptability of the Pharmacist Asthma Support Service (PASS) – intervention content at the first consultation and three-month follow-up*

<u>Acceptability of</u>	<u>After first consultation</u> <i>(n = 31)</i>	<u>Three-month follow-up</u> <i>(n = 15)</i>
<b>Content (total)</b>	3.93 ± 0.49	4.05 ± 0.64
Affective attitude	4.20 ± 0.73	4.50 ± 0.54
Perceived effectiveness	3.89 ± 0.63	3.89 ± 0.73
Burden	3.60 ± 1.10	3.43 ± 1.24
Coherence	4.57 ± 0.51	4.47 ± 0.64
Self-efficacy	4.23 ± 0.46	4.43 ± 0.62
Opportunity cost	3.30 ± 1.34	4.20 ± 1.01
All values expressed as means ± standard deviations Higher scores indicate higher acceptability (scale 1 – 5)		

Participants liked the information they were given about their asthma, inhalers, and asthma management (affective attitude). They found the information easy to understand (intervention coherence) and felt they could follow the recommendations outlined in the intervention (self-efficacy). Participants may have doubted the added value of the intervention content on top of their usual asthma care (opportunity cost, 3.30 ± 1.34), although this improved at the three-month follow-up (4.20 ± 1.01).

Intervention burden scored the lowest in terms of acceptability. These questionnaire items concerned the effort needed to fill in the profiling questionnaire, demonstrate inhaler technique, give a peak flow measurement, and apply the intervention’s recommendations in everyday life. As shown in Table 28, filling in the profiling questionnaire was the least acceptable out of these tasks (i.e. required the most effort) (3.32 ± 1.38 and 3.07 ± 1.39).

Table 28. Acceptability of the Pharmacist Asthma Support Service (PASS) – intervention burden and perceived effectiveness for intervention content

<u>Questionnaire Item</u>	<u>After first consultation</u> ( <i>n</i> = 31)	<u>Three-month follow-up</u> ( <i>n</i> = 15)
<b>Burden related to:</b>		
Profiling questionnaire	3.32 ± 1.38	3.07 ± 1.39
Inhaler technique checks	3.71 ± 1.24	3.86 ± 1.46
Peak flow measurement	3.71 ± 1.42	3.36 ± 1.50
<b>Perceived intervention effectiveness for:</b>		
Beliefs about asthma	3.51 ± 1.21	3.93 ± 1.03
Inhaler technique	4.32 ± 0.79	4.40 ± 0.83
Necessity beliefs about ICS	4.27 ± 0.83	4.36 ± 0.84
Concerns – long-term effects of ICS	3.42 ± 1.29	3.13 ± 1.51
Concerns – side effects of ICS	3.48 ± 1.29	3.14 ± 1.56
Adherence	4.35 ± 0.84	4.57 ± 0.51
All values expressed as means ± standard deviations Higher scores indicate higher acceptability (scale 1 – 5)		

Perceived intervention effectiveness also scored slightly lower compared to other TFA components (see Table 27). These items asked participants whether they thought intervention content could change their beliefs about asthma, necessity beliefs about ICS, concerns about ICS, inhaler technique, and adherence. Participants were most sceptical about the intervention content changing their concerns about ICS-related long-term effects (3.42 ± 1.29 and 3.13 ± 1.51) and side effects (3.48 ± 1.29 and 3.14 ± 1.56). In contrast, they felt intervention content could possibly change their necessity beliefs about ICS (4.27 ± 0.83 and 4.36 ± 0.84), inhaler technique (4.32 ± 0.79 and 4.40 ± 0.83), and adherence (4.35 ± 0.84 and 4.57 ± 0.51) (see Table 28).

#### Delivery channel

Participants rated the acceptability of the intervention’s delivery channel (i.e. the pharmacist) high at both the first consultation and three-month follow-up (3.97 ± 0.48 and 4.10 ± 0.60 respectively). The scores for each TFA component are outlined in Table 29.

Table 29. Acceptability of the Pharmacist Asthma Support Service (PASS) – intervention delivery channel at the first consultation and three-month follow-up

<u>Acceptability of</u>	<u>After first consultation</u> ( <i>n</i> = 31)	<u>Three-month</u> <u>follow-up</u> ( <i>n</i> = 15)
<b>Channel (total)</b>	3.97 ± 0.48	4.10 ± 0.60
Affective attitude	4.45 ± 0.62	4.53 ± 0.64
Perceived effectiveness	3.92 ± 0.56	3.97 ± 0.70
Burden	2.68 ± 1.38	2.27 ± 1.47
Self-efficacy	4.19 ± 0.54	4.47 ± 0.52
Opportunity cost	4.26 ± 0.97	4.47 ± 0.64
All values expressed as means ± standard deviations Higher scores indicate higher acceptability (scale 1 – 5)		

The findings above suggest that participants liked having a pharmacist deliver this type of service (affective attitude). They felt that the pharmacist could change their beliefs about asthma, necessity beliefs and concerns about ICS, inhaler technique, and adherence behaviour (perceived effectiveness). Participants reported that seeing the pharmacist in addition to their usual asthma care was worthwhile (opportunity cost), and they felt confident in their ability to explain their asthma to a pharmacist (self-efficacy). The acceptability of the pharmacist delivery channel was lowest for intervention burden ( $2.68 \pm 1.38$  and  $2.27 \pm 1.47$ ), which referred to the effort required to see the pharmacist in the GP surgery.

In addition to the TFA-based items, we asked four general acceptability questions regarding the pharmacist delivery channel (see Table 30). Findings from these items were encouraging as participants reported that they trusted and felt comfortable with their pharmacist. Furthermore, they felt that pharmacists listened to them during their consultations and reported that they would recommend pharmacist-led services to other people with asthma.



Table 30. Acceptability of the Pharmacist Asthma Support Service (PASS) - general pharmacist delivery channel questions

<u>Questionnaire Item</u>	<u>After first consultation</u> ( <i>n</i> = 31)	<u>Three-month follow-up</u> ( <i>n</i> = 15)
Trusting a pharmacist with asthma	3.97 ± 1.08	4.47 ± 0.64
Recommending a pharmacist to other people with asthma	4.16 ± 0.90	4.40 ± 0.63
Feeling listened to by the pharmacist	4.32 ± 1.01	4.60 ± 0.51
Feeling comfortable with the pharmacist	4.48 ± 0.96	4.20 ± 1.21
All values expressed as means ± standard deviations Higher scores indicate higher acceptability (scale 1 – 5)		

### Comparing the intervention pharmacists

As outlined in Section 9.3.1, the intervention pharmacists differed in terms of their clinical experience and job structure. These differences did not seem to affect the acceptability of the PASS from the participant perspective in most domains (see Table 31). However, at the three-month follow-up, participants seen by Pharmacist One scored the acceptability of the intervention delivery channel significantly higher than participants seen by Pharmacist Two ( $4.41 \pm 0.61$  versus  $3.74 \pm 0.38$ ,  $p = 0.03$ ).

Table 31. Acceptability of the Pharmacist Asthma Support Service (PASS) - comparing the intervention pharmacists

<u>Acceptability</u>	<u>Pharmacist 1</u>	<u>Pharmacist 2</u>	<u>Mean Difference</u>	<u>Differences between pharmacists (<i>p</i>)<sup>a</sup></u>
<b>After first consultation</b>	<i>n</i> = 18	<i>n</i> = 13		
Intervention	3.97 ± 0.46	3.90 ± 0.41	-0.07 [-0.39 – 0.26]	0.67
Content	3.97 ± 0.56	3.88 ± 0.41	-0.09 [-0.46 – 0.29]	0.63
Channel	3.98 ± 0.48	3.94 ± 0.50	-0.04 [-0.40 – 0.32]	0.82
<b>Three-month follow-up</b>	<i>n</i> = 8	<i>n</i> = 7		
Intervention	4.31 ± 0.71	3.77 ± 0.34	-0.54 [-1.16 – 0.09]	0.09
Content	4.26 ± 0.78	3.80 ± 0.35	-0.46 [-1.14 – 0.22]	0.16
Channel	4.41 ± 0.61	3.74 ± 0.38	-0.67 [-1.23 – -0.10]	0.03*
Values expressed as means ± standard deviations Higher scores indicate higher acceptability (scale 1 – 5) <sup>a</sup> Independent t-test comparing acceptability scores for the two intervention pharmacists * $p < 0.05$				

## Acceptability and study follow-up

To explore whether initial experiences of the intervention may have affected follow-up rates, participants who completed or missed the one- and three-month follow-up points were compared in terms of the acceptability data from their first pharmacist-led consultation (baseline). There were no significant differences in acceptability scores between completers and drop-outs at both the one- and three-month follow-up points (see Table 32). Therefore, acceptability scores from the first pharmacist-led consultation were not linked to retention rates at the one- and three-month follow-ups.

Table 32. Acceptability of the Pharmacist Asthma Support Service (PASS) – comparing participants who did and did not complete the one- and three-month follow-up points based on the acceptability scores from their first consultation

	Acceptability (mean ± SD)		Mean difference	Differences between groups (p) <sup>a</sup>
	Drop-outs	Completers		
<b>1-month follow-up</b>	<b>n = 15</b>	<b>n = 16</b>		
Content	4.00 ± 0.52	3.88 ± 0.48	-0.11 [-0.48 – 0.25]	0.53
Channel	3.86 ± 0.51	4.07 ± 0.44	0.21 [-0.14 – 0.55]	0.24
Total	3.94 ± 0.44	3.95 ± 0.44	0.01 [-0.31 – 0.33]	0.95
<b>3-month follow-up</b>	<b>n = 16</b>	<b>n = 15</b>		
Content	3.93 ± 0.57	3.93 ± 0.42	0.00 [-0.37 – 0.37]	0.99
Channel	3.86 ± 0.53	4.08 ± 0.41	0.22 [-0.13 – 0.56]	0.22
Total	3.90 ± 0.48	3.99 ± 0.38	0.08 [-0.24 – 0.40]	0.60
Values expressed as means ± standard deviations				
Higher scores indicate higher acceptability (scale 1 – 5)				
<sup>a</sup> Independent t-test comparing acceptability scores for the two intervention pharmacists				

## Written feedback section

Nine (29%) participants provided feedback in the written comments section of the acceptability questionnaire.

## Doubts about the intervention

One participant expressed doubts about the added value of the PASS, mainly because he preferred to see his GP about his asthma. Another participant suggested that people

should be informed about the time required to fill in study questionnaires before they agree to participate.

*“Happy to receive more information and advice on asthma – but I’m not sure about it in addition to the GP. It might be a simpler solution to just have GPs who are better equipped to advise.”*

– P105, male, aged 20 – 29

*“Make sure the patient knows the visit will take longer than usual with the questionnaires etc.”*

– P107, male, aged 20 - 29

#### *Receiving new information*

The remaining feedback about the intervention was highly positive. Participants highlighted the differences between the PASS and their nurse-led asthma reviews. One participant recounted a previous positive experience with a local community pharmacist, and this carried over into their perspective of the PASS.

*“I spoke to my pharmacist in my local chemist before this survey was done and he explained to me that asthma is not considered ‘well controlled’ if you need to take Ventolin [reliever inhaler] regularly...I would have benefited from having this info sooner...I found the info the [PASS] pharmacist gave me highly informative and helpful – much more so than the asthma checks with the nurse offered at my GP surgery, which I feel are a waste of time...thank you!”*

– P102, female, aged 40 – 49

#### *Resolving medication-related issues*

Participants explained how the intervention pharmacists improved their quality of life by resolving medication-related issues. These examples illustrate how pharmacists may be able to provide support to people who ‘slip through the cracks’ in the healthcare system, thereby missing out on valuable information about their asthma and medication.

*“I found it very valuable to have this time with the pharmacist...it was most useful to discover I was on too low a dose of the long-acting part of my preventer inhaler, so changing inhalers has really helped the breathlessness I was experiencing on walking (which I had attributed to weight or lack of fitness!).”*

– P114, female, aged 60 - 69

*“I have never felt so involved in my asthma treatment programme...This consultation was much more meaningful than the usual ‘asthma check-up’ with the nurse...no one has ever explained how the preventer inhaler works (as far as I can remember, over 37 – 40 years of being asthmatic) and I now truly understand how important it is to continue regularly to take it with the spacer. I feel so much more in control of my asthma and more confident than I have ever done.”*

– P118, female, aged 40 - 49

### *Intervention pharmacists*

Each pharmacist had an individual feedback session with VW, lasting between 73 and 86 minutes. Feedback was categorised into training/compensation, intervention content, intervention delivery, pharmacists’ role and education, and research design issues.

### *Training and compensation*

Both pharmacists agreed that the researcher-led training session helped them familiarise themselves with the new intervention. For future training, they recommended training pharmacists in groups to create additional opportunities for role-play and case study discussions. Pharmacist Two recommended using remote training methods (e.g. online training with videos of sample consultations) to increase the accessibility of training for pharmacists in full-time jobs.

*“I think role-playing might be a really nice way to say ‘ok, so you have a patient who is concerned about side effects. Looking at your manual, what conversation would you have with them?’...it was a bit difficult because both [Pharmacist Two] and I did [the training separately]...”*

– Pharmacist One

*“I would have liked to see an example of a consultation...So I just have a video of someone who done [the PASS consultation]...that would cut a lot of reading of [the intervention manual]....there’s a lot of consultation now online for people to do, for clinicians and all like that...”*

– Pharmacist Two

The pharmacists differed in their perspectives of compensation for pharmacist training. While both agreed that half- and full-day training courses would be useful, Pharmacist One recommended charging pharmacists a small training fee to encourage them to attend. In contrast, Pharmacist Two felt that both pharmacists and their practices should be compensated for attendance at training sessions. She also advised against evening sessions to maintain high attendance rates.

*“I think don’t have it for free because people will kind of enrol and then not turn up...I think compensating people, you might get the wrong calibre of people, because there are people who think ‘Ok, I’m going to get a day off work, and now I’m going to get paid for it’...[ask pharmacists to pay] even £5... because then you’ll get the people who are really motivated to learn.”*

– Pharmacist One

*“[A full day or half day training session is possible] if it is compensated to the practice [and] myself, my own time...it is a possibility, evening sessions, but from my experience, I think you are happy before you say yes [to an evening session] but on the day you may change your mind.”*

– Pharmacist Two

#### *Intervention content and delivery channel*

The pharmacists were satisfied with the intervention content, particularly the demonstration aids. They felt that the PASS, and more generally adherence support, filled a gap they saw in current clinical practice.

*“...historically nurses do the annual reviews, they tick the box, you know....And then [the patients] come in for an asthma attack, the doctor gives them a high dose inhaled corticosteroid. Again, nowhere along this line does anyone talk about adherence, so it’s something that is completely missed.”*

– Pharmacist One

However, they reported that general practice pharmacists often work across multiple long-term conditions, meaning that they have to address multiple comorbidities in one

consultation. The pharmacists felt that the time required for a PASS consultation (15 – 20 minutes) may be a barrier to future implementation.

*“During [a long-term condition] consultation, pharmacists might have to do asthma, they might have to do diabetes or cholesterol...one of the barriers you might get is if this [asthma intervention] is taking 20 minutes or half an hour, then they’re not going to be able to do their diabetes [and other topics]...which means it’s more costly for the GP practice.”*

– Pharmacist One

*“...I booked half an hour for each [PASS] consultation...[we, as pharmacists at my current practice] had 20 minutes before, initially, but the practice reduced it to 15 minutes...so now practices have 15 minutes for [long-term] condition consultations only.”*

– Pharmacist Two

The PASS deviated from the pharmacists’ usual practice. One of their initial concerns was maintaining a balance between intervention fidelity and patient rapport: they wanted to appear genuine and in control of their consultations, and avoid rigidly delivering intervention content.

*“I had to change the way I had my consultations. I found that a little bit difficult, I had to almost think about it again, what was I doing...”*

– Pharmacist One

*“You are not...in control to the patient because the moment they see that you are doing something [like reading off a pre-written script], the trust, you know....they don’t want to be, feel that they are the guinea pig, the patients....they want to know that you’re confident, you know what’s going on.”*

– Pharmacist Two

#### *Pharmacist role and pharmacy education*

Pharmacist One reported that while adherence support is an important component of the pharmacist role, there are gaps in current pharmacy practice and education that create significant variability between pharmacists.

*“So, I feel that small interventions can have such a massive impact on someone’s life, and it’s quite sad that we [as pharmacists] don’t do [this intervention] anyway [in our usual practice].”*

– Pharmacist One

*“The problem with pharmacists at the moment is, they could be excellent, and they know exactly how to have a conversation with a patient and they know what to do. And, you also get pharmacists who are not. So you’ve got massive variability.”*

– Pharmacist One

This variability may have resulted from a lack of patient-facing work experience and communication training for pharmacists. While the intervention manual was a useful tool for structuring adherence-focused consultations, Pharmacist One recommended additional communication training for pharmacists to ensure that their skillset was optimised to deliver the PASS.

*“I tell everyone, you should all do a motivational interviewing course...it’s not something [we, as pharmacists, are] taught at school, how to talk.”*

– Pharmacist One

*“One of my bugbears is, of all the healthcare professionals, pharmacists are the only ones that don’t spend any time with any other healthcare professionals or with patients during their schooling.”*

– Pharmacist One

#### *Research design issues*

The research design issues outlined in Section 9.4.2 were mirrored in the pharmacists’ feedback, including recruitment difficulties at the end of the NHS year, the approvals process, and questionnaire-related burden for participants. The pharmacists also highlighted that the paper-based study measures used in their consultations increased their workload because they were also required to record the same outcomes (e.g. PEF and ACT) in their electronic patient records.

“So one of the things I think did put people off [the study] was filling in those questionnaires. You know, the time. Because I don’t think they were expecting it even though they got their information letters before, they don’t all read it.”

– Pharmacist One

“Another thing I was going to mention was the timing of the year... the academics, they need to be mindful [of the QOF targets], it’s before April, a lot, so, from January until April, things are going mad in the GP practices because they need to reach all that target before the end of the financial year.”

– Pharmacist Two

#### 9.4.4 Exploratory analyses

##### *Beliefs about medicines*

Participants did not have particularly strong necessity beliefs or concerns about ICS at baseline (see Table 33).

Table 33. Results from the Beliefs about Medicines Questionnaire - Specific (BMQ-S) across the study

<u>BMQ-S</u>	<u>Mean ± SD</u>			
	<u>Baseline</u> ( <i>n</i> = 31)	<u>Post-consultation</u> ( <i>n</i> = 30)	<u>1-month follow-up</u> ( <i>n</i> = 16)	<u>3-month follow-up</u> ( <i>n</i> = 15)
Necessity beliefs	3.49 ± 0.98	3.79 ± 0.92	3.75 ± 0.87	3.75 ± 0.82
Concerns	2.51 ± 0.89	2.21 ± 0.95	2.31 ± 0.86	2.26 ± 0.84
Necessity-Concerns Differential	0.98 ± 1.37	1.58 ± 1.40	1.44 ± 1.41	1.49 ± 1.26
All values expressed as means ± standard deviations Necessity beliefs and concerns: higher scores indicate stronger beliefs (scale 1 – 5) Necessity-Concerns Differential = necessity beliefs - concerns				

Changes in the BMQ-S data were in the expected direction: an increase in necessity beliefs and the NCD, and a decrease in concerns between baseline and three months.

At the one-month follow-up, there was a slight decrease in necessity beliefs and the NCD, and an increase in concerns. Paired samples t-tests between baseline and three months revealed a significant change in concerns ( $2.66 \pm 0.85$  to  $2.26 \pm 0.85$ ,  $p = 0.02$ ) and the NCD ( $-0.86 \pm 1.08$  to  $1.49 \pm 1.26$ ,  $p = 0.01$ ), but not in necessity beliefs ( $3.52 \pm 0.81$  to  $3.75 \pm 0.82$ ,  $p = 0.32$ ) (see Table 34).



Table 34. Changes in necessity beliefs, concerns, and the necessity-concerns differential (NCD) between baseline and three months

	<u>Baseline</u>	<u>3-months</u>	<u>df</u>	<u>Mean Difference</u>	<u>p-value<sup>a</sup></u>	<u>Effect size <i>r</i></u>
Necessity beliefs	3.52 ± 0.81	3.75 ± 0.82	14	-0.23 [-0.71 – 0.25]	0.32	0.26
Concerns	2.66 ± 0.85	2.26 ± 0.85	14	0.40 [ 0.09 – 0.72]	0.02*	0.59
NCD	-0.86 ± 1.08	1.49 ± 1.26	14	-0.63 [ -1.12 – -0.15]	0.01*	0.60
Values expressed as means ± standard deviations Necessity beliefs and concerns: higher scores indicate stronger beliefs (scale 1 – 5) Necessity-Concerns Differential = necessity beliefs - concerns						
<sup>a</sup> Paired samples t-test comparing baseline to three months * <i>p</i> < 0.05						

### Perceptions of asthma

At baseline, participants reported high levels of treatment control (“How much do you think your treatment can help your illness?”, 7.48 ± 2.03) and a long disease timeline (“How long do you think your asthma will continue?”, 8.24 ± 2.56). The emotional impact of asthma (“How much does your asthma affect you emotionally?”) was limited at 4.13 ± 3.15 (see Table 35).

Table 35. Results from the Brief Illness Perceptions Questionnaire (brief IPQ) across the study

	<u>Mean ± SD</u>			
	<u>Baseline</u> <u>(<i>n</i> = 31)</u>	<u>Post-consultation</u> <u>1 (<i>n</i> = 30)</u>	<u>1-month follow-</u> <u>up</u> <u>(<i>n</i> = 16)</u>	<u>3-month follow-up</u> <u>(<i>n</i> = 15)</u>
Consequences	5.32 ± 2.78	4.87 ± 3.06	5.25 ± 3.57	4.47 ± 3.09
Timeline	8.24 ± 2.56	7.23 ± 2.93	6.88 ± 3.38	8.20 ± 2.48
Personal control	6.06 ± 2.38	6.62 ± 2.16	6.44 ± 2.50	7.20 ± 2.31
Treatment control	7.48 ± 2.03	7.97 ± 1.88	8.75 ± 1.18	8.80 ± 1.21
Identity	5.13 ± 2.47	5.03 ± 2.53	5.81 ± 2.86	4.53 ± 3.34
Concern	5.45 ± 3.00	5.57 ± 3.19	6.75 ± 2.72	5.40 ± 3.44
Understanding	6.61 ± 2.46	7.33 ± 2.17	8.06 ± 2.08	7.93 ± 1.62
Emotional response	4.13 ± 3.15	4.07 ± 3.32	3.94 ± 3.36	3.29 ± 3.12
All values expressed as means ± standard deviations (scale 1 – 10)				

Consequence-related illness representations (“How much does your asthma affect your life?”) and identity-related illness representations (“How much do you experience symptoms from your asthma?”) changed in the expected direction: decreasing overall, despite a slight increase at the one-month follow-up consultation. Both personal control (“How much control do you think you have over your asthma?”) and treatment control beliefs consistently strengthened over time.

Timeline-related illness representations remained unchanged overall, but there were unexpected decreases directly after the first consultation and at the one-month follow-up. Interestingly, concern-related representations (“How concerned are you about your asthma?”) decreased slightly overall, but increased around the two pharmacist-led consultations.

Encouragingly, participants’ understanding of their asthma (“How well do you feel you understand your asthma?”) steadily increased up to and including the one-month follow-up, with a minor decrease at the three-month follow-up. Participants’ emotional response to asthma changed in the expected direction: a steady decrease over the duration of the study. When asked about the three most important causal factors of their asthma, participants reported symptom triggers such as smoking, pollution, exercise, allergies, illness (colds/flu/infections), stress, dust, cold weather, and dampness. Causal factors such as genetics and childhood asthma were rarely listed.

Paired samples t-tests between baseline and three months (see Table 36) revealed no significant changes in illness representations, except for a significant increase in participants’ understanding of their asthma ( $6.67 \pm 2.26$  to  $7.93 \pm 1.62$ ,  $p = 0.03$ ).

Table 36. Changes in perceptions of asthma between baseline and three months

	<u>Baseline</u>	<u>3 months</u>	<u>df</u>	<u>Mean Difference</u>	<u>p-value<sup>a</sup></u>	<u>Effect size <i>r</i></u>
Consequences	4.80 ± 3.17	4.47 ± 3.09	14	0.33 [-0.38 – 1.05]	0.33	0.26
Timeline	8.36 ± 2.65	8.36 ± 2.50	13	0.00 [-0.75 – 0.75]	1.00	0.00
Personal control	6.60 ± 2.32	7.50 ± 2.31	14	-0.60 [-1.72 – 0.52]	0.27	0.29
Treatment control	7.87 ± 1.96	8.80 ± 1.21	14	-0.93 [-2.16 – 0.30]	0.13	0.40
Identity	4.87 ± 2.77	4.53 ± 3.34	14	0.33 [-0.47 – 1.14]	0.39	0.23
Concern	5.53 ± 3.07	5.40 ± 3.44	14	0.13 [-0.93 – 1.20]	0.79	0.07
Understanding	6.67 ± 2.26	7.93 ± 1.62	14	-1.27 [-2.40 – 0.13]	0.03*	0.54
Emotional response	3.57 ± 3.18	3.29 ± 3.12	13	0.29 [-0.60 – 1.18]	0.50	0.19

Values expressed as means ± standard deviations (scale 1 – 10)  
<sup>a</sup>Paired samples t-test comparing baseline to three months  
 \**p* < 0.05

### Medication adherence

At baseline, self-reported mean adherence was 3.76 ± 0.90. Scores were lowest for the item “I only use my preventer when I need it” (2.94 ± 1.59), and highest for “I use it as a reserve, if my other treatment does not work” (4.32 ± 1.17) (see Table 37).

Table 37. Results from the Medication Adherence Report Scale (MARS) across the study

	<u>Mean ± SD</u>		
	<u>Baseline</u> <u>(<i>n</i> = 31)</u>	<u>1-month follow-up</u> <u>(<i>n</i> = 16)</u>	<u>3-month follow-up</u> <u>(<i>n</i> = 15)</u>
<u>Medication Adherence Report Scale (MARS)</u>			
Total Score	3.76 ± 0.90	4.42 ± 0.46	4.28 ± 0.60
I only use my preventer when I need it.	2.94 ± 1.59	4.19 ± 1.38	3.40 ± 1.72
I only use it when I feel breathless.	3.45 ± 1.34	4.27 ± 1.39	3.46 ± 1.76
I decide to miss out on a dose.	3.84 ± 1.27	4.63 ± 0.62	4.67 ± 0.62
I try to avoid using it.	4.16 ± 1.19	4.31 ± 0.95	4.85 ± 0.56
I forget to take it.	3.97 ± 1.22	4.31 ± 0.95	4.29 ± 0.83
I alter the dose.	3.74 ± 1.37	4.31 ± 0.95	4.43 ± 0.94
I stop taking it for a while.	3.97 ± 1.30	4.86 ± 0.54	5.00 ± 0.00
I use it as a reserve, if my other treatment does not work.	4.32 ± 1.17	4.75 ± 0.68	4.57 ± 1.16
I use it before doing something which might make me breathless.	3.32 ± 1.42	3.94 ± 1.18	3.86 ± 1.51
I take it less than instructed.	3.84 ± 1.34	4.75 ± 0.45	4.79 ± 0.58

All values expressed as means ± standard deviations  
 Higher scores indicate higher adherence (scale 1 – 5)

Self-reported adherence changed in the expected direction, with an overall increase between baseline and three months. There was an increase between baseline and the one-month follow-up, followed by a slight decrease at three months (see Table 37). However, paired samples t-tests between baseline and three months found no significant difference in self-reported adherence based on the total MARS score ( $4.11 \pm 0.60$  and  $4.28 \pm 0.60$ , mean difference  $-0.17$  [ $-0.58 - 0.25$ ],  $df = 14$ ,  $p = 0.40$ ,  $r = 0.22$ ).

### Peak Expiratory Flow

There was an unexpected decrease in PEF between baseline ( $363.23 \pm 125.58$ ,  $n = 31$ ) and the one-month follow-up consultation ( $329.88 \pm 99.87$ ,  $n = 16$ ). However, paired samples t-tests based on participants who attended both consultations ( $n = 16$ ) showed an increase in PEF, but this change was not significant ( $316.25 \pm 99.72$  to  $329.88 \pm 99.87$ ,  $p = 0.17$ ) (see Table 38).

Table 38. Changes in clinical indicators (Peak Expiratory Flow and Asthma Control) between baseline and follow-up (one month or three months)

	Baseline	Follow-up <sup>a</sup>	df	Mean Difference	p-value <sup>b</sup>	Effect size <i>r</i>
Peak expiratory flow	$316.25 \pm 99.72$	$329.88 \pm 99.87$	15	$-13.63$ [ $-33.82 - 6.57$ ]	0.17	0.35
Asthma control	$3.55 \pm 1.38$	$3.93 \pm 1.03$	14	$-0.39$ [ $-0.79 - 0.02$ ]	0.06	0.48

<sup>a</sup>PEF = one month, asthma control = three months  
<sup>b</sup>Paired samples t-test comparing baseline to follow-up (one or three months)

### Asthma control

Asthma control at baseline was poor, with a mean ACT score of  $16.45 \pm 6.28$  (Nathan et al., 2004). Participants reported frequent shortness of breath ( $2.94 \pm 1.46$ ) and reliever inhaler use ( $2.84 \pm 1.51$ ). In contrast, their asthma only hindered their performance at work/school/home some of the time ( $3.77 \pm 1.52$ ) (see Table 39).

Table 39. Results from the Asthma Control Test (ACT) across the study

<u>Asthma Control Test (ACT)</u>	<u>Mean ± SD</u>		
	<u>Baseline</u> <u>(n = 31)</u>	<u>1-month</u> <u>follow-up</u> <u>(n = 16)</u>	<u>3-month</u> <u>follow-up</u> <u>(n = 15)</u>
ACT total score	16.45 ± 6.28	17.17 ± 5.61	19.67 ± 5.16
In the past four weeks:			
How often did your asthma keep you from getting as much done at work/school/home?	3.77 ± 1.52	4.13 ± 1.26	4.20 ± 1.15
How often have you had shortness of breath?	2.94 ± 1.46	3.31 ± 1.58	4.07 ± 1.33
How often did your asthma symptoms wake you up at night/earlier than usual?	3.36 ± 1.76	3.06 ± 1.73	4.13 ± 1.36
How often have you used your reliever inhaler?	2.84 ± 1.51	3.03 ± 1.32	3.40 ± 1.50
How would you rate our asthma control?	3.55 ± 0.93	3.56 ± 0.73	3.87 ± 0.83
All values expressed as means ± standard deviations			

The overall ACT score showed a steady increase from baseline to the three-month follow-up (see Table 39). This was mirrored by all ACT items except for the item on night-time awakening, which showed a small decrease in asthma control at the one-month follow-up. The overall increase in asthma control neared significance in a paired samples t-test between baseline and three months ( $3.55 \pm 1.38$  to  $3.93 \pm 1.03$ ,  $p = 0.06$ ) (see Table 38).

## 9.5 Overview of findings

### 9.5.1 Recruitment

Recruitment to the PASS study was difficult. Delayed study approvals affected study timelines and recruitment procedures. In Haringey, potential participants frequently refused study participation, possibly because the invitations were extended over the telephone. Linking onto an existing respiratory service, as we did in C&H, generated more appointment bookings. However, poor appointment attendance rates (56%) still hindered recruitment. Most of the missed appointments were due to DNAs and cancellations. This may have been because we were recruiting late in the NHS year,

and therefore attempting to recruit people that were generally disengaged with general practice.

#### 9.5.2 Retention

Interestingly, both the retention rates for the follow-up consultation (one month after baseline) and postal follow-up (three months after baseline) fell at approximately 50%. Those who completed the follow-up points were older, with higher self-reported adherence and a lower PEF at baseline. Retention may also have been affected by the availability of pharmacist appointments, particularly for participants in full-time employment.

#### 9.5.3 Feasibility of the study design

There were several issues with data collection and the outcome measures chosen for the study. Most participants were unable to complete the study questionnaires within the allocated time before their appointments, suggesting that the questionnaires may have been too long. These issues delayed the pharmacist appointments and may also have discouraged participants from continuing with the study. Participants struggled with the BMQ-S, MARS, and acceptability questionnaire, while pharmacists found the inhaler technique checklists impractical for use during their consultations.

#### 9.5.4 Intervention fidelity

Intervention fidelity for the standardised intervention components (e.g. using the profiling questionnaire and checking EMIS) was high, mainly because these tasks had been part of pharmacists' previous work. However, pharmacists only engaged in collaborative goalsetting in 33% of consultations. Most consultations (76%) revolved around addressing participants' concerns about their medication. While pharmacists were able to use the tailored intervention components, they made inappropriate tailoring decisions in 5% to 10% of consultations.

Our findings suggest that the study in its present form is not feasible for the general practice context. Feasibility could be improved by adjusting the study's approvals process, recruitment strategies, and data collection. Intervention fidelity could be improved with further pharmacist training.

#### 9.5.5 Acceptability of the intervention

##### *Participants*

Encouragingly, participants reported high acceptability for the intervention as a whole, as well as its content and delivery channel. Participants liked the information included in the intervention, and they reported feeling comfortable with their pharmacist.

Intervention burden seemed to be an issue for participants, namely the effort required to fill in the profiling questionnaire (intervention content) and to attend the appointments at the practice (delivery channel). However, participants were asked to fill in baseline research questionnaires in addition to their profiling questionnaire. Therefore, the lower acceptability scores for the profiling questionnaire may be a reflection of the study design, rather than the questionnaire itself.

There were no differences in acceptability scores between participants that completed and missed the one- and three-month follow-up points. However, acceptability scores for the intervention delivery channel at the three-month follow-up were significantly higher among participants seen by Pharmacist One compared to those seen by Pharmacist Two. The retention rate at the three-month follow-up was slightly higher for Pharmacist One compared to Pharmacist Two ( $n = 9$  and  $6$  respectively). People who liked their pharmacist may have been more likely to return the postal questionnaires and rate the pharmacist delivery channel highly, although we cannot confirm this with the study data.

### *Intervention pharmacists*

Intervention acceptability from the perspective of the intervention pharmacists was high, mainly because they felt it addressed a gap in current clinical practice. While they found the intervention content useful and well-structured, they expressed concerns about the time constraints associated with a 15 to 20 minute consultation. As general practice pharmacists frequently work across multiple long-term conditions, a single consultation may not be sufficient to deliver the PASS *and* address additional comorbidities. Therefore, the PASS may be better-suited to respiratory-specific clinics, as seen in C&H or secondary care.

The pharmacists felt that they became more efficient with practice in delivering the PASS. They therefore recommended additional pharmacist training for the PASS in group settings or through online programmes. However, Pharmacist One highlighted that gaps in pharmacy education and work experience may generate variability in pharmacists' clinical skillset, creating a potential barrier to intervention implementation.

These findings suggest that the acceptability of the intervention was high, from both the recipient and implementer perspectives. Many of the issues affecting the acceptability of the intervention were related to the study's research procedures, and could therefore be resolved with further refinement of the study design. Pharmacist training for the intervention will need to be revised and expanded to account for the variability in pharmacists' skillsets.



## *Exploratory analyses*

### *Beliefs about Medicines*

Changes seen in participants' beliefs about ICS (BMQ-S) were in the expected direction: increased necessity beliefs and NCD, and decreased concerns. Changes in the NCD and concerns were significant between baseline and three months, suggesting that the intervention shows promise in changing concerns about ICS in the intended population.

### *Perceptions of asthma*

Participants' perceptions of asthma (brief IPQ) all changed in the expected direction, with the exception of concern- and timeline-related illness representations. There were unexpected increases in concern-related representations at the one- and three-month follow-ups, perhaps because the study asked participants to actively reflect on their asthma. Interestingly, participants' timeline-related illness representations did not change overall. However, most participants acknowledged at baseline that their asthma was a long-term condition. When asked about the causes of their asthma, participants often listed their triggers, suggesting that their view of asthma was symptom-based. Exploratory findings from the brief IPQ suggest that the intervention shows promise in changing illness representations.

### *Medication adherence*

There was no significant change in self-reported adherence (MARS) between baseline and three months. However, MARS scores increased as expected. Interestingly, the mean PEF decreased between the two pharmacist-led consultations. This was because many participants with a high baseline PEF (and perhaps better asthma control) skipped the one-month follow-up consultation. Those who attended both consultations

showed an increase in PEF, although this change was not significant. Asthma control increased steadily and neared the ‘controlled’ category of ACT scores at the three-month follow-up. However, this change was not significant ( $p = 0.06$ ) (Nathan et al., 2004).

## 9.6 Discussion

The findings from this study highlight the importance of detailed feasibility and acceptability work before interventions are evaluated in practice. Findings should be interpreted with the study’s strengths and limitations in mind.

### 9.6.1 Strengths and limitations

A strength of this study was the fact that it examined the acceptability of the intervention’s content *and* delivery channel in a single study, in line with the 3CBC approach (Horne, 2012; Horne & Clatworthy, 2010). This overview was further strengthened by including the perspectives of two important stakeholders (adults with asthma and intervention pharmacists). Two types of pharmacist job structures were compared to examine where the study and intervention might fit in current clinical practice, accounting for differences in pharmacists’ clinical experience and access to support (e.g. from practice staff). These feasibility and acceptability indicators generated a detailed overview that enabled us to pinpoint specific issues related to the intervention itself and our study design.

#### *Generalisability of study findings*

The generalisability of our findings may be limited as most of our participants were of Black or White ethnicity. Furthermore, only two pharmacists delivered the intervention and they may not be representative of UK pharmacists in general. Practices in C&H may have booked in any people with asthma in the interest of

increasing their asthma review numbers for the QOF, rather than targeting people with asthma identified as ‘high risk’. Therefore, the PASS may have been delivered to people with asthma who did not struggle with adherence or asthma control.

### *Recruitment*

We were unable to reach the original recruitment target of 100 participants, however our findings may have underestimated the recruitment potential of each CCG. In C&H, most potential participants had already seen the practice pharmacist as part of the QOF targets, meaning that we may have been recruiting from a smaller less-engaged patient group. In addition, the recruitment process in the Haringey CCG did not follow the four-week period outlined in our protocol because Pharmacist Two’s contract came to an end in March 2018. This meant that the recruitment *and* one-month follow-up consultations in Haringey occurred in just under six weeks. This severely limited recruitment time, thereby underestimating the CCG’s recruitment potential. Retention data included follow-up consultations from three to six weeks after baseline. These earlier and later follow-up consultations were included because we felt they would fall within the acceptable cut-off points set out in larger trials.

### *Intervention fidelity*

The intervention fidelity checklist was a crude quality indicator for intervention delivery because each consultation was tailored. Furthermore, the presence of the researchers in the consultation may have affected pharmacist and participant behaviour. Intervention fidelity findings may also have been affected by detection bias, as the researchers completing the checklists were involved in the design of the intervention.

### *Acceptability*

While the acceptability findings from the participant perspective were encouraging, they were generated using a non-validated questionnaire. Despite the use of TATs and Patient and Public Involvement (PPI) during its development, participants found the acceptability questionnaire lengthy and difficult to complete. This issue may suggest that there were differences in research competency between the patient contributors involved in the PPI process and the general practice patient population.

This issue highlighted differences in research capability between the general practice patient population and patient contributors involved in PPI. However, the high acceptability scores from the questionnaire aligned with the positive written feedback given by some participants in the questionnaire's open feedback section. Acceptability scores generally increased at three months, but it is likely that those who returned the postal questionnaires were more enthusiastic about the intervention. Furthermore, participants may have responded positively on the acceptability questionnaire because they liked their pharmacists and thought the questionnaire was a performance review.

The pharmacist feedback sessions were not treated as a qualitative study, and therefore not analysed using qualitative methodology. There were two reasons for this. Firstly, both pharmacists offered some feedback during the development of the intervention manual, and were therefore not representative of 'intervention-naïve' pharmacists. Secondly, we viewed the intervention pharmacists as study collaborators rather than participants, and they were listed as such in the study's NHS ethics application. Pharmacists' perception of the intervention may have been more positive because they were involved in its development. Feedback from GPs and practice receptionists was not collected due to the limited time and resources available for this PhD. Furthermore, these additional research activities (e.g. interviews with GPs and receptionists) may

have made practices more hesitant about participating in the study due to the increased workload for its staff.

#### *Exploratory analyses*

The analyses of the BMQ-S, brief IPQ, MARS, PEF, and ACT were based on a small sample ( $n = 15$ ) and affected by attrition bias due to the study's high drop-out rate. Furthermore, significant changes in these exploratory measures may have been the result of regression to the mean. However, these analyses were used to understand whether the intervention showed any promise in the intended population, thereby informing the potential for future evaluations of the intervention (i.e. pilot studies and RCTs) (Orsmond & Cohn, 2015).

#### *Self-report measures*

With the exception of PEF, all process and outcome measures were self-reported. While capturing the patient perspective is an important component of healthcare research (especially for long-term conditions), this study highlighted that the quality of self-reported data was affected by response burden and error. While adherence could have been measured with electronic monitoring devices (EMDs) or dose counting, both of these methods fell beyond the resources available for this PhD. Secondary database analysis (e.g. prescription and general practice data) was considered, although changes in adherence would be difficult to detect with a study duration of only three months, especially if participants were on repeat prescriptions.

#### 9.6.2 Comparison with existing literature

Recruitment difficulties are commonly cited in the literature about primary care research. According to a report by Bower, Wilson, and Mathers (2007), only 29% of primary care trials recruit to timeline. To facilitate recruitment, 56% of trials extend

their recruitment period and close to a third (31%) apply for extra funding. Other strategies include adding research sites (44%), adding recruitment methods (18%), and recalculating power (21%). Nonetheless, 18% of trials still close recruitment with an insufficient number of participants (Bower et al., 2007).

Certain participant characteristics (e.g. old age or low socioeconomic status) have been linked to decreased engagement in healthcare and research (Prescott et al., 1999). Participants' initial experiences with a study have also been shown to affect their willingness to continue, highlighting why our baseline questionnaires may have affected retention (Lawton, Fox, Fox, & Kinmonth, 2003). Other studies have reported recruitment failure because healthcare professionals could not combine their recruitment efforts with their primary care workload (Bell-Syer & Moffett, 2000; Bower et al., 2009; Pearl, Wright, Gamble, Doughty, & Sharpe, 2003). General practice clinicians may also overestimate the recruitment potential in their practices (Bower et al., 2009).

The findings from this chapter mirror those of another feasibility study examining a nurse-led ICS adherence intervention. Chapman et al. (2015) trained nurse specialists to use a 'no-blame approach' to identify and address potential causes of non-adherence in adults with asthma. While the nurses reported high satisfaction with the intervention, the study encountered issues with recruitment and data quality because nurses were asked to combine recruitment/data collection with their clinic workload. Necessity beliefs, concerns, the NCD, and self-reported adherence (MARS) were measured at baseline and one month after the nurse-led consultation. In line with our findings, the nurse-led study found a significant increase in the NCD, significant decrease in concerns, and no significant changes in necessity beliefs or self-reported adherence between baseline and follow-up.

Fidelity for the nurse-led intervention was low, with the no-blame approach used correctly in 28.6% of consultations, necessity beliefs elicited in 18.6% of consultations, and concerns elicited in 63.3% of consultations (Chapman et al., 2015). While nurses were able to elicit beliefs about ICS, they frequently left them unaddressed. The PASS pharmacists addressed concerns in 76% of consultations and reinforced necessity beliefs in 57% of consultations, showing a marked improvement from the nurse-led intervention. However, pharmacists still made inappropriate tailoring choices in 5% to 10% of consultations.

In line with our findings, Mann et al. (2018) found that pharmacists in the Clinical Pharmacists in General Practice (CPGP) pilot scheme also needed additional training. While GPs often expected pharmacists to be fully autonomous when they started their post, pharmacists often needed extensive training and mentoring before becoming clinically autonomous. Mann et al. (2018) recommended that pharmacists shadow key practice staff, work at reception, and attend training on primary care structures to facilitate their learning in the general practice context.

Our findings from the brief IPQ suggested that participants did not differentiate their asthma from its symptoms, frequently listing triggers as ‘important causes’ of their asthma. This is in line with the previously reported ‘no symptoms, no asthma belief’: the belief that asthma only exists when it is symptomatic (Halm et al. (2006).

### 9.6.3 Implications for research

#### *Research design considerations*

When designing studies in general practice, researchers should assign eight months to obtain study approvals, keeping in mind that the ideal time to start recruitment is at the start of the NHS year (April onwards). Site-specific approvals (CCG-wide or per

practice) should be obtained in advance to streamline study procedures. When drafting study protocols, researchers should shadow staff at potential recruitment sites to gauge recruitment potential (e.g. research capacity of practice staff, appointment attendance rates). Linking onto an existing service, perhaps practices already involved in the CPGP scheme, will facilitate the research process.

#### *Recruitment, retention, and data collection*

Additional research is needed to produce evidence-based guidance for primary care recruitment (Bower et al., 2009; Foy et al., 2003). Researchers could identify effective recruitment strategies and ways to increase research engagement. However, the implementation of these findings should also be supported by effective research infrastructure (Bower et al., 2009). While the NIHR Clinical Research Networks (CRNs) provide research support through their Primary Care Speciality, primary care still lacks the level of research experience and infrastructure seen in secondary and tertiary care (Cooke, Owen, & Wilson, 2002).

In terms of recruitment, future studies could purposively sample based on age, gender, ethnicity, and educational background to obtain an accurate representation of the general practice population with asthma. In terms of retention, researchers should focus on reducing questionnaire burden by utilising healthcare records and online questionnaires sent out ahead of appointments for data collection. Participants' characteristics (e.g. age, employment status) and the availability of pharmacist appointments should also be considered when choosing an appropriate follow-up method. With regards to data collection, future studies should triangulate findings from self-report measures (e.g. MARS) with data from healthcare records wherever possible.



### *Acceptability and study outcomes*

Future research could explore the acceptability of the PASS to other members of the general practice team, such as GPs, nurses, and practice receptionists. This will establish the value of the intervention in current clinical practice, identify ways to improve integration and collaboration between healthcare professionals, and reduce the risk of role overlap. The findings from the exploratory analyses of participants' beliefs about medicines, perceptions of asthma, medication adherence, and clinical indicators showed promise. However, the actual effect of the PASS on these outcomes will need to be established in pilot studies and RCTs.

Pharmacist training for the PASS needs to be expanded based on the training needs of intervention-naïve pharmacists, perhaps by using a baseline measurement or screening tool to assess pharmacists' skillset and knowledge at baseline. Future studies could focus on developing the training programme and identifying effective teaching methods to deliver pharmacist training.

#### 9.6.4 Implications for practice

Our findings suggest that additional research support is needed for studies conducted in general practice. This may include providing additional research support staff, streamlining and clarifying practice-based approval procedures, and providing access to healthcare records for more efficient data collection.

Encouragingly, this chapter highlighted that pharmacists with different educational backgrounds and work experience can deliver the PASS with adequate training. However, the PASS pharmacists were enthusiastic about adherence support and they may not be representative of the general pharmacist population in terms of skillset and overall engagement. Future pharmacist-led adherence support initiatives will need to tailor pharmacist recruitment and training based on this variability among pharmacists.

## 9.7 Conclusion

This chapter demonstrated the importance of feasibility and acceptability research in the design and evaluation of new healthcare interventions. While the study in its present form was not feasible for the general practice context, it did identify potential issues in the study approvals, recruitment, data collection, and pharmacist training processes that could be resolved to improve the feasibility of future studies. In terms of the PASS itself, feedback from the intervention pharmacists suggested that the intervention may be best-suited to respiratory-focused clinics in general practice or secondary care. As general practice pharmacists frequently work across multiple long-term conditions, delivering the PASS *and* addressing additional comorbidities may not be feasible in a single consultation.

Encouragingly, the PASS demonstrated high acceptability from both the participant and pharmacist perspective. Our findings suggest that participants generally trusted their pharmacists and that they appreciated the additional medication-specific support. Both the study participants and intervention pharmacists felt that the PASS filled a gap in current asthma care provided by GPs and nurses, where medications and adherence may not be discussed in detail. Paired with the exploratory findings on beliefs about medication, perceptions about asthma, medication adherence, and clinical indicators (PEF and asthma control), as well as the growing pressure on primary care practitioners in the UK, these findings suggest that pharmacists should continue to be explored as a potential delivery channel for adherence support.

After addressing the aforementioned feasibility issues, pilot studies and large-scale evaluations of the PASS can be used to establish the effectiveness of pharmacist-led adherence support for asthma. These studies could explore changes in adherence, as well as the associated effects on health outcomes (e.g. asthma control), healthcare

spending (e.g. cost-effectiveness), and healthcare access (e.g. waiting times for appointments in general practice).

## 10 General Discussion

This thesis examines UK pharmacists as a potential delivery channel for a theory-based intervention targeting adherence in adults with asthma. This aim was broken down into three objectives: 1.) to assess the effectiveness of pharmacist-led interventions in improving medication adherence in adults with asthma, through a systematic review and meta-analysis, 2.) to explore the perspectives of UK pharmacists and adults with asthma on pharmacist-led adherence support, and 3.) to investigate the feasibility and acceptability of pharmacists as the delivery channel for a theory-based adherence intervention delivered to adults with asthma in general practice. This discussion chapter will outline the empirical findings and limitations of the research. Findings will be considered in the context of previous research, and practical implications and future directions will be explored.

### 10.1 Overview of the empirical findings

The first step in the research process was to review previous literature on pharmacist-led interventions and their effect on adherence in adults with asthma. We wanted to establish their overall effectiveness, and identify potential factors influencing their effectiveness. The findings from the systematic review and meta-analysis (Chapter 6) were as follows:

1. Pharmacist-led adherence support significantly improved adherence in adults with asthma, based on a narrative synthesis and meta-analysis ( $d = 0.49$ ,  $SE = 0.08$ , 95% CI [0.35 – 0.64],  $p < 0.0001$ ) (Mes et al., 2018).
2. The effectiveness of pharmacist-led adherence interventions was influenced by intervention content *and* context. Effective intervention content often employed a tailored approach targeting the motivation and ability to adhere, as

outlined in the Perceptions and Practicalities Approach (PAPA) and recommended in the National Institute for Health and Care Excellence (NICE) guidelines for medicines adherence (Horne, 2001, 2015; Nunes et al., 2009). Possible contextual factors influencing the effectiveness of pharmacist-led interventions included pharmacy accessibility, healthcare and health insurance infrastructure, pharmacist training, funding, and pharmacists' inclusion in healthcare policy (Mes et al., 2018).

While the systematic review/meta-analysis established the overall effectiveness of pharmacist-led interventions and identified potential influential factors, the included studies were conducted across several countries and pharmacy settings. Therefore, the next step was to explore pharmacist-led adherence support within the UK context. This involved exploring the perspectives of both UK pharmacists and adults with asthma as the potential implementers and recipients of the service.

The online questionnaire study with UK pharmacists (Chapter 7) explored the UK pharmacy context in relation to the PAPA (Horne, 2001, 2015). Spanning across community pharmacy and integrated care settings (e.g. hospitals and primary care), the questionnaire examined which components of PAPA-based adherence support for asthma were already part of UK pharmacy practice. It also explored how confident UK pharmacists felt in delivering components of PAPA-based adherence support, and identified potential barriers to service delivery from the pharmacist perspective. Differences in the perspectives of community and integrated care pharmacists were explored. The findings were as follows:

3. Pharmacists viewed the provision of adherence support as an integral part of their role. However, they focused primarily on providing information about asthma and its treatment.
4. Pharmacists felt most confident with information provision and basic clinical activities (e.g. taking a medication history). Confidence dropped for complex consultation-related tasks such as discussing the Asthma Action Plan and tailoring adherence support.
5. Pharmacists identified patient-related factors (e.g. people's lack of asthma knowledge) and resource-related factors (e.g. lack of pharmacist time and funding) as potential barriers to pharmacist-led adherence support for asthma.
6. Integrated care pharmacists (ICPs, hospital and primary care pharmacists) reported significantly higher confidence than community pharmacists across several components of asthma-specific adherence support (e.g. interpreting and understanding sources of medical information). Furthermore, community pharmacists reported significant service delivery barriers (e.g. lack of pharmacist time and funding) within the community pharmacy context, in line with findings from previous evaluations of community pharmacy services (Boyd et al., 2014; Latif et al., 2011; Latif et al., 2016).

Based on these findings and previous research on community pharmacy-based interventions, we chose to focus on integrated care settings over community pharmacy as the potential context for pharmacist-led adherence support for asthma.

Potential integrated care settings included general practice and hospitals, and general practice was chosen because the majority of asthma cases in the UK are managed in primary care (British Thoracic Society/Scottish Intercollegiate Guidelines Network, 2016). Furthermore, investigating general practice pharmacist-led care aligned well

with the introduction of the Clinical Pharmacists in General Practice (CPGP) Scheme (NHS England, 2015) and the expanding role of pharmacists in primary care as outlined in the NHS Forward View (NHS England, 2014, 2017b).

Given the novelty of general practice pharmacist-led adherence support, it was important to explore the perspectives of the potential recipients of the service – adults with asthma. This study (Chapter 8) took a qualitative approach, with a focus on how perspectives of general practice pharmacist-led adherence support were formed:

7. Adults with asthma built their trust in a healthcare professional over time and based on their perceptions of the healthcare professional's clinical competence (e.g. broad clinical knowledge paired with detailed knowledge about asthma). They often used their trust and previous experiences with other healthcare professionals (e.g. GPs, nurses, and community pharmacists) as 'benchmarks' for their trust in general practice pharmacists.
8. For adults with asthma, the added value of general practice pharmacists was based on perceived gaps in current asthma care. They considered potential role overlap between pharmacists and other healthcare professionals, and contemplated how adding another healthcare professional to their care team would affect continuity of care. Pharmacists were seen as potential medication experts.
9. Adults with asthma were acutely aware of the limited resources within the NHS. They referred to a perceived hierarchy of healthcare professionals (GPs at the top, then nurses, and finally pharmacists) to guide their interaction with the healthcare system, and this hierarchy also determined their perspectives of general practice pharmacists. It was both a facilitator and barrier to pharmacist-led adherence support: pharmacist consultations were seen as informal and

accessible opportunities for additional support, but participants also perceived pharmacists as limited in their ability to expand into clinical roles similar to those of GPs and nurses (higher up the hierarchy).

Although there were some concerns from adults with asthma regarding pharmacists' training/clinical competency and potential role overlap with other healthcare professionals, our findings suggest that most participants were willing to consider general practice pharmacist-led care. However, their perspectives were formed based on previous experiences with asthma care and other healthcare professionals, rather than direct experience of a general practice pharmacist-led consultation. Therefore, further research was needed to explore the performance of pharmacist-led adherence support for asthma in general practice.

In collaboration with another PhD researcher (see *PhD Structure* for cooperation details), the final component of the PhD incorporated the aforementioned empirical findings into a feasibility and acceptability study of a pharmacist-led adherence support service delivered in general practice – the Pharmacist Asthma Support Service (PASS). The aims of this before-and-after study were to examine the feasibility of the PASS and its associated study design, as well as the acceptability of the intervention (both content and delivery channel) from the pharmacist and patient perspectives. Additional process and outcome measures (beliefs about medicines, perceptions of asthma, inhaler technique, self-reported adherence, peak expiratory flow, and asthma control) were explored to establish whether the intervention showed promise within the intended population, thereby informing the possibility for pilot studies and RCTs in the future (Orsmond & Cohn, 2015). The findings are described in detail in Chapter 9, and summarised below:



10. The feasibility of the PASS study design was low. There were significant delays in study approvals at the UCL Joint Research Office (JRO) and NHS ethics stages. Furthermore, obtaining site-specific approval was difficult due to the limited research infrastructure in general practice. Recruitment rates were low across all sites, and the study had an approximate attrition rate of 50% from baseline at each follow-up point (one and three months). Both the participants and intervention pharmacists struggled with aspects of the data collection processes.
11. The acceptability of the PASS (intervention content and pharmacist delivery channel) was high from the perspectives of adults with asthma. Participants liked the information included in the intervention and reported feeling comfortable with the intervention pharmacists. Intervention burden seemed to be an issue for participants, specifically the effort required to fill in the profiling questionnaire (intervention content) and to attend the pharmacist appointments at the practice (delivery channel).
12. The acceptability of the PASS was high from the perspectives of the intervention pharmacists as they felt it filled an existing gap in current asthma care. However, they highlighted that general practice pharmacists frequently work across multiple conditions. Therefore, a single general practice consultation may not be sufficient to deliver the PASS *and* address additional comorbidities. As such, the PASS may be best-suited to respiratory-specific clinics in general practice.
13. Intervention fidelity varied across the different intervention components, ranging from 33% of consultations where asthma-specific goalsetting was successfully used to 100% of consultations where the profiling questionnaire

was utilised. Inappropriate tailoring choices were made by the pharmacists in 5% to 10% of the consultations. Both intervention pharmacists found their training session with researchers useful, but recommended additional training for future implementation (possibly through group-based or remote training methods).

14. The exploratory outcomes associated with the PASS (beliefs about medicines, perceptions about asthma, medication adherence, peak expiratory flow, and asthma control) changed in the desired direction after the intervention, and therefore showed promise for further investigation in pilot studies.

The empirical findings outlined above suggest that UK pharmacists are a suitable and acceptable delivery channel for adherence support targeting adults with asthma, although barriers to future research, service implementation, and service effectiveness exist. Low recruitment and retention rates may affect future research in general practice, and these research difficulties must be considered during the study design process. Pharmacists need additional training to deliver PAPA-based adherence support effectively and confidently. For the pharmacist role to expand, public trust in pharmacists will need to increase, perhaps by increasing public awareness of pharmacy education and training.

## 10.2 Limitations of the empirical research

### 10.2.1 Sampling bias

The aforementioned findings may have been affected by sampling bias. The online questionnaire with UK pharmacists (Chapter 7) had a low response rate, and respondents who completed it may have been more enthusiastic about delivering adherence support than the general UK pharmacist population. In the qualitative study with adults with asthma (Chapter 8), thematic saturation was reached with 17

participants. However the sample was relatively homogenous – participants were primarily White, female, and recruited through Asthma UK. As such, participants may have held similar views and may have been more engaged in asthma care and research than the general asthma population. The feasibility and acceptability study of the PASS (Chapter 9) recruited 31 participants despite the initial target of 100 participants, with a drop-out rate of approximately 50% from baseline at both the one- and three-month follow-up points ( $n = 16$  and  $15$  respectively). While these participants varied in terms of age, asthma control, educational background, and employment status, participants who completed the follow-up points may have been more supportive of pharmacist-led care than study drop-outs or the general asthma population.

#### 10.2.2 Perceptions-based research

Due to the use of self-report questionnaires and interviews, findings were based on people's perceptions of their own behaviour rather than objective measures. These perceptions may differ from actual behaviour, particularly for self-reported adherence and pharmacist workflow. Research shows that self-reported estimates of adherence are often higher than adherence estimates obtained through electronic monitoring (Daniels et al., 2011; Lam & Fresco, 2015). As such, participants in the PASS study (Chapter 9) may have overestimated their own adherence. Previous research also found significant differences between healthcare professionals' self-reported workflow (e.g. time spent per activity, number of care activities completed in a day) and researcher observations of workflow (Ampt, Westbrook, Creswick, & Mallock, 2007; Burke et al., 2000). Therefore, it is unclear whether the lack of time reported by the pharmacist respondents in the online questionnaire study (Chapter 7) corresponds with their behaviour in practice.

The online pharmacist questionnaire (Chapter 7) and PASS acceptability questionnaire (Chapter 9) were not previously validated, thus their reliability and validity are unknown. While they serve as an exploratory starting point for research on this topic, further work is needed to refine and validate the questionnaires as measurement tools.

### 10.2.3 Cross-sectional studies or short follow-up periods

Both the online questionnaire and qualitative interview study were cross-sectional, and the PASS study had a follow-up period of three months. Participants' perceptions of the healthcare system, beliefs about medicines and asthma, and adherence behaviour may have changed over time. Therefore, both our understanding of the temporal association between constructs and the stability of study findings over time is limited. This limitation could have been addressed by conducting follow-up questionnaires or interviews. However, this would have increased the study burden on participants and may have increased the recruitment difficulties already seen across the studies.

### 10.2.4 United Kingdom focus

The research outlined in this thesis had a UK focus, and its applicability in other countries is therefore unknown. However, general practice pharmacist-led care has also been studied extensively in the USA, Australia, and Canada, and with increasing interest in Brazil, Chile, Thailand, Japan, and Jordan (E. C. K. Tan, Stewart, Elliott, & George, 2014).

### *Generalisability of findings to other countries*

Some of the findings outlined in this thesis may be applicable in countries similar to the UK with an established general practice pharmacist care model and the majority of asthma management occurring within primary care. Possible examples include the USA, Canada, and Australia (Lougheed et al., 2012; National Asthma Council

Australia, 2019; National Asthma Education and Prevention Program, 2007; E. C. K. Tan et al., 2014).

However, other contextual factors affecting healthcare and adherence should be considered when looking at the transferability of findings. For example, reimbursement policies and prescription costs can influence adherence behaviour (Kennedy & Morgan, 2009; Law, Cheng, Dhalla, Heard, & Morgan, 2012). Annual prescription costs for a person with asthma are approximately \$300 (AUD) in Australia (Mellis, Peat, Bauman, & Woolcock, 1991), \$209 (CAD) in Canada (Sadatsafavi et al., 2010), over £100 in the United Kingdom (Asthma UK, 2019), and \$1680 in the USA (Barnett & Nurmagambetov, 2011). Therefore, the aforementioned findings may be more applicable in countries such as Canada or Australia, where the prescription costs for asthma are similar to those in the UK.

#### *Differences in pharmacy practice and research within the United Kingdom*

Major differences in pharmacy research and practice exist even within the UK, and these differences became more apparent as the PhD progressed. For example, most of the published research on pharmacist-led services in the UK was conducted in England (Elliott et al., 2016; Latif et al., 2011; Mann et al., 2018), whereas published evaluations of services such as the Chronic Medication Service in Scotland and the Manage Your Medicine Service in Northern Ireland are lacking. Funding for pharmacy research may also be more common in England, with fewer funded projects in Wales, Scotland, and Northern Ireland (Pharmacy Research UK, 2017). However, this may simply be due to the fact that many of the UK's pharmacy schools are located in England.

In terms of pharmacy practice, pharmacist-led services are funded differently – community pharmacy-based services are contracted by the NHS in Scotland, England, and Wales (Community Pharmacy Scotland, 2018; NHS Digital, 2017) and funded by the Health and Social Care Board in Northern Ireland (HSC Business Services Organisation, 2010a). Furthermore, there are significant differences in the availability of pharmacy services. For example, the general practice pharmacist role has only been introduced in England so far and the eligibility criteria for community pharmacist-led services differ across the UK (HSC Business Services Organisation, 2010a; NHS Employers, 2013b; NHS England, 2015; NHS Inform, 2012). As such, the research findings outlined in this thesis will be most relevant in England. As the PASS study was conducted across general practices in London, findings may also not be representative of general practices in other regions in England (e.g. differences in practice size, patient demographics).

### 10.3 Comparison with existing literature

#### 10.3.1 The effectiveness of pharmacist-led adherence support

The systematic review and meta-analysis (Chapter 6) found that pharmacist-led interventions significantly improved adherence among adults with asthma, with a moderate to high risk of bias across the review due to instances of detection and contamination bias in the included studies. While the review included studies conducted in several countries, it did not identify any eligible studies from the UK. Previous UK-based studies of pharmacist-led interventions focused on clinical outcomes over adherence (Barbanel, Eldridge, & Griffiths, 2003) or analysed adherence by combining people with asthma and COPD into one group (Elliott et al., 2016).

The RCT of the New Medicine Service (NMS) in England looked at the effect of community pharmacist-led support on adherence in people with asthma/COPD. At 10 weeks, they found that the likelihood of adherence in the NMS group tended to be higher than in the control group (OR 5.26, 95% CI [0.93 – 29.56]). However, this effect did not reach statistical significance ( $p = 0.06$ ) and the analyses were underpowered and exploratory due to the small number of participants in each group ( $n = 58$  and  $59$  in the control and NMS group respectively) (Boyd et al., 2014).

The self-reported adherence outcome in the PASS study changed in the expected direction, with an overall increase between baseline and three months. This increase in adherence was not significant ( $p = 0.40$ ). However, the study was not designed to measure the effectiveness of the intervention. Given the small effect size ( $r = 0.22$ ), a much larger sample would be needed to detect an intervention effect. In addition, the change in adherence may have been the result of a regression to the mean among participants with low adherence scores at baseline.

Therefore, while there is sufficient evidence to suggest that pharmacist-led interventions can improve adherence in adults with asthma in general, the literature specifically concerning UK pharmacists is still limited (Mes et al., 2018). Additional research is needed to establish the effectiveness of the PASS, starting with pilot studies and working towards large-scale RCTs.

### 10.3.2 The perspectives of UK pharmacists

#### *Information provision and patient education*

Pharmacists felt most confident in providing information about asthma and its treatment compared to other complex consultation-related activities (e.g. discussing the Asthma Action Plan) (Chapter 7). Previous studies in the UK community

pharmacy context also found that pharmacists favoured educational activities, perhaps due to a lack of confidence with the informational ambiguity associated with clinical decision-making (Boyd et al., 2014; Gregory & Martin, 2007; Rosenthal, Breault, Austin, & Tsuyuki, 2010).

#### *The pharmacist role and boundary encroachment*

In contrast to previous research, our findings suggest that pharmacists view adherence support provision as part of their role (Boyd et al., 2014; Latif et al., 2016). Pharmacists were not concerned about encroaching on the responsibilities of other healthcare professionals (e.g. GPs and nurses).

The Clinical Pharmacists in General Practice (CPGP) pilot found initial resistance to the general practice pharmacist role from practice nurses due to concerns about professional boundary encroachment (Mann et al., 2018). To address this, many practices asked pharmacists to shadow members of the general practice team during their induction to clarify established role boundaries. In some practices, senior nursing staff acted as the clinical mentors for incoming pharmacists and this strengthened inter-professional collaboration. Nonetheless, role overlap between pharmacists and nurses remained in some practices (Mann et al., 2018).

#### *Pharmacist time and funding*

Community pharmacists were significantly more concerned about funding for adherence support compared to ICPs. This could be due to the fact that medication reviews (e.g. the NMS and MUR) represent a significant source of income for community pharmacies and funding is based on the number of reviews performed. Pharmacists have previously reported that the pressure to reach review targets affected the quality of their consultations (Boyd et al., 2014; Latif et al., 2011). In contrast, the



funding structure for general practice pharmacists is not directly tied to the number of reviews conducted. It is split between NHS England and the recruiting practices, and it goes directly to the pharmacist post (NHS England, 2015). Therefore, while general practice pharmacists are still under pressure to perform and add value, their funding structure allows for both the quality and quantity of consultations.

However, GPs and site leads in the CPGP pilot reported that the general practice pharmacist role can be expensive for most practices, particularly in its first year when training and clinical mentorship is crucial (Mann et al., 2018). For the role to be sustainable, site leads suggested that pharmacists should be working autonomously in patient-facing consultations 24 months into their post. However, the resources for initial pharmacist training and clinical mentoring varied across sites. Despite these concerns, many GPs agreed to continue funding the pharmacist role after the pilot study ended (Mann et al., 2018).

### 10.3.3 The perspectives of adults with asthma

#### *Perceptions of pharmacists and pharmacy*

The commercial characteristics of the community pharmacy context may have limited community pharmacists' expansion into clinical roles. Previous research found that the general public viewed community pharmacists as specialist shopkeepers, possibly due to the retail characteristics of the community pharmacy context. The general public and other healthcare professionals have also expressed concerns about the increased involvement of corporate entities (e.g. Boots) in healthcare environments and the potential conflicts of interest between commercial profit and patient wellbeing (Bush et al., 2009; Gidman et al., 2012).

Interestingly, placing pharmacists in general practice (away from the retail activities in community pharmacy) did not necessarily change perceptions of the pharmacist role. The adults with asthma in our qualitative study (Chapter 8) had no previous experience with general practice pharmacists and therefore used their experiences with community pharmacists to inform their expectations of the new service, as seen in previous research (Naik Panvelkar et al., 2010). Therefore, initial perceptions of general practice pharmacist-led adherence support may be negatively impacted by public perceptions of the ‘retail pharmacist’.

#### *Comparisons with other healthcare professionals*

The adults with asthma in our qualitative study placed pharmacists below GPs and nurses in a hierarchy of healthcare professionals. Similarly, Gidman et al. (2012) found that the general public viewed GPs as the established authority in their care, with pharmacists fulfilling a supplementary role under the guidance of the GP. This may be because many participants were familiar with the requirements of the medical education system, increasing institutional trust in the medical profession. Participants also highlighted that GPs could provide a full range of care including diagnosis, prescriptions, and referrals. In contrast, participants were unfamiliar with the pharmacy education system and were therefore unsure about pharmacists’ skillset (Gidman et al., 2012).

While participants in our qualitative study viewed pharmacists as medication experts, they also felt that pharmacists lacked the broad clinical knowledge and prescribing qualifications to be competent patient-facing clinicians. Cooper et al. (2008) had similar findings in their interview study with pharmacists, nurses, doctors, patients, academic researchers, and policymakers about independent and supplementary prescribing in the UK. All participants agreed that there were clear differences

between pharmacists and nurses – nurses were seen as more competent in interpersonal skills and counselling, while pharmacists were seen as having better pharmacological knowledge (Cooper et al., 2008). This perception of pharmacists' clinical skillset may reinforce the perceived hierarchy of healthcare professionals in asthma care and hinder pharmacists' expansion into clinical roles.

#### *Building rapport with pharmacists*

The participants in our qualitative study supported placing pharmacists in general practice over community pharmacy because they felt it would improve pharmacist availability and facilitate the patient-pharmacist relationship. Many participants experienced unsatisfactory care in busy community pharmacies. They felt that the general practice context would give pharmacists additional time to spend with patients. Many participants failed to build rapport with community pharmacists because they visited different pharmacies, saw different pharmacists at each visit, or interacted only with pharmacist technicians during their visits. They felt that the registration- and consultation-based system in general practice would facilitate consistent contact and trust between patients and pharmacists.

These findings are in line with previous research on UK community pharmacy. Previous studies found that community pharmacists found it difficult to combine their responsibilities in the dispensing process with private patient consultations, possibly because pharmacies only hired one or two full-time pharmacists (Boyd et al., 2014; Hughes et al., 2010; Latif & Boardman, 2008; R. McDonald et al., 2010). However, pharmacists working in well-structured and adequately-staffed pharmacies should be able to delegate the majority of the dispensing process to pharmacy technicians (R. McDonald et al., 2010). While the accessibility of UK community pharmacies is high, previous research suggests this accessibility also hinders consistent contact between

patients and pharmacists. As such, building a consistent patient-pharmacist relationship in the community pharmacy context is difficult (Gidman et al., 2012; Todd et al., 2014; van Boven et al., 2016).

#### *Multidisciplinary teams and continuity of care*

Adults with asthma were concerned about adding a pharmacist to their existing care team because they felt that a lack of multi-disciplinary communication would affect their asthma care. Previous research suggests that collaboration between community pharmacists and other healthcare professionals (e.g. GPs and nurses) was hindered by differences in information technology systems (e.g. electronic records), doubts about pharmacist competency, concerns about professional boundary encroachment from other healthcare professionals, and a lack of co-location (Bradley, Elvey, et al., 2008; Edmunds & Calnan, 2001). Placing pharmacists in the general practice context would facilitate collaboration through co-location and shared access to patients' extended medical records and consultation notes. However, doubts about pharmacist competency and concerns from nurses about professional boundary encroachment may still be significant barriers to service implementation within this context (Mann et al., 2018).

#### 10.3.4 The feasibility and acceptability of pharmacist-led adherence support in general practice

Recruitment and retention rates in the feasibility and acceptability study of the PASS (Chapter 9) were low, with only 31 participants recruited to the study and a drop-out rate of approximately 50% from baseline at both the one- and three-month follow-up points.

### *Recruitment and retention for adherence interventions in asthma care*

Recruitment and retention varies in studies examining adherence interventions for asthma. In their pilot study, Chapman et al. (2015) delivered a nurse-led adherence intervention to 68 adults with asthma, with 51 participants (75%) returning the questionnaires given to them immediately after their consultation and 38 participants (56%) returning the one-month follow-up questionnaires by post. While this pilot study recruited more participants than the feasibility and acceptability study of the PASS ( $n = 68$  and  $31$  respectively), the retention rates at the one-month follow-up in the studies were similar (56% and 52%).

However, the intervention by Chapman et al. (2015) was delivered in secondary care and participants were not asked to attend a follow-up appointment. The studies investigating pharmacist-led interventions for adults with asthma included in our systematic review (Chapter 6) had a mean attrition rate of  $16\% \pm 10\%$ , ranging from 1% to 35%. However, most of these studies were conducted in community pharmacy outside of the UK.

### *Recruitment and retention in primary care*

In terms of recruitment through primary care, previous research found that only 29% of primary care trials recruit to timeline, with 18% of trials closing recruitment with an insufficient number of participants (Bower et al., 2007). Factors affecting recruitment and retention in the primary care context may include participant demographics previously linked to lower research and healthcare engagement (e.g. older age, low socioeconomic status) (Prescott et al., 1999), participants' initial experiences of a study (e.g. number of baseline questionnaires) (Lawton et al., 2003), healthcare professionals' ability to combine recruitment activities with their primary care workload (Bell-Syer & Moffett, 2000; Bower et al., 2009; Pearl et al., 2003), and

clinicians' overestimation of recruitment potential in their practices (Bower et al., 2009).

Initial recruitment rates for the PASS study were similar to previous studies recruiting through UK primary care. S. J. C. Taylor et al. (2012) recruited people with COPD through primary care for the pilot study of a peer-led self-management training programme. Following the 507 postal invitations sent to potential participants, 116 people (24%) were recruited to the study. Holloway and West (2007) contacted 612 adults with asthma through a GP surgery for a study on a physiotherapy-based breathing intervention. Of these participants, 142 (23%) responded and 85 (14%) were recruited into the study.

In the PASS study, the 71 postal invitations sent out in the Haringey CCG led to 23 appointment bookings (32%) and 16 attended appointments (23%). Recruitment was higher in the City and Hackney (C&H) CCG, with 39 appointments booked and study information packs posted, and 18 (46%) participants recruited. However, recruitment approaches differed between the two CCGs due to the existing pharmacist-led respiratory service in C&H.

Retention rates in the PASS study (52% and 48% at one and three months respectively) were lower than other studies recruiting through primary care. In the study by S. J. C. Taylor et al. (2012), 91 participants (78%) completed the 6-month follow-up questionnaires. However, 27 participants (35%) did not attend any of the programme's training sessions. Holloway and West (2007) had a retention rate of 85% at their 12-month follow-up consultation. In a general practice pilot study of allergy and trigger avoidance counselling for adults with asthma, Bobb and Ritz (2003) had a retention rate of 90% for the study's follow-up appointments (three to six months after baseline).

### *Factors affecting recruitment and retention*

There are several possible reasons for the lower recruitment and retention rates in the PASS study. Firstly, recruitment at the end of the NHS year, which runs from April to March, meant that most adults with asthma had already been seen for their annual asthma review as part of the Quality Outcomes Framework (QOF) targets. Therefore, we may have been recruiting from the remaining patients who may have been less engaged with their asthma care.

Secondly, many participants struggled with the number and length of study questionnaires at their baseline consultation and this may have discouraged them from completing the follow-up points. Thirdly, participants may have felt that the one-month follow-up appointment was unnecessary because their regular asthma reviews may not have included a follow-up appointment.

Retention at the one-month follow-up is also likely to have been affected by the limited appointment availability of the PASS pharmacists. Finally, previously published studies (particularly large-scale clinical trials) may have had more resources than the PASS study to follow up participants, including research support staff at each practice. The higher retention rates in the aforementioned studies may also be, in part, due to publication bias – publication may have been more likely for trials with high retention rates.

### *Consultation length*

Consultation length is a key component of the feasibility of pharmacist-led interventions. In their study of a community pharmacist-led inhaler technique intervention, Giraud, Allaert, and Roche (2011) found that the feasibility of the intervention was high because it fitted into everyday practice, with a median

consultation duration of only six minutes (Giraud et al., 2011). In contrast, the intervention pharmacists in the PASS study reported that their PASS consultations took between 15 and 30 minutes, while standard consultation times for general practice pharmacists fall between 10 and 15 minutes. The PASS consultations were longer because they targeted a range of motivation- and ability-related factors affecting ICS adherence, including but not limited to inhaler competence. While this approach is in line with the NICE guidelines for medicines adherence, the time required for the intervention may be a barrier to its implementation in general practice (Nunes et al., 2009).

#### *Acceptability of pharmacist-led care from the perspectives of adults with asthma*

Encouragingly, the acceptability of pharmacist-led support was high among adults with asthma. Participants receiving the PASS reported high acceptability for both its content and delivery channel. They reported that they trusted their pharmacist and that they would recommend pharmacist-led adherence support to other people with asthma.

Giraud et al. (2011) also found that pharmacist-led interventions were highly acceptable to adults with asthma – 67% of participants found the community pharmacist-led intervention useful and 81% felt it was minimally inconvenient. Similarly, in an interview and focus group study on the Pharmacist Asthma Management Service in Australia, Naik-Panvelkar et al. (2015) found that adults with asthma receiving the intervention were very positive about the enhanced role of their community pharmacist. However, some participants did report that the length of the consultations (median 20 to 75 minutes) was a concern (Naik-Panvelkar et al., 2015).



### *Factors affecting the acceptability of pharmacist-led care*

Findings from the PASS study suggest that the number and length of consultations may have been primary contributors to intervention burden. Participants expressed concerns about the length of consultations and the effort required to go to their GP surgery for appointments, and the retention rate at the one-month follow-up appointment was low (52%). Future efforts to reduce the length of the PASS consultations could revise intervention content, or provide additional pharmacist training for more time-efficient intervention delivery. Different follow-up methods should also be explored to help reduce intervention burden. For example, telephone-based follow-ups may be more convenient than face-to-face appointments for people in full-time employment.

## 10.4 Implications for practice

The aforementioned findings suggest that pharmacists have the potential to become an acceptable and effective delivery channel for adherence support in asthma care. However, the research also highlighted several practical issues that will need to be considered for pharmacist-led adherence support to reach its full potential.

### 10.4.1 Pharmacists' place in the NHS workforce

A recurring criticism of pharmacist-led care is the potential role overlap with other healthcare professionals such as GPs and nurses (Edmunds & Calnan, 2001; Schindel et al., 2017). As described in Chapter 9, some adults with asthma felt that training GPs and nurses to provide adherence support would be more effective than training up pharmacists. Similar concerns about pharmacist competency were voiced by the general public and other healthcare professionals in response to independent pharmacist prescribing (Paola, 2019; Schindel et al., 2017). However, the potential of UK pharmacists should also be considered within the context of a changing NHS.

Most asthma cases in the UK are managed within primary care by GPs, nurses, and pharmacists (British Thoracic Society/Scottish Intercollegiate Guidelines Network, 2016). However, GP workload has grown substantially, with a 15.2% increase in consultations between 2010 and 2015. Current GPs are retiring early, and newly qualified GPs often opt for part-time posts (Baird et al., 2016; NHS, 2019). Nurses are expanding into specialist health services such as contraception clinics, heart failure response teams, mental health, and community nursing. The nurse-led NHS screenings and NHS Health Checks are currently underperforming and will demand additional resources in the future. However, there currently is a UK-wide shortage of registered nurses and nursing students (National Audit Office, 2019; NHS, 2019). Therefore, while GPs and nurses may be suitable candidates to provide adherence support for asthma, their capacity to do so will be reduced in the future.

Our findings suggest that pharmacists have the potential to provide effective adherence support for asthma, mirroring initiatives by the NHS and Primary Care Workforce Commission to train allied healthcare professionals (e.g. pharmacists) for extended clinical roles (NHS, 2019; Primary Care Workforce Commission, 2015). Increased pharmacist involvement may re-distribute the workload within primary care, and therefore contribute to the sustainability of the NHS workforce. When looking specifically within respiratory care, increased pharmacist involvement with a focus on medicines optimisation was recommended in the recently published NHS Long Term Plan (NHS, 2019). While such healthcare initiatives support increased pharmacist involvement, our findings also suggest that there are gaps in UK pharmacists' current skillset for asthma-specific adherence support, and these will need to be addressed for the service to be effective in the future.

#### 10.4.2 Pharmacist training and support

Healthcare professionals delivering adherence support for asthma should have sufficient pharmacological knowledge to educate people about their inhalers, address medication-related concerns, choose a suitable inhaler device, and teach correct inhaler technique, as well as sufficient counselling ability to elicit and address people's unique beliefs about asthma and their medication (British Thoracic Society/Scottish Intercollegiate Guidelines Network, 2016; Chan et al., 2019; Horne, 2001, 2006, 2015). While UK pharmacists may have strong pharmacological knowledge, our findings suggest that they may need additional support in developing their counselling skillset.

#### *Continuing professional development*

Registered pharmacists in the UK are required to complete four Continuing Professional Development (CPD) records per year outlining planned and unplanned learning activities, accompanied by self-reflection (General Pharmaceutical Council, 2018). Specific training modules on topics like person-centred consultations, general practice pharmacy, medicines optimisation, and medicines reviews are available through programmes led by the Centre for Postgraduate Pharmacy Education (CPPE) and Royal Pharmaceutical Society (RPS) (Centre for Pharmacy Postgraduate Education, 2018; Royal Pharmaceutical Society, 2016).

However, relevant CPPE courses may be costly and are only available to pharmacists and pharmacy technicians in England. Furthermore, CPPE training is optional. The mandatory CPD requirements are not specifically geared towards adherence support. One potential option to improve pharmacists' adherence counselling skillset would be to incorporate adherence support in the mandatory CPD requirements, perhaps through training in psychology-based intervention methods similar to previous work

with nurses, physicians, and physiotherapists (Chapman et al., 2015; Dimeff et al., 2009; Godfrey et al., 2016; Sholomskas et al., 2005). Another option may be to provide additional funding to subsidize adherence-focused courses and/or enable pharmacists to take time off work to do additional adherence-focused training.

### *Pharmacy education*

An alternative solution would be to solidify adherence counselling skills much earlier in pharmacists' training, thereby reducing the impact of potential barriers to CPD. Pharmacy degrees offer an excellent opportunity to teach adherence counselling to all incoming pharmacists in a standardised manner. However, the main drawback of the current UK curriculum is that it lacks opportunities for experiential learning in patient-facing clinical environments (Dooley, Coombes, Michaels, Duggan, & Bates, 2017; Sosabowski & Gard, 2008).

Students in the UK's Master of Pharmacy (MPharm) degrees typically only have one to four weeks of experiential learning through visits to pharmacies and hospitals (Sosabowski & Gard, 2008). While pharmacy practice and patient counselling modules are now more frequently taught in MPharms, there is a lack of opportunity to apply this knowledge before the pre-registration year. In contrast, medical and nursing students have extended clinical placements in multi-disciplinary environments during their degrees. This may be because government funding is available to secure clinical placements for medical and nursing students, while this is not the case for pharmacists (Howe et al., 2004; Sosabowski & Gard, 2008).

Pharmacy students would benefit from earlier and more frequent exposure to patient-facing work in clinical environments, even if it is just in a shadowing capacity. These placements could form part of their degree assessments. For example, they could

observe and score pharmacist-led consultations using the Medication-related Consultation Framework (Abdel-Tawab et al., 2011) to understand the components of effective consultations. If possible, they could also assist in consultations led by a registered pharmacist mentor. These activities may develop their practical counselling skills, acting as the first steps towards developing an adaptable and person-focused pharmacy workforce (Dooley et al., 2017). However, financial incentives for placement providers may be necessary to launch this initiative, as seen with the organisations providing training and clinical placements for medical students (Health and Social Care Workforce Strategy Branch, 2017).

#### 10.4.3 Research support in general practice

The PASS study (Chapter 9) highlighted the difficulties in general practice research. The approvals process was lengthy and complex, and recruitment was resource-intensive. The healthcare professionals and administration staff working in each practice had limited capacity to assist during the approvals and research process.

These findings highlight the importance of research support initiatives such as the Clinical Research Networks (CRNs) in the general practice context, especially given the growing pressure on this portion of the NHS (Baird et al., 2016). Future studies will need assistance and guidance in the study approvals process, as well as general practice contacts to identify recruitment sites and additional clinical research staff to facilitate recruitment and data collection. Further involvement of the intervention pharmacists during the design of the PASS study may also have tackled some of the feasibility challenges identified in the study (e.g. resources needed for recruitment).

## 10.5 Future directions

The findings outlined in this thesis provide a useful starting point for further research exploring the place of pharmacist-led adherence support in current UK asthma care.

### 10.5.1 Pharmacist workflow

Both the community and integrated care pharmacists in our online questionnaire study reported a lack of time in their regular workday to provide adherence support of asthma. However, these findings are based on pharmacists' perceptions and should be confirmed with further observational work.

Future research could conduct time-and-motion or work-sampling studies, where researchers would observe pharmacists (either continuously or at selected intervals) to record and understand the structure and content of their workdays. Although labour intensive, these methods could identify potentially modifiable workflow inefficiencies that hinder the delivery of adherence support (e.g. lack of delegation, understaffing) (Finkler, Knickman, Hendrickson, Lipkin, & Thompson, 1993; Meguerditchian, Krotneva, Reidel, Huang, & Tamblyn, 2013). Furthermore, understanding the workflow of pharmacists in different contexts (e.g. community pharmacy versus general practice) will help identify the ideal setting for asthma-specific adherence support.

### 10.5.2 Pharmacist training

As demonstrated in Chapter 6, pharmacist training for asthma-specific adherence support varied considerably across the literature. We did not measure the effectiveness of the training provided to the intervention pharmacists in the PASS study (Chapter 9). Future studies should strive to evaluate pharmacists' intervention delivery before the PASS is implemented in practice. This could be done using tests for asthma-specific knowledge and/or scored role-play of patient case studies using the PASS

manual. Recording and reviewing initial consultations led by the pharmacists may also help researchers identify areas for improvement in pharmacists' delivery of the PASS.

The pharmacists delivering the PASS also recommended expanding the pharmacist training sessions to improve intervention delivery. Future work could focus on identifying the most acceptable and effective ways to deliver training for the PASS. This would involve collaborating with UK pharmacists to design a training programme that captures the core components of the intervention. Alternative delivery methods for pharmacist training (e.g. online, face-to-face individual or group sessions) could also be explored. Future efforts will need to consider when training should take place (e.g. evening sessions) and whether pharmacists (and potentially their employers) will need compensation to attend training.

#### 10.5.3 Perspectives of other healthcare professionals

This thesis focused on the perspectives of adults with asthma and UK pharmacists. However, our findings and previous research suggest that concerns about professional boundary encroachment from other healthcare professionals remain a persistent barrier to pharmacist-led care (Edmunds & Calnan, 2001; Mann et al., 2018). Further research is needed to understand the perspectives of GPs and nurses on general practice pharmacist-led adherence support. Capturing these perspectives, perhaps through qualitative interviews, will help identify areas of concern and ways to ensure optimal pharmacist integration into the general practice team.

General practice pharmacist roles can vary considerably between sites based on the local needs of each practice (Mann et al., 2018). Researchers could collaborate with general practice healthcare professionals to build a basic framework for pharmacist integration, similar to the model for GP and community pharmacist collaboration designed by Bradley, Ashcroft, and Noyce (2012). This framework could outline

general recommendations for pharmacist job descriptions, funding, introductory meetings with the general practice team, effective multi-disciplinary communication, and the benefits and drawbacks of full-time versus part-time pharmacist posts. The framework could act as a useful guide for practices introducing the new general practice pharmacist role.

#### 10.5.4 An evaluation of general practice pharmacist-led adherence support

While the exploratory outcomes in the PASS study (Chapter 9) changed in the expected direction, the study had a high drop-out rate and changes could be the result of regression to the mean (e.g. low adherence scores may simply have increased because they moved closer to the mean). Further piloting work and an eventual RCT are needed to establish the effectiveness and cost-effectiveness of general practice pharmacist-led adherence support for asthma. Establishing the potential value of the service is crucial for future funding and inclusion in healthcare policy (Mann et al., 2018). Future evaluations could look at the healthcare utilisation of participants (e.g. number of GP appointments, A&E visits, hospital admissions) and its associated costs in addition to the outcomes explored in the PASS study (adherence, beliefs about medicines, perceptions about asthma, peak expiratory flow, and asthma control).

Mann et al. (2018) recommended that future evaluations of the CPGP scheme measure impact at the practice, pharmacist, and patient level. Practice-level outcomes include pharmacist capacity and workload, medicines optimisation, and medication safety. Pharmacist-level outcomes encompass job satisfaction, clinical autonomy, and clinical skills. Patient-level outcomes include patient satisfaction, access to appointments, and clinical outcomes for people with long-term conditions (Mann et al., 2018). Based on our findings in the PASS study, future evaluations should employ either electronic monitoring devices (EMDs) or prescription refill data as an additional adherence



measure. Collecting clinical data from medical records (e.g. peak expiratory flow or asthma control) would reduce questionnaire burden for participants, and including a large number of recruitment sites might address the low recruitment rates seen in general practice.

## 10.6 Future models of pharmacist-led adherence support for adults with asthma

While the future directions for research and practice outlined above will contribute towards the implementation of pharmacist-led adherence support for adults with asthma, it is also important to discuss potential models for this healthcare service. Recent changes to UK healthcare policy suggest that the role of community pharmacy is moving away from medicines reviews for people with long-term conditions (except for those with newly prescribed medication), and towards prevention, minor ailments, emergency medicine supply and public health to reduce the burden on general practice. For example, the new Community Pharmacy Contractual Framework (CPCF) for 2019 – 2024, published by the Department of Health and Social Care (2019), is phasing out the Medicines Use Review (MUR). Furthermore, starting October 2019, people contacting the NHS information line (NHS 111) can be referred to their local community pharmacy for support, particularly when it comes to minor ailments and emergency medication supply.

These changes, coupled with renewed funding for the Clinical Pharmacists in General Practice (CPGP) scheme in the NHS Long-term Plan, suggest that pharmacist-led support for people with long-term conditions, such as asthma, will be a focus within general practice. These changes may facilitate the expansion of general practice pharmacist-led adherence support services for adults with asthma, such as the

intervention described in Chapter 9. However, a key consideration for future models of support is whether consultations should be asthma-specific or applicable to multiple long-term conditions.

The Pharmacist Asthma Support Service (PASS) described in Chapter 9 was asthma-specific, meaning that other comorbidities could not be addressed during the intervention consultation. A major limitation of this approach is that it asked pharmacists to target adherence to asthma medication in isolation from other long-term conditions and medications, even though research suggests that adherence behaviour is affected by multimorbidity and polypharmacy (two scenarios frequently seen in general practice). For example, having to take multiple medications may affect people's ability or motivation to adhere, and people may prioritise some long-term conditions and medications over others to maintain partial adherence (M. Kelly, McCarthy, & Sahn, 2014).

Therefore, designing an adherence-based consultation that is flexible enough to address multiple comorbidities and medications may be more suitable for a general practice setting. It may also make more effective use of general practice resources and pharmacists' time, although this would need to be confirmed with further research. Building on the findings from this thesis, future efforts could explore whether the consultation approach taken in the PASS can be expanded to other long-term conditions, such as diabetes or hypertension.

However, asthma-specific pharmacist-led adherence support may still be beneficial for a short period of time following the recent changes to asthma guidelines – both internationally and in the UK – aiming to decrease SABA use and expand the use of ICS to all people diagnosed with asthma (British Thoracic Society/Scottish

Intercollegiate Guidelines Network, 2019; Global Initiative for Asthma, 2019). This drastic shift poses a significant challenge in terms of adherence, particularly when it comes to people with mild asthma who previously were only prescribed a SABA. These people may have more complex asthma-specific adherence needs that cannot be addressed in a consultation covering multiple long-term conditions.

Additional pharmacist support may help ensure optimal adherence levels following these changes in asthma management. It could be delivered as a temporary service, with a general practice pharmacist working across multiple practices to review existing asthma patients and to address asthma-specific adherence needs following changes to clinical management. Once all asthma patients have been reviewed and followed-up in accordance with the new guidelines, then general practice pharmacist-led adherence support can continue as a broad service across multiple long-term conditions.

## 11 Conclusions

Pharmacists in the UK should be considered as a potential delivery channel for asthma-specific adherence support. General practice was identified as a suitable context for pharmacist-led adherence support based on previous research and the perspectives of UK pharmacists and adults with asthma, deviating from previous community pharmacy-based initiatives.

While UK pharmacists have sufficient pharmacological knowledge and clinical skills to deliver the educational components of adherence support, further growth in complex consultation-related skills is needed. These include working with asthma-specific resources such as the Written Asthma Action Plan, as well as eliciting and addressing people's unique beliefs about asthma and its treatment. The intervention

fidelity findings from the PASS study suggest that pharmacists were able to deliver a theory-based adherence intervention with sufficient training. However, the two pharmacists involved in the study were familiar with the intervention material and considerable variation exists in UK pharmacists' consultation skillset.

Experiential learning opportunities in pharmacy education and adherence-focused professional development modules may help reduce this variation and improve pharmacist-led adherence support. It is important to note that the patients most in need of adherence support may also be the most disengaged in their healthcare (e.g. lack of attendance at annual asthma reviews). Pharmacists' ability to reach these patients will be an important determinant in their effectiveness as adherence support professionals.

The adults with asthma involved in our research were supportive of pharmacist-led adherence support delivered in general practice. Pharmacists were seen as medication experts that could possibly fill gaps in current asthma care. Pharmacist-led consultations were viewed as accessible and informal opportunities for additional support, particularly for adults with asthma who felt hesitant about taking up GP and nurse time. However, this also meant that pharmacists fell below GPs and nurses in a perceived hierarchy of healthcare professionals. Improved continuity of care and communication between healthcare professionals were important prerequisites for increased pharmacist involvement in asthma care from the patient perspective. Our findings suggest that the general practice context may be able to fulfil some of these requirements.

To conclude, there are gaps in the current skillset of UK pharmacists when it comes to asthma-specific adherence support. However, our findings suggest that with adequate support and training, pharmacists can deliver theory-based adherence

interventions. A pharmacist-led adherence intervention delivered in general practice was highly acceptable from the perspectives of UK pharmacists and adults with asthma, signalling that general practice pharmacists may be a valued but underutilised resource in current asthma care. While the effectiveness of general practice pharmacist-led adherence support still needs to be established, our findings indicate that this delivery channel is worth exploring further in the future.

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## 13 Appendices

### Appendix A

Search strategy for systematic review/meta-analysis

#### **Web of Science (all databases)**

1. TS=(pharmacist OR pharmacy)
2. TS= (“pharmaceutical services” OR “pharmaceutical care”)
3. 1 or 2
4. TS=(intervention\*)
5. TS=(asthma or asma or astma or wheez)
6. 3 and 4 and 5

Where TS=topic search

Possibility to refine to “clinical trial” documents only

#### **EMBASE (Ovid):**

1. Pharmacist.sh/
2. Pharmacy.sh/
3. Hospital pharmacy.sh/
4. Clinical pharmacy.sh/
5. Pharmacist\$.tw
6. Pharmacy.tw
7. Pharmacies.tw
8. Pharmaceutical care.sh/
9. Medication therapy management.sh/
10. Pharmaceutical service\$.tw
11. Pharmaceutical care.tw
12. Medication management.tw
13. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12
14. Asthma.sh/
15. (Asthma\$ or astma\$ or asma\$ or wheez\$).tw
16. 14 or 15
17. 13 and 16
18. Randomized controlled trial.pt
19. Controlled clinical trial.pt
20. Randomized.ab
21. Placebo.ab
22. Clinical trials as topic.sh
23. Randomly.ab
24. Trial.ti
25. 18 or 19 or 20 or 21 or 22 or 23 or 24
26. Exp animal/ not human.sh

27. 25 not 26

28. 17 and 27

Where:

.sh = Medical Subject Heading (MeSH term)

/ = all subheadings selected

Exp = exploded

.tw = text word

.pt = publication type

.fs = floating subheading

.ab = word in abstract

.ti = word in title

Searches 18 – 27 represent the Cochrane Highly Sensitive Search Strategy for identifying randomized trials, sensitivity- and precision-maximising version in Ovid format (2008)

## CENTRAL

1. MesH descriptor: [Pharmacists] explode all trees
2. MesH descriptor: [Pharmacy] explode all trees
3. MesH descriptor: [Pharmacies] explode all trees
4. MesH descriptor: [Pharmaceutical Services] explode all trees
5. MeSH descriptor: [Medication Therapy Management] explode all trees
6. Pharmacist\*: ti,ab,kw
7. Pharmacy: ti,ab,kw
8. "Pharmaceutical care": ti,ab,kw
9. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8
10. MesH descriptor: [Asthma] explode all trees
11. Asthma\*: ti,ab,kw OR astma\*:ti,ab,kw OR asma\*: ti,ab,kw OR wheez\*:ti,ab,kw
12. 10 or 11
13. 9 or 12

Where:

Ti= title

Ab= abstract

Kw = key word

## MEDLINE® (Ovid):

1. Pharmacists.sh/
2. Pharmacy.sh/
3. Pharmacy service, hospital.sh/
4. Community pharmacy services.sh/
5. Clinical pharmacy.tw

6. Pharmacist\$.tw
7. Pharmacy.tw
8. Pharmacies.tw
9. Pharmaceutical services.sh/
10. Medication therapy management.sh/
11. Pharmaceutical care.tw
12. Pharmaceutical service\$.tw
13. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12
14. Asthma.sh/
15. (Asthma\$ or astma\$ or asma\$ or wheez\$).tw
16. 14 or 15
17. 13 and 16
18. Randomized controlled trial.pt
19. Controlled clinical trial.pt
20. Randomized.ab
21. Placebo.ab
22. Drug therapy.fs
23. Randomly.ab
24. Trial.ab
25. Groups.ab
26. 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25
27. Exp animals/ not human/.sh
28. 26 not 27
29. 17 and 28

Where:

.sh = Medical Subject Heading (MeSH term)

/ = all subheadings selected

Exp = exploded

.tw = text word

.pt = publication type

.fs = floating subheading

.ab = word in abstract

.ti = word in title

Searches 18 – 28 represent the Cochrane Highly Sensitive Search Strategy for identifying randomized trials, sensitivity-maximising version in Ovid format (2008)



## Appendix B

### Study inclusion screening form for systematic review/meta-analysis

<b>Instruction:</b> Check yes/no/unclear for each of the questions listed below. If a 'no' response emerges, the study can be excluded.			
<b>Reference (author, year):</b>			
<b>Study ID:</b>			
<b>Date Retrieved:</b>			
	Yes	No	Unclear
<b>Participants</b>			
Are the participants aged 18+?			
Are participants prescribed medication for diagnosed asthma?			
Are participants responsible for administering their own medication?			
<b>Intervention</b>			
Is the intervention delivered by a registered pharmacist ONLY? (no other healthcare professionals involved in the delivery of the intervention)			
Is the pharmacist working in the community, hospital, or primary care pharmacy sector?			
Is the method of delivery face-to-face, over the phone, or through electronic/postal correspondence?			
Is the intervention delivered to each patient individually? (no group sessions)			
<b>Comparisons</b>			
Does the study involve a comparison between an intervention group and an inactive standard care group (control)?			
Are patients limited to participating in one intervention at a time?			
<b>Outcomes</b>			
Is patient adherence to prescribed medication for asthma a primary or secondary outcome in the study?			
Is at least one measure of adherence used?  <i>Include:</i> patient self-report, biological measures (biomarkers, serum concentrations, saliva concentrations), medication diaries, clinic or pharmacy records, healthcare provider reports, adherence questionnaires, pill counts, electronic monitoring devices, and other types of systematic adherence measurements  <i>Exclude:</i> adherence to behavioural recommendations (e.g. exercise) or attendance in clinical trials			
<b>Design</b>			
Is the study a randomized controlled trial with randomization at either the cluster or individual level?			
Can this study be included in the review?			
<b>Please elaborate on the inclusion decision above:</b>			

## Appendix C

### Online questionnaire with UK pharmacists

\*ICS = Inhaled Corticosteroid

#### **Demographic and Work Information**

- 1.) Your gender: Male, Female, Other, Prefer not to disclose
- 2.) Your age: years
- 3.) I spend the majority of my working hours as a: community pharmacist, hospital pharmacist (list specialty), or patient-facing primary care pharmacist
- 4.) Hours worked per week:
- 5.) Number of years since registration:
- 6.) Postcode of workplace:

#### **Section 1: Delivered Services**

This first section will focus on your work with patients' beliefs about asthma and its treatment.

For each activity described, please indicate whether or not you are currently providing this service.

Dichotomous items (delivered or not delivered)

- 1.) Discussing the chronic nature of asthma with the patient
- 2.) Communicating that well-controlled asthma is mostly asymptomatic
- 3.) Eliciting patients' beliefs about how necessary they believe their ICS are for their asthma management
- 4.) Discussing the necessity of ICS even in the absence of symptoms
- 5.) Discussing patients' concerns regarding side effects attributed to their medication
- 6.) Discussing patients' concerns about developing long-term dependence on their ICS
- 7.) Discussing patients' concerns about the long-term use of ICS and its potential side effects (e.g. beliefs about weight gain)
- 8.) Educating the patient about the physiological mechanisms of asthma
- 9.) Inhaler technique lessons when first prescribed a new inhaler
- 10.) Inhaler technique checks on a regular basis
- 11.) Developing strategies to help patients remind themselves to take their ICS
- 12.) Tailoring the provided information to the patient's individual needs.
- 13.) Reviewing the appropriateness of the patient's current prescriptions
- 14.) Explaining the difference between preventer and reliever medication
- 15.) Teaching the patient self-monitoring techniques for asthma control (e.g. symptom tracking or peak flow measurements)
- 16.) Discussing the Asthma Action Plan
- 17.) Checking the patient's peak flow readings
- 18.) Discussing individual trigger factors and avoidance strategies

#### **Section 2: Confidence**

We would like to ask you how confident you feel about providing certain services to asthma patients. These are statements other pharmacist have made about asthma-specific services. Please indicate the extent to which you agree or disagree with each statement.

Likert-type scale items

1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree

- 1.) I feel confident discussing a patient's medication adherence with another healthcare professional (e.g. a specialist consultant or a general practitioner)
- I understand the clinical management of asthma and I feel confident explaining this to a patient
- 2.) I feel confident tailoring adherence support to meet the individual needs of a patient
- 3.) I am confident that I can provide patients with appropriate self-management advice for asthma
- 4.) I know how to take a medication history
- 5.) I can interpret and understand sources of medical information (e.g. Personal Medical Records or medical notes)
- 6.) I am able to take and interpret peak flow measurements
- 7.) I can understand and discuss a patient's Asthma Action Plan in detail
- 8.) I can identify patients' individual concerns about inhaled corticosteroids (ICS) such as worries about side effects, long-term-effectiveness, or dependence.
- 9.) I can explain the difference between ICS (preventer) and reliever inhalers
- 10.) I am confident that I can communicate the necessity of ICS to a patient.
- 11.) I am confident that I can elicit a patient's beliefs about how necessary they believe ICS are in their treatment
- 12.) I am confident in demonstrating and teaching the use of Metered-Dose Inhalers
- 13.) I am confident in demonstrating and teaching the use of Accuhalers
- 14.) I am confident in demonstrating and teaching the use of Turbohalers
- 15.) I feel comfortable asking patients about their smoking status
- 16.) I feel comfortable asking patients about their illicit drug use

### **Section 3: Potential Barriers**

The following factors may impact on a pharmacist's ability to provide pharmaceutical care to asthma patients. Based on your own experience working as a pharmacist, please indicate the extent to which you agree or disagree with each statement.

Likert-type scale items

1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree

- 1.) I do not have enough time in a working day to provide pharmaceutical care consultations to asthma patients
- 2.) Most patients do not have enough time to receive a pharmaceutical care consultation
- 3.) Most patients believe that they already receive sufficient care from their doctors
- 4.) Most patients do not have enough knowledge about asthma
- 5.) Most patients do not view their asthma as a chronic problem
- 6.) Most patients feel that their symptoms are not severe enough to justify further care
- 7.) Most patients do not want help from their pharmacist
- 8.) My work premises are not suitable for private consultations
- 9.) Most patients do not visit the same pharmacy repeatedly
- 10.) I do not think it is my role to provide this type of service to asthma patients
- 11.) I have not received sufficient training to provide pharmaceutical care to asthma patients
- 12.) I do not receive sufficient financial compensation for providing this service
- 13.) Many of my patients have difficulty speaking or understanding English
- 14.) I do not want to encroach on the responsibilities of the patient's doctor or consultant

## **Asthma Care from Pharmacists: What Do You Think?**

**Share your experiences with us, receive £20 of online shopping credit, and help us improve asthma care!**

Are you an **adult (aged 18 and over)** currently **living in the UK** with a **diagnosis of asthma (with no other respiratory conditions)** and a prescription for a **preventer/controller inhaler**? If so, we'd like to invite you to take part in our study.

### **What is this research about?**

We would like to hear **your opinion on pharmacist involvement in medication support for asthma**: Are there any pharmacists involved in your care at the moment? Could you see pharmacists getting more involved in the future? This research is **not pushing to replace your GPs or consultants** with pharmacists. We want to see if pharmacists will be a **helpful addition** to asthma care in the UK.

### **What will I have to do?**

If you are interested, please contact the researcher using the details on this flyer. When you contact her, she will ask you some **broad questions about your asthma and medications** to assess if you are eligible to participate. You will be given an information sheet and consent form **via e-mail** to review before you make your decision.

If you decide to participate, a researcher will ask you to pick a convenient timeslot for a **telephone interview of 1 hour**. The researcher will call you for that timeslot, you will not need to call them. During the interview, you will be asked about pharmacist involvement in asthma care. After the interview, the researcher will e-mail you a **brief online survey** about your basic information (e.g. age and gender) and asthma history.

To complete the study, you will need access to a **telephone number and e-mail account**. You will also need to be **fluent in English**.

### **How will my answers be used?**

With your permission, the telephone interview will be recorded.

Your answers will be analysed and compiled into a report for a PhD thesis and academic journals. All identifiable information will be removed before your data is put into the report. **Your participation is completely confidential** and your contact details will not be used outside of this specific study. All data will be collected and stored in accordance with the Data Protection Act 1998.

### **How will I benefit?**

By completing the interview, you will help us shape future pharmacy services for asthma patients in the UK. We would be happy to **send you a report of our final results** should you wish to see them.

After completing the interview, you will receive a **£20 online shopping voucher** via e-mail.

**Questions or comments? Would you like more information? Would you like to participate?**

**For more information:** <https://tinyurl.com/pharmacistsandasthma>

**Please contact me:**

Marissa Mes (Asthma UK Centre for Applied Research Student)

**E-mail:** [marissa.mes.15@ucl.ac.uk](mailto:marissa.mes.15@ucl.ac.uk)

**Telephone:** +44 (0)20-7874-1291



## Appendix E

### Participant information sheet for the qualitative study with adults with asthma



Asthma UK Centre  
for Applied Research



**NHS**  
**National Institute for  
Health Research**

Collaboration for Leadership in  
Applied Health Research and Care  
**North Thames**

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#### PARTICIPANT INFORMATION SHEET

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**Title:** Getting pharmacists more involved in asthma care: what do adults with asthma think?

**Name of Chief Investigator:** Professor Robert Horne (University College London)

**Name of PhD Student:** Ms. Marissa Mes (University College London)

**Research Team:** Professor Robert Horne, Professor Stephanie Taylor, Ms. Marissa Mes, Ms. Caroline Katzer, Mr. David McRae, Dr. Paul Pfeffer

**Study Sponsor:** University College London

This project has been approved by the Harrow Research Ethics Committee (REC) and the Health Research Authority (HRA): Reference 17/LO/1565, IRAS 205928

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#### Please read this information sheet carefully

We would like to invite you to join a telephone interview study from the University College London (UCL) School of Pharmacy. The study is led by Professor Robert Horne, who is a professor in behavioural medicine at UCL.

Before you decide to take part, we would like to tell you more about our research and how you can be involved. If you have any questions or concerns about the study, please contact the researcher (Marissa Mes) and she will be happy to discuss them.

#### Who are we?

We are a team of healthcare researchers at University College London (UCL) and Queen Mary University of London (QMUL) with a special interest in asthma research.



Prof. Rob Horne



Prof. Steph Taylor



Ms. Marissa Mes



Ms. Caroline Katzer

#### Why have I been invited?

We are looking for adults (aged 18 years and over) with an asthma diagnosis and a prescription for a preventer inhaler. You should be able to administer this inhaler yourself, without help from a carer. A preventer inhaler may also be known as an inhaled corticosteroid

(ICS), a brown inhaler, or a controller/maintenance inhaler. In order to collect all of the information that we need, we are looking for participants that are fluent in English and have access to a telephone and e-mail account.

### Do I have to take part?

No. You should only take part in this study if you want to. If you choose not to take part, your decision will not affect you or your asthma care in any way. You also do not have to explain your choice to the research team.

Before you make that choice, please read this information sheet carefully and contact the research team if you have any questions or concerns.

### What is this research about?

The number of people with asthma in the United Kingdom (UK) is one of the highest in Europe. We know from research that the healthcare for people with asthma in the UK needs improvement.

We are looking for new ways to support people with asthma. One option for doing so is to get pharmacists more involved in asthma care. We know from research that many asthma patients have questions or concerns about using their inhalers. However, asthma patients may not book appointments with their GPs/nurses/consultants just for these types of questions. We would like to create a medication support service where people with asthma can go **talk to a clinical pharmacist in a GP surgery about their medication. This service would not replace GPs/nurses/consultants**, but it could help people get the most out of their inhalers.

**This is where you come in.** We'd like to get a better picture of how people with asthma feel about this type of service. Do you think it would be a useful addition to your asthma care?

### What will I have to do?

To determine whether or not you're eligible to participate, the researcher will ask you a set of broad screening questions about your medications and asthma history via e-mail. These questions are kept broad, so you will only have to answer with a "yes" or "no". For example, you will be asked "Are you between the ages of 18 and 100 years?". You will not have to provide exact information about yourself (e.g. your exact age) at this stage. You have been given this participant information sheet and a consent form so you can familiarise yourself with the study before deciding to participate.

If you are eligible and willing to participate, you will plan a convenient timeslot for a telephone interview. The researcher will call you for that timeslot, you will not have to call them. The researcher will take your informed consent over the phone by reading out a series of statements (see consent form), to which you can respond "yes" or "no". The interview will be done over the telephone and will take 1 hour. With your permission, the telephone interview will be recorded.

The researcher will ask you questions about your asthma, your experiences with pharmacists, and what you think of a pharmacist-led medication support service. She may ask you to

elaborate on some of your answers. The interview will be very informal; there are no right or wrong answers, and you can refuse to answer any questions you are not comfortable with. We are interested in your opinion so please feel free to talk about anything that you think is relevant.

After the telephone interview is done, the researcher will e-mail you a link to a brief online survey that asks for your basic information (e.g. age and gender) and asthma history. This information will be kept strictly confidential and will only be used to give us more detail for the analysis process. Once that survey is complete, the study is finished.

### **Are there any risks or disadvantages in taking part?**

The overall risk of this study is low. You do not have to travel to take part. The topics and questions for the interview have been reviewed by other people with asthma to make sure they are appropriate and easy to understand.

### **How will I benefit by taking part?**

Based on yours and the other opinions we collect, we may be able to assess whether placing more clinical pharmacists in GP surgeries would be useful for people with asthma in the UK. We are happy to send you a brief summary of our results once the study is finished.

### **Expenses and payment**

You will not have to pay for the telephone call because the researcher will call you. As a thank you for your time, we will give you a £20 online shopping voucher. The voucher will be e-mailed to you.

### **What happens if I don't want to carry on with the study?**

You have the right to quit the study at any point and you do not have to explain your decision. You are free to quit even after the telephone interview is finished. Just contact the researcher and any data collected from you will be deleted and will not be included in our report.

There is no penalty whatsoever for quitting the study.

### **What if there is a problem?**

If you have a complaint or concern about any aspect of the way you have been approached or treated by members of the research team during this study, UCL complaints mechanisms are available to you. If you wish to make a complaint about the conduct of the study you can contact UCL using the details below for further advice and information:

Prof Robert Horne (Chief Investigator)  
UCL School of Pharmacy, Department of Practice and Policy  
Mezzanine Floor, BMA House  
Tavistock Square, London WC1H 9JP.

The Chief Investigator will then pass the claim to the Sponsor's Insurers, via the Sponsor's office. You may have to bear the cost of legal action initially, and you should consult a lawyer about this.

## **Will my participation in this study be kept confidential and stored securely?**

Yes. We have a duty of confidentiality to you as a research participant. All data will be collected and stored in accordance with the Data Protection Act 1998.

With your permission, the telephone interview will be recorded. After your interview, the recording of your interview will be sent securely to a professional transcription service. This company has signed a confidentiality agreement. They will produce a written transcript of your interview. When we get the written transcript, we will remove all personal details mentioned in the interview (such as your name or location). These redacted transcripts will be used for data analysis.

Your contact information (name, phone number, e-mail address), interview recording, interview transcript, and online survey responses will be password-protected and stored on a secure server called the UCL Data Safe Haven. This secure server fulfils the confidentiality and security standards set out by the NHS. Only the research team will have access to this server.

As is common practice, your data will be stored securely for 20 years before being deleted. Only the research team will have access to your data. After the end of the study, data will be accessed for an additional two years by the researcher during the write-up phase of her PhD (due in 2019).

## **What will happen with the results of this study?**

The results from this study will be included in the researcher's PhD thesis. We also want to present the results from this study at relevant conferences and in published academic journals. Any report of this study's findings will not have any identifiable information about you.

## **Further information and contact details.**

If you have any further questions relating to this study please do not hesitate to contact the research team.

### **Marissa Mes**

Telephone: +44 (0)20-7874-1291

Email: marissa.mes.15@ucl.ac.uk

### **Professor Robert Horne**

Telephone: +44 (0)20-7874-1281 (Research Administration, Karen Lindsay)

Email: r.horne@ucl.ac.uk



## Appendix F

### Description of a pharmacist-led adherence consultation for asthma delivered in general practice

We will describe this service as if you were receiving it.

#### **The service**

The service is delivered by a clinical pharmacist based at your local GP practice. The aim is to **help people with asthma get on better with their inhalers**. This means answering all of your questions and discussing all of your concerns about your inhalers in detail.

#### **Pre-consultation**

You are booked in for a consultation with the clinical pharmacist by the GP receptionist (just like you would with a GP appointment).

#### **The main consultation**

You have a one-to-one consultation with the pharmacist in a consultation room. They will begin with a **standard asthma review**. You will talk about your asthma control, recent symptoms, smoking history, and your asthma action plan. They will check your inhaler technique and lung function.

You will then have an **in-depth discussion about your inhalers**. You can ask any questions or mention any concerns you have about your inhalers. This could be anything from concerns about side effects or questions about how the medication works. The pharmacist will give you useful information and feedback that is **specifically suited to you**. They may use a short video or print-outs to guide their discussion with you.

At the end of the consultation, you will set an asthma-related goal with the pharmacist. This could be something like “less night time asthma symptoms”. The pharmacist will advise you on how to achieve your personal goal using your inhalers.

#### **The follow-up consultation**

1 month later, you will see the pharmacist again for a short consultation (no more than 10 minutes). The pharmacist will briefly ask how your asthma has been and check your inhaler technique/lung function. You will then discuss how you are getting on with your medicines and your personal asthma goal. Based on this discussion, the pharmacist will give further recommendations regarding your medication.

## Appendix G

### Topic guide for the qualitative study with adults with asthma

#### **Background and Previous Experience**

1. To start the interview, could you tell me when you were diagnosed with asthma?
2. What type of medications are you currently prescribed for your asthma?
  - a. How has your experience been with these medications? (Prompting to see if there are concerns, side effects etc.)
3. A lot of people with asthma have questions or concerns about their inhalers or tablets. What do you do when you have any questions or concerns specifically about your asthma medication?
  - a. Prompts: do you do research online? Do you talk to friends and family? Do you go talk to a healthcare professional?
  - b. Could you tell me a bit about why you prefer (insert route, e.g. researching online, talking to the GP, talking to family etc.) when it comes to your medication?
4. Have you ever talked to a pharmacist about your asthma medication?
  - a. If **YES**: Could you walk me through what happened during that interaction?
    - i. Where did it take place? (community pharmacist, hospital pharmacist etc.)
    - ii. Prompts: what type of information did they give you? Were they able to answer your questions? Did you feel comfortable talking to them about your asthma medication? Did you feel like it was helpful for you?
    - iii. Would you consider the pharmacist as a regular part of your asthma care team? Why or why not?
  - b. If **NO**: Could you imagine a pharmacist as part of your regular asthma care team?
5. I'd now like to talk specifically about your preventer inhaler (brown inhaler, steroid inhaler). They're normally prescribed for daily or twice daily use. A lot of asthma patients we've talked to often don't take the inhaler as regularly as prescribed, is this something you've experienced as well?
  - a. Could you tell me a little bit about why?

#### **Pharmacist in General Practice**

Great, that's the first part of our interview. Now we're going to continue on to the part where I'd like to get your thoughts on pharmacist-led consultations in general practice. I've e-mailed you a description of the service already, but would you like to review it to refresh your memory?

**Do you have any questions or anything you would like me to clarify before we move on to the questions?**

6. What are your initial thoughts on this pharmacist medication support service?
  - a. Explore which aspects of the service are most salient to the participant, use prompts below when needed.
- In your opinion, would this type of service be a useful addition to the care you get from your GP/nurse/asthma specialist?
  - o Is this a type of service you could see yourself using? Why or why not?
  - o Do you think this service is any different from the asthma care you already receive?
- Do you think this type of service would help you take your preventer inhaler more regularly?
- How do you feel about a pharmacist taking on this type of clinical role?
  - o Do you think pharmacists have enough training for this type of work?
    - What type of knowledge would you expect the pharmacist to have?
  - o How do pharmacists compare to your other healthcare professionals (e.g. GP or nurse)?
  - o Do you think this service is any different from seeing a community pharmacist? (Are they familiar with the NMS and MUR?)
  - o Would you feel comfortable talking to a pharmacist about your asthma and your medication?
  - o Do you feel like you can trust a pharmacist in this type of role?
- How do you feel about having a pharmacist based in a GP surgery?
  - o How would you feel about this pharmacist having access to your medical records?
- What do you think about seeing a pharmacist on an appointment basis?
- When you think about (concerns/side effects discussed for question 2a), do you think those types of questions or concerns could be addressed by a pharmacist?
  - o What would be the ideal way to support you with those questions or concerns?
- Do you think this type of service is convenient for people with asthma?
- What do you think about the use of a video/visual aids?

How do you feel about filling in a list of questions before your consultation to help the pharmacist identify exactly what type of advice and help is most useful for you?

## Appendix H

### Brief online questionnaire for the qualitative study with adults with asthma

#### **Introductory text:**

Thank you for speaking to us over the phone. In order to complete our study, we will need to ask you some basic questions about you and your asthma history. This information will add further detail to our data analysis and will only be used for this study. Any answers you give here will be treated confidentially and stored on a secure database. All identifiable information will be removed before any form of publication. Once the study is completed, your information will be deleted from our database.

1. Participant number (this number was included in the e-mail we sent you) :  
\_\_\_\_\_
2. Age:
  - a. \_\_\_\_\_
  - b. I prefer not to disclose my age
3. Gender:
  - a. Male
  - b. Female
  - c. Other (please specify)
  - d. I prefer not to disclose my gender
4. Which of the following best describes your ethnic origin?
  - a. White
    - i. British
    - ii. Irish
    - iii. Any other White background
  - b. Asian or Asian British
    - i. Chinese
    - ii. Bangladeshi
    - iii. Indian
    - iv. Pakistani
    - v. Any other Asian background
  - c. Black or Black British
    - i. African
    - ii. Caribbean
    - iii. Any other Black background
  - d. Mixed
    - i. White and Asian
    - ii. White and Black African
    - iii. White and Black Caribbean
    - iv. Any other mixed background
  - e. Other ethnic background (please specify)
  - f. I prefer not to disclose my ethnicity
5. Please write down the first letter(s) of your home postcode (e.g. Write “E” for E2 6DC or “SW” for SW2 7AC)

- a. \_\_\_\_\_
6. Have you ever been hospitalised for your asthma?
- a. Yes
  - b. No
7. Based on symptoms such as wheezing, coughing, shortness of breath, or tightness in the chest, please indicate which category applies to your asthma:
- a. Mild – my symptoms only appear from time to time
  - b. Moderate – I have some form of these symptoms every day
  - c. Severe – my symptoms appear every day and do not respond all the time to conventional treatments like inhalers
8. Within the last 12 months, how often have you visited the hospital for your asthma? (write “0” if you have not visited the hospital)
9. Within the last 12 months, how often have you visited your GP about your asthma?  
(write “0” if you have not visited the GP)
10. Would you like to receive a short summary of our results when this study is completed?
- a. Yes
  - b. No

## Appendix I

### Profiling questionnaire for the PASS study

The questions below will relate to the two types of medication you are being prescribed to control your asthma:

- 1) The **reliever** inhaler (usually blue):
  - Works very quickly in an emergency/when you are out of breath
  - Only to be taken when required
- 2) The **preventer** inhaler (usually brown, purple, orange, pink, grey, pink or red):
  - Maintenance treatment to prevent asthma attacks and symptoms
  - To be taken regularly everyday



There are no right or wrong answers – simply answer the questions as honestly as you can. This will help us to tailor the information during the consultation to your specific needs.

Q1. How important is your **RELIEVER** inhaler to you?

Not at all important                      Quite important                      Very important



Q2. How important is your **PREVENTER** inhaler to you?

Not at all important                      Quite important                      Very important



Q3. Do you have any concerns about taking your **PREVENTER** inhaler everyday?

YES                       NO                       MAYBE



Q3a. These are concerns that **other people with asthma have reported**. Please tick any concerns about your **PREVENTER** inhaler that you have (tick all relevant to you):

	YES	NO	MAYBE
<b>Side-effects</b>			
1. I am currently having side effects	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Getting side-effects in the future	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Other concerns</b>			
3. Getting long term effects	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Becoming too dependent on my <b>preventer</b> inhaler	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. It might stop working in the future	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. The drug building up in my body	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. The treatment is too strong	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Any other concerns: Please state below**

---

If you ticked more than one YES box above, which of these is the **most important concern** for you? Please write the number in the box below:

Q4. What difficulties do you think you might face with taking your medication every day?

	Always	Some-times	Never
1. Forgetting to take my <b>preventer</b> inhaler	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Difficulty using my inhalers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. My medication is too expensive	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. The <b>preventer</b> inhaler is disrupting my life	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Getting my medication when I run out	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Any other difficulties: Please state below**

---

## Do's:

- **Ask about their concerns:** Many patients are unsure about their medication and they may not think that it is appropriate for them to questions a health professional's decision. Openly asking about concern may help them to open up to you.
- **Ask them about their preferences:** Your patients have beliefs about their medication and what is best for them. They will most likely have their own preferences regarding medication, so involve them in the decision making process.
- **Dig deeper when someone states forgetfulness:** Most people will not just forget the inhaler, it is often linked to them doubting the importance of the inhaler or they intentionally forget because they have concerns. They often like to report forgetting as this takes blame away from them compared to actually making a decision to not follow the recommendations.
- **Use normalisation statements:** If you use these actively in the conversation, it will help your patients opening up to you.
- **Make a one month plan and use goal setting:** Ask your patients to take the inhaler every day for one month, so you can see how they get on in the follow-up appointment. Set a goal together with them, e.g. being able to climb one flight of stairs without stopping or getting the PEF up to a certain value – let your patient come up with the goal that is personally important for them.
- **Start the session with an agenda:** Tell the patient what you want to achieve in this session and what will be covered in the session. This way you are both on the same page and your patient will feel well informed. Of course check in with the patient, whether they are happy with what you suggest (use your checklist as a guide as well as the patient's individual profiling questionnaire).

## Don'ts:

- **Patronise your patients:** They are the ones living with the condition and they have made experiences you might not be able to understand. Acknowledge their stories and worries (even irrational ones) and let them be part of the decision making process.
- **Be judgemental:** Patients most likely already feel bad enough about not adhering to their doctor's recommendation, it is a gesture of trust by them to open up about their medication taking in your consultation.
- **Use medical jargon:** Most likely, your patients are not experts in the medical or pharmaceutical field and may have trouble following your explanations and advice. Medical jargon might in places even sound scary to them. So actively use the language we provide you with in the video and manual, e.g. use over reactive instead of inflammation.



- **Focus on practicalities only:** While it is important to check inhaler technique and to make sure there are no other practical barriers preventing your patient from using the inhaler, most of the time, your patient will actually have made a decision to not take the inhaler. Therefore it is important to focus on the beliefs influencing this decision.
- **Be secretive:** Always tell your patient what you are doing, e.g. when assessing their profiling questionnaire, talk to them while doing this and show them you are taking them seriously. Also, use the profiling questionnaire e.g. to set up the agenda for the session with them.

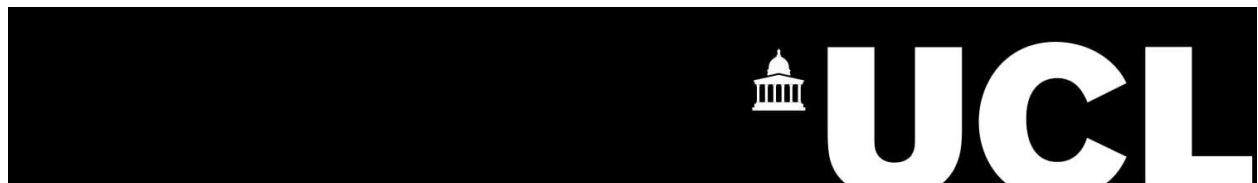
## Appendix K

### Pharmacist training materials: patient case study example

The patient is an elderly woman, reporting to experience side-effects (itchiness) with a new inhaler/brand (singulair). She didn't take her inhaler for 1 month, because the chemist wouldn't order the other brand for her (which she had used previously). The patient says she wants to take her medication correctly and that she is not a child, as she knows the medication is good for her and she does not want to be patronised. She even went to a herbal place for alternatives. She struggled to understand the PIL and therefore went to see her doctor about it. She feels like she has to take a generic/cheaper drug instead of her usual medication (she is very sceptical about it and does not trust her chemist is trying everything he can to get her the "proper" medicine)

When you have a look at the "new" inhaler, in particular its brand and ingredients and come to the conclusion, that it is actually just the packaging that was changed. Both, brand and ingredients are exactly the same as before.

**Suggestions:** Try to explain to the woman that the brand of her inhaler hasn't changed, but that it is only a new packaging and also mention that even for generics, the ingredients wouldn't change. In this example, the lady was not happy with this answer and stuck with her belief that she was getting a cheap generic version. Hence, you could try and emphasize the importance of taking the preventer regularly again (video), use the demonstration aids to show the small amounts of steroids and finally offer her to change her inhaler, if she is very unhappy with the current one and feels like it is giving her side effects.



Dear Sir/Madam,

We are a team of healthcare researchers working with:



Collaboration for Leadership in  
Applied Health Research and Care  
**North Thames**



Asthma UK Centre  
for Applied Research



We are working on a new project with Haringey CCG and City & Hackney CCG. We want to help people with asthma get the most out of their inhalers. We sent you this information pack because we feel you may be interested in participating in this research.

In short, we are offering a **new asthma service** where you can have **two face-to-face consultations with a trained pharmacist** in your local GP surgery. In this consultation, you can discuss any questions or concerns you have about your inhalers with the pharmacist. This service is completely free.

If this sounds interesting to you, please read through the other documents included in this package. They contain detailed information on what our research is about and what happens if you participate. If you have any questions or concerns, please feel free to contact Marissa ([marissa.mes.15@ucl.ac.uk](mailto:marissa.mes.15@ucl.ac.uk)) or Caroline ([caroline.katzer.15@ucl.ac.uk](mailto:caroline.katzer.15@ucl.ac.uk)). We hope you consider taking part in our research. Thank you for taking the time to read this letter.

Sincerely,

**Professor Rob Horne**

Centre for Behavioural Medicine, University  
College London

**Marissa Mes & Caroline Katzer**

PhD Candidates, University College London

**Hetal Dhruve**

Pharmacist, City & Hackney CCG

**Professor Steph Taylor**

Centre for Primary Care and Public Health, Queen  
Mary University London

**Forough Toosi**

Pharmacist, Haringey CCG

Participant identification number:

Centre number:



Asthma UK Centre  
for Applied Research



Collaboration for Leadership in  
Applied Health Research and Care  
North Thames

### Informed Consent Form

**Project Title:** PASS – Piloting the Pharmacist Asthma Support Study (**Student Study**)

**Name of Researchers:** Professor Rob Horne, Professor Steph Taylor, Ms. Caroline Katzer, Ms. Marissa Mes, Ms. Hetal Dhruve, Ms. Forough Toosi

**Please read through these statements carefully and initial in the matching box:**

- 1. I confirm that I have read and understand the information sheet dated 08/12/2017 (version 1.1) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.
- 2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my medical care or legal rights being affected.
- 3. I understand this consultation with the pharmacist is part of a research study and it does not aim to replace the role of my primary healthcare provider (e.g. General Practitioner, nurse, or consultant).
- 4. I understand that my participation is strictly confidential and all versions of my information will be stored in accordance with the Data Protection Act 1998.
- 5. I understand that relevant sections of my medical notes and data collected during the study, may be looked at by individuals from the sponsor of the trial (University College London) and responsible persons authorised by the sponsor, from regulatory authorities or from the NHS Trust, where it is relevant to my taking part in this research. I give permission for these individuals to have access to my records.
- 6. I agree that my General Practitioner (GP) may be informed of my participation in this study
- 7. I understand that the final set of questionnaires for this study will be mailed to my address with a pre-paid return envelope. If I do not send the questionnaires back, the researchers may contact me via the telephone.
- 8. I agree to take part in this study.

\_\_\_\_\_  
Name of Patient

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Name of Person taking consent

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Name of Chief Investigator  
*(if different to the person taking consent)*

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature



Asthma UK Centre  
for Applied Research



**NHS**  
National Institute for  
Health Research

Collaboration for Leadership in  
Applied Health Research and Care  
North Thames

## Participant Information Sheet

### Part 1

**Study title:** PASS – **Piloting the Pharmacist Asthma Support Study (Student Study)**  
**Protocol Reference Number:** IRAS 216830

We would like to invite you to take part in our research study. Before you decide, we would like you to understand why the research is being done and what it would involve for you. One of our team will go through the information sheet with you and answer any questions you have. We'd suggest this should take about 5 minutes. Talk to others about the study if you wish.

**Part 1** tells you the purpose of this study and what will happen to you if you take part. **Part 2** gives you more detailed information about the conduct of the study.

Ask us if there is anything that is not clear. Take time to decide whether or not you wish to take part.

#### Who are we?

We are a team of healthcare researchers at University College London (UCL) and Queen Mary University of London (QMUL) with a special interest in asthma research.

#### 1. What is the purpose of the study?

Research shows that there is room for improvement in asthma care in the United Kingdom (UK). Many people with asthma still struggle with the condition, its symptoms, and its treatment. One way to improve the health of people with asthma is to support them in taking their preventer inhaler more consistently. If taken as prescribed, the preventer inhaler helps prevent potentially dangerous asthma attacks.

Research shows that many people with asthma have questions or concerns about their preventer inhaler. To address some of these questions and concerns, we'd like to give people with asthma two consultations with a pharmacist in a General Practice (GP) surgery. The pharmacist has the knowledge and training to tackle any medication-related issues.

The purpose of this study is to see if this type of service would be useful for people with asthma. Does it address the questions and concerns people have about the preventer inhaler? Will it help people with asthma take their inhaler more consistently?

#### 2. Why have I been invited?

Your GP surgery **St. Ann's Road Surgery** has a pharmacist available for these asthma-specific consultations. The consultations are free of charge. We have invited you because you may be interested in participating.

We are looking for participants that meet all of the following criteria:

- Adults (18 years and over)
- Prescription for a preventer inhaler (aka brown inhaler, inhaled corticosteroid)
- Fluent in English
- Able to use inhalers without help (e.g. from a nurse or carer)
- No other lung conditions (e.g. chronic obstructive pulmonary disease, lung cancer, cystic fibrosis etc.)

### 3. Do I have to take part?

No, it is up to you to decide to join the study. If you agree to take part, you will be booked in to have two asthma-specific consultations with Ms. Forough Toosi, the pharmacist at your GP surgery. You will be asked to sign a consent form. You are free to withdraw at any time without giving a reason. Your medical care will not be affected by the decisions you make about this research study.

If you decide not to take part, you will not have to come in to see the pharmacist and you will carry on with your asthma care as usual.

Your pharmacist, Ms. Forough Toosi, will contact you to see if you are interested in participating. She will be able to answer any questions you have about the service

### 4. What will happen to me if I take part?

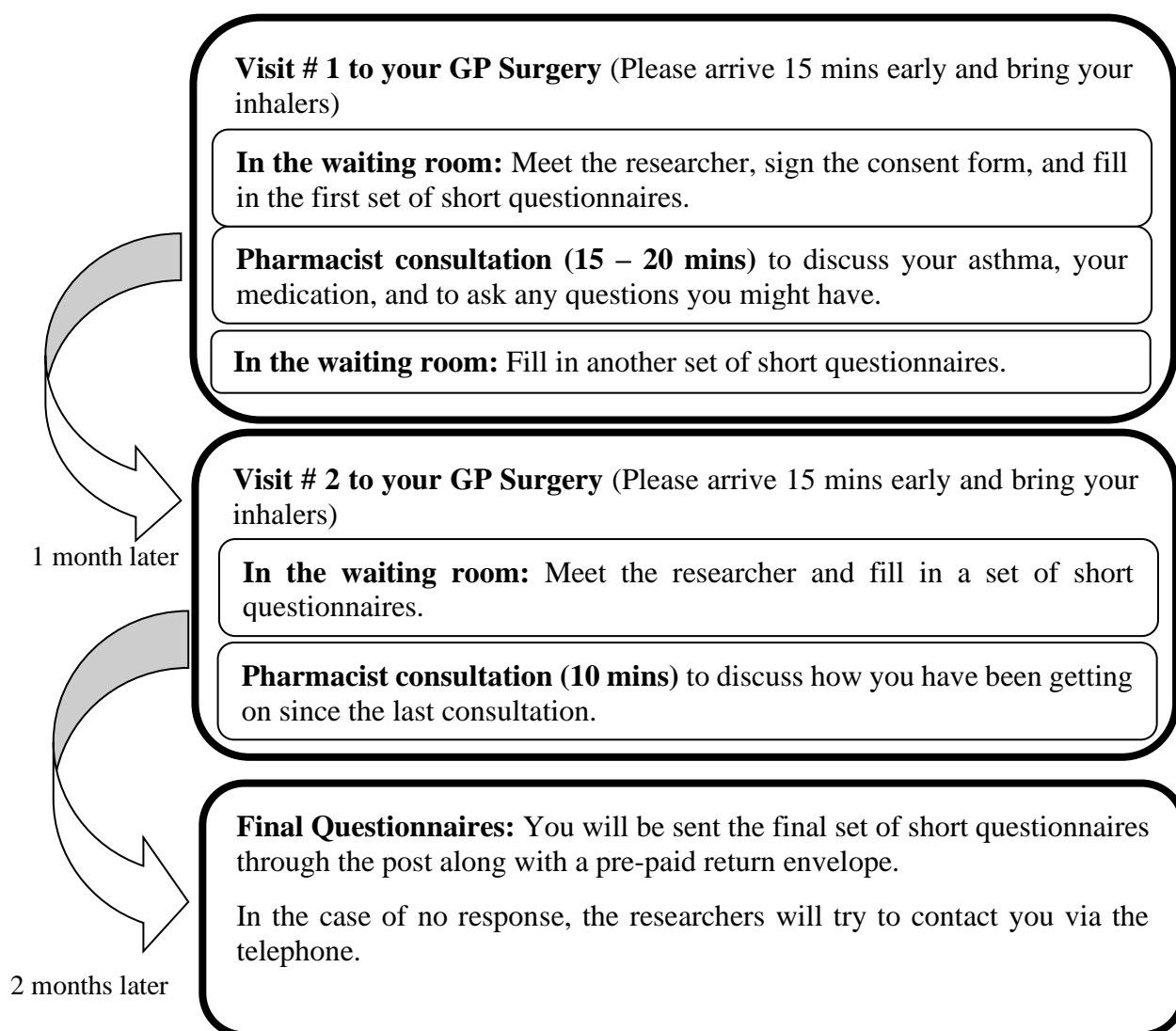
If you decide to take part, you will be booked in for two appointments with the pharmacist (Ms. Forough Toosi) at your GP surgery. You will be asked to **bring your inhalers with you** and to **come 15 minutes early to both appointments**.

Upon your arrival and registration with a receptionist, the receptionist will point you to a researcher, who will be awaiting you in the waiting room at your GP surgery before your appointment with the pharmacist (Ms. Forough Toosi). The researcher will outline the study in detail and address any questions or concerns you may have. If you accept, the researcher will provide you with a consent form, which you will be asked to sign in order to take part (see other document for info).

Right before your first consultation with the pharmacist, the researcher will give you a short set of questionnaires to fill out. After that, you will have a 15 to 20 minute consultation with the pharmacist. In this consultation, you will discuss your asthma and inhalers with the pharmacist. Based on your unique needs, the pharmacist will give you personalised information and tips for your asthma and medications. She will also check your asthma control and Peak Expiratory Flow (PEF). At the end of the consultation, you will agree on personalised asthma goals for the upcoming month. The pharmacist will book you in for the second appointment in 1 month's time. You will fill in another short set of questionnaires directly after the consultation, which the researcher will give you upon your return to the reception/waiting area.

Right before the second consultation, the researcher will give you the same set of short questionnaires to fill out again in the waiting room. This second appointment will take roughly 10 minutes. The pharmacist will check how you have been getting on with your personalised goals and medication since the first consultation. They will also check your PEF and asthma control again. Once this consultation is over, you will not have to come into the GP surgery for the study anymore.

Roughly 3 months after the first consultation, the research team will send the final set of questionnaires to your home address through the post. You will be asked to complete them and post them back in a pre-paid envelope. If the research team does not get a response from you, they will try to contact you over the telephone. If this happens, you will be able to answer the questionnaires over the telephone instead. You can see the timeline of the study below:



The questionnaires will include questions about your basic personal details (e.g. age and gender), your opinion on your preventer inhaler, your view of asthma, your use of the preventer inhaler, and your opinion on the consultation with the pharmacist. All of these measures will be used to determine if this type of treatment is worth investigating with further research.

This study is a before-and-after study. This means that anyone who participates will receive the consultations with the pharmacist and will be measured at several time points.

## **5. Expenses and payments**

The postage fee for the final set of questionnaires sent to your home will be paid ahead of time. You will not receive any reimbursement for your study-participation.

The researchers involved in this study and the pharmacist delivering the intervention are funded by the National Institute for Health Research Collaboration for Leadership in Applied Health Research and Care (NIHR CLAHRC North Thames).

## **6. What are the alternatives for diagnosis or treatment?**

The consultation with the pharmacist will not replace your consultations with your primary healthcare provider (e.g. respiratory consultant, asthma nurse, or GP). You will still receive all of the care that you normally receive.

We are hoping that providing this extra service will give people with asthma the time and place to discuss any issues they have with their asthma medication in detail. The pharmacists will be able to answer any questions you may have about your preventer inhaler.

## **7. What are the possible disadvantages and risks of taking part?**

This study delivers a psychology-based service to people with asthma. There are no experimental drugs involved. This means that the service is relatively low risk.

One disadvantage of taking part is that you will have to come into the GP surgery for both of your consultations. However, we hope that the consultations with the pharmacist to discuss your asthma-related questions will be of use to you. We have kept the questionnaires as short as possible.

One minor risk of taking part is the Peak Expiratory Flow (PEF) measurement in the consultations. PEF is a non-invasive lung function test that measures how fast you can breathe out. You will be asked to blow out as fast as you can into a small plastic tube called a peak flow meter. The pharmacist will ask you to repeat this test a few times. In some cases, you may feel slightly light-headed or out of breath. When this happens, you can always ask to take a break. The consultations will also take place at a GP surgery in the presence of a trained pharmacist, so you will be in good hands should you feel ill. PEF is a standard measure taken in most asthma reviews within the NHS.

Before participating you should consider if this will affect any insurance you have and seek advice if necessary



## **8. What are the side effects of any treatment received when taking part?**

There are no new drugs involved in the delivery of this service. It is a one-on-one consultation with a trained pharmacist to discuss your asthma and asthma medication.

The pharmacist will ask about your asthma history and asthma medication. If at any point you feel distress from the topic of conversation, you are free to leave the study and leave the consultation without explanation. We have shared the potential content of the consultations with other people with asthma and feedback has been positive.

You will be asked to conduct a PEF test, which may leave you slightly light-headed or out of breath. If this is the case, you are always welcome to ask for a break.

If you experience side effects from your asthma medication, then we recommend that you discuss this with your primary healthcare provider (e.g. your GP, asthma nurse, or respiratory consultant).

## **9. What are the possible benefits of taking part?**

You will not receive any reimbursement for your study-participation. We cannot promise the study will help you but the information we get from this study will help improve the treatment of people with asthma. We hope that the time spent with a pharmacist will help people with asthma manage their medications more easily.

We are happy to provide you with a short summary of our findings at the end of the study should you wish to see them.

## **10. What happens when the research study stops?**

After the research study stops, you will no longer be asked to fill in questionnaires. However, you can still continue to have consultations with your pharmacist should you wish to.

## **11. What if there is a problem?**

Any complaint about the way you have been dealt with during the clinical trial or any possible harm you might suffer will be addressed. The detailed information concerning this is given in Part 2 of this information sheet.

## **12. Will my taking part in the study be kept confidential?**

Yes. We will follow ethical and legal practice and all information about you will be handled in confidence. The details are included in Part 2.

**This completes Part 1 of the Information Sheet.**

**If the information in Part 1 has interested you and you are considering participation, please read the additional information in Part 2 before making any decision.**

## **Part 2**

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

You are free to leave the study at any point. You will not be asked to provide justification for your decision. If you withdraw from the study, we will destroy all of the information we have collected from you. Your data will not be used in any analysis or reports as we complete the research study. If you withdraw from the study, you will still be able to book an appointment with the pharmacist at your GP practice. However, you will not receive the asthma-specific programme designed specifically for this research study.

### 14. What if there is a problem?

If you have a complaint or concern about any aspect of the way you have been approached or treated by members of the research team during this study, complaints mechanisms are available to you.

Every care will be taken in the course of this study. However in the unlikely event that you are injured by taking part, compensation may be available.

If you suspect that the injury is the result of the Sponsor's (University College London) or the GP surgery's negligence then you may be able to claim compensation. After discussing with your researcher, please make the claim in writing to the Chief Investigator for the study. The Chief Investigator will then pass the claim to the Sponsor's Insurers, via the Sponsor's office. You may have to bear the costs of the legal action initially, and you should consult a lawyer about this.

Participants may also be able to claim compensation for injury caused by participation in this study without the need to prove negligence on the part of University College London or another party.

Regardless of this, if you wish to complain, or have any concerns about any aspect of the way you have been approached or treated by members of staff or about any side effects (adverse events) you may have experienced due to your participation in this study, the normal National Health Service complaints mechanisms are available to you. Please ask your researcher if you would like more information on this. Details can also be obtained from the Department of Health website: <http://www.dh.gov.uk>.

The **Patient Advise Liaison Service (PALS)** at the Whittington Hospital Trust can provide you with impartial advice and assistance regarding any of these queries:

[www.pohwer.net/Haringey](http://www.pohwer.net/Haringey)

PALS Whittington Health  
Magdala Avenue, London N19 5NF  
Tel: 020-7288-5551  
Email: [whh-tr.whitthealthPALS@nhs.net](mailto:whh-tr.whitthealthPALS@nhs.net)

Contact POhWER for support and advocacy:

POhWER  
Telephone: 0203-553-5960  
E-mail: [pohwer@pohwer.net](mailto:pohwer@pohwer.net)

**15. Will my taking part in this study be kept confidential?**

If you consent to take part in this study, the records obtained while you are in this study as well as related health records will remain strictly confidential at all times. The information will be held securely on paper and electronically at your GP surgery and the main academic site managing this research (School of Pharmacy, University College London) under the provisions of the 1998 Data Protection Act. Your name will not be passed to anyone else outside the research team or the Sponsor (UCL), who is not involved in the study. You will be allocated a participant number, which will be used as a code to identify you on all study forms. Any information about you which leaves the surgery will have your name and address removed so that you cannot be recognised.

Your records will be available to people authorised to work on the study but may also need to be made available to people authorised by the Sponsor, which is the organisation responsible for ensuring that the study is carried out correctly. All will have a duty of confidentiality to you as a research participant. By signing the consent form you agree to this access for the current study.

If you withdraw consent from further study treatment, your data will be deleted and excluded from the final analysis.

In line with the regulations, at the end of the study your data will be securely archived for a minimum of 20 years. Arrangements for confidential destruction will then be made. You have the right to check the accuracy of the data held about you and correct any errors, should you wish to do so.

**16. Will my GP be informed of my involvement?**

With your permission, your GP, and other doctors who may be treating you, may be notified that you are taking part in this study.

**17. What will happen to the results of the research study?**

The results of the study will be available after it finishes and will usually be published in a medical journal or be presented at a scientific conference. The data will be anonymous and none of the patients involved in the study will be identified in any report or publication.

We are happy to provide you with a summary of our findings at the end of the study, should you wish to see them.

**18. Who is organising and funding the research?**

This study is organized and funded by the National Institute for Health Research (NIHR). They run a programme called the Collaboration for Leadership in Applied Health Research and Care (CLAHRC) that brings together universities, the NHS, and other relevant organisations across the country.

This particular study is funded by the NIHR CLAHRC North Thames under the Optimising Behaviour and Engagement with Care (OBEC) theme. We are conducting the study with two Clinical Commissioning Groups (CCGs); Haringey CCG and City & Hackney CCG.

**19. Who has reviewed the study?**

All research in the NHS is looked at by an independent group of people, called a Research Ethics Committee, to protect your interests. This study has been reviewed and given favourable opinion by the Camden & King's Cross Research Ethics Committee (Reference 17/LO/1965).

**20. Further information and contact details**

You are encouraged to ask any questions you wish, before, during or after your participation in this study.

**21. What now?**

Your GP surgery or pharmacist will be in touch over the telephone to ask if you are interested in participating in this study. If you decide to participate, you will be given an appointment with the pharmacist. **Please bring your inhalers along and arrive 15 minutes early to the appointment.** A researcher will meet you in the waiting room with a consent form and the first set of questionnaires. If you do not wish to participate, you will not have to come in for an appointment.

You can have more time to think this over if you are at all unsure.

**Thank you** for taking the time to read this information sheet and to consider this study.

## Appendix M

### PASS intervention fidelity checklist

#### PASS – Pharmacist Asthma Support Study

##### FIDELITY CHECKLIST (for researchers)

PASS session 1 Date ..... Start time: ..... End time: .....

Pharmacist observed (initials): .....

Indicate whether the following aspects were addressed during the consultation.

*Has the pharmacist:*

<i>Fully</i>	<i>Partial</i>	<i>Not at all</i>	
			<b>1. Received the completed profiling questionnaire from the patient</b> <b>2. Extracted relevant information from EMIS</b>
			<b>3. Used a normalisation statement</b> <b>4. Completed a Behavioural Review:</b> <ol style="list-style-type: none"> <li>a. Explored inhaler adherence behaviour</li> <li>b. Reviewed smoking history</li> </ol>
			<b>5. Assessed the impact of asthma:</b> <ol style="list-style-type: none"> <li>a. Symptom assessment (exacerbation frequency, quality of life, vaccines, allergies and triggers)</li> <li>b. Lung function test (PEF measurement)</li> </ol>
			<b>6. Reinforced necessity beliefs:</b> <ol style="list-style-type: none"> <li>a. Explained the problem with non-adherence</li> <li>b. Showed the video*</li> <li>c. Used goal setting**</li> </ol> <b>7. Reduced individual concerns:</b> <ol style="list-style-type: none"> <li>a. Normalised concerns</li> <li>b. Reframed steroids               <ol style="list-style-type: none"> <li>i. Showed demonstration aid 1 on amount of steroids</li> </ol> </li> <li>c. Educated about nocebo-effect               <ol style="list-style-type: none"> <li>i. Showed demonstration aid 2 on side-effect occurrence</li> </ol> </li> <li>d. Used extra tips on tailoring for individual concerns</li> </ol>
			<b>8. Changed practicalities:</b> <ol style="list-style-type: none"> <li>a. Checked and practiced inhaler technique</li> <li>b. Provided practical strategies               <ol style="list-style-type: none"> <li>i. Handed out medication diary</li> </ol> </li> </ol>
			<b>9. Adjusted the inhaler dose</b>

**\*Video:** Please note whether the video has been shown in full and whether the patient paid attention throughout

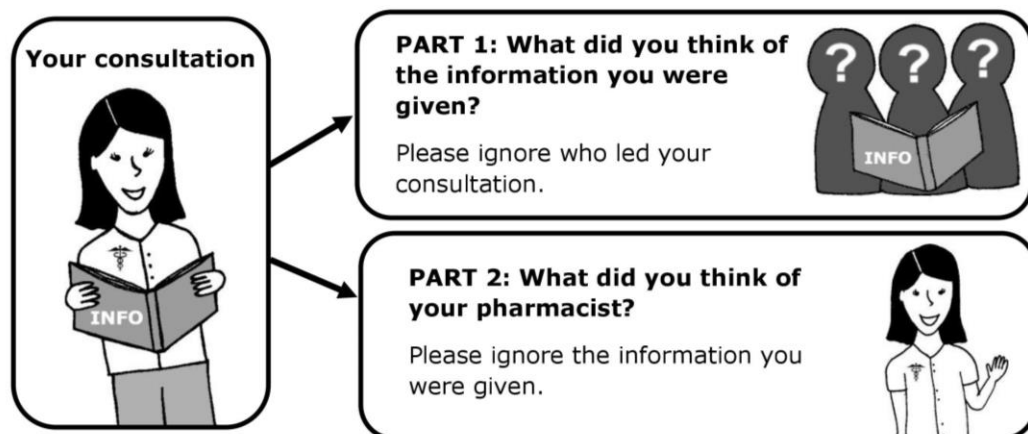
**\*\*Goal setting:** Please note the goals that have been set including if-then plans

NOTES (e.g. why were certain parts of the intervention left out? Any notable events during the session?):

## Appendix N

### PASS acceptability questionnaire

You had a consultation with a pharmacist in your GP practice about your asthma. We want to hear your views on **two parts of the service** - **the pharmacist** who led your consultation (Hetal Dhruve or Forough Toosi), and **the information** you were given:



We will ask you questions about each of these parts **separately**. When answering, please try to focus on each part one at a time (the pharmacist **or** the information you were given).

#### Part 1: The information in the consultation



Just thinking about **the information** rather than the pharmacist, what did you think about **the information given during your consultation?**

Please tick how much you agree or disagree with each statement below. There are no right or wrong answers, we are interested in your personal opinion.

Statement about the information	1 Strongly disagree	2 Disagree	3 Uncertain	4 Agree	5 Strongly agree
1. I did not like getting information through a video					
2. I really liked the information I was given about:					
a. My asthma					
b. My inhaler					
c. How to manage my asthma					
3. It took a lot of effort to:					
a. Fill out the questionnaire about my inhalers before the consultation					
b. Show the pharmacist my inhaler technique					
c. Give a peak flow measurement					
4. The information I got during the consultation was easy to understand					
5. The information I got during the consultation was not more valuable than my usual asthma care (e.g. information from my GP).					

6. After receiving the information in the consultation:					
a. I changed the way I think about asthma					
b. I still don't know how to use my inhaler correctly					
c. I believe I need my preventer inhaler					
d. I still worry about the long-term effects of my preventer inhaler					
e. I still worry about the side effects of my preventer inhaler					
f. I believe I will take my preventer inhaler regularly					
7. Based on the information I got in the consultation, I feel confident that:					
a. I know what to do to manage my asthma					
b. I am able to do what I need to for my asthma management.					
8. Following the pharmacist's recommendations in my everyday life will take a lot of effort.					

## Part 2: The pharmacist



Thank you for telling us what you thought about the information. Now we'd like to know what you thought about **the pharmacist** who provided you with the information.

These are statements about your **pharmacist** (Hetal Dhruve/Forough Toosi). Please tick how much you agree or disagree with each statement below. There are no right or wrong answers, we are interested in your personal opinion.

	1	2	3	4	5
Statement about pharmacist	Strongly disagree	Disagree	Uncertain	Agree	Strongly Agree
1. I really liked having a pharmacist provide this type of asthma service					
2. It was a lot of effort for me to have this pharmacist consultation in my GP surgery.					
3. It was really worthwhile to spend my time with a pharmacist as well as my usual asthma care (e.g. GP or nurse)					
4. After seeing the pharmacist...					
a. I have not changed the way I think about my asthma					
b. I believe I will take my preventer inhaler regularly					
c. I don't believe I need my preventer inhaler					
d. I am less worried about the long-term effects of my preventer inhaler.					
e. I am less worried about the side effects of my preventer inhaler.					
f. I don't know how to use my inhaler correctly					
g. I won't forget to use my preventer inhaler					
5. I feel confident that I can explain my asthma to a pharmacist.					



6. I do not trust a pharmacist with my asthma care.					
7. I would recommend seeing a pharmacist to other people with asthma.					
8. My pharmacist did not listen to me.					
9. My pharmacist made me feel comfortable.					

**Part 3: Further comments**

If you have any further comments or issues regarding the content of the consultation or the pharmacist delivering it, please outline them below:

## Appendix O

### PASS pharmacist feedback session questions

#### **Topic: Background as pharmacist** (few minutes warm up)

1.1 Before we begin can you briefly tell me a little about your background as a pharmacist? *Years of experience/context/clinical setting.*

1.2 What approaches have you previously tried with people not adhering to their prescribed preventive medication? *How successful do you feel those approaches were?*

#### **Topic: Expectations and Motivations**

2.1 The intervention, intended for people who are not adhering to their prescribed preventive medication, is underpinned by theory based psychology that is known to relate to adherence behaviour. Had you any prior knowledge of psychological approaches to medication adherence?

2.2 What were your thoughts when you first heard about the Pharmacist Asthma Support Study? *Did you have any expectations of what it was about/what it would entail? What motivated you to take part?*

#### **Topic: PASS Training**

3.1 What were your expectations of training? *(May naturally evolve to whether the expectations were met but if not, included as prompt below)*

3.2 Did you review the intervention materials (e.g. the manual and demonstration aids etc.) before your training sessions? *Easy/self-explanatory/difficult? Would it have been useful to have at-home study materials? (e.g. if rolled out to larger study) Would it be more realistic to introduce these materials in an introductory training session? (e.g. if people do not have time to study at home)*

3.3 What did you think of the training you received before the study began? *What did you feel was the most helpful or unhelpful aspects of the training sessions/ Strengths and weaknesses of training? Were your initial expectations met? Explore, content, structure, quantity and length of sessions, training materials/the case studies. Individual vs group.*

3.4 Did the training equip you to deliver the intervention? If not, what would have helped? *Were there are aspects more difficult to master? If so, how do you think these aspects could be taught more efficiently? Was anything missed that you might have expected to learn?*

3.5 What do you think is the ideal time/place to train pharmacists? *Full/Half days? Evening sessions? Should pharmacists be compensated for their time if they attend training sessions?*

3.6 Are there any barriers to pharmacists being trained to deliver this intervention? *How would you train pharmacists that are new to delivering this intervention?*

**Topic: Consultations *Pharmacist experience and perspective***

4.1 What was your experience of delivering the consultations in practice? *Explore initial and later sessions. Structure of the consultation was it logical for you/ easy to follow/any challenges? Enough time? Form completion?*

4.2 Did you use a normalisation statement at the beginning for each patient?

4.3 Were you able to **address** (not just identify) patients' illness and medication beliefs?  
How?

4.4 How did you address practical barriers (forgetting, diary, expense etc)?

4.5 How did you use the intervention materials during the consultations? *Explore some examples and confidence. How did you decide on whom to show which materials? Which one was your favourite material? Why?* Prompt: tailoring questionnaire, video, demo aids, diary)

4.6 Did you motivate your patients with the prospect of stepping down their inhaler dose?  
Did you prescribe different inhalers/ devices?

**Topic: Consultations *Patient experience and perspective***

5.0 What do you think your patients thought about the structure of the consultation?  
How useful do you think your patients found the study materials: tailoring questionnaire, video demonstration aids?

How do you think patients viewed you as a clinician?

Do you feel you had impact on your patients? If so, please elaborate.

## Appendix P

PASS exploratory measures

### *The Beliefs about Medicines Questionnaire – Specific (BMQ-S)*

**(Horne et al., 1999)**

<u>Construct</u>	<u>Beliefs about Medicines Questionnaire – Specific (BMQ-S) item</u>
Necessity beliefs	My health at present depends on my preventer inhaler My life would be impossible without my preventer inhaler Without my preventer inhaler, I would be very ill My health in the future will depend on my preventer inhaler My preventer inhaler protects me from becoming worse
Concerns	Having to take my preventer inhaler worries me I sometimes worry about the long-term effects of my preventer inhaler My preventer inhaler is a mystery to me My preventer inhaler disrupts my life I sometimes worry about becoming too dependent on my preventer inhaler My preventer inhaler gives me unpleasant side effects
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### *The Brief Illness Perceptions Questionnaire (IPQ)*

**(Broadbent et al., 2006)**

<u>Construct</u>	<u>Brief Illness Perceptions Questionnaire (IPQ) item</u>
Consequences	How much does your asthma affect your life?
Timeline	How long do you think your asthma will continue?
Personal control	How much control do you feel you have over your asthma?
Treatment control	How much do you think your treatment can help your asthma?
Identity	How much do you experience symptoms from your asthma?
Concern	How concerned are you about your asthma?
Coherence	How well do you feel you understand your asthma?
Emotion	How much does your asthma affect you emotionally?
Cause	Please list in rank-order the three most important factors that you believe caused your asthma

*Inhaler technique checklist (Turbohaler)*

Based on work by Scullion and Fletcher (2016)

Please tick the box for each step that is **successfully completed** by the patient.

	Before the first time, turn the device twice
	1. Unscrew and lift off the cover
	2. Hold the turbohaler upright with the grip at the bottom
	3. Turn the grip fully in one direction and then back as far as possible (audible click). Only load inhaler immediately before use
	4. Breathe out away from the device
	5. Place the mouthpiece between the lips and breathe in through the mouth as <b>deeply</b> and as <b>hard</b> as possible.
	6. Remove the turbohaler from mouth and hold breath for 10 seconds (or as long as comfortable)
	7. Breathe out slowly away from the device
	8. After 30 seconds, repeat steps 2-7 if more than one dose is required
	9. Replace cover after use
	10. If medication contains a steroid – rinse mouth out after use

*The Medication Adherence Report Scale (MARS)*

**(Horne & Hankins, 2004)**

<p style="text-align: center;"><u>Medication Adherence Report Scale (MARS) items</u></p>
<p>I only use my preventer inhaler when I need it I only use it when I feel breathless I decide to miss out on a dose I try to avoid using it I forget to take it I alter the dose I stop taking it for a while I use it as a reserve, if my other treatment doesn't work I use it before doing something which might make me breathless I take it less than instructed</p>
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*The Asthma Control Test (ACT)*

**(Nathan et al., 2004)**

<u>Asthma Control Test (ACT) items</u>	<u>Scale</u>
During the past four weeks, how often did your asthma prevent you from getting as much done at work, school, or home?	1 (all of the time) 2 (most of the time) 3 (some of the time) 4 (a little of the time) 5 (none of the time)
During the past four weeks, how often have you had shortness of breath?	1 (more than once a day) 2 (once a day) 3 (3 – 6 times a week) 4 (1 – 2 times a week) 5 (not at all)
During the past four weeks, how often did your asthma symptoms wake you up at night or earlier than usual in the morning?	1 (4 or more times per week) 2 (2 – 3 nights per week) 3 (once a week) 4 (once or twice) 5 (not at all)
During the past four weeks, how often have you used your reliever inhaler?	1 (3 or more times a day) 2 (1 – 2 times a day) 3 (2 – 3 times a week) 4 (once a week or less) 5 (not at all)
How would you rate your asthma control during the past four weeks?	1 (not controlled) 2 (poorly controlled) 3 (somewhat controlled) 4 (well-controlled) 5 (completely controlled)