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**Improving medication adherence in stroke survivors
Development of a novel and acceptable intervention**

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**Improving medication adherence in stroke survivors: Development
of a novel and acceptable intervention**

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King's College London

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Supervised by Dr. Mark Ashworth & Dr. Alison Wright

Abstract

Medications are recommended for the secondary prevention of stroke and have shown good efficacy, yet adherence is suboptimal. To date, most interventions targeting medication adherence in stroke survivors have shown limited effectiveness. Therefore, this thesis aimed to develop a novel, evidence-based and theory driven behaviour change intervention targeting medication adherence in stroke survivors.

Three key studies were conducted. A systematic review identified psychological determinants of medication adherence in stroke survivors. Then, an extensive intervention development process was undertaken, utilising the Behaviour Change Wheel (BCW), a guide to intervention development. Finally, semi-structured interviews were conducted with stroke survivors (n=16) and health care professionals (HCPs; n=19), to explore acceptability of the potential intervention components. Framework analysis was employed to analyse results and the intervention design was refined and finalised. All studies were underpinned by the Theoretical Domains Framework (TDF).

Three TDF domains ('Knowledge', 'Beliefs about consequences', and 'Emotions'), were found to have most influence on medication adherence. Employing the BCW, five intervention functions, five policy categories and 11 BCTs were identified and explored for acceptability with stroke survivors and HCPs. The qualitative interviews revealed that habit formation, supported by action planning, self-monitoring of the behaviour and information about health consequences were the most acceptable BCTs. Participants felt that the intervention should be delivered within the NHS, with written and verbal modes of delivery perceived as acceptable.

Use of the TDF, BCW and consideration of intended intervention context has supported the development of a novel and acceptable intervention. Further research is required to test intervention feasibility.

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Abbreviations

AMT – Abbreviated Mental Test	NHS – National Health Service
APEASE – Affordability, Practicality, (Cost)Effectiveness, Acceptability, Side effects, Equity	NICE – National Institutes for Health and Care Excellence
BCT – Behaviour Change Technique	NIHSS - National Institute of Health Stroke Scale
BCTTV1 – Behaviour Change Technique Taxonomy Version 1	NMS – New Medicines Service
BCW – Behaviour Change Wheel	ONS – Office of National Statistics
BMQ – The Beliefs about Medicines Questionnaire	PCL-S - Modified PTSD Checklist-Specific to stroke/mini stroke
COM-B – Capability, Opportunity, Motivation model of Behaviour	PHQ-8-8-item Patient Health Questionnaire Depression Scale
DH – Department of Health	PPI – Patient and Public Involvement
EFQ- Everyday Functioning Questionnaire	PRISMA –The Preferred Reporting Items of Systematic Reviews and Meta- Analysis
EQ-5D - EuroQoL-5D	RCT – Randomised Controlled Trial
ESD – Early Supported Discharge	RCP – Royal College of Physicians
ESDQ- The Emotional and Social Dysfunction Questionnaire	RDS – Research Design Service London
GP – General Practitioners	RE-AIM – Reach, Efficacy/effectiveness, Adoption, Implementation, Maintenance
HADS – Hospital Anxiety and Depression Scale	RMBT- The Rivermead Behavioural Memory Test
HAS-U – Hyper Acute Stroke Unit	RPS – Royal Pharmaceutical Society
HBM – Health Belief Model	SNNAP - Stroke Sentinel National Audit Programme
HCP – Healthcare Professional	SRBAI – Self-Report Behavioural Automaticity Index
INR – International Normalised Ratio	SRHI – Self-Report Habit Index
IPQ-The Illness Perception Questionnaire	SRM – Self-Regulation Model
LOT-R - Life Orientation Test-Revised	TAS - Treatment Assessment Schedule
MARS – Medication Adherence Report Scale	TCS – Theory Coding Scheme
MCA – Multi-compartment Compliance Aid	TDF – Theoretical Domains Framework
MDT – Multi-disciplinary Team	TIA – Transient Ischaemic Attach
MEMS – Medication Event Monitoring System	TIDieR – Template for Intervention Description and Replication
MFMER - Mayo Foundation for Medical Education and Research	TPB – Theory of Planned Behaviour
MMAQ - Morisky Medication Adherence Questionnaire	TTM – Transtheoretical Model
MMSE- The Mini-Mental State Examination	WHO – World Health Organisation
MRC – Medical Research Council	
MUR – Medication Use Review	
NCF – Necessity-Concerns Framework	

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1 Chapter 1: Overview of the Thesis

1.1 Chapter overview

This chapter aims to provide an introduction to the thesis, setting the key research questions to be addressed and presenting an outline of each included chapter.

1.2 Thesis research questions

1.2.1 Aim

The overarching aim of this thesis is to develop a theory driven and evidence-based intervention, targeting medication adherence in stroke survivors.

1.2.2 Objectives

The aim will be addressed by four objectives:

1. To identify psychological determinants that influence medication adherence in stroke survivors, establishing the magnitude of this relationship where possible
2. To map these psychological determinants into a theoretical framework (the Theoretical Domains Framework (TDF)) to facilitate systematic and evidence-based selection of intervention components (including behaviour change techniques (BCTs))
3. To explore acceptability of the selected intervention components with key stakeholders

4. To refine intervention design based on perceived acceptability of intervention components.

1.3 Overview of chapters

Chapter Two

This chapter provides a detailed overview of stroke and medication adherence. The chapter begins with a discussion of what stroke is and the risk factors for this condition, describing how best to control these risk factors. Then, the concept of medication adherence is introduced, with a proposed definition of adherence for the thesis. Methods of measurement and a discussion surrounding non-adherence then takes place. Finally, the chapter brings the two concepts together, considering medication adherence in stroke survivors. A discussion of what is currently known about the influences of adherence take places before presenting a critical appraisal of interventions that have been developed to improve medication adherence.

Chapter Three

To support understanding of medication adherence in stroke survivors, Chapter Three presents a series of models (or theories) of determinants of behaviour that could be selected to underpin the intervention development in this thesis. The chapter is in three parts: 1) a discussion to support understanding of the behaviour (medication adherence in stroke survivors); 2) an appraisal of several psychological theories of the determinants of behaviour, with critical consideration of the strengths and limitations of these theories; and 3) the chosen theoretical approach for this thesis is presented along with a rationale and critical appraisal of this selection.

Chapter Four

To build on concepts introduced in Chapter Two and Three, a systematic review was undertaken and presented in Chapter Four. The aim of this review was to identify the psychological determinants that influence medication adherence in stroke survivors. Identified determinants were mapped into the theoretical framework of this thesis (the TDF). The domains containing the greatest number of statistically significant determinants, tested across the largest number of studies and samples, were proposed to be more influential to medication adherence, and formed the evidence and theoretical foundations of the intervention development.

Chapter Five

This chapter presents the systematic intervention development process, advocated by the Behaviour Change Wheel. A discussion of the use of Affordability, Practicality, (Cost-)Effectiveness, Acceptability, Side-effects and Equity (APEASE) evaluative criteria, and how this has facilitated initial evaluation of intervention components also takes place. The chapter concludes with a proposed 'toolbox' of potential intervention components, including intervention functions and BCTs that could be included in the final intervention design.

Chapter Six (a and b)

These chapters present a qualitative study exploring acceptability of intervention components with stroke survivors and healthcare professionals (HCPs). Semi-structured interviews were utilised to explore acceptability. The chapter was split into

two parts: part a) the stroke survivor interviews and, part b) the HCP interviews. The findings from Chapter Five (i.e. the 'toolbox' of potential intervention components), as well as engagement with a Patient and Public Involvement group, supported development of an interview schedule for this study.

Chapter Seven

This chapter proposes the final intervention design, deemed to be most acceptable to the key stakeholders (stroke survivors and HCPs) and as such the findings from Chapter 6a and 6b underpin this chapter. A discussion of potential settings, modes of delivery and operationalisation of BCTs is presented, narrowing down to a final, coherent intervention design considered to be the most implementable within the current NHS system.

Chapter Eight

This final chapter presents a critical appraisal of the overall findings of this thesis, discussing how the research questions have been addressed. Contribution to knowledge and implications for future research are also discussed.

2 Chapter 2: Conceptualising Stroke Risk Factor Management and Medication Adherence

2.1 Chapter overview

This chapter has two main sections. The first is a general overview of stroke. This section presents what stroke is, as well as stroke risk factors and management of these risk factors. The second section describes the concept of medication adherence along with applied definitions for this thesis. The issue of non-adherence, as it relates to long-term conditions, will be considered and the consequences of this behaviour outlined. The section will conclude with a discussion on how medication adherence is relevant for stroke and why it is the focus of this thesis. This will include consideration of what is already known about medication adherence in stroke survivors and previous interventions that have been developed to improve medication adherence in this population.

2.2 Stroke

2.2.1 What is a stroke?

A stroke occurs when the blood supply to the brain is disrupted, either through a blockage (ischaemic stroke) or through a blood vessel rupturing (haemorrhagic stroke) (McKay & Mensah, 2004). The resultant damage to the brain can lead to serious, life altering or fatal consequences (Young & Forster, 2007). In 2009, the World Health Organization (WHO) listed stroke as the second leading cause of death

in developed countries (WHO, 2009), with an estimated 110,000 first or recurrent strokes in the United Kingdom (UK) per annum (NICE, 2008a). Cumulative risk of a secondary stroke was identified to be 26% in the first five years following a stroke (Mohan et al., 2011), with a significantly increased personal risk (compared to the general population) in the immediate month following stroke (up to 20%; (RCP, 2012)). The focus of this thesis will be on the secondary prevention of stroke.

2.2.2 Stroke risk factors

There have been over 300 identified risk factors for coronary heart disease and stroke (McKay & Mensah, 2004). High blood pressure, high serum cholesterol levels, atrial fibrillation, use of tobacco, unhealthy diet, physical inactivity and diabetes are some of the most established risk factors, due to their prevalence, their independent impact on risk of stroke and the ability to modify these risk factors and reduce the overall risk of stroke occurrence (McKay & Mensah, 2004). Other risk factors include low socioeconomic status, use of certain medications such as oral contraceptives, family history and alcohol use (McKay & Mensah, 2004). The importance of such risk factors varies between the two conditions (coronary heart disease and stroke). For example, whilst high blood pressure is a strong risk factor for coronary heart disease, it is considered the most important risk factor for stroke. Conversely, unhealthy diet is estimated to be the cause of coronary heart disease in around 31% of cases, compared to 11% of stroke events worldwide (McKay & Mensah, 2004).

2.2.3 Controlling risk factors

There are a number of different guidelines providing recommendations for stroke risk factor control (e.g. NICE, 2008a; RCP, 2012). These focus on both primary prevention of stroke (i.e. managing risk factors to avoid a stroke event) and secondary prevention of stroke (i.e. managing risk factors following a stroke event). As previously stated, the focus of this thesis is the secondary prevention of stroke. These guidelines present numerous methods of prevention, such as use of medications. Other recommendations include life-style changes such as increasing activity levels or consuming a healthier diet (RCP, 2012). The use of medications is the focus of this thesis.

Medications prescribed for stroke risk factors include antihypertensive medications (that support blood pressure control) such as angiotensin-converting enzyme (ACE) inhibitors, statins (which target cholesterol levels), aspirin or other antiplatelet medications (that thin blood) and warfarin or other anticoagulant medications (that also thin blood), prescribed in patients who have atrial fibrillation (AF). These medications have demonstrated reasonable levels of efficacy. Data presented in Health in Scotland (2007) identified that blood thinning, cholesterol lowering and anti-hypertensive medication could account for an estimated 376-926 avoided strokes in Scotland (Warlow et al., 2008). Research has also indicated that antihypertensive therapies can reduce the risk of stroke by as much as 30% (Law, Morris, & Wald, 2009). Similarly, there have been trials to support the efficacy of warfarin. Guidelines for prevention of stroke from the American Heart Association/American Stroke Association Council on Stroke pooled data from five trials. Results indicated

that there were reductions in stroke rates by an overall relative risk reduction of 68% [95% CI: 50-79] and an absolute reduction per annum from 4.5% in the control group to 1.4% in the adjusted dose warfarin group. This indicated that a potential 31 ischaemic strokes per 1000 patients treated with warfarin therapy would be prevented each year (Sacco et al., 2006). There has also been evidence to show cumulative reductions in relative risk by as much as 75% (Yusuf, 2002).

2.3 Medication adherence

2.3.1 What is medication adherence?

Understanding and defining 'adherence' is complex. The language used to describe or discuss adherence, as it relates to a medication regimen, has gone through a transition over the past six decades. Convention has shifted from using compliant (implying patient passivity) to adherent (assuming a patient has a more active role in this behaviour). Concordance (a patient and doctor coming to a shared agreement regarding the therapeutic goals (Chen, 1999)) and persistence ("the duration of time from initiation to discontinuation of therapy" (Cramer et al., 2008 pp.46)) are other terms that are often used when discussing adherence. To further add to the complexity, the terms compliance, concordance, adherence and persistence are often used interchangeably. This can cause issues when trying to interpret and synthesise existing research, particularly as some terms represent slightly different behaviour. For example, adherence refers to taking the medication at the prescribed time and would be assessed on a day-to-day or dose-to-dose basis. Persistence, on the other hand, refers to the duration of time that a person is prescribed the

medication, so there could be periods in this duration where a person is non-adherent but still persistent to the regimen.

This thesis will use the term, medication adherence, defined as “the extent to which the patient's action matches the agreed recommendations” (Nunes et al., 2009 pp. 3). This definition was chosen as it implies a more active role of the patient in the decision to take a medication. As many patients can select not to take medications for rational reasons (such as not wanting to experience a side effect), this more collaborative definition seemed appropriate. The definition also captures the importance of taking medications to the agreed recommendations. Many of the stroke preventative medications need to be taken on a daily basis, and missing periods of time can be detrimental to the medication efficacy (i.e. blood pressure could increase in periods where the medications are not being taken as prescribed).

Non-adherence can encompass missing one dose, taking ‘drug holidays’ or pauses in regimen, taking less or more of a dose at any one time point than required or not taking the medication at all. There are numerous approaches to measuring medication adherence, both direct assessment (i.e. analysis of urine samples) and indirect measurement (e.g. the 8-item Morisky Medication Adherence Scale (Morisky, Ang, Krousel-Wood, & Ward, 2008)). Often in research, measurement is dichotomised into adherent versus non-adherent (Horne & Chatworthy, 2010), despite the variability in adherence behaviours. It is important to keep this in mind when trying to understand the complexity of adherence as a concept.

2.3.2 Measurement of adherence

Currently, there is no accepted gold standard of medication adherence measurement. Therefore, it is challenging for researchers to select a measurement tool or approach and to be confident in the reliability or validity of this method. This is compounded by the fact that there exists a plethora of adherence measures, each with strengths and weaknesses. Furthermore, the measurement approach chosen is likely to operationalise adherence for that study to some extent, as different measures are often sensitive to different types of (non)adherence (Horne & Chatworthy, 2010). Below, a number of these measures will be considered and categorised into 'direct' and 'indirect'.

Direct methods encompass approaches such as measurement of the drug or its metabolite concentration in bodily fluids (i.e. blood or urine), or direct observation of the patient taking the medication (Osterberg & Blaschke 2005). Indirect methods include self-report (questionnaires, interviews or diaries), doctor estimations and prescription refill rates, pill counts and Medication Event Monitoring Systems (MEMS, which measures the date and time a medication container is opened).

Direct methods, whilst having the benefit of often objective and quantifiable findings, do have some limitations. For example, some direct methods could also be considered invasive, such as taking blood, which may deter participants from having their adherence measured (Lam & Fresco, 2015). There is also a higher level of expense and required expertise to deliver these methods of measurement.

Indirect methods are often used within research as they offer more practical solutions to measurement of adherence; such as low cost, flexibility of delivery medium (online, face-to-face, pen-to-paper) (Lam & Fresco, 2015). However, these methods, too, are not without limitation. Self-report measures rely on accurate reporting from the respondent (so not being subject to response bias; an overestimation of adherence) and assume that they will not be subject to social desirability bias (the desire to please the researcher) or the Hawthorne effect (i.e. the knowledge of being monitored changes behaviour (Horne & Chatworthy, 2010). Methods, such as checking prescription refill records, also rest on assumptions about links between prescription refill rates and medicine taking behaviour i.e. if you refill your prescription you must be taking your medication. As these methods are indirect, there is no way to be confident that one behaviour can reliably infer another. Due to this, these measures can have lower sensitivity and specificity than direct methods (Lam & Fresco, 2015), and can cause over-estimation of adherence rates. Table 1 presents the strengths and weaknesses of different types of measurement categorised into direct and indirect methods.

Table 1. Displaying a number of measurement methods for medication adherence along with suggested strengths and weaknesses

Measurement Method	Example	Strengths	Weaknesses	Suitability to measure adherence in stroke
Direct Methods				
Direct observation	Observing patients taking their medications	<ul style="list-style-type: none"> • Higher accuracy 	<ul style="list-style-type: none"> • Impractical for large samples • Impractical for complex medication regimens • Patients can still hide pills (under tongue etc. and discard later) • Labour intensive 	<ul style="list-style-type: none"> -Only practical for a short duration of time -Stroke medicine regimens can be complex (multiple pills and multiple times) -Difficult to directly observe patients in community settings
Measure of drug/metabolite in body fluids	E.g. INR readings for warfarin established through a blood test	<ul style="list-style-type: none"> • Objective • Quantifiable 	<ul style="list-style-type: none"> • Expensive • Requires high level of expertise • Time consuming • Impractical for community settings • Variations in individual metabolisms 	<ul style="list-style-type: none"> -Difficult to directly observe patients in community settings -Some drug half-life(s) may only be able to show recent adherence, i.e. if it was taken that day -INR can be assessed with this method
Indirect Methods				

Measurement Method	Example	Strengths	Weaknesses	Suitability to measure adherence in stroke
Self-report questionnaires/scales	E.g. Filling in the MARS	<ul style="list-style-type: none"> • Cheap • Simple to administer • Flexible delivery • Feasible in clinical & community settings • Some well validated 	<ul style="list-style-type: none"> • Subjective • Subject to social desirability bias • May need good literacy levels • Can have poor sensitivity and specificity 	<ul style="list-style-type: none"> -Realistic for stroke patients who have dexterity to write -Can be easily implemented in community and healthcare settings -These measures can assess shorter and longer durations of adherence and be easily administered frequently to assess persistence
Interviewer/computer assisted completion of questionnaires/scales	E.g. Interviewer reading through and completing MARS with patient	<ul style="list-style-type: none"> • Cheap • Simple to administer • Flexible delivery • Feasible in clinical & community settings • Some well validated 	<ul style="list-style-type: none"> • Subject to social desirability bias • Requires two people's time to complete (i.e. an interviewer and a patient) • May required good language skills to take part in interview 	<ul style="list-style-type: none"> -Could be difficult to complete with patients who have aphasia/don't speak same language as interviewer

Measurement Method	Example	Strengths	Weaknesses	Suitability to measure adherence in stroke
			<ul style="list-style-type: none"> • Can have poor sensitivity and specificity 	
Pill counts	Physically counting the number of pills within patients' medication containers to calculate if the correct number have been taken since the prescription was picked up	<ul style="list-style-type: none"> • Objective • Quantifiable • Simple • Lower cost than measure of drug/metabolite in body fluids 	<ul style="list-style-type: none"> • Cannot directly infer medicine taking (patients can remove/bin pills prior to count) • Cannot identify patterns of non-adherence 	<p>-Stroke risk factor prevention medications are all tablets (pill counts appropriate)</p> <p>-Difficult to maintain for patients in community settings (labour intensive)</p>
Prescription refill rates	Checking the frequency for which a patient requests prescription to calculate if they are being refilled as frequently as expected	<ul style="list-style-type: none"> • Objective 	<ul style="list-style-type: none"> • Cannot directly infer medicine taking 	<p>-Feasible for stroke patients in multiple settings</p>

Measurement Method	Example	Strengths	Weaknesses	Suitability to measure adherence in stroke
Clinician estimates	Clinician making estimates of adherence based on the information available e.g. the number of appointments made to get prescriptions & the number of repeat prescriptions requested	<ul style="list-style-type: none"> • Cheap 	<ul style="list-style-type: none"> • Relies on information gathering from patient (subject to social desirability bias/miss-remembering) 	<ul style="list-style-type: none"> -Medicines for stroke risk factor control can be picked up via repeat prescription systems/delivered directly to patient by pharmacy, bypassing GP appointments/ direct contact with pharmacist
Use of electronic medication monitors (e.g. MEMS)	Gathering data from an electronic monitoring system, e.g. a MEMS, which provides information on when the bottle is opened	<ul style="list-style-type: none"> • Quantifiable • Tracks patterns of medicine taking i.e. were medications taken at right time intervals 	<ul style="list-style-type: none"> • Expensive • Data needs to be downloaded • Cannot directly infer medicine taking 	<ul style="list-style-type: none"> -Stroke risk factor medicines are tablets-appropriate to use MEMS -Implementable in community settings -Difficult to use if patients received Dosette or blister packs from pharmacy -Could be used for short and long durations of time to monitor adherence & persistence
Diaries/self-completed records of adherence	Where patients are asked to record their adherence	<ul style="list-style-type: none"> • Tracks patterns of medicine taking 	<ul style="list-style-type: none"> • Subject to social desirability bias 	<ul style="list-style-type: none"> -Patients with dexterity issues/severe cognitive

Measurement Method	Example	Strengths	Weaknesses	Suitability to measure adherence in stroke
	i.e. record each time they take a set of medications in a diary	<ul style="list-style-type: none"> Not heavily reliant on memory compared to retrospective self-report 		<p>impairments may not be able to complete diaries (could require support from others to complete)</p> <p>-Practical to use in community settings</p> <p>-Would be able to assess adherence patterns daily and over time</p>

INR-International Normalised Ration; MEMS-Medication Events Monitoring Systems; MARS-Medication Adherence Report Scale

The choice of which measure to use is likely to rest on the practical considerations within the setting of intended use. For example, if medication adherence is going to be assessed in a low literacy sample, patient interview or monitoring of prescription refill rates might be better suited than filling in a questionnaire. Considerations will also need to be made with regards to how long medication adherence needs to be assessed for, the size of the sample and budget of the project.

Recommendations have been made to use multiple methods (Farmer, 1999; Osterberg & Blaschke 2005), but whether this is an effective strategy is debateable. Research employing several measures of adherence has found data difficult to synthesise. For example, Holzemer and colleagues (2006) conducted a randomised controlled trial (RCT) to test an intervention developed to support medication taking in those with human immunodeficiency virus (HIV) and acquired immune deficiency syndrome (AIDS) (Holzemer et al., 2006). The researchers compared and assessed five different medication adherence measures including self-report, pill counts and prescription refills. The results showed little correlation between the measures ($\phi=0.09$) and therefore made the results of the trial difficult to synthesise (Holzemer et al., 2006). The low correlations may be indicative that the measures each assess slightly different behaviours and thus this questions validity, at least for the sample included in the intervention. Use of several measurement methods, that are likely assessing different variations of non-adherence behaviour, also questions whether there was a clear definition of adherence and a clear primary outcome for this study. Results such as these

may indicate that it can be counterintuitive to use multiple measures. More recently, a study comparing three different measures (8-item Morisky Medication Adherence Scale, the 100-point Visual Analogue Scale (VAS) and medication refill adherence (MRA)), assessing warfarin medication adherence in 174 patients, found weak associations with the 8-item Morisky Medication Adherence Scale and both the VAS ($r=0.23$; $p=0.002$) and the MRA ($r=0.18$; $p=0.02$). No association was found between VAS and MRA values ($r= 0.08$; $p = 0.32$) (Wang, Kong, & Ko, 2013). However, as each of the measures assessed adherence over different time points (varying from 2 weeks to 3 months (where specified)) and likely assessed different variations of non-adherence behaviour, the results again demonstrate difficulties in using multiple methods of measurement to assess adherence.

2.3.3 Identifying the problems with non-adherence

Non-adherence can sometimes be a logical response of a patient to avoid unwanted side effects. However, sub-optimal adherence to any treatment is considered a public health concern, particularly in long-term conditions that often involve lifelong regimens of medications and other treatments. Within the healthcare system in the UK, medication prescription is one of the most common interventions. In England in 2015, 1,083.6 million prescription items were dispensed over the year (Health and Social Care information Centre, 2016a), costing a total of £9.27 billion (Health and Social Care information Centre, 2016b). Optimal use of these medications for the management of chronic conditions is therefore essential.

However, UK guidelines (pertaining to long-term health conditions) estimate that between 33-50% of all medications prescribed are not taken as recommended (Nunes et al., 2009). Other estimates, made previously by the WHO, found that rates of non-adherence were similar globally, reaching approximately 50% in developed countries and assumed to be greater in developing countries (WHO, 2003). The prevalence of medication adherence can be difficult to estimate, as there may be 'hidden problems'. For example, medication adherence often rests on a patient's own self-management of the condition. The patient will be responsible for: 1) initiating doctor appointments to get prescriptions; 2) applying for repeat prescriptions before the medication supply runs out; 3) either going to the pharmacy to pick up medications or arranging to have the medications delivered from there; and 4) taking the medication at the correct time, dose and frequency. As many of these processes often go unmonitored in day to day life, it may be quite easy for patients to not disclose their non-adherence and difficult for healthcare professionals to detect non-adherence (Horne, Weinman, Barber, Elliott, & Morgan, 2005). Despite this, it has been reported that adherence in long-term conditions declines after the first few months of treatment, usually at around 3-6 months (Cramer, Rosenheck, Kirk, Krol, & Krystal, 2003; Haynes, McDonald, & Garg, 2002; Osterberg & Blaschke 2005; Rodriguez, Carrier, & Wells, 2013; Yeaw, Benner, Walt, Sian, & Smith, 2009), which offers an insight into the most opportune time to intervene with adherence. For example, research focusing upon cardiovascular disease (CVD) patients (inclusive of those with stroke) has shown that approximately 25-50% of

patients, who are prescribed statins, stop taking them within six to twelve months. For those on a dual antiplatelet regimen, the discontinuation of clopidogrel has been observed to occur within one to three months of initiation in between 12-14% of patients, and increases to 20% of patients discontinuing at six months (e.g. Melloni et al., 2009; Pallares et al., 2009; Roy et al., 2009; Spertus et al., 2006).

This failure to translate advances of medicine into health gain for individual patients can be costly. Non-adherence to medication regimens can cost socially, economically and at an individual level. A report from the Health Economics Consortium and The School of Pharmacy University College London indicated that the cost of unused medications in 2009 was approximately £300 million in England alone (YHEC/School of Pharmacy, 2010). Poor clinical outcomes, additional medical or psychological complications, reduced patient quality of life and increasing sickness rates in workplaces (see WHO, 2003), are further examples of the consequences of non-adherence to medications.

2.3.4 Potential determinants of non-adherence

Behaviour change (such as improving medication adherence) will be key to improving the healthcare outcomes for many long-term conditions. In order to influence and change a behaviour, its determinants must be understood.

Epidemiological work has shown that there is great variety in the performance of behaviour. When considering medication adherence, it is clear that some

people take their medications more often than others and so identifying the underlying reasons for this variety can enhance understanding of the behaviour. Broad categorisations of these factors have been made, for example, intrinsic factors of an individual (e.g. socio-demographic factors, personality, cognitions) and extrinsic factors to the individual (e.g. incentivising structures such as taxing tobacco and legal structures such as banning substances or issuing fines for use) (Conner & Norman, 2015). The WHO have also suggested categorisation of determinants into five groups; Socio-economic factors, healthcare team and system related factors, condition related factors, therapy related factors and patient related factors (WHO, 2003).

Previously, over 200 variables have been identified as influential to medication adherence (Cameron, 1996; Vermeire, Hearnshaw, Van Royen, & Denekens, 2001). Most recently, a review of systematic reviews has attempted to identify determinants of medication adherence for a number of long-term conditions including diabetes, hypertension, cancer and psychiatric conditions. This review found 400 determinants related to long-term medication adherence (143 with positive influence; 155 with negative influence; 102 with neutral influence). Generally, determinants such as family and social support, social stigmatisation from a disease, poor access to healthcare, asymptomatic conditions, less favourable treatment regimens (e.g. high frequency of doses or long duration), and self-efficacy, were frequently reported to have influence on adherence across the 51 included reviews (Kardas, Lewek, & Matyjaszczyk, 2013). With systematic reviews,

results have to be interpreted with caution, taking into consideration the quality of included primary studies. In the case of reviews of reviews, this is also true, but consideration also has to be given to the quality of the systematic reviews that have been included (Hartling, Vandermeer, & Fernandes, 2014; Thomson, Russell, Becker, Klassen, & Hartling, 2010). In Kardes et al's (2013) review of reviews, no papers were excluded on the grounds of quality. The general consensus for a hierarchy of evidence begins with systematic reviews as highest quality and then moves through other forms of evidence synthesis, RCTs, cohort studies and case-controlled studies, with expert consensus viewed to be of lowest quality (e.g. Burns, Rohrich, & Chung, 2011). Of course, this is often a pragmatic decision to ensure that as much data as available can be reviewed. However, it does mean that the poorer quality studies could have skewed the overall conclusions, with many of the included studies deemed to have poorer designs, unclear definitions of adherence and lacking quantitative data of the magnitude of the relationships between determinant and adherence. Despite the large numbers of determinants identified as influential to medication adherence, it has been consistently reported that demographic variables such as gender and marital status have limited or no influence on medication adherence (Horne et al., 2005; Kardas et al., 2013).

The literature will often conceptualise and categorise determinants of adherence into intentional and unintentional factors. Intentional non-adherence implies that a patient makes a conscious decision not to adhere to the agreed recommendations. For example, the choice not to take a

medication may be due to not wanting to experience unpleasant side effects any longer, or not perceiving a need to take the medication as there is no evidence of condition improvement. This type of non-adherence is a good demonstration of the important influence patient beliefs and understanding have on medication adherence. Unintentional non-adherence is less clearly defined, but is considered to be the result of a passive process, less associated with beliefs and cognitions of a person, and often as a result of forgetting to take the medications, for example (Lehane & McCarthy, 2007; Lowry, Dudley, Oddone, & Bosworth, 2005; Wroe, 2002). This could be due to poorer cognitive abilities (such as executive functioning deficits (caused by conditions such as dementia)), poorer physical abilities (such as poor limb functioning or dexterity preventing the ability to physically take medications) or poorer economic abilities (such as financial constraints) (Horne, Clatworthy, Polmear, & Weinman, 2001).

Whilst classification of determinants as intentional and unintentional is now widely used, some variables are difficult to classify in this way. For example, a person may lack the financial means to purchase the medication prescribed. This could be categorised as unintentional non-adherence (as the financial barrier prevents the person from buying the medicine) or intentional non-adherence (as the person may be choosing to spend their money on something different to the medicine) (Jackson, Eliasson, Barber, & Weinman, 2014).

For this thesis, it might be more helpful to consider determinants of adherence in terms of how amenable to change they are; that is whether they are modifiable or not modifiable. Whilst it might be important to acknowledge the influence that non-modifiable determinants, such as age, have on behaviour, this information will not assist in the development of interventions to change the behaviour. Therefore, the identification of modifiable determinants, such as concerns about medication side effects, will better inform intervention development and be more beneficial overall in addressing patient needs, health outcomes and cost-effectiveness.

2.4 Medication adherence in stroke survivors

As previously discussed, the prescription of medications comes with the inherent problem of adherence. Stroke is no exception. Stroke, along with many other long-term conditions, presents further complication when considering non-adherence. Stroke is, from the moment of diagnosis, a long-term condition and the risk factor control, whether initiated prior to stroke or following the event, is lifelong. Furthermore, stroke risk factors are asymptomatic, exhibiting no tangible reminder to take the medications prescribed.

Consistently, up to one third of stroke survivors are non-adherent to their medications for stroke risk factor control, recently reported in a meta-analytic review (Al Aishaikh, Quinn, Dunn, Walters, & Dawson, 2016). Below Table 2 displays the medications typically prescribed for secondary stroke risk factor

control along with indications for prescription and common side effects. The table also presents the relevant clinical guidelines and percentage of stroke survivors not adhering to these medications reported in the literature. As with other long-term conditions, adherence is a dynamic and shifting process with patients exhibiting varying levels of adherence throughout their long-term condition. Consistent with other long-term conditions, adherence has been found to decline in this cohort at around three to six months and continues to decline over a 24 month period (Brown & Bussell, 2011; Glader, Sjölander, Eriksson, & Lundberg, 2010). Evidently, this has quite pronounced implications for the secondary prevention of stroke. Research should focus on better understanding this behaviour and identifying the potential barriers and facilitators to improving adherence. This is one of the key aims of this thesis.

Table 2. Table presenting secondary stroke risk factor control medications, clinical guidance and adherence rates

Medication Group (with examples)	Medication Indication and Common Side Effects ¹	Clinical Guidelines ¹	Percentage of Non-adherent Stroke Survivors Reported in Previous Literature ²
Antihypertensive agents			
Angiotensin-converting enzyme inhibitor	Offered to those <80years old with stage 1 hypertension with one or more of following: target organ damage, established cardiovascular disease, renal disease, diabetes, a 10-year cardiovascular risk equivalent to 20% or greater. Offered to those of any age with stage 32 hypertension <i>Indicators:</i> Prescribed to people aged under 55 with either stage 1 hypertension (& one or more of following: target organ damage, established cardiovascular disease, renal disease, diabetes, a 10-year cardiovascular risk equivalent to 20% or greater) or with stage 2 hypertension. <i>Side effects:</i> E.g. Cough, increased blood-potassium level (hyperkalemia), fatigue, dizziness, headaches, loss of taste	BNF (by NICE) – Management of Stroke (2018) NICE-Clinical Knowledge Summaries – Stroke and TIA (2017) National Clinical Guidelines for Stroke _ Royal College of Physicians (2016) NICE guidance-CG127 (2011)	24-32% across different antihypertensive agents (Khan et al 2010)
Long-acting calcium channel blocker	<i>Indicators:</i> Prescribed to people aged over 55 years & those with an ethnicity of black African or Caribbean origin of any age, with either stage 1 hypertension (& one or more of following: target organ damage, established cardiovascular disease, renal disease, diabetes, a 10-year cardiovascular risk equivalent to 20% or greater) or with stage 2 hypertension. <i>Side effects:</i> E.g. Constipation, headache, palpitations, dizziness, rash, drowsiness, flushing, nausea.		

¹ References accessed for guidelines and to identify indicators/common side effects: (MedicineNet, 2018; MFMER, 2018a, 2018b; NHS 24, 2018; NHS, 2018a, 2018b, 2018c; NICE, 2008b, 2011, 2014b, 2016, 2017, 2018; RCP, 2016)

² Reference accessed for percentage of stroke survivors' non-adherence: (Hamann, Weimar, Glahn, Busse, & Diener, 2003; Khan, Yun, Humphries, & Kapral, 2010; Luger et al., 2015; Sjölander, Eriksson, & Glader, 2016)

Medication Group (with examples)	Medication Indication and Common Side Effects ¹	Clinical Guidelines ¹	Percentage of Non-adherent Stroke Survivors Reported in Previous Literature ²
Thiazide-like diuretic	<p><i>Indicators:</i> Prescribe when a calcium channel blocker is not suitable, for example because of oedema or intolerance, or if there is evidence of heart failure or a high risk of heart failure</p> <p><i>Side effects:</i> E.g. dizziness and light-headedness, blurred vision, loss of appetite, itching, stomach upset, headache, weakness.</p>		
Beta-blockers	<p><i>Indicators:</i> Not preferred initial therapy. May be considered for women of child-bearing potential, or people with evidence of increased sympathetic drive and in younger people, particularly when ACE inhibitors and angiotensin II receptor antagonists are not tolerated or contraindicated.</p> <p><i>Side effects:</i> E.g. dizziness, tiredness, blurred vision, cold hands and feet, slow heartbeat, diarrhoea and nausea</p>		
Antiplatelet Agents			
Clodidogrel	<p><i>Indication:</i> Prescribed following ischaemic stroke.</p> <p><i>Side Effects:</i> E.g. headaches or dizziness, nausea, diarrhoea or constipation, indigestion (dyspepsia), stomach ache or abdominal pain, nosebleeds, increased bleeding (slower blood clotting) or easy bruising</p>	BNF (by NICE) – Management of Stroke (2018) NICE-Clinical Knowledge Summaries – Stroke and TIA (2017)	16-38% across different antiplatelet agents (Haman et al 2003)
Dipyridamole	<p><i>Indication:</i> Prescribed if clodidogrel and aspirin are contraindicated/cannot be tolerated.</p> <p><i>Side Effects:</i> E.g. nausea, diarrhoea and vomiting, headaches, dizziness, feeling hot and flushed</p>	National Clinical Guidelines for Stroke _ Royal College of Physicians (2016)	
Aspirin	<p><i>Indication:</i> Prescribed to people with acute stroke who have had a diagnosis of primary intracerebral haemorrhage excluded by brain imaging. Prescribed if clodidogrel and dipyridamole are contraindicated/cannot be tolerated.</p> <p><i>Side Effects:</i> E.g. mild indigestion, increased bleeding (slower blood clotting), nosebleeds or easy bruising</p>	NICE guidance- CG68 (2008)	

Medication Group (with examples)	Medication Indication and Common Side Effects ¹	Clinical Guidelines ¹	Percentage of Non-adherent Stroke Survivors Reported in Previous Literature ²
Anticoagulant Agents			
Adjusted-dose warfarin	<i>Indication:</i> Prescribed following ischaemic stroke or TIA and paroxysmal, persistent or permanent atrial fibrillation or atrial flutter <i>Side Effects:</i> E.g. increased bleeding (slower blood clotting), skin rashes, hair loss	BNF (by NICE) – Management of Stroke (2018) NICE-Clinical Knowledge Summaries – Stroke and TIA (2017)	19-25% across different oral anticoagulation agents (Haman et al 2003; Lugar et al 2015)
Direct thrombin/ Factor Xa inhibitor	<i>Indication:</i> Prescribed following ischaemic stroke or TIA and paroxysmal, persistent or permanent for people with non-valvular atrial fibrillation or atrial flutter <i>Side Effects:</i> E.g. nausea, vomiting, diarrhoea, constipation, dyspepsia, abdominal pain, hypotension, dizziness, headache, renal impairment, bleeding, bruising, pain in extremities, pruritus, rash, anaemia, nose bleeds.	National Clinical Guidelines for Stroke _ Royal College of Physicians (2016) NICE-Clinical Knowledge Summaries – Anticoagulation-Oral (2016)	
Lipid Modification Agents			
Statins	<i>Indication:</i> Prescribed in people with cardiovascular disease with atorvastatin 80 mg. Prescribe unless contraindicated. Aims to reduce non-HDL cholesterol by more than 40%. <i>Side Effects:</i> E.g. nosebleeds, sore throat, non-allergic rhinitis, headache, nausea, constipation diarrhoea, indigestion, muscle and joint pain, hyperglycaemia	BNF (by NICE) – Management of Stroke (2018) NICE-Clinical Knowledge Summaries – Stroke and TIA (2017) National Clinical Guidelines for Stroke _ Royal College of Physicians (2016) NICE guidance-CG181 (2014)	26% (Sjolander et al 2016)

2.4.1 Determinants of medication adherence in stroke survivors

To date, there has been much research exploring factors that influence adherence in stroke survivors and reasons for sub-optimal adherence. The majority of this evidence is derived from primary studies, both qualitative and quantitative (e.g. Bauler et al., 2014; Boan et al., 2014; Chambers et al., 2011; O'Carroll et al., 2011). Most recently, a systematic review and meta-analysis was conducted by Al AlShaikh and colleagues (2016) to identify factors predictive of non-adherence to secondary preventative medications after stroke. They classified factors according to the WHO (2003) classification, outlined above in section 2.3.4. Factors such as, education and employment status, smoking, alcohol consumption, reduced cognitive function, disability, cost of medication and the sub-type of stroke, were found to influence medication adherence in stroke survivors. These factors were often identified in multiple papers included in the review. There were some key methodological limitations of this review, including not having two full text reviewers, something advocated by Cochrane guidance to ensure better rigour and reduction of bias (Higgins & Green, 2011), and not contacting authors for missing or additional information. As such, this missing data may have skewed conclusions drawn from this review. Results for the meta-analysis (assessing the effect of factors on medication adherence) should also be interpreted with caution, as the analysed studies utilised different methods of measuring adherence. As discussed above in section 2.3.2, different measures of adherence can measure different aspects of adherence behaviour. This can make it more difficult to draw confident conclusions from the data.

Since Al AlShaikh and colleagues (2016) review, further primary studies have been published exploring determinants of medication adherence in stroke survivors. For example, Wei et al. (2017) conducted a cross-sectional, questionnaire based study to assess the influence beliefs about medicines can have on adherence in stroke, diabetes and rheumatoid arthritis patients. Across this sample, non-adherence was found to be associated with having higher concerns about medicines (OR=1.35 [95%CI 1.07 to 1.71]) and a belief of being personally sensitive to the effects of medications (OR=1.44 [95%CI 1.16 to 1.85]) (Wei et al., 2017). However, as this was a cross-sectional study, as opposed to a prospective study design, the effect of these beliefs on medication adherence over time cannot be determined from the results here.

At the time this PhD commenced (in 2014), there had been no known systemic reviews focused on determinants of medication adherence in stroke survivors. As such, the first key objective of this thesis was to conduct a systematic review, which is presented in Chapter 4. Although Al AlShaikh and colleagues (2016) published their systematic review during this time, the review presented in this thesis has some key strengths and differences. For example, Al AlShaikh and colleagues (2016) utilised the WHO classification to categorise influences on adherence (WHO, 2003). In this thesis, a different approach to categorisation (applying the Theoretical Domains Framework (TDF) (Cane, O'Connor, & Michie, 2012)) was undertaken, which may have yielded different insights and implications for intervention development. In addition, whilst previous literature (including Al AlShaikh et al's. (2016) review)

has found many potential underlying determinants of medication adherence in stroke survivors, the identification of factors less amenable to change, such as younger age, does not provide researchers with strong foundations for a behaviour change intervention development. Therefore, the systematic review conducted for this thesis focused on psychological determinants, as these were considered to be more modifiable. Previous work has infrequently been linked to behavioural theory. Considering identified determinants within the context of a theory (in this thesis the TDF) can not only enhance understanding of a behaviour, but it can also provide stronger foundations for evidence and theory driven intervention development. This will ensure that selected behaviour change techniques (BCTs) are more likely to target underlying determinants of the behaviour. BCTs are the active ingredients of an intervention. Through a Delphi exercise and open sort task, a consensually agreed, hierarchically structured taxonomy of 93 BCTs was developed: the BCT taxonomy version 1 (BCTTV1) (Michie et al., 2013), providing a consistent language to describe intervention components. In light of this, the systematic review conducted for this thesis was underpinned with a theoretical framework; The Theoretical Domains Framework (Cane et al., 2012) discussed in more detail in Chapter 3.

2.4.1.1 Interventions to improve medication adherence in stroke survivors

It is evident that medication adherence is sub-optimal in stroke survivors, despite the efficacy of these medications. Many attempts have been made to intervene, in an effort to improve medication adherence. For example, a

Cochrane review from 2014 identified 13 studies with interventions targeting medication adherence in stroke survivors (Lager et al., 2014). A more recent systematic review, published in 2017, identified a further 11 studies, in addition to seven of the studies included in the Cochrane review (Wessol, Russell, & Cheng, 2017). Both these reviews are discussed in more detail below. Unfortunately, the majority of interventions targeting medication adherence in stroke survivors have shown limited effectiveness (e.g. Lager et al., 2014). The complexity of measuring adherence and the variability in reasons identified for non-adherence are reflected in results from previous intervention studies.

The Cochrane review by Lager et al. (2014) collated RCTs testing interventions targeting stroke risk factor control, with 13 interventions targeting medication adherence for secondary prevention of stroke. Six interventions were categorised as educational and behavioural by the review authors, although these categories were not explicitly defined. Seven of the studies were categorised as organisational interventions, further broken down into six subcategories: revision of professional roles, collaboration between multidisciplinary teams, integrated care services, knowledge management systems, quality management and financial incentives. Findings indicated that there was disparity in the methods applied to measure adherence, including subjective and objective measures. This contributed to data heterogeneity and prevented meta-analysis in this review, a consistent issue in studies reporting on medication adherence. The majority of studies (12/13) reported no statistically significant difference in adherence outcome measures between

the intervention and control groups. Of these 12 studies, five reported use of theory to underpin the intervention (Lager et al., 2014). Only one study by O'Carroll and colleagues (O'Carroll, Chambers, Dennis, Sudlow, & Johnston, 2013) found statistically significant differences between adherence outcomes in the intervention and control groups. Sixty-two stroke and transient ischaemic attack (TIA) survivors were recruited and randomised into intervention (n=31) and control (n=31) groups. The intervention, informed by Leventhal's Theory of Self-Regulation, consisted of several elements. First, participants developed a coping plan for improving medication adherence, using the implementation intentions approach. After two weeks', barriers and mistaken beliefs were discussed, and the plan revised. Adherence to antihypertensive medications was followed for three months, measured via a MEMS and the Medication Adherence Report Scale (MARS). The results indicated that doses taken on schedule were significantly higher for the intervention group, measured by MEMS (mean difference of percentage of doses taken on schedule = 9.8 %; [95 % CI 0.2-16.2] p = 0.048). When adherence was measured via the MARS there was a significantly greater improvement in adherence for the intervention group (mean difference= 0.61; [95 % CI (0.1-1.2); p=0.027) (O'Carroll et al., 2013). The most notable concern is the small sample size, although this trial was powered to detect a medium effect of the intervention (with adherence measured by MEMS). As this was a pilot RCT a smaller sample size was acceptable and the results give encouraging evidence of the intervention effectiveness and feasibility.

Wessol and colleagues (2017) synthesised RCTs assessing interventions aiming to improve medication adherence in stroke survivors. Of the 18 studies identified, only five had statistically significant improvements in adherence outcomes, with reported effect sizes ranging from $d=0.08$ to $d=4.53$. Of those interventions, three were categorised by the authors of this review as 'cognitive/education and behavioural' and two as 'cognitive/education', with reported interventions including sessions to establish medicine-taking routines, education and case coordination, use of an automated short messaging service, use of standardised discharge orders/templates and pharmacist-led education (Wessol et al., 2017). Authors of this review did not state what was meant by the terms cognitive/educational and behavioural, and so it is difficult to be clear on what these categorisations would encompass. This presents a limitation with the review's utility to inform future intervention development. Three of the five interventions reporting significant effect on medication adherence outcomes used theory to underpin the intervention (including Leventhal's Self-Regulation Theory, the Health Belief Model with Social Cognitive Theory and Adult Learning Theory). All five studies had relatively poor external validity. None of the five studies (0/5) selected samples representative of the population they were derived from and only three studies (3/5) carried out the intervention in a setting representative of where and from whom patients would usually receive treatment from. Moreover, in terms of internal validity, only one (1/5) study attempted to blind the participants, only one (1/5) study attempted to blind those measuring the main outcomes and only one (1/5) study attempted to control for confounding variables in the analysis (Wessol et al., 2017). There was also insufficient

power for one (1/5) of the studies to detect a significant effect on adherence outcomes. Thirteen interventions in this review were found to have no statistically significant effect on medication adherence. Of these studies, seven did not report using a theory to underpin the intervention, a known recommendation in intervention development guidance (Craig et al., 2008). These 13 interventions were categorised by the authors of the review as 'Cognitive/education and behavioural' (8/13) and 'cognitive/education' (5/13), and described as delivering interventions such as self-management, self-care, motivational interviews, web-based education, peer-led workshops and intensive pharmacist case management (Wessol et al., 2017). This review again highlighted issues with varying methods to measure medication adherence, contributing to an inability to compare results across different studies, and synthesise the data quantitatively with meta-analysis.

A limitation of several of the current interventions developed is that they have either not clearly described or applied existing behaviour change theory to underpin the design. This is a step advocated by the Medical Research Council (MRC) framework for designing and evaluating complex interventions (Craig et al., 2008) and of the five studies reporting significant results described above, three reported using theory to support intervention design (Kamal et al., 2015; Nayeri, Mohammadi, Razi, & Kazemnejad, 2014; O'Carroll et al., 2013). Intervention ineffectiveness may also, in part, be due to the identification of factors that influence adherence, but are not amenable to change. Effective interventions described in the reviews above such as O'Carroll and colleagues (2013) (O'Carroll et al., 2013) and Nayeri and

colleagues (2014) (Nayeri et al., 2014) strengthen this assertion. These interventions targeted determinants more amenable to change, for example forgetfulness, by the use of implementation intentions and increasing knowledge of stroke, rehabilitation, diet and medications, through education underpinned by Adult Learning Theory.

2.5 Strategies to improve medication adherence in stroke survivors

There is a need to develop strategies that support and improve medication adherence in order to enhance healthcare delivery efficiency, to improve patient health outcomes, and to ensure that healthcare is targeting the needs of patients (Horne et al., 2005).

This thesis will attempt to fill this gap by systematically identifying modifiable determinants of medication adherence in stroke survivors, and linking these determinants to behaviour change theory in order to better understand adherence. This evidence will then underpin a systematic intervention development. Use of guidance for developing interventions, such as the Behaviour Change Wheel (BCW; Michie, Atkins, & West, 2014), which is underpinned by theory, enables evidence based selection of intervention components such as BCTs (Michie et al., 2013). A process of identifying underlying, modifiable determinants of a behaviour, as well as using theory and a systematic process of evidence-based selection of BCTs will allow for a more targeted intervention development. This will ensure that the known

influences of a behaviour are being directly targeted by components embedded within an intervention, which should enhance effectiveness.

To my knowledge, this thesis will be the first to employ the Theoretical Domains Framework (TDF; discussed in more detail in Chapter 3) and the BCW (described in more detail in Chapter 5) in order to develop an intervention aimed at improving medication adherence in stroke survivors.

3 Chapter 3: Selecting a Theoretical Framework to Understand Medication Adherence and Enhance Intervention Development

3.1 Chapter overview

The purpose of this chapter is to outline the theoretical framework that will underpin this thesis. This chapter will firstly summarise the behaviour of medication adherence in context. Then, the relevance of a theoretical framework to understanding medication adherence will be outlined, along with a discussion of several theories of health behaviour. The final part of this chapter will justify the rationale behind choosing the selected theoretical framework and how it will be used in this thesis.

3.2 Understanding the behaviour of medication adherence

Before discussing the theoretical framework that will underpin this thesis, it is important to outline the key aspects of the behaviour of interest in context, which for this thesis is medication adherence in stroke survivors.

The definition of medication adherence that is being applied in this thesis is: “the extent to which the patient's action matches the agreed recommendations” (Nunes et al., 2009pp. 3) (discussed in more detail in Chapter 2, Section 2.3.1). There are a number of behavioural steps that need to be taken in order to be successful at medication adherence. For example, a

person must: 1) obtain a prescription from a doctor; 2) collect the prescription (or arrange collection/delivery of the prescription) and; 3) take the medication at prescribed times and doses. These steps are essentially 'sub-behaviours' that someone has to complete in order to demonstrate optimal medication adherence. For this thesis, the 'sub-behaviour' of focus is step 3 – taking the medication at prescribed times and doses.

Individual, social, economic and system factors all have influence on medication adherence. For instance, medications can elicit unwanted side effects, purchasing of prescriptions can be costly, it can be difficult to arrange appointments with doctors or to access local pharmacies and people may feel that they lack the time to take medications. In addition, there are personal consequences such as the identification as being someone who is ill or has a health condition. With newer definitions of medication adherence, as opposed to compliance, being widely accepted in healthcare, a more collaborative approach should be taking place between prescriber and patient when recommending the use of medications prescribed for the prevention of stroke (see Chapter 2, section 2.3.1 for more details). This process offers opportunities for patients to view medicine taking as a choice (alone/with doctor) and feel more empowered to make a decision about taking the medication.

When considering the myriad of factors that can influence medication adherence, it may not be surprising that medication adherence in stroke

survivors is sometimes sub-optimal, with up to a third of stroke survivors being non-adherent (Al AIShaikh et al., 2016). Gathering an understanding of why patients adhere or do not adhere to medications for stroke prevention is important, particularly given the efficacy of these medications to reduce risk of future stroke (see chapter 2). It is also important to understand the different factors that influence a patient's decision or ability to adhere to their medications or not. The use of behaviour change theory facilitates improved understanding of a behaviour and assists identification of barriers and enablers to a behaviour being performed.

3.3 Why use a theoretical framework?

The overarching objective of this thesis is to change medication adherence in stroke survivors. To do this, the underlying mechanisms of action through which the behaviour (medication adherence) will change need to be understood. Theories of behaviour change assist in this process.

Theory has been defined previously as:

“A set of interrelated concepts, definitions, and propositions that present a systematic view of events or situations by specifying relationships between the variables in order to explain and predict events or situations”

(Glanz, Rimer, & Viswanath, 2008 pp. 26)

And has been more recently defined as:

“A set of concepts and/or statements with specification of how phenomena relate to each other” providing “an organising description of a system that accounts for what is known, and explains and predicts phenomena”

(Davis, Campbell, Hildon, Hobbs, & Michie, 2015 pp. 327)

These definitions suggest that a theory of health behaviour should identify the constructs that explain behaviour and the inter-relationships between these constructs. These definitions also imply that the relationships between constructs can vary across different contexts, behaviours, time-points and populations.

Therefore, theory enables a researcher to search for underlying reasons why a behaviour is not being performed, despite public health and medical advice (Glanz et al., 2008). It has been advocated that, in order to change behaviour successfully through intervention, the application of a theoretical framework and evidence base is essential (Craig et al., 2008; Michie et al., 2014). This ability to understand or explain behaviour allows for more targeted intervention that specifically focuses on influencing the underlying determinants of that behaviour, specified by the theory. Also, much innovative work has recently taken place to link theoretical constructs to behaviour change techniques (BCTs), which are the active ingredients in interventions (Michie et al., 2013). This is important in this thesis, as one of the key research aims is to identify the underlying determinants of medication adherence in stroke survivors in order to inform intervention development.

It seems appropriate, therefore, to utilise behaviour change theories that can investigate and start to explain medication adherence. This will enhance the ability to find novel solutions to sub-optimal medication adherence. It is a well understood concept that health behaviour change is difficult to achieve and difficult to maintain (e.g. Middleton, Anton, & Perri, 2013). Application of a behaviour change theory offers a systematic approach to understanding the determinants that influence medication adherence and act as mediators to behaviour change. Use of such theory and evidence in this thesis, will support development of an overview of how to change behaviour (medication adherence), population (stroke survivors) and context (within the National Health Service (NHS)) (Davis et al., 2015). This is also an important step recommended for behaviour change intervention development (Craig et al., 2008; Hardeman et al., 2005), as barriers and enablers to behaviour specified by theories can be appropriately identified and targeted by intervention (Davis et al., 2015; Hardeman et al., 2005; Michie & Abraham, 2004; Michie, Johnston, Francis, Hardeman, & Eccles, 2008). The component BCTs within an intervention can be selected, operationalised and tailored to target the predictors of behaviour identified in the relevant theory (Davis et al., 2015; Michie et al., 2008; Michie & Prestwich, 2010; Rothman, 2004).

The next section will explore which theories best lend themselves to enhancing understanding of medication adherence in stroke survivors.

3.4 Selection of a theoretical framework

Within disciplines such as health psychology, the Biopsychosocial Model is often applied to consider healthcare. It not only encompasses the biomedical model stance (that biological processes have an impact on health) but also considers psychological and social factors that can influence health behaviours. Within medication adherence literature, it has been found that determinants such as age and gender have little influence on behaviour (e.g. Al AlShaikh et al., 2016; Kardas et al., 2013). These determinants are relatively unmodifiable, offering little scope for intervention. Therefore, it seems pertinent to focus on determinants that could be considered more amenable to change, utilising a more holistic approach to understanding and changing behaviour.

Theories and model of health behaviour have been applied to understand and predict health behaviour (Conner & Norman, 2015). That is to say that these models can support understanding of what influences someone to perform or not perform a behaviour. The identification of such influences forms the first step in developing better interventions to change health behaviours, promoting improvement to health and wellbeing at individual and population levels (Conner & Norman, 2015). It is understood that there is considerable variation in the performance of behaviour between individuals (Conner & Norman, 2015). Numerous factors could be attributed to this variation in behavioural performance, such as sociodemographic variables and a person's prior experiences or cognitive abilities, but some factors will be more

amenable to change. Many of the existing, widely used models focus predominantly on cognitive, reflective determinants of behaviour, firstly because health cognitions are considered to be important determinants of behaviour that mediate the effect of other determinants and secondly, the influences are considered more modifiable (Conner & Norman, 2015). However, it has been argued that insufficient attention has been paid to impulsive or more automatic processes, that may be stronger influences of behaviour (Hagger, 2016; Hollands, Marteau, & Fletcher, 2016; Marteau, 2018). As individuals can still engage in health-harming behaviours, even when fully informed about the risks and consequence, it could be reasoned that these behaviours are not solely driven by reflective, deliberative processes and instead occur as a response to environmental cues without necessary representation of the consequences (Hollands et al., 2016). As such, this thesis will be taking a holistic approach to identifying determinants of medication adherence and utilising theory to facilitate this.

3.4.1 Models of determinants of behaviour

Currently, there is no single theory predominantly used to understand health behaviours, inclusive of medication adherence. In a recent review carried out by psychologists, sociologists, anthropologists and economists, 83 theories of behaviour and behaviour change were identified (Davis et al., 2015; Michie, West, Campbell, Brown, & Gainforth, 2014). This presents a challenge for those wanting to intervene and change health behaviours, as it can be unclear which theory is most appropriate. In spite of this, there are notable trends in

the literature for a range of health conditions in theory use (Glanz et al., 2008; Painter, Borba, Hynes, Mays, & Glanz, 2008). In a systematic review, the application of behavioural models to the prediction of adherence to medications was appraised, providing a 20 year critical assessment of empirical evidence of determinants of medication adherence (Holmes, Hughes, & Morrison, 2014). The Health Belief Model (HBM), self-regulation models, and the Theory of Planned Behaviour (TPB) were most frequently employed (Holmes et al., 2014). In another review (Patton, Hughes, Cadogan, & Ryan, 2017) interventions developed to address poor adherence in older adults with multi-morbidity were reported. The most frequently used models were: Social Cognitive Theory (SCT), HBM, the Transtheoretical Model (TTM) and self-regulation model. Therefore, the models discussed below have been selected based upon these two systematic reviews (Holmes et al., 2014; Patton et al., 2017).

3.4.2 The Health Belief Model

One of the most widely known models in health psychology is the Health Belief Model (HBM) (Janz & Becker, 1984; Rosenstock, 1966). This model primarily focuses on predicting behaviours at one time point, and has been frequently used in research due to the wide applicability to a range of different health behaviours (e.g. Armitage & Conner, 2000; Connor & Norman, 2015). Originally, self-efficacy (the ability of a person to be able to achieve a behaviour (Johnson, 2002)) had not been considered within the HBM, which was identified as a limitation by Rosenstock, Strecher, and Becker (1988)

(Rosenstock, Strecher, & Becker, 1988). There have since been several revisions (Janz & Becker, 1984; Rosenstock, 1974; Rosenstock, 1966) with each version aiming to predict the likelihood that a behaviour will occur as a result of core beliefs of an individual. In the most recent version of this model there are six identified core beliefs: *perceived susceptibility*, *perceived severity*, *perceived benefits*, *perceived barriers*, *health motivation* and *cues to action*. These core beliefs are not only intended to predict behavioural outcomes independent of other components, but also combinations of the core beliefs are thought to enhance the likelihood that a desired behaviour will or will not be enacted.

Perceived susceptibility refers to a person's belief about the likelihood of contracting a condition. A person might be more inclined to adhere to anti-hypertensive medication following a stroke (understanding that high blood pressure can increase risk of stroke), as they feel more susceptible to having another stroke. *Perceived severity* refers to the seriousness of an illness, assessed by the emotional arousal the disease elicits and the analysis of the potential difficulties a particular health condition might create. For example, a person might make comparisons between illnesses to identify severity, such that a cold is seen as very low severity but stroke is seen to be extremely severe. Both these constructs have a strong reliance on cognition and the knowledge a person holds (Rosenstock, 1974). These two core beliefs, when considered in combination, form perceived threat. One of the underlying assumptions of the HBM is that a person's behaviours will be contingent on the perceived threat of an illness, unique to each individual (Johnson, 2002).

Perceived benefits refer to a person's beliefs about the benefits to taking action, not the objective analysis of the benefits to taking action (Abraham & Sheeran, 2015). An individual will assess the possible courses of action available to them and consider the effectiveness and benefits of each (i.e. does it reduce symptoms or risk of an illness). For example, if an individual has suffered a stroke and is asked to take aspirin indefinitely to reduce the risk of stroke recurrence, they may believe that aspirin is effective and thus perceive the benefits of taking the medication (reducing the risk of recurrent stroke) as high. In contrast, an individual may feel that whilst taking aspirin will undoubtedly reduce the risk of stroke, the cost of the medication and the impact to daily routine (needing to remember to obtain and take the medication) outweighs the medication benefits, leading to avoidance of the behaviour. This provides an example of the *perceived barriers* to performing behaviour. Together, *perceived barriers* and *perceived benefits* formulate a type of cost-benefit analysis that an individual may undertake to assess a health situation.

In the HBM, an individual's *health motivation* is their "readiness to be concerned about a health matter" (Abraham & Sheeran, 2015 pp. 31). Ultimately, health motivation represents the point in time at which someone is ready to be concerned and accept they have, or are at risk of, a health condition, for example a person's readiness to accept their risk of future stroke. *Cues to action* refers to a cue or trigger to take suitable action. This cue can be internal (perceiving symptoms) or external (input from family or

media sources). A person may choose to be adherent to their anti-hypertensive medications when they see a news article informing them of new research suggesting the importance of being fully adherent to a medication regimen. However, it is noteworthy that broad definitions given to *health motivation* and *cues to action* have been criticised as making the constructs difficult to operationalise. Thus, the constructs could be presenting different modifiable psychological factors contingent on population, context and behaviour patterns (Abraham & Sheeran, 2015). Figure 1 provides a visual representation of how the HBM can be used to predict medication adherence.

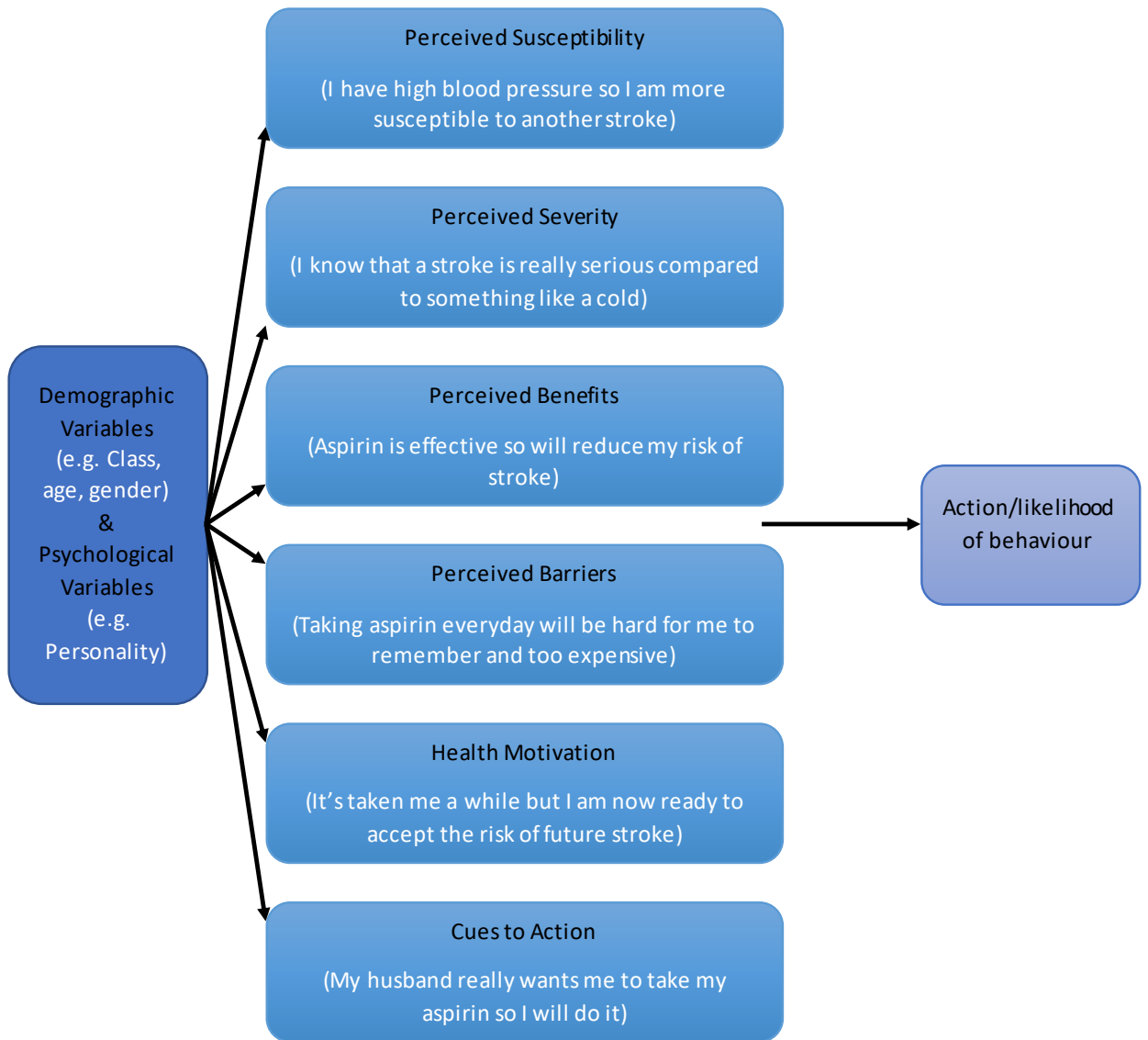


Figure 1 The Health Belief Model to explain medication adherence. Adapted from Ogden (2007).

3.4.2.1 Utility of the HBM for understanding medication adherence

Originally developed to help explain health promoting behaviours, the HBM has since been applied to a wide range of health conditions and utilised in the development of health behaviour change interventions (Jones, Smith, & Llewellyn, 2014). However, a vast majority of research utilising the HBM only focuses on four of the six core beliefs within the model; threat (perceived susceptibility and severity) and behavioural evaluation (perceived barriers and benefits), with health motivation and cues to action less scrutinised. A review of reviews by Abraham and Sheeran (2005) reported that effect sizes of the magnitude of the relationship between the four core beliefs and behaviour were often small despite statistical significance (Abraham & Sheeran, 2005). This is likely indicative of varying use of study designs, measures and applied operationalisations of theoretical constructs. Moreover, in reviewing 20 years of empirical literature focused on medication adherence interventions, Holmes and colleagues (2014) concurred that some constructs from the HBM appeared to have significant influence on adherence (perceived susceptibility, perceived barriers, perceived benefits and what they termed perceived adverse effects) (Holmes et al., 2014). The HBM was found to only explain a limited proportion of the variance in adherence, even if constructs were found to be significantly predictive of medication adherence. A meta-analysis would have been more powerful in ascertaining the utility of the HBM, however heterogeneity of data prevented this synthesis (Holmes et al., 2014). Variations in the operationalisation of theoretical constructs and varying methods applied in the reviews included papers prevented data being meta-analysed, reducing ability to infer a causal relationship between HBM

constructs and medication adherence. As the majority of studies included in this review were cross-sectional in design, this further limits the ability to infer causal relationships, because exposure and outcomes are simultaneously assessed, with no evidence of the temporal relationship. That is to say that this study design limits the ability to determine if, for example, perceived susceptibility influenced adherence or whether adherence influenced perceived susceptibility. In addition, methods of medication adherence measurement across papers was most frequently self-report. As discussed in Chapter 2, these methods can be subject to response bias (i.e. over-estimating adherence) impacting on the validity and confidence in overall findings.

In 2014, Jones, Smith and Llewellyn systematically reviewed the effectiveness of HBM based interventions targeting adherence. Fourteen studies (14/18) reported significant improvement in adherence. Effect sizes varied ($d=0.02-1.00$) and only seven studies showed modest to large effect sizes (Jones et al., 2014). However, the authors conclude that the success of the interventions studied were unrelated to HBM constructs (Jones et al., 2014), as studies often did not target all constructs of the HBM (with perceived susceptibility and benefits being the constructs most likely to be measured). Only five of the included studies in this review assessed health beliefs pre- and post- intervention to examine if they changed as a result of exposure to the intervention. All of these studies employed different measures to assess health beliefs and thus there was variation in the operationalisation of HBM constructs. Also, only one out of these five studies conducted path

analysis to examine which of the HBM constructs mediated the impact of the intervention on adherence, finding only perceived barriers mediated intervention impact on adherence. In addition, clear reporting of the intervention content (and thus a clear understanding of how theory was linked to intervention components) was not evident in the included papers of this review, thus making it difficult to ascertain whether interventions were successful due to the use of a HBM informed design.

In meta-analytic reviews establishing the statistical relationship between the HBM constructs and the prediction of behaviour, there have been varying results. Recently, Conn and colleagues (2016) undertook a meta-analysis of theory use in medication adherence interventions. The largest effect sizes (calculated as a standardised mean difference) were found for interventions based on the HBM ($d=0.477$), comparative to some of the other theoretical models identified in the review (Conn, Enriquez, Ruppap, & Chan, 2016). This is arguably a modest effect size. As the review did not closely examine the intervention content, it is possible that the theoretical constructs were operationalised differently across studies resulting in variation of BCT use, which could, in part, account for the modest effect size. Michie & Prestwich (2010) developed a method of assessing the extent to which interventions are theory based, deriving a Theory Coding Scheme (TSC) (Michie & Prestwich, 2010). The TSC codes: 1) whether a theory/model was mentioned. 2) utilisation of theories in intervention design, 3) how intervention evaluations tested theory and 4) implications of findings for theory development (Michie & Prestwich, 2010). Within Conn et al's. (2016) meta-analysis, the TCS was not

the approach used to operationalise theory and use of theory had not been explicitly operationalised by the reviewers. This may well contribute to the variation in effect sizes for “theory based” interventions. Therefore, limited operationalisation of theory use in the primary studies and meta-analysis by Conn and colleagues (2016) reduces the confidence to draw firm conclusion of the utility of the HBM from the findings.

3.4.3 The Theory of Planned Behaviour

The Theory of Planned Behaviour (TPB) (Ajzen, 1985, 1991) comprises of three constructs: *attitudes towards a behaviour*, *subjective norms* (an individual’s beliefs about their social world) and *perceived behavioural control*. The theory postulates that individuals process available information to form intentions, a proximal determinant of behaviour (Conner & Sparks, 2015). Intentions predict behaviour, and these intentions are determined (or predicted) by the three constructs (*attitudes towards a behaviour*, *subjective norms* and *perceived behavioural control*) (Michie et al., 2014). The TPB suggests that *attitudes towards a behaviour* and *subjective norms* do not directly influence behaviour, intention and *perceived behavioural control* are direct determinants of behaviour (Michie et al., 2014).

Attitude towards a behaviour refers to an individual’s beliefs about how favourable or unfavourable the outcomes of a behaviour are. For example, a person may perceive medicine taking to be favourable, as they can see the utility for their future health status.

Subjective norms refer to an individual's perceived social pressure to perform a behaviour and motivation to comply with these social norms. For example, stroke survivors may perceive that family members want them to take the prescribed medication for stroke risk factor control and may feel motivated to start taking the medications regularly.

Perceived behavioural control refers to an individual's understanding of how easy or difficult a behaviour will be to perform, influenced both by previous experiences and environmental and other obstacles. So, a stroke survivor, who has pre-existing medical conditions requiring medication, may feel that it is easy to take tablets on a daily basis and reflect on previous medication taking to affirm this view. It would be reasonable to assume, contingent on this model, that if attitudes and subjective norms towards a behaviour were positive, and reinforced by good *perceived behavioural control*, then the intention to perform a behaviour would be stronger (Ajzen, 1988). Ajzen (1988) makes a clear distinction from actual behavioural control and *perceived behavioural control*, where actual behavioural control is the real-life situation that will allow or inhibit a behavioural outcome and perceived behavioural control is the individual's belief about their ability to achieve a behavioural intention (Ajzen, 1988). The addition of this factor in the TPB, and Ajzen's understanding of *perceived behavioural control*, led to the hypothesis that *perceived behavioural control* can both directly and indirectly elicit action (Ajzen, 1991). The closer these two principles match up, the more likely that

intentions have less of a mediating role on a behavioural outcome, allowing *perceived behavioural control* to directly influence behavioural outcomes. If actual and *perceived behavioural control* do not match so closely, *subjective norms* and *attitudes towards a behaviour* (and how these affect intentions) will have a much greater bearing on behaviour. Figure 2 demonstrates the TPB constructs and interactions using medication adherence in stroke survivors as an example.

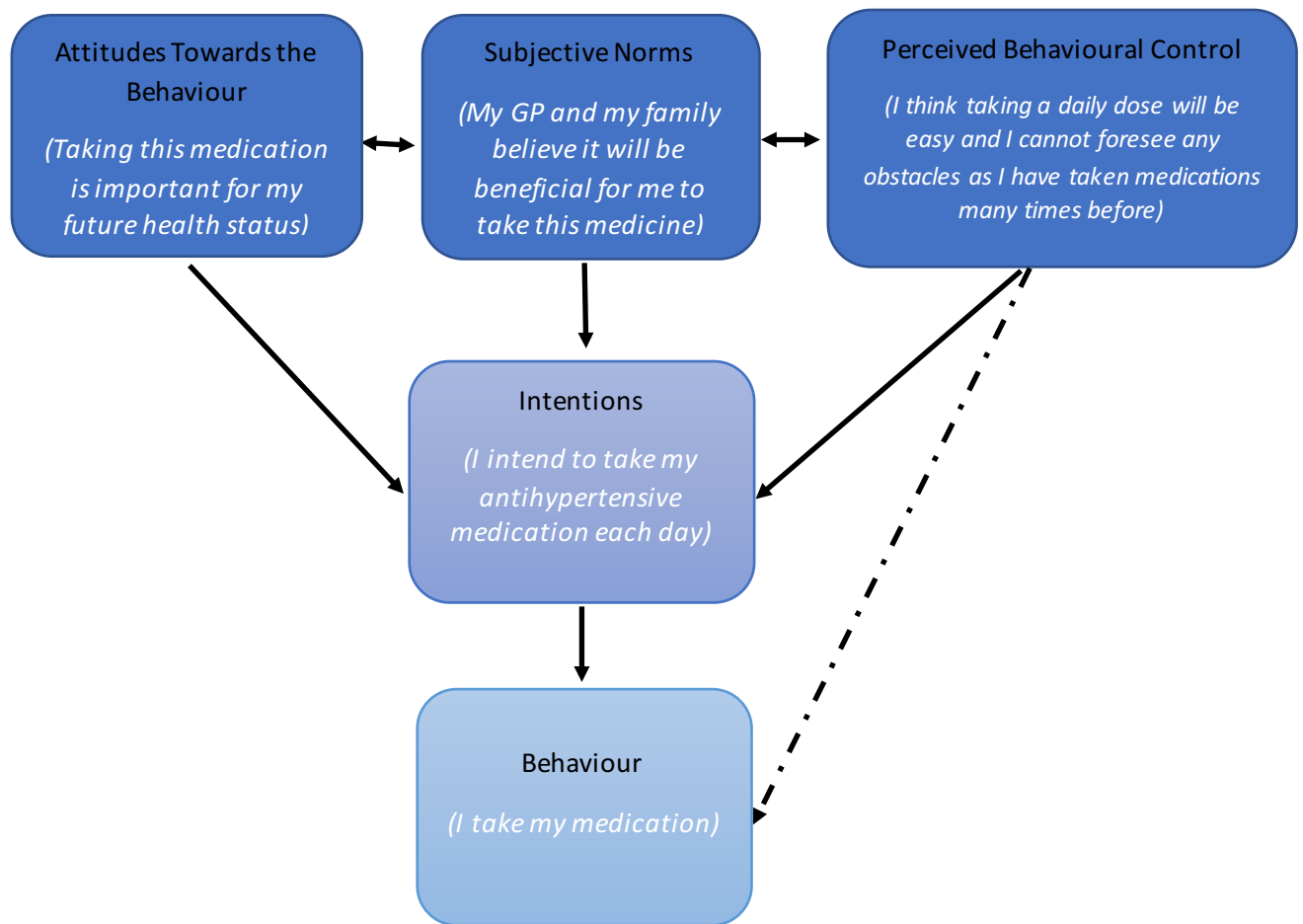


Figure 2 The Theory of Planned Behaviour to explain medication adherence. Adapted from Ajzen (1988).

3.4.3.1 Utility of the TPB in understanding medication adherence

The TPB has been applied to a wide range of health behaviours. This may be in part due to the clear operationalisation of theory constructs and guidance on how to measure, analyse and develop interventions using the TPB (McEachan, Conner, Taylor, & Lawton, 2011). However, the TPBs utility to underpin an intervention design is questionable. A robust meta-analysis

conducted by McEachan, Conner, Taylor and Lawton (2011) assessed the prospective prediction of health-related behaviours, using the TPB (McEachan et al., 2011). It was found that the TPB explained 19.3% and 44.3% of the variance in behaviour and intention respectively. Nonetheless, the efficacy of the TPB varied between different health behaviours (with safer sex, risk, abstinence and detection behaviours relatively poorly predicted (McEachan et al., 2011)). Intention showed the strongest relationship with prospective behaviour (calculated using the mean true score correlation), with a medium to large effect (mean $p=0.43$) (according to Cohen's classification (Cohen, 1992)). Attitudes and perceived behavioural control also showed medium sized relationships with behaviour (mean $p=0.31$ across both constructs (McEachan et al., 2011)). McEachan and colleague's (2011) meta-analysis examined prediction of health-related behaviour, using prospective tests of the TPB. From these findings, causation cannot be inferred between TPB constructs and behaviour. Moreover, behaviour was measured with a mixture of objective and self-report measures across studies included in the review. Analysis was conducted to assess the impact of type of measure on outcomes (physical activity), but there were substantially less objective measures (14) than self-report measures (91) that could be included in analysis. As discussed previously, self-report measures can present a number of limitations, with one of the most marked being response bias. Differences were found between objective and self-report measures, such that prediction of objectively measured behaviour for intention, perceived behavioural control and attitude was more modest than self-reported behaviour. Moreover, only 12.1% of the variance in objectively measured behaviour was predicted

compared to 25.7% of the variance in self-reported behaviour (McEachan et al., 2011).

There have been experimental studies conducted to assess the TPB, but most have failed to provide concrete support for the theoretical assumptions of the model (Sniehotta, Pesseau, & Araújo-Soares, 2014). For instance, a systematic review by Hardeman and colleagues (2002) reported that evidence was insufficient to draw conclusions about the utility of the TPB. From a total of 24 interventions identified, it was found that the TPB was not commonly used in the design of the intervention, rather to measure process and outcome variables or to predict intentions and behaviour (Hardeman et al., 2002). Although not consistently reported, only half the interventions appeared to influence intentions (with most studies reporting small to moderate effect sizes $d=0.2-0.5$, although two studies reported effect sizes $d>0.8$). Two-thirds of the interventions reported were effective at influencing behaviour change. However, only small effect sizes were reported from these interventional studies (Hardeman et al., 2002). This is the same issue reported across multiple reviews assessing the utility of the HBM. It is likely indicative again, that more transparent reporting of theory linkage to intervention components is needed, along with consistent follow up time frames and study design to allow for meta-analysis and assessment of pooled effect sizes.

More recently, a meta-analysis was conducted to assess the utility of TPB in predicting adherence to treatment (including medication) in chronic conditions (Rich, Brandes, Mullan, & Hagger, 2015). This review again found small to medium effect sizes (calculated using zero-order correlation coefficient (r)), particularly for the intention-behaviour relationship. Across 27 studies, encompassing 12 long-term conditions (including diabetes, heart disease, and hypertension), effect sizes between TPB component and adherence ranged from 0.22-0.51 (Rich et al., 2015). These effect sizes are generally lower than those reported in other meta-analyses (Armitage & Conner, 2001; McEachan et al., 2011). Path analysis indicated that attitudes ($\beta=0.20$; $p<0.001$), subjective norm ($\beta=0.16$; $P<0.001$) and perceived behavioural control ($\beta=0.39$; $P<0.001$) were statistically significant predictors of intention, which in turn was a statistically significant predictor of behaviour ($\beta=0.21$; $p<0.001$). Moreover, in this review the TPB accounted for 9% and 33% of the variance in adherence and intention respectively (Rich et al., 2015). These percentages were smaller than that reported by McEachan and colleagues for other health behaviours such as physical activity and safer sex. That being said, the considerable heterogeneity in data for this meta-analysis, as well as others, makes comparisons challenging. Heterogeneity in the pooled analysis suggests the presence of other moderator variables that have not been controlled for in analysis. There could also be inconsistencies of operationalisations of theory use in the interventions, varying methods of measurement (both self-report and objective) of behaviour and inclusion of study designs that do not allow inference of causation, all contributing to the heterogeneity. It is frequently advocated in literature supporting the use of

theory to underpin behaviour change intervention, that clear operationalisation of theory and rigorous study methods and reporting of results are employed to enhance future applicability of the findings (e.g. Craig et al., 2008; Michie & Prestwich, 2010; Prestwich et al., 2014).

From the evidence presented above, relationships between an individual's intentions and subsequent behaviours are indicated, although there are limitations to the research. The TPB does not clearly indicate how an intention formation is translated into an action i.e. how the motivation to engage in a behaviour becomes a performed behaviour. The lack of clarity on how a person moves from intention to behaviour can make it more challenging to develop interventions that target such theoretical determinants, and questions the utility of the TPB for this current intervention development. This is also a limitation with other theories of the determinants of behaviour such as the HBM. Recently, commentators have called in doubt the utility of TPB, presenting criticisms of validity and utility of the TPB as well as other historical critique of the theory (Sniehotta et al., 2014). Some of the key criticisms raised include: the TPBs focus on rational and deliberative influences of behaviour, as opposed to more unconscious ones (Sheeran, Gollwitzer, & Bargh, 2013; Sniehotta et al., 2014) and the limited predictive validity of the TPB. With the TPBs mediation assumptions contradicting evidence, it could be argued that the TPB does not support useful intervention development and does not lend itself to experimental tests (Sniehotta et al., 2014). Therefore, there could be substantial limitations to the utility of the TPB for the intervention development in this thesis.

3.4.4 Social Cognitive Theory

Social Cognitive Theory (SCT (Albert Bandura, 1986)), an expansion of Bandura's earlier Social Learning Theory (1977) (Bandura, 1977), proposes that personal factors, the environment and the behaviour all determine each other through inter-relation (Michie et al., 2014). The theory posits that a person's motivation and action are regulated through forethought (Luszczynska & Schwarzer, 2015). This is considered to be an anticipatory control mechanism which encompasses expectations regarding the outcomes of performing a behaviour (Luszczynska & Schwarzer, 2015). Below the central factors of the model will be outlined.

The two central determinants of behaviour in this theory are *perceived self-efficacy* and *outcome expectancies* (Luszczynska & Schwarzer, 2015). There are considered to be the four sources of *self-efficacy* (i.e. belief in a person's ability to complete a task with the desired outcome) (Michie et al., 2014) which are: previous experience, exposure to others success via modelling (for example), verbal encouragement from trusted sources or due to emotional arousal in a situation (Johnson, 2002). *Perceived self-efficacy* refers to a person's belief that they can perform an action in order to achieve a certain outcome. In terms of medication adherence, an individual may fully understand the rationale for taking medications, but may have the belief that they will be unable to adhere or remember the exact combinations of medications to take at prescribed times and doses. Thus, causing a barrier to adherence. *Self-efficacy* can be enhanced by personal mastery of a task,

where this accomplishment is internalised and able to be repeated. It can also be enhanced through vicarious experience, that is where a 'model' person (someone perceived to be similar to the individual) masters a difficult situation. The social comparison that takes place can increase *self-efficacy*. In addition, *self-efficacy* can be enhanced by verbal persuasion from others (such as family members reassuring a person that they are capable of taking their stroke medicines every day when required). Emotional arousal can also enhance or effect *self-efficacy*, whereby a person may feel no apprehension in undertaking a task (such as taking their medications every day), and thus feel capable of mastering it (Luszczynska & Schwarzer, 2015).

Outcome expectancies refer to a person's belief about the possible consequences of their actions. This construct can be considered across three categories of consequence: 1) areas of consequence (physical; social; self-evaluative), 2) short or long term consequences and, 3) positive or negative consequence. For instance, a person may believe that if they take the medications prescribed for stroke risk factor control, then they will be less likely to suffer a stroke in the future. In addition, SCT also encompasses goals and the perceived facilitators and impediments within socio-cultural factors.

This theory proposes that behaviour is directly predicted by *perceived self-efficacy* and *outcome expectancies*, but these constructs can indirectly influence goal setting and perceptions of socio-cultural factors (the barriers and opportunities that arise from health, economic, environmental and political

systems and living conditions (Bandura, 1997). In order to initiate a behaviour, individuals are seen to first form and then carry out a goal (Luszczynska & Schwarzer, 2015). *Outcome expectancies* is considered an important determinant in the initial formation of intentions (as it is unlikely someone would set a goal to perform a behaviour if they perceived substantial disadvantage, rather than advantage, to performing the behaviour). *Self-efficacy* beliefs also effect behaviour indirectly through the formation of foals, influencing the level of challenge people set in goals (Luszczynska & Schwarzer, 2015). Those with higher *perceived self-efficacy* will likely be more persistent in meeting goals set. Goal setting is also contingent on perceived sociocultural factors, with *self-efficacy* influencing whether individuals attend to opportunities within their sociocultural surroundings (Luszczynska & Schwarzer, 2015). See Figure 3 for a diagrammatic representation of the model with medication adherence as the example behaviour.

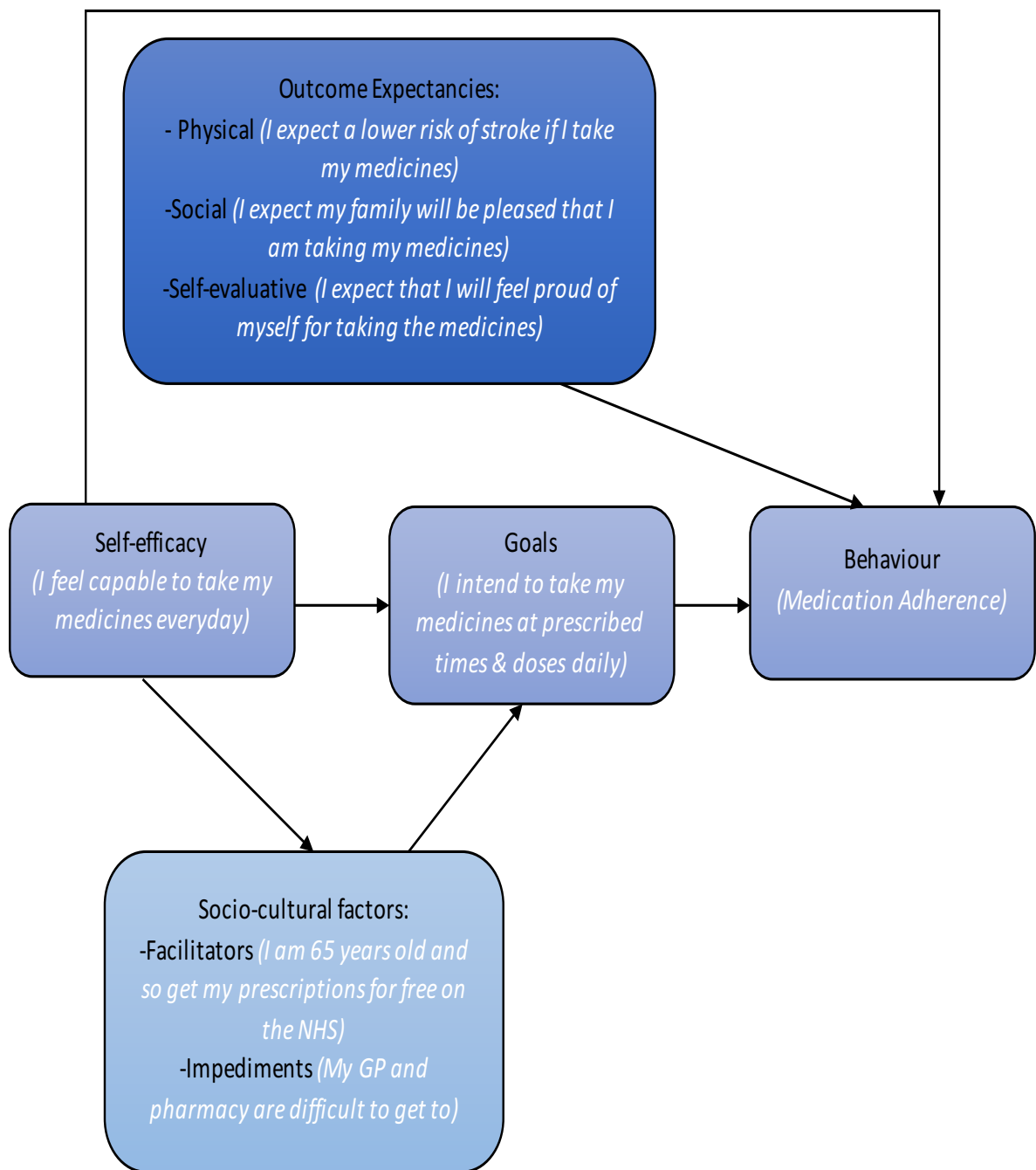


Figure 3 Social Cognitive Theory (SCT) to explain medication adherence. Adapted from Bandura (2000).

3.4.4.1 Utility of the SCT in understanding medication adherence

It may be pertinent at this point to ask, to what extent does SCT function as a complete, succinct and parsimonious theory of behaviour? A meta-analysis, conducted by Conn and colleagues (2016; also, presented above for assessing utility of the HBM), assessed theory use in medication adherence interventions. Analysis identified a small effect size for the influence of a SCT based intervention on medication adherence ($d=0.350$). Analysis for this review did not look at the effect size of individual model constructs on behaviour. The small effect size could be indicative that SCT is not able to provide a fully parsimonious theory of health behaviour, appropriate to apply for the intervention development in this thesis. However, as described in section 3.4.2.1, this review had a number of weaknesses, limiting its ability to fully test whether SCT-based interventions were more or less effective than those based on other theories.

Therefore, given the weakness of the evidence pertaining to SCT's influence on adherence, the discussion will broaden to tests of SCT in other behaviours. A meta-analysis conducted by Young et al (2014) aimed to identify the utility of SCT to explain physical activity. An effect was observed between SCT and physical activity ($R^2=0.31$ [95% CI 0.24-0.37]) (Young, Plotnikoff, Collins, Callister, & Morgan, 2014). Structured equation modelling and path models revealed that self-efficacy and goals were consistently associated with positive changes in physical activity, whereas outcome expectancies and sociocultural factors were not (Young et al., 2014). This casts doubt on the

parsimony of the theory as a whole, as not all constructs appear to have direct or indirect influence on the behaviour. Although moderator analysis was conducted to assess the effect study design (cross-sectional and longitudinal) had on outcomes, cross-sectional designs limit the ability to infer causation, as described earlier in this chapter. Furthermore, as with other reviews already discussed in this chapter, the primary studies included in the review utilised a mixture of self-report and objective measurements of behaviour, presenting limitations to the research. Self-report measures can cause elements of bias in measurement which can affect outcomes and limit the ability to draw firm conclusion.

Similarly, Stacey and colleagues (2015) conducted a meta-analysis to assess SCT based interventions to enhance physical activity and nutrition behaviours in cancer survivors. Overall, SCT based interventions produced a small, but significant, effect on physical activity (SMD=0.34, [95% CI 9.24-0.44]) (Stacey, James, Chapman, Courneya, & Lubans, 2015). Data heterogeneity prevented analysis of individual constructs effect on physical activity outcome. Self-efficacy was the most widely applied construct across all interventions, with two studies only targeting this construct (Stacey et al., 2015). It would be beneficial to identify, in further research, the contribution that each construct provides to the effectiveness of the intervention. This is a limitation of this review, and Conn et al's. (2016) meta-analysis (Conn, Enriquez, et al., 2016). However, both provide evidence to suggest that there may be a lack of parsimony in SCT and the utility of using the model as a whole is limited, with self-efficacy instead being the largest contributor to health behaviour change.

These reviews, support previous findings, where often only self-efficacy and outcome expectancies are tested in research claiming to assess SCT (Luszczynska & Schwarzer, 2015).

Overall, SCT is potentially insufficient to predict medication adherence. The limited parsimony currently identified of the theory as a whole, as well as varying levels of description of how theory use is operationalised in the interventions suggest that further research is needed to explore the utility of SCT and so this theory alone will not form the basis for the intervention development in this thesis.

3.4.5 The Transtheoretical Model

Continuum models, such as those presented above, suggests that individuals reside within a range or continuum reflecting the likelihood of action, with the aim of intervention to move a person along the continuum towards action (Schwarzer, 2008). A core assumption of these models is that behaviour is an outcome of intention. These models focus on identifying a series of parsimonious predictors that combine into a prediction equation to explain behavioural intention and behaviour change (Schwarzer, 2008).

In contrast, The Transtheoretical Model (TTM (e.g. Prochaska & DiClemente, 1983)) is an example of a stage model and has been utilised to explain a wealth of health behaviours including smoking (Prochaska & DiClemente,

1983; Sutton, 2015). Stage models differ in their assumptions from continuum models, such as the TPB. An integral assumption of a stage model is that different factors are influential at different stages. The transition between stages is the variable of interest and the constructs that are assumed to influence transition are the independent variables (Sutton, 2015). At the simplest level, stage theories assume that a person can transition from one discrete stage to the next in order, contingent on the magnitude of factors that affect transition. Stage models can be more complex however, whereby backwards transitions and movement to non-adjacent stages are possible (Sutton, 2015).

The TTM encompasses four constructs: *The stages of change*; *decisional balance* (weighing the pros and cons of a behaviour); *self-efficacy* (confidence and temptation); and the *process of change*. Within the *stages of change* there are five sub-stages (*pre-contemplation*, *contemplation*, *preparation*, *action* and *maintenance*), with a more recent sixth stage now added; *termination* (Sutton, 2015). Within these stages, individuals can dynamically move through stages, both forwards and backwards, until eventually a resulting behaviour change is elicited.

The other three constructs of this model (*decisional balance*, *self-efficacy* and *the process of change*) are the constructs assumed to influence transition between stages. *Decisional balance* refers to a person's perceived advantage or disadvantage to engaging in a behaviour; a form of cost-benefit analysis. A

person who is deciding whether or not to take antihypertensive medication may consider that taking the medication is advantageous as it has good health outcomes according to the health professional's advice, but disadvantageous as they will need to continually pay for the prescription and develop a new daily routine to take the medication. *Confidence* and *temptation* draw on Bandura's (1986) *self-efficacy* construct within the SCT (Bandura, 1986). The construct refers to a person's confidence to carry out a behaviour within a range of different daily situations. Temptation is referring to the temptation to engage in the unhealthy behaviour that could arise in any given situation (Luszczynska & Schwarzer, 2015). Finally, the *Process of Change* makes reference to the explicit or covert activities that an individual engages in to transition or regress from one stage to the next (Luszczynska & Schwarzer, 2015). These processes or activities that one engages in can be further considered as experimental (cognitive-affective) or behavioural as defined by the TTM originators; The Rhode Island Group (Luszczynska & Schwarzer, 2015; Prochaska & DiClemente, 1983). Briefly, a cognitive-affective process could be 'self-revaluation' for example, where a person chooses to make the new behaviour a part of their identity (e.g. 'I am a person with hypertension and therefore I take antihypertensive medication'). Whereas, a behavioural process could be 'helping relationships', where a person seeks or utilises social support to help the healthy behaviour change (e.g. 'if I get my wife to remind me to take my medications each day I am more likely to remember to take them').

Progression through stages is not always linear, as individuals may relapse (i.e. return to previous behavioural performance) and make multiple attempts to achieve behaviour change (Michie et al., 2014). The ten *processes of change* (presented in Table 3 below) facilitate movement through stages, with different process having more or less influence of movement between different stages (Michie et al., 2014). For example, experimental processes (such as *environmental re-evaluation*) often mediate movement across contemplation and preparation stages of change (Michie et al., 2014). *Decisional balance* also mediates movement between stages, most influential in the decision to move towards action, contingent on the pro-con assessments made by an individual (Michie et al., 2014). Finally, *self-efficacy* can also mediate transitions between stages, by influencing the use of *processes of change* between each stage (Michie et al., 2014).

A full description of the TTM, presented with the inter-relations of the model and with examples relevant to stroke are displayed in Table 3.

Table 3. Displaying the constructs of the TTM with descriptions, examples and proposed inter-relations.

Construct	Description	Example	Inter-relationship to SoC (if applicable)
Stages of change (SoC)			
Pre-contemplation	No intention to take action within the next 6 months	I know I have been prescribed these medicines, but I don't want to take them right now	N/A
Contemplation	Intends to take action within the next 6 months	I'm starting to think about taking my medicines for stroke sometime in the next 6 months	N/A
Preparation	Intends to take action within the next 30 days and has taken some behavioural steps in this direction	I think I want to take my stroke medicines soon and I have gone to my GP to request the prescription	N/A
Action	Changed overt behaviour for less than 6 months	I have now been taking my stroke medicines as prescribed for the past 4 months	N/A
Maintenance	Changed overt behaviour for more than 6 months	It's been more than 6 months and I have been taking my stroke medicines as prescribed	N/A
Termination	No temptation to relapse, completely confident	Taking my medicines is now normal for me, I know I am able to take them every day and intend to keep doing this for as long as I need to take the medicines	N/A
Decisional balance			

Construct	Description	Example	Inter-relationship to SoC (if applicable)
Pros	Benefits of changing	If I take my medicines, then I am less likely to have another stroke	The pro-con balance differs stage to stage. Pros begin to outweigh cons when in contemplation
Cons	Cons of changing	My pharmacy isn't close to me, it's going to be difficult to pick up my prescriptions	The pro-con balance differs stage to stage. Pros begin to outweigh cons when in contemplation
Self-efficacy			
Confidence	Confidence that one can engage in the healthy behaviour across different challenging situations	I only have to take the tablets twice a day, it should be easy to do even when I am staying with my family over Christmas	Influences processes of change which in turn mediate SoC transitions
Temptation	Temptation to engage in the unhealthy behaviour across different challenging situations	Maybe it won't matter if I miss my tablets when I go on holiday, it's only a week	Influences processes of change which in turn mediate SoC transitions
Process of change			
Experimental processes			
Consciousness-raising	Finding and learning new facts, ideas and tips that support the healthy behaviour change	I've found out that I can use a Dosette box to help me organise my tablets and prompt me to take them	Mediates between pre-contemplation & contemplation
Dramatic relief	Experiencing the negative emotions (fear, anxiety) that accompany unhealthy behavioural risks	I cannot help but feel worried and guilty that I am not taking my stroke medicines	Mediates between pre-contemplation & contemplation

Construct	Description	Example	Inter-relationship to SoC (if applicable)
Self-re-evaluation	Realising that the behaviour change is an important part of one's identify as a person	I have always been the strong, well one in the family, I need to take my meds so I can still be this person	Mediates between contemplation & preparation
Environmental re-evaluation	Realising the negative impact of the unhealthy behaviour or the positive impact of the health behaviour on one's proximal social and/or physical environment	My family avoid coming over at the moment as they are frustrated that I am not taking my medicines	Mediates between pre-contemplation & contemplation
Self-liberation	Making a firm commitment to change	I have promised my wife, daughter and physician that I am going to take my medicines from now on and have set up a repeat prescription to help with this	Mediates between preparation & action
Behavioural processes			
Helping relationships	Seeking and using social support for a healthy behaviour change	I have asked my husband to help me with medicine taking. He sets up my Domette box each fortnight and reminds me if I forget to take a tablet	Mediates between pre-action & maintenance
Counter-conditioning	Substitution of healthier alternative behaviours and cognitions for the unhealthy behaviour	I have decided to get organised in order to counter the fact that I keep forgetting to take my tablets. I now put my tablets in an easy to spot place and tick off on a calendar each time I take them	Mediates between pre-action & maintenance
Reinforcement management	Increasing the rewards for the positive behaviour change and decreasing the rewards of the unhealthy behaviour	It used to be easier to not take the medicines as then I didn't have to worry about it, but now I've got myself into a	Mediates between pre-action & maintenance

Construct	Description	Example	Inter-relationship to SoC (if applicable)
Stimulus control	Removing reminders or cues to engage in the unhealthy behaviour and adding cues or reminders to engage in the healthy behaviour	routine it's easy to take them every day, I feel happier in myself and my GP and family are really pleased with me I have removed the tablets from the boxes as I find this off putting and confusing and have put them into a Dosette box which is a bright colour that I leave in view on my kitchen table. I know see this every morning when I come down for my breakfast	Mediates between pre-action & maintenance
Social liberation	Realising that the social norms are changing in the direction of supporting the healthy behaviour change	I was asked by my GP to attend a support group for stroke survivors. They keep promoting the importance of medicine taking here and some of my friends have had strokes and they all keep telling me how important it is to take the medicines	Mediation across multiple SoC

SoC-Stages of Change; GP-General Practitioner

3.4.5.1 Utility of the TTM in understanding medication adherence

There is emerging evidence applying the stages of change construct of the TTM to medication adherence research (e.g. Genberg, Lee, Rogers, Willey, & Wilson, 2013). A recent systematic review (Arafat, Ibrahim, & Awaisu, 2016) assessed the use of the TTM to enhance self-management of Type 2 diabetes (inclusive of medication adherence). Whilst the utility of an intervention, underpinned by TTM for some self-management behaviours, was evident (e.g. following a healthier diet and exercising more), the same was not found for medication adherence (Arafat et al., 2016). A meta-analysis was not conducted to pool effect sizes and identify the magnitude of the relationship between an intervention underpinned by TTM and self-management behaviours. Moreover, the review authors provided no justification for not conducting a meta-analysis, limiting the utility of this study's results.

A meta-analysis by Marshall and colleagues (2001) also assessed the utility of the TTM's application to physical activity and exercise, but considered all proposed TTM constructs, not just the stages of change. The review found that results were consistent with the purported model, i.e. that physical activity increased as individuals moved to higher stages of change, with the largest effect observed from *preparation to action* ($d=0.85$). Interestingly, the review also detected a small effect on physical activity when participants shifted from *pre-contemplation to contemplation* ($d=0.34$) (Marshall & Biddle, 2001); stages that are thought to be relatively inactive, and thus unlikely to produce effects on behaviour change. This could be indicative of errors in classification of participants in stages, a lack of validity of measures assessing TTM constructs, or ultimately a larger problem with

the TTM's core construct conceptualisation and parsimony. When assessing the remaining constructs of the TTM, the review authors identified that, with regards to *decisional balance*, stage progression is associated with small increases in the perceived benefits and larger decreases in the perceived disadvantages to engaging in a behaviour. Authors also identified that all ten *processes of change* seemed influential to changes in psychological activity. Changes in *self-efficacy* were also found to be moderately consistent with the predictions of the TTM (Marshall & Biddle, 2001). However, a large number of the studies included in this review were cross-sectional in design. This is a significant limitation, as the TTM purports a dynamic process, where individuals can shift backwards and forwards and constructs interact. Cross-sectional studies do not allow for longitudinal assessment of an individual through the process of change, limiting the ability to know if individuals follow each stage in turn, or move backwards through stages before they move forward.

More recently, a Cochrane review by Mastellos and colleagues (2014) examined the utility of the TTM (stages of change construct) for change in diet and physical activity for weight loss management in a sample of overweight and obese adults. Of the three studies that met inclusion criteria, inconclusive evidence was found for sustained weight loss (Mastellos, Gunn, Felix, Car, & Majeed, 2014). Some significant improvements in diet and physical activity, in those receiving TTM interventions, were observed across included studies. However, the small number of studies included in the review, along with the low quality of evidence and inadequate reporting of outcomes (identified by the review authors) limit the utility and generalisability of these findings.

Despite the widespread popularity that seems to surround the TTM in literature, the model has undergone some extensive criticism (e.g. Littell & Girvin, 2002; West, 2005). Some of the most notable criticisms have included arbitrary boundaries between each stage (West, 2005), and limited longitudinal evidence to provide stronger conceptual support for the TTM (e.g. Armitage, 2009; Marshall & Biddle, 2001). Sutton (e.g. Sutton, 2000; Sutton, 2001, 2015) has also extensively criticised the TTM's applications to smoking cessation and substance use. Critique has questioned some of the fundamental premises of the model, and current evidence does not conclusively provide evidence for the utility of the TTM. When assessing measurement of the stages of change, Sutton (2001) identified numerous issues with the model. When the TTM was measured with staging algorithms challenges arose, such as arbitrary time periods (e.g. Pre-contemplation; no intention to take action within the next six months), whereby applying different time periods would affect a person's allocations to a stage and the distribution of stages (Sutton, 2001). This questions whether the TTM stages are in fact discrete, or distinct, something posited by the model. Likewise, multidimensional questionnaires have also been used to assess stages of change, once again finding evidence from factor analyses that stages may not be discrete as suggested (as large correlations have been found between adjacent and non-adjacent sub-scales) (Sutton, 2001). Predictions from stage theories can be tested through a range of study designs including cross-sectional, examination of stage sequence, longitudinal and experimental studies (Sutton, 2015). The TTM has rarely been tested with the latter two study designs (longitudinal and experimental); arguably stronger research designs to test predictors of stage transitions. In instances where studies have been reported to test the TTM with these designs, findings provided only partial or mixed support for the TTM

(Sutton, 2015). The strongest evidence would be provided by conducting randomised experimental studies showing that stage-matched interventions are more effective than stage-mismatched interventions at supporting a person's progression through stages of the model (Sutton, 2015). Once again, very few studies of this nature have been conducted and results provide little evidence in support of the TTM (Sutton, 2015).

3.4.6 Leventhal's Self-Regulatory Model

Self-regulation perspectives have also been adopted to model health behaviours such as adherence. Leventhal's Self-Regulatory Model (SRM; Leventhal, Nerenz, & Steele, 1984) advocates that individuals self-regulate their behaviours contingent on the perceived health changes they experience. This model displays a dynamic process of steps, whereby an individual is undergoing continuous appraisals of a health threat and can shift back and forth through the steps to continuously address and change or maintain behaviour. The model depicts how someone copes with a symptom experience, along with the cognitive and emotional responses to a health threat or diagnosis of illness (Leventhal et al., 1984), whereby the cognitions and emotions guide behaviour. The SRM can be broken down into three stages; *Interpretation* (through *cognitive and emotional representations of the problem*), *coping* and *appraisal*.

There are two main channels through which a person can be confronted with a potential illness: *symptom perception* and *social messages*. *Symptom perception* encompasses anything perceived to be a symptom by the individual (such as a sore

throat). The perception of symptoms can be influenced by individual differences of the person, mood and cognitions. *Social messages* refer to information that comes from other people, often through lay sources, such as a friend describing their experiences of similar symptoms, or through avenues such as a doctor diagnosing you with an illness (e.g. I have been told by my doctor that I have high blood pressure and this caused my stroke). Once a symptom or health threat is perceived, *Interpretation* takes place, a stage where an individual makes sense of the health-related problem. The model suggests that the individual becomes motivated to 'solve' the problem and return to a state of normality (Ogden, 2007). Illness perceptions (i.e. cognitive representations of an illness) are a key feature of the SRM (Weinman, Petrie, Moss-morris, & Horne, 1996). It is proposed that a person interprets, or makes sense of, their illness by the formation of representations that are both cognitive (illness representations) and emotional (emotional representations). These representations form part of the dual track model, working in parallel. The illness representations may act as enablers or barriers to performance of a health-related behaviour. The symptom perceptions and social messages, through which a person can be confronted with a health threat or illness, assist in the development of cognitive illness representations, which are constructed according to several dimensions: *identity* (what is it?), *cause* (what caused it?), *consequences* (what effect will this have on me?), *timeline* (how long will I be ill?) and *cue/control* (can it be cured or controlled?) (Leventhal, Diefenbach, & Leventhal, 1992). These cognitive representations of the health problem enable an individual to consider strategies for coping (Ogden, 2007).

Coping (dealing with the health problem to return to a state of normality) is influenced by a person's illness perceptions (Leventhal et al., 1984). When presented with a health problem, and once the person has interpreted the problem, they will then select coping strategies in order to return to their state of normality. Leventhal (1997) argued that selection of the coping strategies is affected by a person's representation of the health problem (Leventhal, Benyamini, Brownlee, & al., 1997). For example, if a person represents the cause of their illness (e.g. hypertension) as stress, they will select coping procedures perceived to reduce stress and avoid those perceived to increase stress. Coping can be further conceptualised into problem focused and emotional focused coping, both of which can occur concurrently (Leventhal et al., 1984). Contingent upon the information provided about the health threat or illness, and how that is understood, a coping strategy is selected and employed. Adhering to medications for stroke risk factor control would be an example of problem focused coping, whereas avoiding medical appointments or ignoring information about the health threat or illness could be an example of emotion focused coping.

Appraisal, i.e. assessing how successful the coping strategies were (Leventhal, Breland, Mora, & Leventhal, 2010), encompasses a person assessing how effective their coping strategy was and deciding whether to continue with that strategy or to move back to stage 2 (Coping) and identify a different strategy to employ. The SRM argues that people appraise the effectiveness of their selected coping strategy. When it is perceived to be effective, this reinforces their belief in the accuracy of their current illness representation. When it is perceived to be ineffective (or not as effective as expected) then this leads to a reappraisal of the health problem and a

subsequent change in illness representations. For example, if a person has a headache, they may perceive this to be a 'stress headache' and select to take a paracetamol. If the headache (the symptom) persists and gets worse, then a person's representation of this symptom may change, perceiving the timeline of the headache as too long for a 'stress headache'. This health threat may then be perceived to be a migraine and an appropriate coping strategy will then be selected based on this representation of the symptom.

To conceptualise the three stages, in terms of medication adherence in stroke survivors refer to Figure 4. Briefly, if a person receives a social message from a GP that they have high blood pressure that caused their stroke, they may interpret this as a health problem and be motivated to return to normality (i.e. have normal blood pressure). They will move through to stage 2, coping, and identify a coping strategy, for example taking antihypertensive medications (problem focused coping). Finally, once they have employed this coping strategy they will appraise its effectiveness. If the blood pressure has returned to normal, and the medicines appear to be working, it is likely that the strategy will be appraised as effective. If the blood pressure remains high, it might be the case that someone will move backwards to stage 2 and re-identify coping strategies to use.

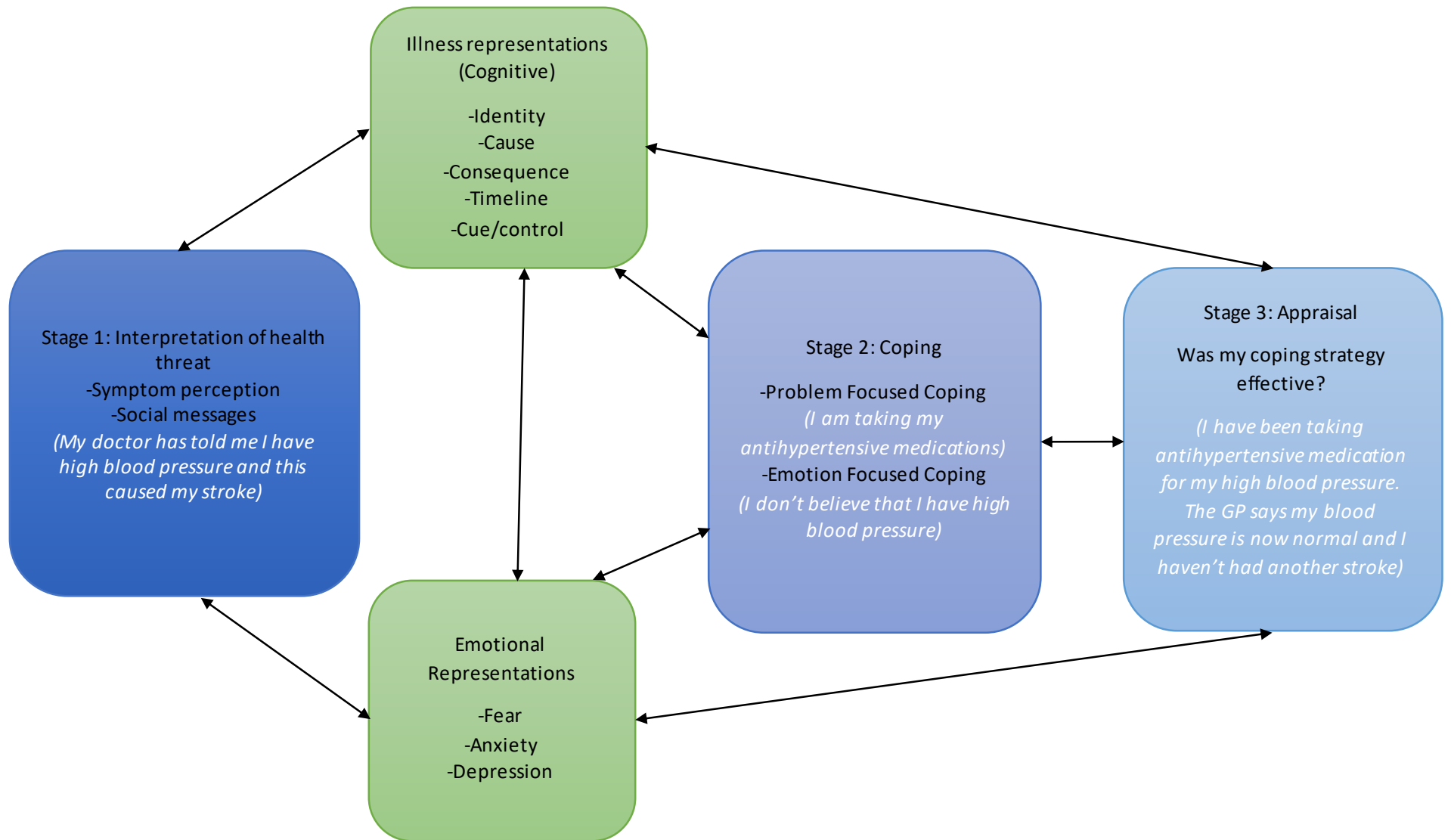


Figure 4 Leventhal's Self-Regulatory Model to explain medication adherence. Adapted from Ogden (2007).

It is noteworthy, as the focus of this thesis is on medication adherence, that suggestions have been made to enhance the SRMs ability to explain treatment adherence by extending the scope of focus to specific treatment beliefs (Horne, 1997; Horne & Weinman, 2002; Horne, Weinman, & Hankins, 1999). Preliminary support for this assertion was provided in a study by Horne and Weinman (2002) exploring adherence to medications in asthma patients (Horne & Weinman, 2002). A person may not only have representations and beliefs about the illness, but also the treatment (Horne & Weinman, 2002) (i.e. a person may have representations of hypotension (illness) and antihypertensives (treatment)). A person can have beliefs about medicines in general, as well as beliefs about the specific medications prescribed for a condition. Beliefs about medications in general could reflect the intrinsic nature of the medication (i.e. are medicines perceived to be harmful substances) and could also reflect beliefs about how doctors use medications (Horne et al., 1999). The beliefs about a specific medication prescribed to a person can be further conceptualised into two groups or beliefs: beliefs about the necessity of the medication to maintain health and concerns about any aversive effects of the medication (e.g. side effects) (Horne et al., 1999). It is proposed that a person's decision to adhere to a treatment is influenced by both beliefs about the necessity of the treatment (in this instance medication) and concerns about potential adverse effects to taking the treatment (Horne & Weinman, 2002). It has been argued that beliefs about the necessity of the treatment are directly linked to the perceptions of the illness, whereas concerns are more likely to arise from the experience and perceptions of the treatment (Horne & Weinman, 1998; Horne et al., 1999).

Beliefs about medicines in general may initially influence consideration of whether to adhere to a treatment or not, but it is thought that the specific medication beliefs a person holds may more strongly influence medication adherence (Horne et al., 1999). In order to decide whether to adhere to a treatment or not, a person may compare and weight necessity beliefs against concern (Horne, 1997). This has been termed the Necessity-Concerns Framework (NCF). This suggests that a person's understanding of the necessity of the treatment, weighted against the perceived concerns of taking the treatment (e.g. side effects), will affect the assessment of the appropriateness of treatment and could potentially influence initiation, adherence and persistence to treatment.

3.4.6.1 Utility of Leventhal's Self-Regulatory Model

There has been a lot of published literature, utilising self-regulation theories as a basis for designing medication adherence interventions. For example, Jones et al (2015) conducted a systematic review assessing effectiveness of interventions targeting adherence (including medication adherence), which were underpinned by the SRM. Of the nine studies included in the review, effect sizes varied ($d=0.00-1.33$), with five reporting moderate to large effect (Jones, Smith, & Llewellyn, 2015). The small number of studies identified by the review, and considerable variation in methodological quality, prevented meta-analysis, therefore limiting the generalisability of the findings and an ability to draw firm conclusion. This review did consider the operationalisation

of theory in the interventions, where this was possible. The authors described when theory was used, as well as how theory was tested or evaluated in the primary studies. The review attempted to assess whether the interventions were described in sufficient detail regarding the linkage between intervention components and theoretical constructs. The authors concluded that this was not the case in the primary studies included in the review.

Some published literature indicates a lack of support for the utility of the SRM in predicting adherence. For example, Brandes and Mullan (2014) conducted a meta-analysis of 30 studies assessing adherence behaviours (including medication adherence) in individuals with chronic illness, with adherence to medication assessed in 26 studies. The analysis identified only small effect sizes (r^+) for the different illness representations (posited by the model) effect on adherence, ranging from -0.02-0.12 (Brandes & Mullan, 2014). The largest effect sizes were reported for aspects of illness representations, with $r^+=0.12$ [95% CI 0.05-0.19] for treatment control and $r^+= 0.12$ [95% CI 0.06-0.18] for personal control. As 28 out of the 30 studies included in this review employed a cross-sectional study design causation cannot be inferred from findings, a common limitation of reviews discussed throughout this chapter. Similarly, Aujla et al (2016) considered whether adherence to self-management behaviours (including medication adherence) could be predicted by illness beliefs conceptualised by the SRM. The meta-analysis revealed effect sizes (r^+) between adherence and illness beliefs to range from 0.04-0.13, indicative of weak relationships (Aujla et al., 2016). These effect sizes are

commensurate with those observed by Brandes and Mullan (2014) in their review (Brandes & Mullan, 2014).

Most recently, Hagger and colleagues (2017) conducted a meta-analysis and test of a process model for the SRM. The review aimed to meta-analyse studies testing relations from the SRM in long-term conditions and apply the generated correlations to test the proposed process model (Hagger, Koch, Chatzisarantis, & Orbell, 2017). As stated above, the SRM presents a relationship between illness perceptions and illness outcomes, mediated by coping strategies. Hagger et al's. (2017) findings reported that coping did not fully mediate this relationship, and therefore the model was not found to be sufficient. This may suggest that coping does not fully explain the effects of illness representations on the subsequent outcomes (Hagger et al., 2017). Whilst the effect of the cognitive and emotional illness representations on illness outcomes are partially accounted for by coping, representations also have effect on outcomes independent of the coping construct (Hagger et al., 2017). Of course, methodological quality of the studies such as appropriate use of measures to constructs such as coping may have affected the results presented here and may have contributed, in part, to the model insufficiency. As the majority of studies included in the review were correlational, the ability to infer causal relationships as well as the ability to demonstrate the dynamic process of the model was limited. Hagger and colleagues (2017) attempted to correct for methodological artefacts (such as sampling and measurement error) that could influence analysis, but still found substantial variability in the reported effect sizes of the SRM constructs in studies included in the analysis.

As with many other reviews reported in this chapter, this quality of the included primary studies affects the ability of the review to draw firm conclusions and may, in part, account for the apparent low support for the model.

The mounting evidence suggests that whilst, in some reviews, there may be partial support for the utility of the SRM, within adherence literature there does not appear to be sufficient support. Moreover, Hagger et al's. (2017) findings suggest that there is scope for revision of the SRM, in order to present a sufficient process model. Until such time, there may be limitations to the application of the SRM to underpin intervention design for medication adherence in its current conceptualisation. This theory alone will not form the basis for intervention development in this thesis.

3.5 The theoretical framework of the thesis

As discussed throughout this chapter, there are many theories of the psychological influences on behaviour (e.g. TPB (Ajzen, 1985), HBM (Hochbaum, 1958; Rosenstock, 1966)). In a recent review carried out by psychologists, sociologists, anthropologists and economists, 83 theories of behaviour and behaviour change were identified (Davis et al., 2015) posing a challenge to those wanting to develop interventions underpinned by theory; namely which one should be used. However, some of these theories of health behaviour (including those discussed above) have been subject to a number of criticisms, including studies not always operationalising the constructs

clearly, not considering the context in which a behaviour occurs, and an over emphasis on rational, deliberative determinants. As there is considerable unexplained variance in adherence, the addition of further predictor variables should enhance the prediction of behaviour (see Conner & Norman, 2005; Connor & Norman, 2015). In partial response to the latter two criticisms, the Theoretical Domains Framework (TDF) has been developed (Cane et al., 2012; Michie et al., 2005).

The TDF was developed via an expert consensus approach (Cane et al., 2012; Michie et al., 2005). Behaviour change professionals identified constructs drawing on 33 major behaviour change theories considered relevant to implementation science. The identified 112 constructs were clustered using open and closed sort tasks, grouping similar constructs together to form, what the authors termed a domain. After revisions, 14 key domains were established (*Knowledge; Skills; Social/Professional role and identity; Beliefs about capabilities; Optimism; Beliefs about consequences; Reinforcement; Intentions; Goals; Memory, Attention and Decision processes; Environmental context and resources; Social influences; Emotions; and Behavioural regulation* (Cane et al., 2012)). See Table 4 for a list of domains with definitions.

Table 4. Domains of the Theoretical Domains Framework with Definitions

Domain	Description ³
Knowledge	<i>An awareness of the existence of something</i>
Skills	<i>An ability or proficiency acquired through practice</i>
Social/Professional role and identity	<i>A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting</i>
Beliefs about capabilities	<i>Acceptance of the truth, reality, or validity about an ability, talent, or facility that a person can put to constructive use</i>
Optimism	<i>The confidence that things will happen for the best or that desired goals will be attained</i>
Beliefs about consequences	<i>Acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation</i>
Reinforcement	<i>Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus</i>
Intentions	<i>A conscious decision to perform a behaviour or a resolve to act in a certain way</i>
Goals	<i>Mental representations of outcomes or end states that an individual wants to achieve</i>
Memory, Attention and Decision processes	<i>The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives</i>
Environmental context and resources	<i>Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behaviour</i>
Social influences	<i>Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours</i>
Emotions	<i>A complex reaction pattern, involving experiential, behavioural, and physiological elements, by which the individual attempts to deal with a personally significant matter or event</i>
Behavioural regulation	<i>Anything aimed at managing or changing objectively observed or measured actions</i>

³ Definitions as stated in Cane et al 2012 who utilised the definitions from the American Psychological Associations' Dictionary of Psychology

3.5.1 Utility of the TDF in understanding medication adherence

In this section, notable limitations of the TDF will be presented first, before going on to explore the strengths that this theoretical framework offers for the intervention development in this thesis.

3.5.1.1 Criticisms of the TDF

There are some limitations of the TDF that are important to consider prior to use in this thesis. For example, the TDF was developed originally to understand a specific set of behaviours: implementation of evidence-based practice. This behaviour is very different to medication adherence in stroke survivors. However, more recent publications have applied the TDF to a much broader range of health behaviours.

In addition, the TDF has been critiqued for providing more of a descriptive framework as opposed to a testable theory, as it does not specify the inter-relationships between each domain, and the subsequent relationship these domains have with behaviour (Francis, O'Connor, & Curran, 2012). Evidence presented by Beenstock et al., (2012) supported this assertion (Beenstock et al., 2012). This study employed the TDF (configured in the old version with a proposed 12 domains (Michie et al., 2005)), to explore barriers and enablers to midwives engaging pregnant women in stopping smoking. The authors

concluded that use of the TDF provided an appropriate way to better understand behaviour of healthcare professionals. However, the study found that the 11 tested domains of the TDF were highly correlated, and a principle component analysis revealed the best fit for the data was a single factor solution (accounting for 66% of the variability in TDF scores), suggesting that the 11 domains best reflected a single dimension (for which the authors termed propensity to act) (Beenstock et al., 2012). Scores on this dimension were independently associated with referral of pregnant women to stop smoking services (the behaviour of interest in this study) (Beenstock et al., 2012). Results such as this suggest that the TDF does not provide a concise set of non-overlapping constructs, all of which independently contribute to the prediction of behaviour, but instead a framework that encompasses determinants from a broad range of theories incorporating these theories explanations for behaviour. Further research needs to be conducted to assess the TDF in the newer configuration (14 domains (Cane et al., 2012)), and test more rigorously the inter-relationships between domains and with different behaviours. Developing and testing an intervention, underpinned by the TDF, offers an opportunity to better test the TDF as a theoretical framework to understand behaviour change and test the inter-relationship between domains and with behaviour.

Furthermore, it is worth highlighting that there are overlaps of the theoretical constructs that load into TDF domains, as indicated by the fuzzy cluster analysis in Cane et al's. (2012) revision of the TDF (Cane et al., 2012). For

example, the construct action planning loaded into both the 'Goals' and 'Behavioural regulation' domains of the TDF. Those using the TDF as a coding framework may find difficulties with the operationalisation of TDF domains, such that the boundaries between domains feel unclear (Francis et al., 2012). For this thesis, the TDF was used to code determinants of medication adherence identified in the systematic review. As such, the criticism discussed above presents a challenge of how to manage determinant mapping, as coders could find that determinants may sit within multiple domains. In order to address this, careful and transparent recording of decision making, along with a reflexive approach to application of the TDF will be undertaken. Multiple coders will also be enlisted who hold good knowledge of the TDF (in addition to the thesis author) when determinant mapping is undertaken. This will reduce subjectivity of coding, but also ensure that determinants are coded into the most appropriate domain, even if it is the case that two domains are considered suitable.

Finally, domains within the TDF could encompass quite a large and varying number of determinants, for example the domain 'Emotions' encompasses a large range of both positive (e.g. hopefulness) and negative (e.g. anxiety) emotions. It could be argued that this is too broad, and that subdivision of domains would better predict behaviour. However, as stated above, the TDF has been described as more of a descriptive framework (Francis et al., 2012). To date, there has been little assessment of the inter-relationships between domains, as well as the predictive relationship between domains and

behaviour, particularly in the 14 domain configuration. Therefore, further testing of the TDF is required. Future application and testing of the intervention developed in this thesis offers scope to test the TDF's ability to predict behaviour, compare to other briefer theories of health behaviour and explore the inter-relationships between domains and behaviour.

3.5.1.2 Strengths of applying the TDF

There exists a plethora of theoretical models of health behaviour. Often the theoretical constructs of these theories overlap and currently there is limited guidance on how to select models perceived to be appropriate for intervention design. The development of the TDF, in part, offered an approach to selecting theory for intervention development to address these concerns (Davis et al., 2015). As each domain of the TDF was derived from multiple theoretical constructs from different theories, the TDF provides a more comprehensive coverage of influences on behaviour than any single theory of behaviour. Existing theories or models of the determinants of behaviour often do not consider more automatic processes such as habit (e.g. TPB, SRM, HBM). Some of these existing models have also been criticised for not describing dynamic behaviours, whereby the experience of behavioural performance (e.g. adhering or not adhering to stroke medicines) can affect predisposing factors such as beliefs about medicines and in turn elicit change in behaviour (e.g. HBM, SCT, TPB) (Jackson et al., 2014). The TDF offers a broader focus on influences of behaviour, inclusive of those more automatic factors, encompassed within domains such as 'Emotions'. This has been of increasing

interest over the last decade, with more focus on dual process models encompassing both reflective and impulsive processes of behaviour (compared to a previous focus on reflective processes alone) (e.g. Strack & Deutsch, 2004). Hollands and colleagues (2016) have gone on to argue that maladaptive health behaviours may not be driven by deliberative, conscious decisions and instead occur as direct responses to environmental cues, stimuli and in a more automatic manner. Hollands et al., (2016) express a need to further explore interventions that target non-conscious processes that could change behaviour (Hollands et al., 2016).

It is evident from the above discussion of models of the determinants of behaviour, that there is inconsistency in which constructs are predictive of behaviour, or behaviour change, and under which contexts. No one theory has yet been able to coherently and completely predict behaviour. The TDF offers a boarder framework, considering multiple constructs from multiple theories. This may give a better scope in future intervention design, enabling researchers to be holistic in considering the determinants of behaviour, overarching theory and evidence-based in the BCT selection. To date the TDF appears to be somewhat underused, in comparison to some of the other models of determinants of behaviour. However, the TDF has been applied to understand and develop intervention to change multiple behaviours (e.g. low back pain management (French et al., 2012); sepsis management (Steinmo, Fuller, Stone, & Michie, 2015); mild traumatic brain injury management (Tavender et al., 2015). Also, from the emerging evidence applying the TDF

and the Behaviour Change Wheel (BCW; a guide to intervention development supporting systematic linkage between evidence-base, theory and intervention components) (Michie et al., 2014), to underpin interventions, feasibility and acceptability of the interventions has been identified, with some evidence to support intervention effectiveness (Bailey et al., 2016; Free et al., 2016).

The TDF offers a theoretical framework that is holistic and addresses some of the previous criticism of other models of the determinants of behaviour. To my knowledge, this is the first time that the TDF has been applied to develop an intervention targeting medication adherence in stroke survivors.

3.6 How theory will be used in the thesis

In this thesis, the theoretical framework (the TDF) will underpin the forthcoming empirical work in the proceeding chapters, in order to support the development of an evidence-based and theory driven intervention development. In Chapter 4, the TDF will be used as a framework for mapping identified psychological determinants of medication adherence in stroke survivors. This will facilitate the intervention development process reported in Chapter 5. The TDF will provide a holistic framework for which to understand the underlying determinants of medication adherence, thus enhancing the understanding of this behaviour. The theory will enable identification of facilitators and barriers to medication adherence and give indication of what

needs to be addressed and changed through intervention in order to see a behaviour change. As there has been recent work linking TDF theoretical domains to BCTs (e.g. Michie et al., 2016) in order to facilitate a systematic intervention development, guided by the BCW, the theoretical framework of this thesis is central to answering the thesis objectives. In addition, as theory driven intervention development has been advocated by the Medical Research Council (MRC) guidance for developing and evaluating complex interventions (Craig et al., 2008) and by the Intervention Mapping Framework (Bartholomew, Parcel, & Kok, 1998), the use of the TDF will facilitate in adhering to this guidance and developing an intervention rooted in theory and evidence.

4 Chapter 4: Psychological Determinants of Medication Adherence: A Systematic Review of Observational Studies

4.1 Abstract

Background

Medications targeting stroke risk factors have shown good efficacy, yet adherence is suboptimal. To improve adherence, its determinants must be understood. To date, no systematic review has mapped identified determinants into the Theoretical Domains Framework (TDF) in order to establish a more complete understanding of medication adherence.

Purpose

The aim of this review was to identify psychological determinants that most influence stroke survivors' medication adherence.

Methods

In line with the prospectively registered protocol (PROSPERO CRD42015016222), five electronic databases were searched (1953-2015). Hand searches of included full text references were undertaken. Two reviewers conducted screening, data extraction and quality assessment. Determinants were mapped into the TDF.

Results

Of 32,825 articles, 12 fulfilled selection criteria (N=43,984 stroke survivors). Tested determinants mapped into 8/14 TDF domains. Studies were too heterogeneous for meta-analysis. Three TDF domains appeared most influential. Negative emotions ('Emotions' domain) such as anxiety, and

concerns about medications ('Beliefs about Consequences' domain) were associated with reduced adherence. Increased adherence was associated with better knowledge of medications ('Knowledge' domain) and stronger beliefs about medication necessity ('Beliefs about Consequences' domain). Study quality varied, often lacking information on sample size calculations.

Conclusions

This review provides foundations for evidence-based intervention design by establishing psychological determinants most influential in stroke survivors' medication adherence. Six TDF domains do not appear to have been tested, possibly representing gaps in research design. Future research should standardise and clearly report determinant and medication adherence measurement to facilitate meta-analysis. The range of determinants explored should be broadened to enable more complete understanding of stroke survivors' medication adherence.

This review has been published in the *Annals of Behavioral Medicine* and a copy of the published article can be found in Appendix 1.

4.2 Introduction

As discussed in Chapter 2, guidelines recommend the use of medication for secondary prevention of stroke (DH, 2007; RCP, 2008, 2012). Nonetheless, adherence rates to stroke prevention medications remain sub-optimal (e.g. Nunes et al., 2009; Sappok et al., 2001), with a pooled prevalent non-adherence rate of 30.9% [95% CI: 26.8–35.3%], derived from studies with multiple definitions of adherence (Al AISHaikh et al., 2016).

A better understanding of the underlying reasons for sub-optimal adherence will enable more informed intervention development. Therefore, the aim of this systematic review was to identify psychological determinants that influence medication adherence in stroke survivors.

Some determinants of medication adherence, such as age, gender or stroke type (Al AlShaikh et al., 2016) are not easily modified. Therefore, a better understanding of the modifiable determinants of medication adherence is required to facilitate the design of behaviour change interventions.

Psychological determinants, defined as determinants of, or relating to, the mind or mental processes; also relating to or affecting a person's emotional state (Oxford University Press, 2001), are one type of potentially modifiable determinant. Considerable research effort has been made to link psychological determinants to the behaviour change techniques (BCTs) likely to change each one (Michie et al., 2008; Michie et al., 2015). This could facilitate adherence intervention design. Consequently, the current review focused on identifying the strongest psychological determinants of medication adherence in stroke survivors and considered the quality of the primary studies.

As described in Chapter 3, previous theories of the psychological influences on behaviour have been subject to a number of criticisms, including not always operationalising the constructs clearly, not considering the context in

which a behaviour occurs, and an over emphasis on rational, deliberative determinants. As there is considerable unexplained variance in adherence, the addition of further predictor variables should enhance the theories (see Conner & Norman, 2005). In partial response to the latter two criticisms, the Theoretical Domains Framework (TDF) has been developed (Cane et al., 2012; Michie et al., 2005). Therefore, the most recent revision of the Theoretical Domains Framework (TDF; Cane et al, 2012) will be the overarching theory of this review and this thesis in an attempt to facilitate a theoretical understanding of medication adherence in stroke survivors. A further advantage of the TDF is that the domains can be mapped to BCTs that are thought to be most likely to change each type of determinant (Cane et al., 2012; Cane, Richardson, Johnston, Ladha, & Michie, 2015). For a more in depth discussion of the development of the TDF, as well as the strengths and weaknesses of this framework, please refer to Chapter 3.

4.2.1 Aims of the review

The primary aim of this systematic review was to identify psychological determinants that influence medication adherence in stroke survivors. The secondary aim was to establish the magnitude of the relationships between the psychological determinants and stroke survivors' medication adherence. To our knowledge, there has not yet been a review, which has mapped identified determinants into the TDF in order to establish a more complete understanding of medication adherence in stroke survivors.

4.3 Methods

This review includes studies focused on people with a clinical diagnosis of stroke (ischaemic or haemorrhagic), prescribed medications that targeted stroke risk factors for secondary prevention. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were followed (Moher, Liberati, Tetzlaff & Altman, 2009). The systematic review protocol was prospectively registered on PROSPERO (CRD42015016222).

4.3.1 Search strategy and selection process

The search targeted literature investigating psychological determinants of medication adherence in stroke survivors. A multi-method search was undertaken using combined terms for stroke AND adherence AND psychological determinants and a combination of subject heading and free text searching where applicable (see Appendix 2 for tailored search strategy). Sources included Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R) (1953-Week 44 2015), EMBASE Classic + EMBASE (OVID interface 1953-2015 Week 44), psycINFO (OVID interface 1953-November week 1 2015), CINAHL (EBSCO interface 1953- November 2015) and WEB OF SCIENCE (1953-November 2015; inclusive of conference proceedings) and reference lists of included full text articles. The search was limited to English language as this was the only fluent language understood by the review team. The inception date of the search was 1953 because literature regarding “compliance” in healthcare started to appear from the early 1950’s (Haynes, Taylor, & Sackett, 1979). Eligibility and selection of

relevant articles were assessed by first conducting title/abstract review and then by assessing full texts according to predefined inclusion/exclusion criteria. COVIDENCE software was used to manage this process. The selection process, data extraction and quality assessment were performed independently by two reviewers (EC (thesis author and PhD candidate), MF (colleague)). A third reviewer resolved conflicts and cross-checked data extraction (AJW (supervisor)). Reviewer EC extracted data from all included full texts. Reviewer MF extracted data from a proportion (10%) of the full texts and extracted all subjective and outcome data from the remaining texts (90%). If reviewers required more information, authors were contacted. Seven of the 19 authors contacted responded. Figure 5 displays the PRISMA diagram of the search and selection process.

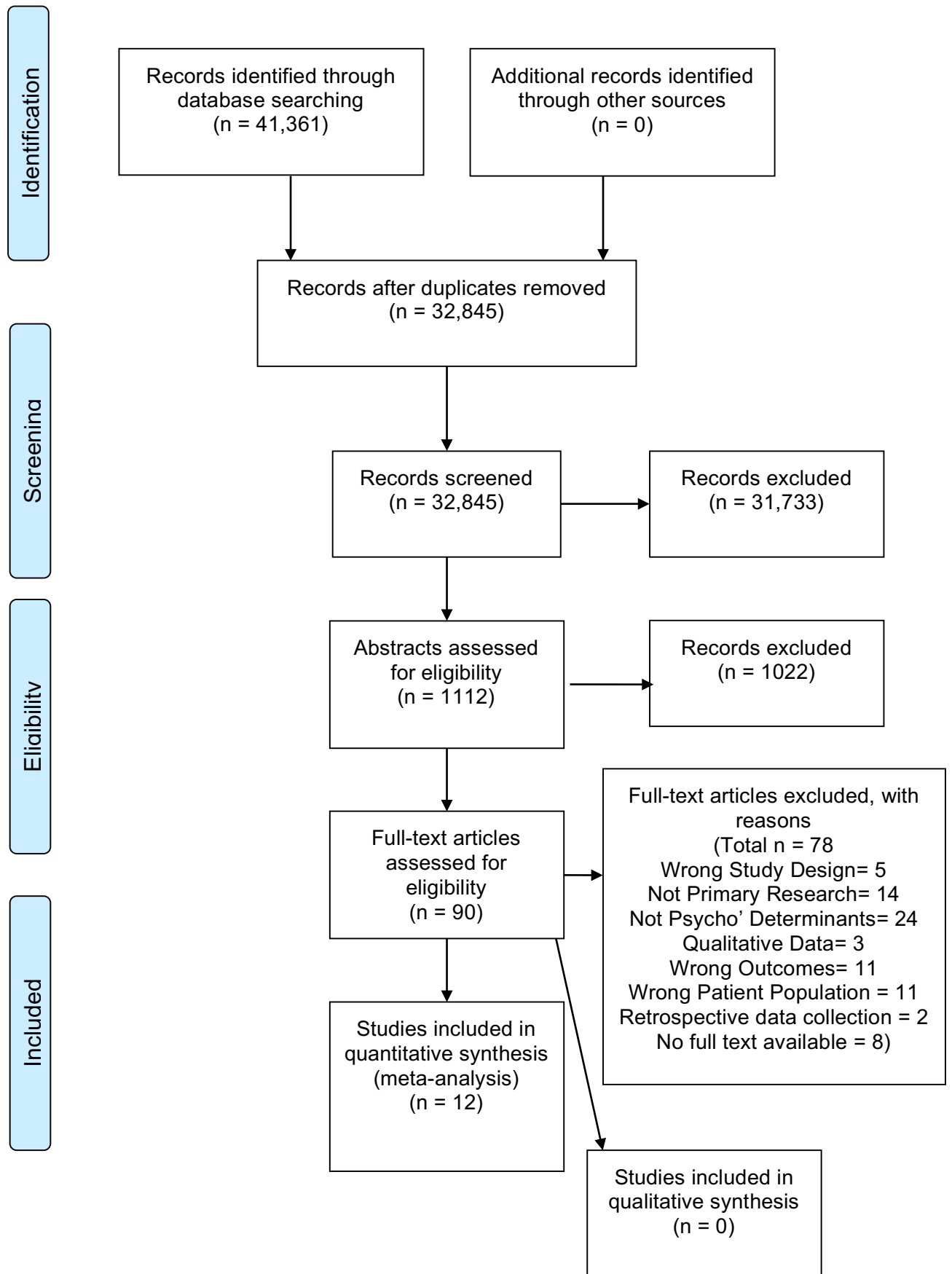


Figure 5. PRISMA Diagram

4.3.2 Criteria for study inclusion and exclusion

Inclusion criteria:

- Studies with a sample of stroke survivors or mixed transient ischaemic attack (TIA)/stroke survivors who were ≥ 18 years of age, and had been prescribed medication(s) that targeted at least one stroke risk factor
- Primary research studies with quantitative research designs measuring at least one psychological determinant and medication adherence

Exclusion criteria:

- Studies with a sample of stroke survivors < 18 years of age
- Mixed condition samples where stroke only data could not be obtained
- Reviews (systematic, narrative or meta-analytic), studies applying retrospective data collection and qualitative study designs

Randomised control trials (RCTs) were not explicitly excluded from the search strategy, but only one RCT identified was relevant to the review research question (O'Carroll et al., 2013). The RCT had been informed and was a sequel to an observational study identifying psychological determinants (O'Carroll et al., 2011). Therefore, for this review the inclusion of the observational study design was considered most appropriate.

4.3.3 Data extraction and analysis

4.3.3.1 Data extraction

Data extraction was completed using a proforma developed for this review (Appendix 3) in accordance with Cochrane guidance (Higgins & Green, 2011).

The data extracted included; 1) Participant clinical and demographic characteristics; 2) Study design and methods; 3) Adherence measures; 4) Identified psychological determinants; and 5) Statistical information.

4.3.3.2 Analysis

Summary data from each full text were extracted. The analysis within this review focused on the effect sizes of the relationship between medication adherence/persistence and the determinants given (where effect sizes were reported). Twelve papers reported on seven different samples. To ensure that the data analysis accounted for this, results were presented considering both the number of papers and the number of samples relevant.

The determinants extracted from the papers were mapped into the relevant TDF domains. Data collection methods (including length of follow up, medication adherence measures used and statistical analysis conducted) from the included papers were too heterogeneous to allow for a meta-analysis. This prevented generation of pooled effect sizes to show the relationship between different determinants (and TDF domains) and medication adherence. Therefore, qualitative description of the data extracted

took place. To identify which domains were most influential to adherence, assessment of the domains with a higher number of tested determinants with significant associations was carried out. P values of 0.05 or less were considered to be statistically significant. As there was substantial overlap between the samples across a number of papers, the number of papers and samples that a determinant was tested in was also extracted and used to establish domains with the most influence on medication adherence. Domains were considered more influential when a larger proportion of the tested determinants had significant associations with adherence and where significant associations were found in a higher proportion of the samples in which at least one determinant from the domain was tested.

4.3.3.3 Quality assessment

Quality assessment of the included articles took place to examine the methodological quality of each full text paper included. Following consideration of a wide number of available quality assessment checklists/tools for observational study designs (Reisch tool (Reisch, Tyson, & Mize, 1989); Cowley checklist (Cowley, 1995); Downs and Black tool (Downs & Black, 1998); Walburn et al's, checklist (Walburn, Gray, Gournay, Quraishi, & David, 2001); Thomas' tool (Thomas, Ciliska, Dobbins, & Micucci, 2004); Sirriyeh et al's tool (Sirriyeh, Lawton, Gardner, & Armitage, 2012); Newcastle-Ottawa Scale (Wells et al., 2011); and the COnsensus-based Standards for the selection of health status Measurement Instruments (COSMIN) Checklist (Mokkink et al., 2010)), the checklist chosen to be used was developed by

Walburn et al, (2001). Other assessment tools were not used for multiple reasons presented in Table 5.

Table 5. Comparison of quality assessment checklists, outlining strengths and weaknesses of each.

Quality Assessment Checklist/Tool	Strengths	Weaknesses
COSMIN	<ol style="list-style-type: none"> 1. Can be used for systematic reviews 2. Useful to assess measurement principles in depth 3. Rigorous development, international Delphi study- had experts from psychology, epidemiology, statistics & clinical medicine 4. Clear guidance book with definitions of measurement terms and examples of application 5. Although reliability was mixed, revisions were made to the tool to try to correct for this 	<ol style="list-style-type: none"> 1. Could not be used alone, would need to be used in conjunction with another scale 2. 10 out of 12 boxes are applicable to assess measurement properties as this review is not focused solely on measurement properties 3. Vague assessment of content validity (developers of COSMIN felt this could not be assessed) although is likely to be high due to the nature of the tool development 4. No formal construct validity (hypothesis testing) was carried out, just expected to be high 5. Inter-rater reliability was mixed. ICCs were low (their measure of inter-rater reliability) but agreement was higher among raters & test for reliability was rigorous
Cowley ⁴	<ol style="list-style-type: none"> 1. Can be used for systematic reviews 2. Quick and easy to use 	<ol style="list-style-type: none"> 1. Unclear how items were generated for tool 2. Unknown reliability and validity of checklist 3. Would need to be modified for this review (some criteria very specific to orthopaedic conditions) 4. Tool does not assess whether study inclusion/exclusion criteria is defined

⁴ Deeks et al., (2003) (Deeks et al., 2003) supported assessment of quality assessment checklist strengths and weaknesses

Quality Assessment Checklist/Tool	Strengths	Weaknesses
		5. Does not assess sample size (important to consider for this review as some judgements based on p values) 6. No guide provided to support completion of checklist
Downs and Black ¹	1. Can be used for systematic reviews 2. Developed from a pooled evidence base, piloted and revised 3. Comprehensive 4. Easy to use 5. Reasonably high validity and reliability	1. Better suited to use in RCT/non-RCT studies 2. Some questions only relevant for RCT study designs 3. External validity items had quite poor validity and reliability 4. Long checklist 5. Would need to be modified for this review
Newcastle Ottawa Tool ¹	1. Can be used for systaltic reviews 2. Developed rigorously, tested and refined 3. Easy to use	1. Unknown validity and reliability 2. Tool does not assess whether study inclusion/exclusion criteria is defined 3. Does not assess sample size (important to consider for this review as some judgements based on p values)
Reisch ¹	1. Can be used for systematic reviews 2. Can be used to evaluate any study design 3. High internal reliability	1. Some items too specific to pharmaceutical studies so would require modification for this review 2. Very long to administer 3. Unknown validity

Quality Assessment Checklist/Tool	Strengths	Weaknesses
Sirriyeh et al	<ol style="list-style-type: none"> 1. Developed for use in systematic reviews 2. Developed to incorporate diverse studies 3. Developed, piloted and refined 4. Good content validity (rigorous in design) 5. Found good inter-rater reliability in terms of consistent scoring between raters in a subset of papers assessed 6. Easy to use 7. Appropriate for health research 8. Good test re-test reliability 	<ol style="list-style-type: none"> 1. Developed to synthesise qualitative and quantitative research (only synthesising quantitative data in this review) 2. Requires a level of judgement (subjective) 3. 4-point likert scales limit inter-rater reliability (stated by the authors) 4. Some disparity in comprehension between external users of the tool
Thomas ¹	<ol style="list-style-type: none"> 1. Can be used for systematic reviews 2. Can be used to evaluate any study design 3. Easy to use with clear guidance for completion of tool 	<ol style="list-style-type: none"> 1. Unclear how items were generated 2. Unknown reliability and validity 3. Tool does not assess whether study inclusion/exclusion criteria is defined 4. Does not assess sample size (important to consider for this review as some judgements based on p values)
Walburn et al	<ol style="list-style-type: none"> 1. Can be used for systematic reviews 2. Can be used on a variety of study designs (the included studies designs can be organised into a hierarchy) 3. Checklist developed from a number of sources and discussion 	<ol style="list-style-type: none"> 1. Unknown reliability and validity 2. Does not provide cut-off scores for quality (although for this review this was useful as it meant individual items could be assessed and all data (only 12 articles) available could be overviewed)

Quality Assessment Checklist/Tool	Strengths	Weaknesses
	<ol style="list-style-type: none">4. Developed for use in psychological research (applicable content for this systematic review)5. Assesses sample representativeness (important for this review as data came from mixed stroke/TIA samples)6. Has been found useful in application in other research	

Walburn et al's. (2001) checklist was deemed to be most appropriate as the checklist was originally developed for use in psychological research (specifically in a study assessing patient and nurse attitudes to medication for mental illness). As such, the checklist prompts consideration of some of the psychometric properties of measures used, such as reliability and validity. This is important in this review as the results presented are reliant on measures of adherence and determinants. Moreover, it prompts careful consideration of the sample included, such as whether there is a sample size calculation, and whether there is justification that the sample is representative of the population. As this checklist has been developed and used in multiple studies (Perry, Watkins, Gilbert, & Rawlinson, 2013; Pollak, Nicholson, Edwards, & David, 2014; Waddell & Taylor, 2009) to assess a mixture of study designs, including non-randomised controlled trials and observational studies, the checklist was also felt to be particularly appropriate for use in this review.

Quality assessment was conducted independently by two reviewers (EC, MF) using Walburn et al's 13-item checklist (Walburn et al., 2001) to appraise studies of attitudes to medicines. The checklist assesses items such as a priori aims, definition/size of population under investigation, sample size calculations and justification that the sample is representative of population. The checklist is not intended to provide a defined cut-off study quality score, below which studies should be excluded from analysis. Instead, using the checklist facilitated qualitative consideration of the impact of study design features on findings.

4.3.4 Determinant mapping

Two coders (EC; SJB (colleague)), with qualifications in Health Psychology (MSc; PhD, MSc), independently mapped the identified psychological determinants into TDF domains. Domain definitions were taken from the most recent version of the TDF at the time of this review (Cane et al., 2012). One coder (MA (supervisor)), a qualified general practitioner with experience in mental health research, resolved disputes. Determinants were coded into the most suitable domain, or domains if it was agreed that the determinant fitted into more than one, or not coded if none of the domains seemed appropriate. Where possible, the wording of the items used to measure a determinant was checked to ensure domains were coded in line with what was measured, rather than simply using the label given to a determinant by the study authors. Cohen's kappa for agreement between the two coders (Cohen, 1960) was $k = 0.69$ (SE=0.07 [95% CI= 0.56-0.82]), indicating substantial agreement.

4.4 Results

A search from inception until November 2015 produced a total of 32,845 articles (duplicates removed). Titles and abstracts were screened producing 90 full texts to assess. Following assessment of full texts, 12 papers reporting on seven samples met inclusion criteria (Figure 5).

4.4.1 Study characteristics

Detailed study characteristics can be found in Table 6. The 12 papers were derived from seven samples, with another two of the papers posing a potential for overlap. Therefore, results will now be considered by displaying the number of papers (x/12) and number of samples (x/7), relevant to each factor. Most studies (9/12; 5/7) assessed medication adherence. Three of the 12 studies (2/7 samples) assessed medication persistence (Bushnell et al., 2011; Bushnell, Zimmer, Pan, & et al., 2010; Glader et al., 2010). The total sample size was 43,984 (range 25 to 21,077). Research was conducted in four countries (USA, Australia, Sweden, United Kingdom) across three continents. Settings for participant recruitment included hospital (5/12; 4/7) (Bushnell et al., 2011; Bushnell et al., 2010; Coetzee et al., 2008; Glader et al., 2010; Sjölander, Eriksson, & Glader, 2011), community (6/12; 2/7) (Edmondson, Horowitz, Goldfinger, Fei, & Kronish, 2013; Kronish et al., 2013; Kronish, Edmondson, Goldfinger, Fei, & Horowitz, 2012; Phillips, Diefenbach, Abrams, & Horowitz, 2015; Phillips, Diefenbach, Kronish, Negron, & Horowitz, 2014; Sjölander, Eriksson, & Glader, 2013) and an outpatient setting (1/12; 1/7) (O'Carroll et al., 2011). The reported stroke subtypes included ischaemic (6/12; 5/7) (Bushnell et al., 2011; Bushnell et al., 2010; Coetzee et al., 2008; Glader et al., 2010; O'Carroll et al., 2011; Sjölander et al., 2011), haemorrhagic (3/12; 3/7) (Coetzee et al., 2008; Glader et al., 2010; Sjölander et al., 2013) and TIA (6/12; 2/7) (Bushnell et al., 2011; Bushnell et al., 2010; Edmondson et al., 2013; Kronish et al., 2013; Phillips et al., 2015; Phillips et al., 2014), with the majority of papers reporting samples with mixed subtypes

(75%). In seven papers (3/7 samples), the stroke subtype was either undefined or only some of the sample's stroke subtypes were defined.

Time periods between measurement of determinants and adherence varied, with 6/12 papers; 2/7 samples using cross-sectional designs (Edmondson et al., 2013; Kronish et al., 2012; Kronish et al., 2013; Phillips et al., 2015; Phillips et al., 2014; Sjölander et al., 2011), and follow-up time frames for prospective studies of five-six weeks (1/12; 1/7) (O'Carroll et al., 2011), three months (2/12; 2/7) (Bushnell et al., 2010; Sjölander et al., 2013), 12 months (2/12; 2/7) (Bushnell et al., 2011; Coetzee et al., 2008) and 24 months (1/12; 1/7) (Glader et al., 2010). A range of questionnaire items (validated and non-validated) were used to measure psychological determinants. Some papers did not clearly describe how determinants were measured.

Table 6. Summary of each included full text article

Author/ Country	Design	Participants	N	Medication Adherence Outcome Measure	Psychological Determinants Measured	Psychological Determinant Outcome Measure	Key Findings	Quality Score
Bushnell 2010/ America	Prospective	Ischaemic stroke (1712) & TIA (465)	2177	Comparison- discharge Vs. current medications (measured by modified MMAQ)	Understanding how to refill medications	Unclear from paper	OR 1.64 (95% CI 1.04-2.58) P=0.03	61.5
					Understanding why medications are being taken	Unclear from paper	OR 1.81 (95% CI 1.19-2.76) p=0.006	
					EQ-5D score	EuroQoL-5D	OR 2.33 (95% CI 1.24-4.38) P=0.009	
Bushnell (2011)/ America	Prospective	Ischaemic stroke & TIA	2092	Comparison- discharge Vs. current medications (measured by modified MMQ)	Receiving medication instructions	The Primary Care Assessment Survey	OR: 1.43 (95% CI 1.13–1.81) p<0.003	61.5
					Understanding medication side effects	Unclear from paper	OR 1.29 (95% CI 1.02-1.63) p=0.032	
					Understanding why medications are being taken	Unclear from paper	OR 1.49 (95% CI 1.03-2.17) p=0.036	
Edmondson (2013) /America	Cross- sectional	TIA & undefined stroke	535	8 item MMAQ	PTSD symptoms	PCL-S	OR 1.02 (95% CI 1.00–1.05)	90.9
					Specific Concerns	BMQ Specific	OR 1.17 (95% CI 1.10–1.25)	
					Depressive symptoms	PHQ-8	OR 1.02 (95% CI 0.97–1.08)	
Kronish (2012) /America	Cross- sectional	Undefined strokes	535	8 item MMAQ	Likely PTSD	PCL-S	OR 2.69 (95% CI 1.71–4.23)	90.9
					Possible PTSD		OR 1.86 (95% CI 1.27–2.74)	
					No PTSD		(Reference category)	

Author/ Country	Design	Participants	N	Medication Adherence Outcome Measure	Psychological Determinants Measured	Psychological Determinant Outcome Measure	Key Findings	Quality Score
					Depressive symptoms	PHQ-8	OR 1.12 (95% CI 0.88-1.42)	
Kronish (2013) /America	Cross- sectional	TIA & undefined strokes	600	8 item MMAQ	High concerns about medications	Modified BMQ Specific Concerns (X4 items)	OR 5.09 (95 % CI 2.81-9.24) p<0.001	90.9
					Low perceived need of medications	Modified BMQ Specific Necessity	OR 1.23 (95% CI 0.79-1.91) p=0.36	
					Low knowledge of stroke risk factors	NV-Qx1 State 3 most important things would recommend to others to lower stroke risk	OR 1.22 (95% CI 0.76-1.96) p=0.42	
					Low trust in personal doctor	Adapted Trust in Doctors Scale (x3 items)	OR 1.30 (95% CI 0.84- 2.01) p=0.23	
					Perceive discrimination due to race, ethnicity, education, or income	NV-5 point likert scale	OR 1.79 (95 % CI 1.14-2.81). P=0.01	
Philips (2014) /America	Cross- sectional	TIA (284) & undefined stroke (316)	600	8 item MMAQ	Necessity beliefs	Adapted BMQ Specific	$\beta=0.25$ (95 % CI= 0.07-0.42) p<0.01	72.2
					Concerns		$\beta=-0.81$ (95 % CI=-0.96- -0.66) p<0.001	
Phillips (2015) /America	Cross- sectional	TIA (284) & undefined stroke (316)	600	8 item MMAQ	Affective illness items	NV-Q x2 How well Blood Pressure and Cholesterol is controlled	r=-.27 p=0.001 $\beta-0.14$ R ² 0.02 (F (1, 564) = 12.33) p<0.001	72.2
					Cognitive illness items	NV-Q x1 Level of worry about future stroke	r=0.29 p=0.001 β 0.18 R ² 0.03 (F(1, 564) = 22.16) p<0.001	
					Affective treatment items	BMQ Specific Concerns (X3 items)	r= -0.40 p=0.001 $\beta-0.31$ R ² 0.08 (F(1, 564) = 56.71) p<0.001	

Author/ Country	Design	Participants	N	Medication Adherence Outcome Measure	Psychological Determinants Measured	Psychological Determinant Outcome Measure	Key Findings	Quality Score
					Cognitive treatment items	BMQ Specific Necessity (X3 items) +NV-“How much do you think medicines can help prevent strokes?”	r= 0.12 p=0.01 β 0.13 R ² 0.02 (F(1, 564) = 11.62) p<0.01	
Coetzee (2008) /Australia	Prospective	Ischaemic (14) & haemorrhagic (11) stroke	25	Q1 & 2 on TAS Pill Counts	(Partner) Emotional Dyscontrol	EFQ	r= -0.66 p<0.01	84.6
					Language Skills		r= -0.44 p<0.001	
					Memory		r= -0.54 p<0.001	
					Planning and Organisation		r= -0.52 p<0.001	
					Anger	ESDQ	r= -0.63 p<0.01	
					Emotional Dyscontrol		r= -0.76 p<0.001	
					Helplessness		r= -0.64 p<0.01	
					Inertia		r= -0.61 p<0.01	
					Fatigue		r= -0.52 p<0.01	
					Indifference		r= -0.54 p<0.01	
					Euphoria		r= -0.51 p<0.01	
					(Partner) Emotional Dyscontrol		r= -0.51 p<0.001	
					(Partner) Inertia		r= -0.51 p<0.01	
					Anxiety	HADS	r= -0.74 p<0.001	
					Specific necessity	BMQ Specific	r= -0.53 p<0.01	
					Care received at home	Questions in TAS	r= 0.53 p<0.01	
O’Carroll (2011) /Scotland	Prospective	Ischaemic stroke	180	Urine samples MARS	Specific medication concerns	BMQ Specific	β= -0.254 p<0.01	76.9
					MMSE score	MMSE	β = 0.000 NS	
					Perceived benefit of medication	NV-Adapted Qs ⁵	β= 0.273 p=0.001	

⁵ Trewby, P. N., Reddy, A. V., Trewby, C. S., Ashton, V. J., Brennan, G., & Inglis, J. (2002). Are preventive drugs preventive enough? A study of patients' expectation of benefit from preventive drugs. *Clinical Medicine*, 2(6), 527-533.

Author/ Country	Design	Participants	N	Medication Adherence Outcome Measure	Psychological Determinants Measured	Psychological Determinant Outcome Measure	Key Findings	Quality Score
					RMBT score	RMBT	$\beta=0.167$ NS	
					Risk perception of further stroke	NV-Visual analogue 0–100 scale	$\beta= -0.044$ NS	
					Illness perceptions- acute/chronic timeline	IPQ	B=0.002 NS	
					Illness perceptions- treatment control		B= -0.021 NS	
					Specific necessity	BMQ specific	B= -0.022 NS	
					Desire for medications now	NV-Adapted Q.s	B= -0.140 NS	
					HADS total	HADS	$\beta=0.064$ NS	
Glader (2010) /Sweden	Prospective	Ischaemic, haemorrhagic & undefined stroke	21077	Data Linkage- RiksStroke with the Swedish Prescribed Drug Register	Support of next of kin	Items from the RiksStroke Register (available online)	AH –OR 1.13 (95% CI 1.02–1.25) p<0.001 S - NS AP - NS W – OR 0.98 (95% CI 0.76–1.26) p<0.05	69.2
					Self perceived general health		AH – OR 0.86 (95% CI 0.76– 0.98) p<0.02 S – OR 0.69 (05% CI 0.59–0.80) p<0.001 AP – OR 0.79 (95% CI 0.70– 0.89) p<0.001 W - NS	
					Low mood		AH – OR 0.88 (95% CI 0.79– 0.98) p<0.001 S – OR 1.12 (95% CI 0.98–1.28) p<0.09	

Author/ Country	Design	Participants	N	Medication Adherence Outcome Measure	Psychological Determinants Measured	Psychological Determinant Outcome Measure	Key Findings	Quality Score
							AP – OR 0.92 (95% CI 0.83– 1.02) p<0.04 W - NS	
					Satisfaction with hospital care and support		AH – NS S – NS AP – NS W - NS	
Sjolander (2011) /Sweden	Prospective	Ischaemic stroke (men- 9331; women- 9016)	19347	Prescription refills	Self reported depression	Items from the RiksStroke Register (available online)	Men – PR 0.96 (95% CI 0.88– 1.05) Women- PR 1.00 (95% CI 0.93– 1.08)	69.2
					Self reported bad general health		Men – PR 0.99 (95% CI 0.90– 1.09) Women – PR 0.97 (95% CI 0.89– 1.06)	
					Dissatisfied with care		Men – PR 0.92 (95% CI 0.74– 1.14) Women – PR 0.93 (95% CI 0.75– 1.16)	
					Dissatisfied with support		Men – PR 0.99 (95% CI 0.89– 1.10) Women – PR 0.99 (95% CI 0.90– 1.10)	
Sjolander (2013) /Sweden	Cross- sectional	Haemorrhagic (40) & undefined stroke (538)	578	MARS	Specific necessity	BMQ	OR 0.90 (95% CI 0.83-0.98) p=0.079	84.6

Author/ Country	Design	Participants	N	Medication Adherence Outcome Measure	Psychological Determinants Measured	Psychological Determinant Outcome Measure	Key Findings	Quality Score
					Specific concerns		OR 1.12 (95% CI 1.05-1.21) p<0.001	
					General overuse		OR 1.29 (95% CI 1.14-1.45) p<0.001	
					General harm		OR 1.12 (95% CI 1.01-1.24) p=0.038	
					General benefit		OR 0.77 (95% CI 0.68-0.87) p<0.001	

MMAQ- Morisky Medication Adherence Questionnaire; MARS- Medication Adherence Report Scale; TAS- Treatment Assessment Schedule; BMQ-Beliefs About Medicines Questionnaire; PCL-S- Modified PTSD Checklist-Specific to stroke/mini stroke; EQ-5D- EuroQoL-5D; PHQ-8-8-item Patient Health Questionnaire Depression Scale; EFQ- Everyday Functioning Questionnaire; ESDQ- The Emotional and Social Dysfunction Questionnaire; HADS- The Hospital Anxiety and Depression Scale; MMSE- The Mini-Mental State Examination; RMBT- The Rivermead Behavioural Memory Test; IPQ-The Illness Perception Questionnaire; NS- Not significant; NV-Non-validated; AH-Anti-hypertensives; S-Statins; AP-Anti-platelets; W-Warfarin

4.4.2 Measurement of adherence

A variety of methods were used to measure medication adherence (Table 7). These included the use of self-report measures such as the Medication Adherence Report Scale (MARS), and more objective methods such as conducting pill counts and monitoring prescription refills. In total, seven different methods were applied (3 subjective, 4 objective), either alone or in conjunction with another. Six articles (50%; 5/7 samples) named the specific medications being assessed for adherence. Of these, five considered antiplatelet, antihypertensive, cholesterol lowering and anti-coagulant medications (Bushnell et al., 2011; Bushnell et al., 2010; Coetzee et al., 2008; Glader et al., 2010; Sjölander et al., 2011) and one assessed adherence to antiplatelet, antihypertensive and cholesterol lowering medications (O'Carroll et al., 2011).

Table 7. Methods of medication adherence measurement

Outcome Measure	Bushnell (2010)	Bushnell (2011)	Coetsee (2008)	Edmondson (2013)	Glader (2010)	Kronish (2012)	Kronish (2013)	O'Carroll (2011)	Phillips (2014)	Phillips (2015)	Sjolander (2011)	Sjolander (2013)
Eight-item Morisky	✓	✓		✓		✓	✓		✓	✓		
MARS								✓				✓
TAS			✓									
Record comparison/ Linkage	✓	✓			✓							
Prescription Refills											✓	
Urine Sample								✓				
Pill counts			✓									

MARS-Medication Adherence Report Scale; TAS-Treatment Assessment Schedule

4.4.3 Quality assessment

Study quality was varied (Table 8). Checklist scores ranged from 8-10 (mean=9.3) out of a possible 13. All included studies reported explicit a priori aims, a sample definition and size, inclusion/exclusion criteria, a response/dropout rate where applicable and whether the research was independent of routine practice. However, only two studies gave a sample size calculation (O'Carroll et al., 2011; Sjölander et al., 2013). In addition, although seven studies stated the response/dropout rate (Bushnell et al., 2011; Bushnell et al., 2010; Coetzee et al., 2008; Glader et al., 2010; O'Carroll et al., 2011; Sjölander et al., 2011, 2013), with response rates ranging from 56% to 96%, only two provided justification for these rates (Coetzee et al., 2008; O'Carroll et al., 2011). There was no clear justification of sample representativeness in four studies (Bushnell et al., 2011; Bushnell et al., 2010; Coetzee et al., 2008; O'Carroll et al., 2011). In addition, the majority of included studies had designed questionnaires or interview schedules purposely for the research, derived from validated and non-validated measures. Three studies did not make the original questionnaire available or provide sufficient information on how all determinants were measured (Bushnell et al., 2011; Bushnell et al., 2010; O'Carroll et al., 2011) and four studies did not justify the reliability/validity of the measures used (Bushnell et al., 2011; Bushnell et al., 2010; Glader et al., 2010; Sjölander et al., 2011).

Table 8. Quality Assessment Checklist Scores

Study (first author and year)	Explicit <i>a priori</i> aims	Definition/ size of population under investigation	Sample size calculation	Justification that sample is representative of population	Inclusion/ exclusion criteria stated	Demographic details	Research independent of routine care/ practice	Justification of validity/ reliability of measures	Original questionnaire available	Response/ dropout rate specified	Justification of response/ dropout rate	Discussion of generalisability	Statement of source of funding	Marks lost	Percentage of maximum quality score
Kronish (2012)	+	+	-	+	+	+	+	+	+	N/A	N/A	+	+	1	90.9
Kronish (2013)	+	+	-	+	+	+	+	+	+	N/A	N/A	+	+	1	90.9
Edmondson (2013)	+	+	-	+	+	+	+	+	+	N/A	N/A	+	+	1	90.9
Coetzee (2008)	+	+	-	-	+	+	+	+	+	+	+	+	+	2	84.6
Sjolander (2013)	+	+	+	+	+	+	+	+	+	+	-	-	+	2	84.6
O'Carroll (2011)	+	+	+	-	+	-	+	+	-	+	+	+	+	3	76.9
Phillips (2014)	+	+	-	+	+	+	+	+	+	N/A	N/A	-	+	3	72.7
Phillips (2015)	+	+	-	+	+	+	+	+	+	N/A	N/A	-	-	3	72.7
Glader (2010)	+	+	-	+	+	+	+	-	+	+	-	-	+	4	69.2
Sjolander (2011)	+	+	-	+	+	+	+	-	+	+	-	-	+	4	69.2
Bushnell (2010)	+	+	-	-	+	+	+	-	-	+	-	+	+	5	61.5
Bushnell (2011)	+	+	-	-	+	+	+	-	-	+	-	+	+	5	61.5
Total	12/12	12/12	2/12	8/12	12/12	11/12	12/12	8/12	9/12	7/7	2/7	7/12	11/12	Mean 2.8	Mean 77.1

4.4.4 Determinant mapping

There were 48 distinct determinants measured across the 12 papers, reporting on seven samples. The most common determinants (6/12 papers; 4/7 samples) were variations of *concerns about medications* and *beliefs about necessity of medications*. Five of 12 articles (4/7 samples) also assessed *depression* as a determinant of medication adherence. Over half the tested determinants were only measured in one study. Table 9 displays the identified determinants from the review mapped into TDF domains.

Determinants tested in the papers could be mapped into 8/14 domains. There were no tested determinants that mapped into 'Social/Professional role and identity', 'Optimism', 'Reinforcement', 'Goals', 'Environmental context and resources' and 'Behavioural regulation'. One tested determinant, *quality of life* (as measured by increments of 10% in EuroQoL-5D score) could not be mapped into the TDF, as no definition seemed appropriate. Only four determinants (*patient reported* and *partner reported inertia*, *patient helplessness* and *affective illness items*) were considered to fit within two separate TDF domains (see Table 9 for determinant mapping). All other determinants sat discretely within one domain. A total of 33 distinct determinants, corresponding to seven TDF domains, significantly influenced adherence/persistence behaviour (Table 10). Each domain will now be discussed in turn, presented similarly to previous results, showing the number of papers (x/12) and number of samples (x/7), relevant to each factor (for numerical details of observed associations and p values, see Table 6).

Table 9. Determinants mapped into the Theoretical Domains Framework

Domain	Description ⁶	Determinant
Knowledge	<i>An awareness of the existence of something</i>	Receiving medication instructions Understanding why meds are being taken Understanding medication side effects Low knowledge of stroke risk factors Understanding how to refill meds Self-perceived general health Self-reported bad general health
Skills	<i>An ability or proficiency acquired through practice</i>	Planning and organisation Language skills
Social/Professional role and identity	<i>A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting</i>	
Beliefs about capabilities	<i>Acceptance of the truth, reality, or validity about an ability, talent, or facility that a person can put to constructive use</i>	Cognitive illness items Helplessness
Optimism	<i>The confidence that things will happen for the best or that desired goals will be attained</i>	

⁶ Definitions as stated in Cane et al 2012 who utilised the definitions from the American Psychological Associations' Dictionary of Psychology

Domain	Description ⁶	Determinant
Beliefs about consequences	<i>Acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation</i>	Concerns about medications Affective illness items Beliefs about necessity Perceived benefit of medication Cognitive treatment items Affective treatment items Risk perception of risk of further stroke Beliefs about benefit Beliefs about overuse Beliefs about harm Illness perceptions-acute/chronic timeline Illness perceptions-treatment control
Reinforcement	<i>Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus</i>	
Intentions	<i>A conscious decision to perform a behaviour or a resolve to act in a certain way</i>	Desire for medication now
Goals	<i>Mental representations of outcomes or end states that an individual wants to achieve</i>	

Domain	Description ⁶	Determinant
Memory, Attention and Decision Processes	<i>The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives</i>	MMSE score RMBT score Patient memory
Environmental context and resources	<i>Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behaviour</i>	
Social influences	<i>Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours</i>	Support of next of kin Low trust in personal doctor Perceived discrimination on account of race, ethnicity, education or income Dissatisfied with care Dissatisfied with support Satisfaction with hospital care/support Care received at home Inertia Inertia (rated by partner)
Emotions	<i>A complex reaction pattern, involving experiential, behavioural, and physiological</i>	Emotional Dyscontrol (rated by partner)

Domain	Description ⁶	Determinant
	<i>elements, by which the individual attempts to deal with a personally significant matter or event</i>	Emotional Dystcontrol Likely/possible PTSD Anger PTSD symptoms (Self-reported) Depression/Depressive symptoms Low mood Fatigue Indifference Euphoria Inertia Inertia (rated by partner) HADS total Anxiety Helplessness Affective illness items
Behavioural regulation	<i>Anything aimed at managing or changing objectively observed or measured actions</i>	

In Table 10 below, the middle two columns display the number of determinants where a statistically significant influence or increased odds of influence on adherence or persistence were reported in the included studies of this review. The righthand column presents the total number of identified determinants within each domain, irrespective of whether the determinant was reported to have a significant or non-significant influence on behaviour.

Table 10. Table showing the number of significant determinants (and their negative or positive influence on adherence) within each domain

Domain		No. of determinants that have a significant influence/ increased odds of influencing adherence/persistence	No. of determinants that have a significant influence/increased odds of influencing non-adherence/poor persistence	Total number of determinants in domain
Knowledge	Good	4	0	7
	Poor	0	1	
Skills	Good	0	0	2
	Poor	0	2	
Beliefs about capabilities	Positive	1	0	2
	Negative	0	1	
Beliefs about consequences	Positive	4	0	12
	Negative	0	5	
Intentions	Has intentions	0	0	1
	No intentions	0	0	
Memory, Attention and Decision processes	Good	0	0	3
	Poor	0	1	
Social influences	Good	2	0	9
	Poor	0	3	
Emotions	Positive	0	0	16
	Negative	0	14	

4.4.4.1 ‘Knowledge’

Seven distinct determinants mapped into this domain (5/12; 4/7). Two determinants did not have a significant effect on adherence (*self-reported bad general health* and *low knowledge of stroke risk factors*). Five significantly influenced medication adherence/persistence. Generally, greater knowledge was associated with better adherence/persistence. Four significant determinants (*receiving medication instructions, understanding how to refill medications, understanding why medications are being taken* and *understanding medication side effects*) were all related to adherence in this manner. *Self-perceived general health* also had a significant effect on adherence, with poorer *self-perceived general health* associated with poorer medication persistence.

4.4.4.2 ‘Skills’

Two distinct determinants tested (*patient language skills* (reported by a partner) and *patient planning and organisation skills*) mapped to this domain (1/12; 1/7). Both determinants had a significant effect on adherence, with poorer skills associated with worse adherence.

4.4.4.3 ‘Beliefs about capabilities’

Two distinct determinants were tested, both significantly influencing medication adherence (2/12; 2/7). *Patient helplessness* had a negative impact

on adherence. Rating oneself as more helpless was related to poorer adherence. *Cognitive illness items*, assessing patients' perceived control over stroke risk factors, had a positive impact, with positive responses indicating higher perceived risk factor control related to better self-reported adherence.

4.4.4.4 'Beliefs about consequences'

Twelve distinct determinants were mapped to this domain (7/12; 4/7). Three tested determinants were not found to have a significant effect on medication adherence (*illness perceptions* relating to acute/chronic timelines of a condition, *illness perceptions* referring to treatment control and *perceived risk of further stroke*). Four determinants had a significant positive influence on medication adherence. Greater *perceived necessity of medications* was related to increased adherence (in 2/5 papers). Greater *perceived benefit of medications* (measured in two ways) was related to increased adherence. Higher scores on *cognitive treatment items* (derived from items from the specific necessity subscale of the Beliefs about Medications Questionnaire (BMQ), plus a question regarding how much patients thought their medications could prevent stroke) were related to better self-reported adherence.

Five determinants significantly negatively influenced adherence. When patients had greater *concerns about medications*, *beliefs about medication overuse* and *beliefs about harm from medication* adherence was worse. In addition, poorer adherence was related to *affective treatment items*,

concerning worries about medications and *affective illness items* concerning worries about stroke.

4.4.4.5 ‘Intentions’

One determinant (*desire for medications now*) was tested (1/12; 1/7), but not found to have a significant effect on adherence.

4.4.4.6 ‘Memory, Attention and Decision processes’

Three distinct determinants were tested (2/12; 2/7) of which two were not significant (*Mini Mental State Exam (MMSE) score* and *Rivermead Memory Behavioural Test (RMBT) score*). In contrast, *Patient memory* (measured by the Everyday Functioning Questionnaire (EFQ)) significantly influenced medication adherence. Poorer reported memory or memory deficits were related to poorer adherence.

4.4.4.7 ‘Social influences’

Nine distinct determinants were tested and mapped into this domain (4/12; 4/7). Four (*low trust in personal doctor, dissatisfaction with care, dissatisfaction with support, and satisfaction with hospital care/support*) did not have a significant effect on medication adherence/persistence. Two determinants had a significant positive influence on medication adherence/persistence. *Increased support from the next of kin* was related to

better persistence with anti-hypertensive and warfarin medications. Moreover, higher levels of *care received at home* was associated with better adherence. In contrast, three determinants negatively influenced adherence. Greater *perceived discrimination due to race, ethnicity, education or income* increased odds of non-adherence. In addition, both *patient-rated* and *partner-rated inertia* influenced adherence negatively. Increasing levels of inertia appeared to relate to increased non-adherence.

4.4.4.8 'Emotions'

Fifteen distinct determinants were tested (7/12; 5/7). Two determinants ((*self-reported*) *depression/depressive symptoms* and Hospital Anxiety and Depression Scale (*HADS*) *total score*) were not significantly associated with medication adherence. Thirteen determinants had a significant negative influence on adherence/persistence. Adherence/persistence was poorer when patients had greater *patient-reported* or *partner-rated emotional dyscontrol* (measured via two different measures), *post-traumatic stress disorder (PTSD) symptoms*, more *anger*, greater *patient-reported* or *partner-rated inertia*, more *fatigue*, *euphoria*, *indifference*, *anxiety*, *low mood*, higher perceived *helplessness* or scores on *affective illness items* (concerning worries about stroke).

4.4.4.9 Challenges when mapping

The provided definitions of TDF domains (Cane et al., 2012), at times, proved somewhat ambiguous. There were instances where the coders were unable to agree upon determinant coding, based on their understanding and interpretation of given definitions. For example, initially self-perceived general health had been coded under the domain 'Social and professional role and identify'. This was disputed. Discussion and further research into definition meanings of the domains and determinants resolved the dispute and this determinant was moved to the 'Knowledge' domain. To demonstrate this process, Knowledge is defined by Cane et al (2012) as "*An awareness of the existence of something*". To perceive oneself as healthy is to be aware of this. If you expand the search of knowledge definitions you can find it defined as "awareness or familiarity gained by experience of a fact or situation", which seems well suited to describe a person's perceived health status.

Moreover, some determinants were mapped into more than one TDF domains. This has been the case in other research (Cane et al., 2012). For example, the *inertia and inertia (rated by a partner)* determinants were mapped into both the 'social influences' and 'emotions' domains. Where possible, the wording of items used to measure a determinant were checked, to ensure that domains were coded in line with what was actually measured, rather than the label given to a determinant by the study authors. This was to facilitate appropriate coding of determinants. To demonstrate further for the inertia determinants, the wording of the Emotional and Social Dysfunction

Questionnaire (Andrewes et al., 2003) was checked as this was used to measure inertia. The wording of these items are:

- Do others sometimes remark that you never start or complete things?
- Do other people have to prompt you to do things?
- Do you lack interests or hobbies?

In this instance, the coders felt these items fit both social influence and emotions domains of the TDF.

One tested determinant, *quality of life* (as measured by increments of 10% in EuroQoL-5D score) could not be mapped into the TDF. It may be the case that this determinant was too broad and encompassed smaller groups of determinants. More specific measurement of determinants may aid coding into theoretical domains. Alternatively, it may be the case that the TDF needs further revision, most specifically more careful operationalisation of domains so that researchers can more succinctly code determinants

4.5 Discussion

The purpose of this review was to identify psychological determinants that influence medication adherence in stroke survivors. Forty-eight distinct determinants were assessed in 12 articles representing seven samples. The identified determinants were mapped into TDF domains, in order to develop a theoretical understanding of how these determinants influence medication adherence and to inform future work. Based on this review, the 'Emotions', (at least one significant determinant in 3/4 samples in which they were tested,

86% of tested associations statistically significant), 'Knowledge" (at least one significant determinant in 3/4 samples in which they were tested, 79% of tested associations statistically significant) and 'Beliefs about consequences' domains (at least one significant determinant in 4/4 samples in which they were tested, 75% of associations statistically significant) appear to have the strongest influence on medication adherence. The TDF has enabled a holistic approach to understanding medication adherence that will be important in future intervention development.

Within the Emotions domain, emotional distress such as '*anxiety*', '*PTSD*' and '*emotional dyscontrol*' was found to have an influence on medication adherence. Similar findings have emerged in recent literature, corroborating this finding. For example, Gentil and colleagues (2012) assessed anti-hypertensive medication adherence in community-living older adults, finding that adherence was lower when participants had an anxiety or depressive disorder (Gentil, Vasiliadis, Prévile, Bossé, & Berbiche, 2012). In addition, a large American study (n=1342), found a significant association between the presence of mental health conditions (anxiety/depression) and difficulty taking anti-hypertensive medications (Vawter, Tong, Gemilyan, & Yoon, 2008). It is posited that depression and anxiety can affect or impair energy, cognitive focus and motivation, which in turn could affect a patient's' ability or want to follow treatment recommendations such as a medication regimen (DiMatteo, Lepper, & Croghan, 2000). To elaborate, patients with depression can feel hopeless and therefore may not see the act of taking medications as worthwhile. Additionally, depression can affect cognitive functioning, which

could affect memory and planning abilities and this may partially account for how depression and other negative mood can affect medication adherence (DiMatteo et al., 2000).

Within the 'Knowledge' domain, *understanding why medications were being taken* and *understanding medication side effects* were found to have influence on medication adherence. This result seems somewhat intuitive, as a lack of understanding about why medications are being taken may result in people putting less significance on this daily activity. Moreover, if there is a lack of understanding about side effects (e.g. what is a serious side effect or misperceptions of the side effects a tablet can cause), this again could reduce adherence. Previous literature has found similar. A prospective cohort study interviewing 130 stroke survivors and 85 caregivers found large gaps in stroke survivor and caregiver knowledge, with 28% of the sample reporting non-adherence. (Koenig et al., 2007). Associations have also been identified (OR=5.67; [95% CI 2.87–11.19]) between adherence and knowledge in a study of heart failure patients (van der Wal et al., 2006). More recently, a qualitative study identifying barriers to medication adherence with stroke survivors, caregivers and general practitioners in the East of England found similar results (Jamison, Graffy, Mullis, Mant, & Sutton, 2016). Knowledge of stroke and medication was identified as a patient level barrier to adherence of secondary prevention medication (Jamison et al., 2016).

Within the 'Beliefs about consequences' domain, both *concerns about medication* and *beliefs about the necessity of medication* were the most common determinants with influence. This is commensurate with previous research. In a meta-analytic review assessing the influence of necessity beliefs and concerns on adherence in patients with long-term conditions, higher adherence was related to increased beliefs about necessity of treatment. Likewise, poorer adherence was associated with increased concerns about treatment (Horne et al., 2013). Moreover, recent research suggests interventions targeting perceived necessity and concerns about medications increase stroke survivors' medication adherence (Barker-Collo et al., 2015; O'Carroll et al., 2013). Therefore, those beliefs appear to play a causal role in adherence.

4.5.1 Quality of included studies

All 12 included studies gave clear descriptions of sample demographics, inclusion/exclusion criteria and sample size. Moreover, although there was disparity in the range of sample sizes (25-21,077) there was a pooled sample of 43,984 stroke survivors. These samples were derived from four countries across three continents. In light of this, it can be assumed, with a certain level of confidence, that the reviews findings are generalizable to stroke survivors from developed, western cultures.

There were no defined cut-offs for quality assessment scores. Nevertheless, assessment of the individual items, for each paper, was important to identify

gaps in research quality. Only two papers reported a sample size calculation. This is problematic when meta-analysis is not possible, as the finding that some determinants tested did not significantly influence adherence may be due to small sample sizes and underpowered studies, rather than genuine lack of relationships. Moreover, three studies did not make the original questionnaire available or provide sufficient information on measurement of determinants (Bushnell et al., 2011; Bushnell et al., 2010; O'Carroll et al., 2011). As several studies used tailor made questionnaires, including a mix of non-validated and validated scales, it would be helpful to future systematic reviewers to make the full questionnaires available.

Additionally, there were only seven discrete samples of participants across the 12 papers. Two papers (Bushnell et al., 2011; Bushnell et al., 2010) reported on the same sample, followed up at different time points. Five papers (Edmondson et al., 2013; IKronish et al., 2012; Kronish et al., 2013; Phillips et al., 2015; Phillips et al., 2014) used the same sample of trial participants' baseline data, with each paper testing different combinations of determinants that might influence medication adherence. This 'salami slicing' approach to research can present problems when undertaking literature reviews, because one samples data can be over-represented in the results if not handled sensitively. This would distort the final results presented and the clinical or other research recommendations that come from the study (Alfonso, Bermejo, & Segovia, 2005; Smolčić, 2013). Therefore, in this review, the number of significant determinants tested and the proportion of samples in which a type of determinant was both tested and found to be a significant predictor, were

reported. Given the relatively small number of independent samples included in this review, and the partial coverage of the TDF domains in the included studies, there remains a need for further, well-designed studies of the predictors of medication adherence in stroke survivors.

The secondary aim of this review, to establish the magnitude of the relationships between determinants and behaviour, could not be achieved, as study design choices were too heterogeneous to permit meta-analysis. Measurement of medication adherence was inconsistent across included papers, with different self-report or objective measures chosen, assessing adherence at a number of different time points. Whilst each time point assessed was appropriate in the respective context of the study, measurement of adherence at a consistent time point would enhance the likelihood of meta-analysis. In other long-term condition literature, non-adherence often starts to manifest at around three months following the first prescription of a medication (e.g. Cummings, Cosman, & Jamal, 2002), offering a potentially more opportune follow-up time point to choose. These difficulties in data synthesis of medication adherence research have also been reported in other literature (e.g. Lager et al., 2014). All methods of adherence measurement have limitations. Electronic, objective monitoring may be the best currently available option, but nevertheless can be reactive and is costly. Prescription data provides information about medication possession but not whether medication was taken, while self-report measures are subject to recall and social desirability biases. The majority of studies in the review used self-report measures. Future research might usefully further explore

psychological and other predictors of adherence to stroke secondary preventive medication using objective adherence measurement.

It could be suggested that the varying methods of medication adherence measurement add strength to the findings in this review. For example, the determinant *concerns about medications* was measured across five studies (3/7 samples) (Edmondson et al., 2013; O'Carroll et al., 2011; Phillips et al., 2014; Kronish et al., 2013; Sjölander et al., 2013), with a significant relationship identified between this determinant and medication adherence. Across the five studies, medication adherence was measured by three different self-report and one pill count method. Irrespective of the measurement method, a significant relationship was found, thus strengthening the conclusion that there is a relationship between determinant and behaviour.

4.5.2 Limitations

The number of papers that met final inclusion criteria was small. Authors were contacted (n=19) to request more information or manuscripts relating to data that had previously been presented at conferences or where no full text access could be found, but only seven responded. Other systematic reviewers have reported a similar issue (Fleetcroft et al., 2015).

In spite of the rigorous method applied to determinant mapping, there is still an element of subjectivity in the process. The task relies on interpretation of TDF domain definitions, and descriptions of scales provided in the primary studies.

No determinants were mapped into six TDF domains. Other research has highlighted the importance of some of these domains in sustained behaviour change. Nicholson and colleagues (2014) identified the importance of 'Environmental context and resources' with the engagement of physical activity in stroke survivors (Nicholson et al., 2014). The limited breadth of domains tested through this review may represent a 'file drawer' problem or limitations in the study designs. This may also be in part due to the inclusion of only psychological determinants, which could be less likely to map into some TDF domains. In particular, the search strategy would have retrieved studies that assessed the association of stroke survivors' perceptions of their environmental context and resources with adherence, but not studies simply testing whether the presence or absence of different environmental and contextual features influenced adherence. Factors such as prescription costs and health insurance coverage also need to be considered. However, non-adherence remains an issue even in healthcare systems providing universal healthcare coverage and prescriptions free of charge (e.g. O'Carroll et al., 2011). Therefore, understanding psychological determinants of adherence remains an important issue to inform intervention design. Despite efforts in the search strategy to access a variety of literature, the 12 selected papers were all identified from the peer-reviewed literature; none were found in the 'grey'

literature, which could result in publication bias. Future work should aim to measure a broader range of psychological determinants that influence medication adherence in stroke survivors to enhance a more holistic understanding of this behaviour.

4.5.3 Implications for psychological theory

The TDF has allowed for a more holistic approach to understanding the underlying determinants of medication adherence in stroke survivors. Much literature has been published to facilitate the use of the TDF, linking domains directly to BCTs known to better address underlying determinants of behaviour. In addition, a lot of focus has been placed on utilisation of this theory to underpin intervention development processes that align with the MRC recommendations, but that better facilitate the researcher to link evidence and theory to the final intervention design and implementation into practice. This approach has been used in this thesis. A full discussion of the intervention development process, underpinned by the TDF and this systematic review, can be found in Chapter 5.

Six of the 14 domains were not tested in this review which could be for numerous reasons, including a focus on psychological determinants, for this thesis, which were felt to be more amenable to change. It could also indicate limitations in the study designs of current published literature and the ongoing 'file drawer' problem, whereby results that are non-significant or other literature not being accepted for publication is not readily available for review.

This does mean that there could be other important determinants that influence adherence and hence other influential domains within the TDF that will not be focused on moving forward with this thesis. A meaningful way to address this issue in the future will be for researchers to use a range of study designs that enable broader testing of underlying determinants of behaviour so that work can be as well informed as possible. For instance, optimism (*The confidence that things will happen for the best or that desired goals will be attained* (Cane et al., 2012)) was one of the TDF domains not tested here, yet meta-analyses and reviews have shown the physical and psychological health benefits of optimism (e.g. Andersson, 1996; Scheier & Carver, 1987; Scheier, Carver, & Bridges, 2001). An observational study assessing optimism as a determinant of medication adherence in stroke survivors, utilising measures such as the Life Orientation Test-Revised (LOT-R) (Scheier, Carver, & Bridges, 1994) could test this association, in order to expand understanding of medication adherence in stroke survivors.

Moreover, not all determinants identified in the papers could be coded either discretely into one domain or coded into any domain. Of course, there is an element of subjectivity to coding, but the inability to code does indicate that the TDF may need to be further broadened (either by expanding the number of domains, or adjusting the operationalisation of a domain) to ensure it encompasses the breadth of determinants that can influence behaviour and to ensure that it continues to provide a holistic theory of behaviour change.

In spite of these limitations, the TDF has provided a holistic and accessible theory to underpin intervention design. Domains deemed to be influential in this review, have also been found to be influential in medication adherence previously as discussed above in section 4.5.

4.6 Implications of the results

The findings from this review have identified psychological determinants, amenable to change, that influence medication adherence in stroke survivors. 'Beliefs about Consequences', 'Knowledge' and 'Emotions' were the most influential domains.

The TDF underpins the Behaviour Change Wheel (BCW), a framework for intervention development. This framework supports systematic identification of the intervention functions and BCTs that target the determinants within each domain. In this thesis, the chapters that follow will describe the intervention development process for an intervention aimed to improve medication adherence. The intervention development will follow the BCW steps so that the intervention is better grounded in existing evidence and theory. This should enhance the interventions effectiveness at targeting and improving medication adherence in stroke survivors.

5 Chapter 5: Improving Medication Adherence in Stroke Survivors: Initial Development of a Theory Driven and Evidence-Based Behaviour Change Intervention

5.1 Chapter overview

The purpose of this chapter is to outline the intervention development process that has been utilised to derive a theory driven and evidence-based intervention targeting medication adherence in stroke survivors. The first part of this chapter will describe the process utilised to systematically develop the intervention. Then the process of linking existing evidence and theory into the intervention development process will be discussed. Finally, the initial intervention design ideas will be introduced.

5.2 Rationale for developing a novel intervention

Many attempts have been made to intervene with sub-optimal medication adherence in stroke survivors. Unfortunately, the majority of interventions have shown limited effectiveness (e.g. Lager et al., 2014; Wessol et al., 2017), which was discussed in detail in Chapter 2 Section 2.4.1.1. This has also been the case in other chronic conditions, such as psychiatric conditions, chronic obstructive pulmonary disease, arthritis and cardiovascular diseases. (e.g. Nieuwlaat et al., 2014). Interpreting the results of previous intervention studies is hampered by the complexity of measuring adherence and the

variability in reasons for non-adherence that are targeted. Sub-optimal measurement limits the ability to discern the true influence of intervention components on adherence while the variation in factors targeted make it difficult to establish the benefit of targeting specific correlates of non-adherence, given most interventions target a combination of factors.

The United Kingdom (UK) Medical Research Council (MRC) framework for designing and evaluating complex interventions advocates systematic intervention development, using evidence base and theory, (Craig et al., 2008). Other frameworks for intervention development also suggest similar e.g. Intervention Mapping (Bartholomew et al., 1998; Kok et al., 2016). A lack of evidence-based selection of behaviour change techniques (BCTs) (Michie et al., 2013) used in the interventions may contribute to limited success to date. Therefore, this thesis aims to develop an evidence-based and theory driven behaviour change intervention targeting medication adherence in stroke survivors.

5.2.1 How theory has been applied to developing this intervention

The overarching theoretical framework of this thesis is the Theoretical Domains Framework (TDF; see Chapter 3).

The Behaviour Change Wheel (BCW) is a guide to intervention development that provides a systematic and structured development process, underpinned

by theory, namely the TDF (Cane et al., 2012; Michie, van Stralen, & West, 2011). The BCW enhances intervention development processes, such that researchers are able to make evidence-based selection of intervention components (including BCTs), ensuring that interventions target the underlying determinants of behaviour. The BCW presents a process of systematically mapping underlying determinants of behaviour, in a series of stages, to BCTs that are perceived to best target and influence these determinants. On this basis, the BCW was chosen to support the process of intervention development in this thesis. Specifying the intervention components in terms of the 93 BCTs from the BCT taxonomy v1 (Michie et al., 2013) is particularly important for replicability of the intervention, as well as for potential future meta-regressions to identify effective interventions. Research applying the BCW to underpin intervention design, in other health behaviours (such as safer sex), have shown good feasibility and acceptability of the interventions, with emerging evidence to support intervention effectiveness in influencing outcomes (Bailey et al., 2016; Free et al., 2016).

5.2.2 Utilising the evidence base for developing this intervention

Systematic reviews can assist in identifying the evidence base for the determinants of the behaviour. This provides foundations for later evidence-based selection of intervention components most likely to elicit behaviour change. The evidence base for determinants of behaviour to be targeted by this intervention was drawn from a systematic review (Chapter 4), identifying

psychological determinants of medication adherence in stroke survivors. The determinants identified were mapped into the domains of the TDF.

The series of steps advocated by the BCW to develop an intervention, which align with other guidance on developing complex interventions (Craig et al., 2008), were utilised and are described in detail below. Application of the literature base, consideration of the context for intervention delivery and use of evaluative criteria, were also discussed. This ensured that components selected for the intervention were not only targeting the underlying determinants of behaviour, but also were appropriate and realistic to be delivered.

5.3 Intervention development method

5.3.1 Aim

The aim of this study was to identify appropriate components for a theory-driven and evidence-based medication adherence intervention for stroke survivors.

5.3.2 Outlining the stages of intervention development

A systematic process of intervention development was followed, advocated by the BCW guidance (Michie et al., 2014) (see Figure 6). This process was underpinned not only by the systematic review (Chapter 4), but also by

Patient and Public Involvement (PPI). This later helped to augment intervention development and to establish perceived relevance to the target patient population. Each stage of the process is discussed in more detail below.

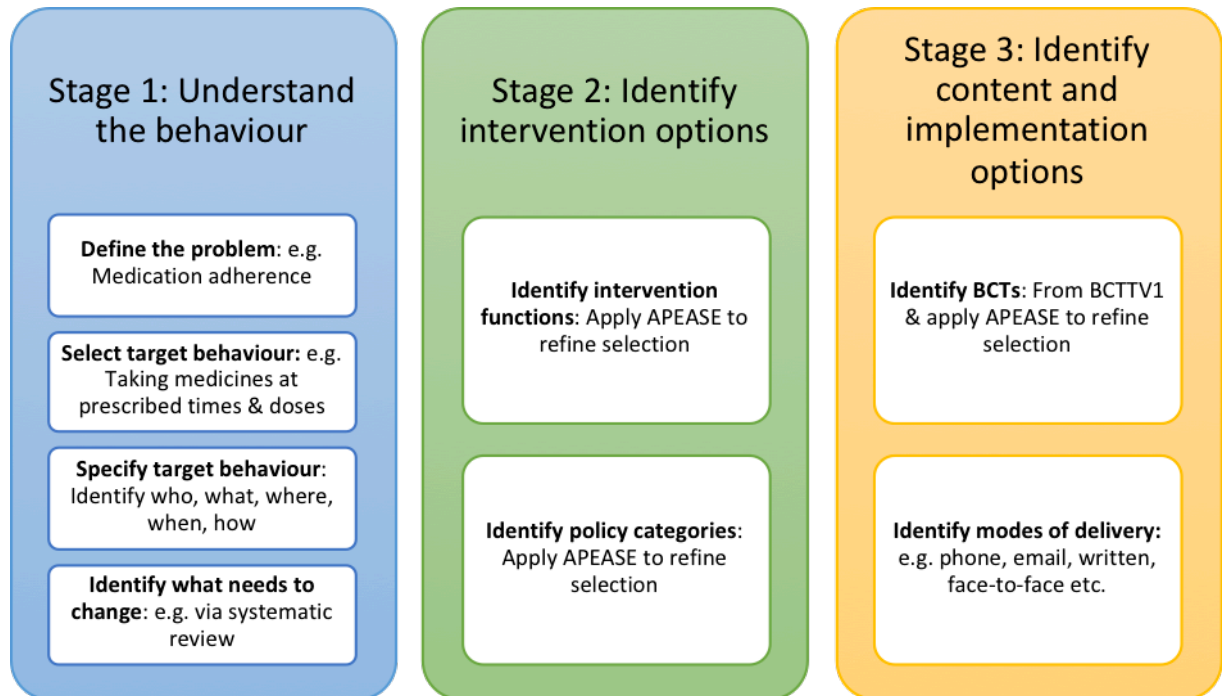


Figure 6. Illustrating a systematic and theory driven intervention development process

BCTTV1 – Behaviour Change Technique Taxonomy Version 1; APEASE - Affordability, Practicality, Effectiveness/Cost-effectiveness, Acceptability, Side effects, Equity

5.3.2.1 Stage 1: Understanding the behaviour

This stage comprises four steps (see Figure 6) that facilitate defining the public health problem in context. Evidence was reviewed to define the behavioural problem (Step 1), breaking this down into specific behaviours and eventually selecting one target behaviour upon which to focus upon (Step 2 and 3; described in Chapter 3). The systematic review (Chapter 4) supported understanding of influences upon the behaviour (Step 4).

5.3.2.2 Stage 2: Identifying intervention options

This stage was supported by the BCW guidance (Michie et al., 2014; Michie et al., 2011), encompassing two steps. This drew on previous research, whereby a systematic review identified 19 frameworks of behaviour change that encompassed the nine intervention functions and seven policy categories used in the BCW (Michie et al., 2011). Also, a consensus exercise undertaken by experts in the field, linked theoretical domains to intervention functions and subsequent policy categories well suited to facilitate the behaviour change via changes in that theoretical domain (e.g. Michie et al., 2014; Michie et al., 2011). Intervention functions are defined as “broad categories of means by which an intervention can change behaviour” (Michie et al., 2014 pp. 109) and policy categories can be understood as “types of decisions made by authorities that help to support and enact the intervention” (Michie et al., 2014 pp. 134). Use of this literature facilitated identification of relevant intervention functions (Step 1) and policy categories (Step 2). Specifically, a mapping exercise was undertaken to map TDF domains being considered for this intervention to intervention functions. Likewise, a mapping exercise was undertaken to link intervention functions to policy categories.

Whilst effectiveness of an intervention is important to consider during the design process, there are other important factors, such as evaluation of intervention component suitability in the intended setting and social context. Affordability, Practicality, Effectiveness, Acceptability, Side effects, Equity

(APEASE) evaluative criteria support this broader consideration by challenging an intervention designer to ask questions such as (Michie et al., 2014):

- (Affordability) Is the cost of the proposed intervention within budget?
- (Practicality) Can the intervention be delivered as designed in the intended setting?
- (Effectiveness) How effective is the intervention? What is the magnitude (effect size) of the relationship between intervention and behaviour?
- (Acceptability) Is the intervention deemed appropriate by key stakeholders?
- (Side effects) Are there any unwanted side effects from delivering this intervention that need to be considered?
- (Equity) Does the intervention reduce or increase disparities between different sectors of society?

A consideration of the likely services the intervention could be implemented into (e.g. health, voluntary, social etc.) also facilitated choice of intervention functions and realistic policy categories. Application of APEASE by the thesis author provided evaluative criteria and also helped to narrow down the potential intervention functions that would be carried forward for this intervention development.

5.3.2.3 Stage 3: Identify content and implementation options

An expert consensus exercise, identifying BCTs better suited to certain intervention functions and underlying theoretical domains, supported evidence-based selection of appropriate BCTs (Cane et al., 2015; Michie et al., 2008). In addition, extensive literature searching for BCTs used in interventions deemed to be effective, targeting akin behaviours or patient groups, as well as application of APEASE criteria supported BCT choice. Affordability, practicality and acceptability were judged to be of particular importance in this evaluative process for this thesis, given the National Health Service (NHS) context for implementation. To set the scene, the NHS provides universal health coverage and is a service in high demand, in part because it is free at the point of use. At present, the UK standard length of a general practitioner (GP) consultation is a 10-minute appointment, although some practices are able to offer longer appointments. Nurse appointments in primary care are usually longer. Community pharmacists do not usually operate an appointment system but offer consultations based on clinical requirements. Healthcare professionals (HCPs) such as community pharmacists are increasingly enlisted to deliver interventions to enhance healthcare. Pharmacists offer medication use reviews (MURs) annually to patients and this may provide an alternative to GP care. Specific to stroke services, patients discharged from a secondary care setting will often only have one or two follow up appointments with the secondary care team before being discharged to primary care services, where the secondary prevention of stroke will then be managed by the GP. BCTs found not to meet these three

APEASE criteria were not carried forward to the next stage of intervention design.

5.3.2.4 Patient and Public Involvement (PPI)

For this intervention development, and throughout this doctoral thesis, the thesis author engaged with a PPI group to discuss and facilitate realistic intervention design.

The PPI group comprised both adult stroke survivors and their caregivers/relatives, or varying ages and physical and cognitive abilities. All stroke survivors who attend are registered on the South London Stroke Register (SLSR). A more detailed description of the SLSR is given in Chapter 6a. The group is well established and meets on a 6-8 week basis to discuss current research being conducted in stroke across the country. The group has an informal format, such that members can come to any session, but are not obliged to attend all. As such each meeting has a varying number of attendees, ranging from 10-30.

Group members consented to being recorded during the PPI sessions and as such any quotes presented are accurate accounts of what was said. No participant information is provided with any quotes to protect anonymity.

1) Systematic review findings

It was considered important to establish the groups understanding and agreement of the thesis author's interpretation of systematic review findings (Chapter 4). These findings underpinned the intervention development and so exploration of agreed interpretation was impotent to enhance the relevance of the intervention to patients.

2) Input on aspects of intervention and study design

It was considered important to establish the groups understanding of medications in order to identify which medicine should be targeted by the intervention (i.e. one, e.g. an anti-hypertensive, or multiple, e.g. all medications prescribed for stroke risk factor control). Group members were also asked about strategies that were helpful for supporting adherence. The language participants used to discuss the strategies, directly supported development of a 'patient friendly' version of the topic guide used with stroke survivors in interviews for the qualitative study (Chapter 6a). Finally, participants of the group were asked about the modes of delivery they perceived to be useful in order to further facilitate topic guide development by incorporating these modes of delivery into the interview discussions.

5.4 Results

5.4.1 Stage 1: Understanding the behaviour

The target behaviour for this intervention is medication adherence, defined as "the extent to which the patient's action matches the agreed

recommendations” (Nunes et al., 2009, pp.3). As discussed in Chapter 2, the behavioural problem for this intervention is medication adherence (Step 1). The target behaviour for this intervention was further defined as: stroke survivors taking medication at the prescribed times, doses and frequencies (Step 2 and 3; see Chapter 3 for more details). A decision was made, following consultation with the PPI group (results reported below), to target all medication as opposed to focusing on one medication, (e.g. an antihypertensive). The systematic review (Chapter 4) identified that *concerns about medications, beliefs about medication necessity, knowledge about medications and negative emotions*, were influential determinants to medication adherence (Step 4), which mapped into three TDF domains: ‘Knowledge’, ‘Beliefs about consequences’ and ‘Emotions’.

5.4.2 Stage 2: Identifying intervention options

A mapping process, recommended by BCW guidance (Michie et al., 2014; Michie et al., 2011) was followed to identify intervention options and policy categories for this intervention, which drew on previous research (Michie et al., 2014; Michie et al., 2011), The possible intervention functions (Step 1) and policy categories (Step 2) selected to target the three TDF domains are displayed in Table 11 and 12.

The use of APEASE criteria (Michie et al., 2014), along with consideration of the intervention context (the NHS), assisted in narrowing down potentially appropriate intervention functions and policy categories. Within Table 11 and

12, reasons for inclusion/exclusion of the intervention functions and policy categories are presented and examples for exclusion of intervention functions and policy categories are discussed.

Table 11. Intervention functions that are appropriate to target underlying theoretical domains.

TDF Domain	Intervention Function	Intervention Function Definitions ⁷	Included/excluded from next stage	Reasons for Inclusion/exclusion (against APEASE criteria)
Knowledge	Education	Increasing knowledge or understanding	Included	Considered affordable, practical , potentially effective , potentially acceptable , should have limited side effects and shouldn't create significant issues of equity
	Training	Imparting skills	Included	Considered affordable, practical , potentially effective , potentially acceptable , should have limited side effects and shouldn't create significant issues of equity
	Enablement	Increasing means/reducing barriers to increase capability (beyond education/ training) or opportunity (beyond environmental restructuring)	Included	Considered affordable, practical , potentially effective , potentially acceptable , should have limited side effects and shouldn't create significant issues of equity
Beliefs about consequences	Education	Increasing knowledge or understanding	Included	Considered affordable, practical , potentially effective , potentially acceptable , should have limited side effects and shouldn't create significant issues of equity
	Persuasion	Using communication to induce positive or negative feelings or stimulate action	Included	Considered affordable, practical , potentially effective , potentially acceptable , should have limited side effects and shouldn't create significant issues of equity
	Incentivisation	Creating an expectation of reward	Excluded	Not considered affordable , unlikely to be acceptable to policy makers and would

⁷ Definitions from Michie, S., L. Atkins, and R. West, *The Behaviour Change Wheel: A Guide to Designing Interventions*. 2014, UK: Silverback Publishing.

TDF Domain	Intervention Function	Intervention Function Definitions ⁷	Included/excluded from next stage	Reasons for Inclusion/exclusion (against APEASE criteria)
				possibly be impractical to incentivise over a sustained period of time
	Coercion	Creating an expectation of punishment or cost	Excluded	Not considered practical to deliver (as HCPs often want to maintain good and balanced relationships with patients), unlikely to be acceptable to HCPs or patients morally and ethically, enforcing punishment or cost onto patients will also likely have unwanted side effects , and could reduce equity for some sectors of the community
Emotions	Persuasion	Using communication to induce positive or negative feelings or stimulate action	Included	Considered affordable, practical , potentially effective , potentially acceptable , should have limited side effects and shouldn't create significant issues of equity
	Incentivisation	Creating an expectation of reward	Excluded	Not considered affordable , unlikely to be acceptable to policy makers and would possibly be impractical to incentivise over a sustained period of time
	Coercion	Creating an expectation of punishment or cost	Excluded	Not considered practical to deliver (as HCPs often want to maintain good and balanced relationships with patients), unlikely to be acceptable to HCPs or patients morally and ethically, enforcing punishment or cost onto patients will also likely have unwanted side effects , and could reduce equity for some sectors of the community
	Restriction	Using rules to reduce the opportunity to engage in the	Excluded	Not considered practical to deliver as medicine taking can be carried out alone and

TDF Domain	Intervention Function	Intervention Function Definitions ⁷	Included/excluded from next stage	Reasons for Inclusion/exclusion (against APEASE criteria)
		target behaviour (or to increase target behaviour by reducing the opportunity to engage in the competing behaviour)		so there will be no one present to enforce rules, unlikely to be acceptable to patients, HCPs or policy makers as rules often require legislation changes to be enforceable and acted upon
	Environmental Restructuring	Changing the physical or social context	Included	Considered affordable, practical , potentially effective , potentially acceptable , should have limited side effects and shouldn't create significant issues of equity unless patients do not have access to similar healthcare services or possess similar abilities
	Modelling	Providing an example for people to aspire to or imitate	Excluded	Not considered to be practical to deliver as patients do not always have contact with HCPs or other patients when collecting prescriptions for medications, could potentially create disparities in equity
	Enablement	Increasing means/reducing barriers to increase capability (beyond education/ training) or opportunity (beyond environmental restructuring)	Included	Considered affordable, practical , potentially effective , potentially acceptable , should have limited side effects and shouldn't create significant issues of equity

APEASE - Affordability, practicality, effectiveness/cost-effectiveness, acceptability, side effects, equity; HCPs – Healthcare Professionals; TDF – Theoretical Domains Framework

Four intervention functions were not considered to be appropriate for this intervention (Restriction; Coercion; Incentivisation; and Modelling). Firstly, Restriction i.e. “use rules to reduce the opportunity to engage in the behaviour” (Michie et al., 2014 pp. 111), when considering APEASE would likely not be *acceptable* or *practical*. Medicine taking is often done alone and so there will be no one there to enforce the rules or witness rule breaking, which in turn will limit the *effectiveness* of this intervention function. Secondly, coercion i.e. “Create an expectation of punishment or cost” (Michie et al., 2014 pp. 111) seems inappropriate, within the service the intervention would likely be implemented (the NHS), morally and ethically (particularly as this conflicts with HCP ethical frameworks). It is inappropriate to create an expectation of punishment if patients do not take their medicines, given that patients can have valid reasons for not wanting to adhere to regimens such as wanting to stop side effects. Moreover, in terms of APEASE, it is likely not *acceptable* to coerce medication adherence, and there will likely be unwanted *side effects* from the use of this intervention function, potentially causing the undesired consequence of even worse adherence from patients. Likewise, Incentivisation i.e. “create an expectation of reward” (Michie et al., 2014 pp. 111), has similar ethical constraints. Finally, Modelling i.e. “provide an example of people to aspire to or emulate” (Michie et al., 2014 pp. 112) was felt to limit some *practicality* and possibly some *equity*. The ability to emulate another’s behaviour could be contingent on multiple other factors, such as access to similar healthcare services and patients possessing similar abilities (cognitive, social, physical) to successfully take their medicines in the same manner.

Table 12. Identification of the potential policy categories appropriate for the intervention based on selected intervention functions.

Intervention Function	Policy Category	Policy Category Definition ⁸	Included/excluded from next stage	Reasons for Inclusion/exclusion (against APEASE criteria)
Education	Communication/Marketing	Using print, electronic, telephonic or broadcast media	Included	Considered affordable, practical , potentially effective , potentially acceptable , should have limited side effects and shouldn't create significant issues of equity
	Guidelines	Creating documents that recommend or mandate practice. This includes all changes to service provision	Included	Considered affordable, practical , potentially effective , potentially acceptable , should have limited side effects and shouldn't create significant issues of equity
	Regulation	Establishing rules or principles of behaviour or practice	Excluded	Not considered practical for this project as the timeline would not allow for the process of changes to current health practice regulations
	Legislation	Making or changing laws	Excluded	Not considered practical for this project as the timeline would not allow for the process of changes to law
	Service Provision	Delivering a service	Included	Considered affordable, practical , potentially effective , potentially acceptable , should have limited side effects and shouldn't create significant issues of equity

⁸ Definitions from Michie, S., L. Atkins, and R. West, *The Behaviour Change Wheel: A Guide to Designing Interventions*. 2014, UK: Silverback Publishing.

Intervention Function	Policy Category	Policy Category Definition ⁸	Included/excluded from next stage	Reasons for Inclusion/exclusion (against APEASE criteria)
Persuasion	Communication/Marketing	Using print, electronic, telephonic or broadcast media	Included	Considered affordable, practical , potentially effective , potentially acceptable , should have limited side effects and shouldn't create significant issues of equity
	Guidelines	Creating documents that recommend or mandate practice. This includes all changes to service provision	Included	Considered affordable, practical , potentially effective , potentially acceptable , should have limited side effects and shouldn't create significant issues of equity
	Regulation	Establishing rules or principles of behaviour or practice	Excluded	Not considered practical for this project as the timeline would not allow for the process of changes to current health practice regulations
	Legislation	Making or changing laws	Excluded	Not considered practical for this project as the timeline would not allow for the process of changes to law
	Service Provision	Delivering a service	Included	Considered affordable, practical , potentially effective , potentially acceptable , should have limited side effects and shouldn't create significant issues of equity
Training	Guidelines	Creating documents that recommend or mandate practice. This includes all changes to service provision	Included	Considered affordable, practical , potentially effective , potentially acceptable , should have limited side effects and shouldn't create significant issues of equity
	Fiscal Measures	Using the tax system to reduce or increase the financial cost	Excluded	Not considered practical (partially due to free prescriptions over the age of 60 in UK, which encompasses a large proportion of stroke

Intervention Function	Policy Category	Policy Category Definition ⁸	Included/excluded from next stage	Reasons for Inclusion/exclusion (against APEASE criteria)
				survivors), unlikely to be acceptable to policy makers who would probably need to instigate legislation changes, potentially not affordable contingent on the economic climate at the time of the change
	Regulation	Establishing rules or principles of behaviour or practice	Excluded	Not considered practical for this project as the timeline would not allow for the process of changes to current health practice regulations
	Legislation	Making or changing laws	Excluded	Not considered practical for this project as the timeline would not allow for the process of changes to law
	Service Provision	Delivering a service	Included	Considered affordable, practical , potentially effective , potentially acceptable , should have limited side effects and shouldn't create significant issues of equity
Environmental Restructuring	Guidelines	Creating documents that recommend or mandate practice. This includes all changes to service provision	Included	Considered affordable, practical , potentially effective , potentially acceptable , should have limited side effects and shouldn't create significant issues of equity
	Fiscal Measures	Using the tax system to reduce or increase the financial cost	Excluded	Not considered practical (partially due to free prescriptions over the age of 60 in UK, which encompasses a large proportion of stroke survivors), unlikely to be acceptable to policy makers who would probably need to instigate legislation changes, potentially not affordable

Intervention Function	Policy Category	Policy Category Definition ⁸	Included/ excluded from next stage	Reasons for Inclusion/exclusion (against APEASE criteria)
				contingent on the economic climate at the time of the change
	Regulation	Establishing rules or principles of behaviour or practice	Excluded	Not considered practical for this project as the timeline would not allow for the process of changes to current health practice regulations
	Legislation	Making or changing laws	Excluded	Not considered practical for this project as the timeline would not allow for the process of changes to law
	Environmental/ Social Planning	Designing and/or controlling the physical or social environment	Included	Considered affordable, practical , potentially effective , potentially acceptable , should have limited side effects and shouldn't create significant issues of equity
Enablement	Guidelines	Creating documents that recommend or mandate practice. This includes all changes to service provision	Included	Considered affordable, practical , potentially effective , potentially acceptable , should have limited side effects and shouldn't create significant issues of equity
	Fiscal Measures	Using the tax system to reduce or increase the financial cost	Excluded	Not considered practical (partially due to free prescriptions over the age of 60 in UK, which encompasses a large proportion of stroke survivors), unlikely to be acceptable to policy makers who would probably need to instigate legislation changes, potentially not affordable contingent on the economic climate at the time of the change

Intervention Function	Policy Category	Policy Category Definition ⁸	Included/ excluded from next stage	Reasons for Inclusion/exclusion (against APEASE criteria)
	Regulation	Establishing rules or principles of behaviour or practice	Excluded	Not considered practical for this project as the timeline would not allow for the process of changes to current health practice regulations
	Legislation	Making or changing laws	Excluded	Not considered practical for this project as the timeline would not allow for the process of changes to law
	Environmental/ Social Planning	Designing and/or controlling the physical or social environment	Included	Considered affordable, practical , potentially effective , potentially acceptable , should have limited side effects and shouldn't create significant issues of equity
	Service Provision	Delivering a service	Included	Considered affordable, practical , potentially effective , potentially acceptable , should have limited side effects and shouldn't create significant issues of equity

APEASE - Affordability, practicality, effectiveness/cost-effectiveness, acceptability, side effects, equity; UK – United Kingdom

Three policy categories were not considered further for this intervention design (Fiscal Measures, Legislation and Regulation). Firstly, Fiscal Measures i.e. “the use of the tax system to reduce or increase the financial cost” (Michie et al., 2014 pp.135) is not a *practical* policy category to consider. This is partly due to the fact that within the UK, residents over the age of 60 years (a category that a large proportion of stroke survivors come under) do not pay for prescriptions and as such an amendment to taxation systems seems a less *practical* option. Moreover, fiscal measures would likely require legislation changes, something that would rely upon elected politicians’ willingness to propose such changes. There would also be questions of *affordability* dependant on the economic climate at the time of the intervention, and thus the use of this policy category could become less *acceptable*. Secondly, Legislation i.e. “making or changing laws” (Michie et al., 2014 pp.135) and Regulation “establishing rules or principles of behaviour and practice” (Michie et al., 2014 pp. 135) were not *practical* to focus on within this project as the processes involved would be out of scope for a research study.

5.4.3 Stage 3: Identify content and implementation options

Table 13 displays the process of systematically using an evidence base to select potential BCTs for this intervention. Careful linking of determinants (within the three TDF domains) to the included intervention functions and policy categories (discussed in more detail above) and application of expert consensus (Cane et al., 2015; Michie et al., 2008) to identify BCTs better suited to certain intervention functions and targeting underlying theoretical domains, has resulted in a potential 21 BCTs that might be considered for this intervention. Application of APEASE, as well as

identifying existing effectiveness of the BCTs within other, similar interventions has enabled the selection to be narrowed down from 21 to 11 BCTs (*information about health consequences (5.1); self-monitoring of behaviour (2.3); biofeedback (2.6); information about antecedents (4.3); credible source (9:1); self-monitoring of outcome(s) of behaviour (2.4); pros and cons (9.2); prompts/cues (7:1); action planning (1:4); habit formation (8:3); social support (emotional) (3.3)*). Tables 14 and 15 presents all 21 BCTs, separated into BCTs that will be included or excluded from the next stage of this intervention development. Reasons for inclusion/exclusion of each BCT are summarised in Tables 14 and 15, assessed against APEASE criteria.

Table 13. Identification of the possible BCTs that could be used in the intervention.

TDF domains	Intervention Functions Identified	BCTs identified
Knowledge	Education	1. Feedback on outcome(s) of the behaviour (2.7) 2. Provide normative information about others behaviour/ experiences (BM5)
	Training	3. Information about health consequences (5.1) 4. Self-monitoring of behaviour (2.3)
	Enablement	5. Provide reassurance (RC10) 6. Feedback on behaviour (2.2) 7. Biofeedback (2.6) 8. Information about antecedents (4.2)
Beliefs about consequences	Education	1. Information about health consequences (5:1) 2. Credible source (9:1)
	Persuasion	3. Self-monitoring of outcome(s) of behaviour (2.4) 4. Information about antecedents (4.2) 5. Pros and cons (9.2) 6. Salience of consequences (5.2) 7. Information about social and environmental consequences (5.3) 8. Information about emotional consequences (5.6) 9. Anticipated regret (5.5) 10. Comparative imagining of future outcomes (9.3)
Emotions	Persuasion	1. Information about health consequences (5:1) 2. Credible source (9:1)
	Environmental restructuring	3. Prompts/cues (7:1) 4. Action planning (1:4)
	Enablement	5. Habit formation (8:3) 6. Self-monitoring of behaviour (2.3) 7. Feedback on behaviour (2.2) 8. Feedback on outcome(s) of the behaviour (2.7) 9. Social support (emotional) (3.3) 10. Reduce negative emotions (11.2)

BCT- Behaviour Change Technique; BM5 – BCT code relating to a specific focus on the target behaviour (B) and maximising motivation (M); TDF – Theoretical Domains Framework

Table 14. List of included BCTs with reasons for inclusion.

BCTs	Reasons for Inclusion (against APEASE criteria)
Information about health consequences (5.1)	Considered affordable , practical , potentially effective , potentially acceptable (for patients and HCPs), should have limited side effects
Self-monitoring of behaviour (2.3)	Considered affordable , practical , potentially effective , potentially acceptable (for patients and HCPs), should have limited side effects and shouldn't create significant issues of equity
Biofeedback (2.6)	Considered affordable (as patients' blood pressure and cholesterol, for example, are often monitored and discussed within routine care), practical , potentially effective and potentially acceptable (for patients and HCPs)
Information about antecedents (4.3)	Considered affordable , practical , potentially effective , potentially acceptable (for patients and HCPs), should have limited side effects and shouldn't create significant issues of equity
Credible source (9:1)	Considered affordable , practical , potentially effective , potentially acceptable (for patients and HCPs), should have limited side effects and shouldn't create significant issues of equity
Self-monitoring of outcome(s) of behaviour (2.4)	Considered affordable (as patients can access, for example, blood pressure monitors for free from local GP surgeries and pharmacists), practical , potentially effective and potentially acceptable (for patients and HCPs)
Pros and cons (9.2)	Considered affordable , practical , potentially effective and potentially acceptable (for patients and HCPs)
Prompts/cues (7:1)	Considered affordable , practical , potentially effective , potentially acceptable (for patients and HCPs), should have limited side effects and shouldn't create significant issues of equity
Action planning (1:4)	Considered affordable , practical , potentially effective , potentially acceptable (for patients and HCPs), should have limited side effects and shouldn't create significant issues of equity

BCTs	Reasons for Inclusion (against APEASE criteria)
Habit formation (8:3)	Considered affordable , practical , potentially effective , potentially acceptable (for patients and HCPs), should have limited side effects and shouldn't create significant issues of equity
Social support (emotional) (3.3)	Considered affordable (as patients may be able to get this support from their own social networks or from community stroke support groups already running), practical , potentially effective , potentially acceptable (for patients and HCPs), should have limited side effects

APEASE - Affordability, practicality, effectiveness/cost-effectiveness, acceptability, side effects, equity; BCT- Behaviour Change Technique; BCTTV1 – Behaviour Change Technique Taxonomy Version 1; HCPs – Healthcare Professionals

Table 15. List of excluded BCTs with reasons for exclusion.

BCTs	Reasons for exclusion (Against APEASE criteria)
Feedback on outcome(s) of the behaviour (2.7)	Not considered practical as most feedback on behavioural outcomes (for stroke medication adherence) routinely provided in NHS is a form of biofeedback and so would add additional workload if HCPs were providing feedback
Feedback on behaviour (2.2)	Not considered practical in this context. Although HCPs based in primary care/community pharmacy have access to prescription acquisition records, this is a proxy measure of adherence and so could be difficult to provide accurate estimates of adherence. Even if stroke survivors provided self-reported accounts of adherence to HCPs/carers and adherence rates were fed back this could be too onerous as an intervention strategy
Provide normative information about others behaviour/experiences (BM5)	Not considered practical to deliver. The impact of stroke and varying medication regimens will make generalised comparisons challenging. This could have unintended side effects if the provision of normative information (e.g. about side effects of medicines) led to patient not seeking medical advice, when in fact they should, as assume it is normal
Salience of consequences (5.2)	Not considered practical for negative consequences of non-adherence e.g. use images of the consequences of stroke - hard to demonstrate paralysis, aphasia and other stroke implications in an image. Potential to have unwanted side effects also, if BCT evokes upsetting emotional responses. Enhancing view about positive consequences of adherence may not be considered acceptable as patient could have suffered a stroke even when adherent to medication and may not find the salience of the consequences meaningful
Information about social and environmental consequences (5.3)	Not considered acceptable . Potential ethical issues. E.g. informing patients that it's not socially acceptable to miss medication doses – patients can have valid reasons for not taking medications
Information about emotional consequences (5.6)	Not considered acceptable and could cause unwanted side effects if information about negative emotions is given. Provision of this information could be upsetting, and patients can have valid reasons for not taking

BCTs	Reasons for exclusion (Against APEASE criteria)
Anticipated regret (5.5)	<p>medications so seems inappropriate in this context. Even if provide information about positive emotions (e.g. taking medicines give peace of mind) may not be considered acceptable to those who have suffered a stroke even when adherent to medication and so may not find the information meaningful</p> <p>Not considered acceptable and could cause unwanted side effects. Provision of this information could be upsetting, and patients can have valid reasons for not taking medications so seems inappropriate in this context. If a patient suffered a stroke following good adherence to medications BCT could be considered unacceptable by intervention facilitators delivering this BCT</p>
Comparative imagining of future outcomes (9.3)	Not considered acceptable . Asking people to imagine different outcomes might not be something HCPs are confident doing or patients are familiar with
Reduce negative emotions (11.2)	Not considered practical and potentially not affordable . Not all patients would require this type of BCT and training in stress management, for example, would be costly and time/labour intensive
Provide reassurance (RC10)	Not considered practical . Patients experiences (e.g. of side effects) are likely not time limited and may vary person to person. Reassurance may not always be the appropriate response and so may not be considered acceptable

APEASE - Affordability, practicality, effectiveness/cost-effectiveness, acceptability, side effects, equity; BCT- Behaviour Change Technique; BCTTV1 – Behaviour Change Technique Taxonomy Version 1; BM5 – BCT code relating to a specific focus on the target behaviour (B) and maximising motivation (M);

5.4.4 Patient and Public Involvement (PPI)

PPI conducted for this stage of the PhD was used to inform two aspects of intervention development:

- 1) Group members understanding and agreed interpretation of the systematic review findings
- 2) Exploration of which medicine to target with the intervention, potential modes of delivery and language used to describe BCTs.

The summarised findings from the PPI are presented below:

1. Systematic review findings

The types of facilitators reported by patients linked more strongly to the strategies they employed to support adherence and as such these are reported under heading 3 below. In terms of barriers to adherence, patients described some of the physical difficulties they face when taking the tablets. For example, the most notable difficulty was swallowing tablets,

“A lot of people have difficulty swallowing and I can swallow a capsule you know the two halves together easier than I can swallow a tablet”.

One patient reported completely stopping medication use, as they had been experiencing unwanted side effects,

“A year after my stroke I stopped taking all of my medicines and I haven’t taken any since...I got side effects from about 3”.

These types of concerns raised were echoed by others in the room and provide some agreement towards the interpretation of the influences of medication adherence reported in the systematic review (Chapter 4).

2. Input on aspects of intervention and study design

Patient understanding of medicines greatly varied. Some reported interest in finding out information about their medicines, for example,

“I’m one of these people that wants to know everything”.

Whereas, others were unable to name or identify their medicines, with many responding “no” when asked whether they felt confident as a group to list their medications for any given condition. For this reason, at this stage of intervention development, it was decided to target all medications for stroke, as opposed to just one. This concept was then explored further among a wider sample of stroke survivors in the subsequent qualitative work (Chapters 6a and 6b).

When considering what modes of delivery could be used in this intervention, participants generated ideas of what may be helpful, such as digital technology,

“There is research going on currently...people are reminded by text to take medication”.

Although, no members of the group reported employing this strategy themselves, with some showing reservation,

“I would find it too intrusive”.

Some participants described the utility of more traditional methods of delivery,

“Paper every time for me...going back to memory issues what you pick up on when you read it one time, next time you read it you might pick up on something different”

The opinions of preferred modes of delivery from group members was variable and as such this aspect of the intervention design was considered further in the qualitative study interviews (Chapters 6a and 6b).

When exploring how participants of the group described BCTs they were asked about strategies they employed to elicit these conversations. Participant most frequently spoke about bespoke routines and habits they employed, with the use of prompts, to support adherence. One participant described the importance of proximity,

“Having them to hand I have ...I take them out of all the packaging and put them in an old fashioned camera film case, all jumbled up, but they’re beside the bed so as soon as I get up I tip them out and then take them, and that’s what reminds me because they’re, you know, it’s almost the first thing I see”.

Another participant described the relevance of a daily task that prompted them,

“I always take with water. So, I put it near the water tap...and I know if I take water I take my medicine. I never forget one”

These accounts given by the PPI group members informed language use in the topic guide to discuss BCTs including *habit formation* (8:3) and *prompts/cues* (7:1).

Phrasing such as ‘system’, ‘routine’ and ‘programme’ were preferable to the term

habit. Examples given in the group of prompts and cues also facilitated the development of prompts in the topic guide, allowing tangible examples of the BCTs to be given by the interviewer.

5.4.5 Logic modelling

A logic model assists in pulling together all the stages of intervention development. It facilitates consideration of the links between the behavioural problem (i.e. influences of medication adherence in stroke survivors), what can be done to address this (i.e. the intervention components) and what the potential outcomes of this could be for individuals or communities (i.e. will this improve adherence and what impact this could have) (Evaluation Support Scotland). More simply, a logic model encourages evaluations of what a programme (in this case an intervention) will do and what changes are expected (Hayes, Parchman, & Howard, 2011).

For the rest of this thesis, a logic model will be presented at each stage of intervention development in order to provide a diagrammatic representation of the intervention and the connections between the underlying theoretical assumptions and the desired intervention. Figure 7 presents the Logic Model for this stage of the intervention development. The Logic Model presented here is an adaptation of guidance from the MRC on process evaluations of complex intervention (Moore et al., 2015), the Wisconsin Model (University of Wisconsin - Extension), one of the most commonly used formats for a logic model and the W.K. Kellogg Foundation approach (H M Treasury, 2011; W.K. Kellogg Foundation, 2004). The model incorporates features to present inputs (determinants), activities (BCTs) outcomes

and impact. As the specific NHS setting (community Vs. secondary care Vs. primary care) and mode of delivery (face-to-face Vs. phone Vs. written Vs. via technology) have not been decided at this stage, these aspects of the logic model will not be reported here. As intervention components have not been refined into a full programme yet, the activities listed will be broader, encompassing the BCTs intended to be delivered.

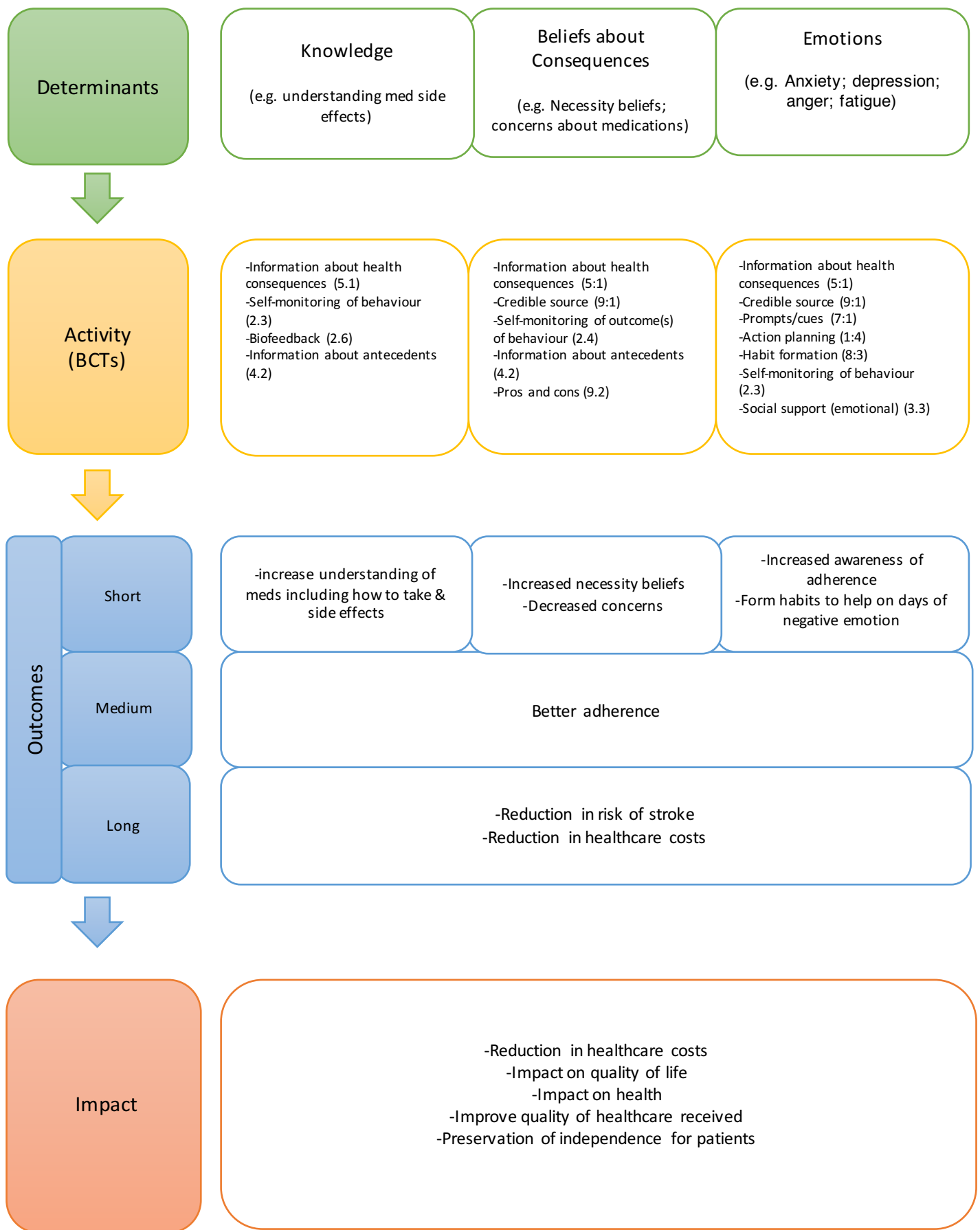


Figure 7. Initial Logic Model for Intervention Development

5.5 Discussion

This chapter presented the first stages in the development of a novel medication adherence intervention for stroke survivors developed using the BCW, underpinned by the TDF, and designed in consideration of implementation into the NHS. Eleven BCTs were identified as potential components for this intervention. BCTs identified included *habit formation (8.4)*, *action planning (1.4)* and *information about health consequences (5.1)*.

Consideration of the intervention context (e.g. time and financial pressures within the NHS), facilitated by using APEASE evaluative criteria (Michie et al., 2014), has enhanced this process and enabled the development of a focused intervention. This process was important to refine initial inclusion of intervention components, as there is currently a lack of experimental evidence in the literature looking at the effectiveness of particular BCTs targeting specific psychological determinants of medication adherence in stroke survivors, and more generally for other chronic conditions. Currently, the identification of potential BCTs is heavily underpinned by research from experts in the field (e.g. Cane et al., 2015; Michie et al., 2008). Work such as the establishment of the links between theoretical domains of the TDF and BCTs is relatively new and is based on hypothesised links and expert consensus. Therefore, more work is required to provide empirical, experimental evidence showing that behaviour change is possible through delivery of specific BCTs targeting underlying determinants known to influence the behaviour. Moreover, inconsistencies in descriptions of published interventions means that it is difficult to establish which BCTs are more effective at targeting medication adherence in stroke

survivors. For example, it is often difficult to identify the type of information provision in an intervention, as varying terms have been used for this intervention component e.g. “an educational booklet” (Rinfret et al., 2009) or “reinforcing relevant knowledge on the chronic diseases they are suffering from” (Wong et al., 2013). With the development of checklists to support reporting of interventions, such as the Template for Intervention Description and Replication (TIDieR) checklist (Hoffmann et al., 2014), clear and transparent recording of what is included within interventions may be enhanced.

This approach to intervention development (use of TDF, BCW and APEASE) has focused the identification of intervention functions through which BCTs will be delivered (Education, Persuasion, Training, Environmental Restructuring and Enablement). It has also identified the most likely effective BCTs that could be delivered in an intervention (e.g. *information about health consequences*, use of a *credible source*, *self-monitoring of the behaviour*, *social support (emotional)*, identifying the *pros and cons* to taking medications and using *habit formation*). The effectiveness of these BCTs has been supported in previous research. A Cochrane review, focused on effectiveness of medication adherence interventions, reported that *information*, *reminders* and *self-monitoring* were included in almost all interventions that showed good effect for improvement in adherence (Haynes, Ackloo, Sahota, McDonald, & Yao, 2008). Crawshaw and colleagues (2017) conducted a meta-analysis assessing the effectiveness of HCP-led interventions to support medication adherence in patients with acute coronary syndrome. Information about health consequences was one of the most commonly employed BCTs across 19 out of the 23 studies included in the review, with meta-analysis revealing that

HCP-led interventions increased the odds of medication adherence by 54% (OR 1.54 [95%CI 1.26 to 1.88]) (Crawshaw, Auyeung, Ashworth, Norton, & Weinman, 2017). It is worth highlighting that the review yielded insufficient data to test effectiveness of specific BCTs on behaviour, and as such direct interpretations of whether the BCT information about health consequences had strong effect on medication adherence is uncertain.

Conn and colleagues (2016) (Conn, Ruppap, & Chase, 2016) conducted a meta-analysis, assessing blood pressure outcomes for medication adherence interventions among adults with hypertension. It was found that BCTs focused on *habit formation* were effective at improving diastolic blood pressure (habit $d = 0.477$; no habit $d = 0.181$; $p < .001$) (Conn, Ruppap, et al., 2016). Furthermore, Gardener (2015) conducted a narrative review to assess the use of habit in health behaviour change. Seven interventions were identified that used habit formation as a BCT (as intended in this intervention development) or used habit as an intervention outcome (Gardner, 2015). Interventions targeted a range of behaviours such as engagements in healthy diet and exercises and promotion of brushing teeth, in samples of overweight and obese adults, and school aged children. Although these behaviours are not the same as medication adherence, there are similarities in that the behaviour should be performed daily. Of the few interventional studies available, a relationship between habit and gains in health promoting behaviours was observed (Gardner, 2015). However, because of the limited number of interventional studies presented, firm conclusions cannot be drawn. In spite of limited evidence to conclusively support the inclusion of some form of habit formation in behaviour change interventions, there is some emerging evidence providing support.

Moreover, O'Carroll and colleagues (O'Carroll et al., 2013) piloted a randomised controlled trial (RCT), testing an intervention targeting adherence to antihypertensive medications in stroke survivors. Significant results were reported, with 10% more doses taken on schedule in the intervention group (intervention, 97 %; control, 87 %; [95 % CI for difference 0.2,16.2]; $p = 0.048$), encompassing BCTs such as *action planning* (O'Carroll et al., 2013). This study is described in more detail in Chapter 2 section 2.4.1.1.

Forms of biofeedback, such as blood pressure monitoring, have shown good effect in interventions to change behaviour. A systematic review and meta-analysis of 28 trials assessing the effect of self-monitoring blood pressure on medication adherence and other lifestyle changes found significant effect. Pooled analysis of 13 trials identified improvement in medication adherence when self-monitoring blood pressure was employed (SMD=0.21 [95% CI 0.08, 0.34]) (Fletcher, Hartmann-Boyce, Hinton, & McManus, 2015). The significant effect of self-monitoring blood pressure on medication adherence has been reported in other reviews (Conn, Ruppap, et al., 2016). As with any review in adherence at present, methodological quality of studies, due to reasons such as use of varying methods of medication adherence measurement, mean that it can be difficult to draw firm conclusion. Nonetheless, the literature does present support for this form of BCT.

A key strength of this work was the application of evaluative criteria such as APEASE. This enabled the thesis author to give strong consideration to the realities

of implementing this intervention in context, in this case the NHS. Utilising this approach to refine selection of intervention functions, policy categories and BCTs should enhance the ability to implement the intervention successfully, as the intervention is likely to be more affordable and practical to implement. Future work assessing the acceptability of the selected BCTs as envisaged for this context and further feasibility assessment and pilot testing of this intervention will also provide evidence about how strongly this approach enhances acceptability and effectiveness of the intervention. It is noteworthy that assessment of intervention components (such as BCTs) using APEASE criteria rests on a certain amount of subjective opinion and assumption. Therefore, to address this limitation, these assessments were carried out by the thesis author and discussed with the doctoral thesis research team (from multidisciplinary backgrounds) who have much experience and knowledge of the current healthcare system within the UK.

As advocated in the literature (e.g. Craig et al., 2008; Michie et al., 2011), the present study also provides a transparent and explicit approach to intervention development. Transparency of reporting should help to overcome previous criticisms of some medication adherence interventions, for example not clearly reporting the intervention components due to use of inconsistent terminology when reporting BCTs (Michie, Fixsen, Grimshaw, & Eccles, 2009). In addition, the research team supporting the work of this thesis came from multidisciplinary backgrounds (primary care; health psychology) which enabled a more holistic decision making process when attempting to narrow down the selection of BCTs. Input from the health psychologists (inclusive of the thesis author), who have been trained and hold

specialist knowledge of the TDF and intervention development applying the BCW, facilitated effective use of the theory to underpin intervention design.

Engagement with a PPI group informed aspects of intervention and study design. As noted earlier, there may be demand characteristics that influence the opinion of this group and this group are likely to be more motivated and informed about stroke research. However, the discussion has enabled confirmation of the relevance of findings from the systematic review (Chapter 4) that underpins this research. Moreover, the group supported decision making around which medicines to target with intervention and identified potential modes of delivery such as digital technology and written information. Variability in opinion meant that it was difficult to derive a conclusive list of potential modes of delivery. Therefore, a range of methods will be further considered within the next stage of this intervention development; exploring acceptability of intervention components with key stakeholders (stroke survivors and HCPs) (Chapters 6a and 6b).

5.6 Implications for further work

Use of the BCW and application of the APEASE criteria to assess the intervention development in context (the NHS), has enabled a novel and potentially practical intervention to be designed, targeting medication adherence in stroke survivors.

Eleven BCTs were considered potentially effective. It could be argued that BCTs do not have a linear relationship with behaviour change (i.e. inclusion of more BCTs in

an intervention may not lead to a more effective intervention) (Kassavou & Sutton, 2018; O'Brien et al., 2015). Kassavou and Sutton (2018) identified that the number of included BCTs in an intervention was not significantly associated with effect size, through conducting meta-regression of an automated telecommunication intervention to promote adherence to cardio-metabolic medications (Kassavou & Sutton, 2018). Moreover, meta-regression of BCTs within interventions targeting physical activity revealed that the number of BCTs did not have significant influence on the effect size (O'Brien et al., 2015). As such, the BCTs included in this stage of the intervention development will be assessed against APEASE criteria in more depth, by exploring stakeholder (HCPs and stroke survivors) acceptability of the proposed intervention components through semi-structured interviews (Chapters 6a and 6b), Therefore, this will move the evaluation of components beyond the opinions of thesis author and the research team supporting the work of this thesis alone.

The 'tool box' of potential intervention components has been explored for perceived acceptability, together with perceived optimal modes of intervention delivery, through semi-structured interviews with stroke survivors and healthcare professionals. The methods and results of this study are presented in Chapters 6a and 6b

6a Chapter 6a: Assessing the Acceptability of a Preliminary Intervention Design Targeting Medication Adherence in Stroke Survivors: Patient Views

6a.1 Abstract

Purpose

The aim of this study was to establish how acceptable a medication adherence intervention was to stroke survivors using qualitative interviews.

Design

This study used a qualitative study design, administering semi-structured interviews.

Methods

Semi-structured, one-to-one interviews were undertaken with 16 stroke survivors aged between 48-86 years, recruited from the South London Stroke Register (SLSR). In two interviews, a family member/carer was also present. Purposive sampling was employed, to recruit stroke survivors prescribed medications for risk factors of stroke. Interviews were recorded, transcribed and analysed using framework analysis.

Results

Exploration of intervention component acceptability revealed that participants perceived information about health consequences, credible source, prompts and cues, habit formation, self-monitoring of behaviour, biofeedback and social support (emotional) as acceptable behaviour change techniques (BCTs) to include in the

intervention. Particularly, BCTs such as prompts and cues, habit formation and self-monitoring of behaviour (via a Doseette box) were particularly acceptable as these were strategies frequently employed by the interviewed participants. The BCTs action planning, pros and cons and self-monitoring of outcomes of behaviour received mixed views from participants. For some participants, these BCTs were difficult to conceptualise and were not something they currently used to support adherence. Information about antecedents was the one BCT perceived to be unacceptable to participants, mainly as it was considered to be too onerous. Generally, the most acceptable settings for intervention were in the individual's own home, or at the GP surgery, with GPs seen to be well placed to deliver the intervention. Verbal delivery of support was also viewed as most acceptable by participants.

Conclusions

This study investigated stroke survivors perceived acceptability of intervention components for an intervention targeting medication adherence. Exploration of this acceptability has supported refinement of the intervention design. However, the feasibility of the refined intervention design will need to be tested.

6a.2 Introduction

Guided by the Behaviour Change Wheel (BCW), discussed in Chapter 5, a preliminary design of an intervention was formed. This has provided a 'toolbox' of 11 behaviour change techniques (BCTs) which could be appropriate for inclusion in the intervention. An important step in intervention development, as recommended by the Medical Research Council (MRC) guidance (Craig et al., 2008) and National Health

Service (NHS) England (Strategy Unit - NHS England, 2013), is to establish the acceptability of the intervention design. This means that researchers should find out peoples' views and opinions of the intervention that has been designed. This should be done with key stakeholders in the process, both those receiving the intervention and those delivering the intervention. The current study explored the acceptability of the 11 candidate BCTs with stroke survivors (reported here) and healthcare professionals (HCPs; reported in Chapter 6b). This will assist in refinement of the intervention to develop not only a theoretically underpinned and evidence driven intervention, but also an acceptable and likely more feasible and implementable intervention.

6a.2.1 Aims of this study

To establish how acceptable a medication adherence intervention was to key stakeholders (stroke survivors), using qualitative interviews. Specifically, four research questions were explored.

1. Which medications should be targeted in the intervention?
2. Which BCTs are or are not acceptable and why?
3. Where is it acceptable for the intervention to be delivered?
4. How should intervention components be delivered and by whom?

6a.3 Methods

6a.3.1 Design

A qualitative study design was employed. This design was considered most appropriate as the nature of this research was exploratory; to identify patient views of the acceptability of intervention design ideas, including the proposed BCTs and modes of delivery.

6a.3.2 Participants and setting

The recruitment strategy utilised the South London Stroke Register (SLSR). The SLSR is a prospective population based stroke register, which was set up in 1995 and gathers information of first-time strokes in patients of all ages for an inner area of south London (Stewart, Dundas, Howard, Rudd, & Wolfe, 1999). The register captures first time stroke from 25 wards across the boroughs of Lambeth and Southwark. Since 2014, data has been collected initially at the time of stroke and then follow up assessments are completed at 3 months, 5 years and then annually from 15 years' post-stroke. Previously, follow up data was collected at 3 months, 12 months and annually thereafter. Structured interview schedules are used to collect data including: living circumstances, employment status, stroke recurrence, activities of daily living (measured by the Frenchay activities Index), changes in risk factors and medications, disability (measured by the Barthel Index and Modified Rankin Scale), memory function (measured by the abbreviated mental test (AMT)), quality of life (measured by the Short Form-12 (SF-12)) and emotional state (measured by the Hospital Anxiety and Depression Scale (HADS)).

Participant sampling was purposive. This ensured inclusion of participants who had stroke risk factors such as diabetes, hypertension, high cholesterol and atrial fibrillation. This was a specific focus during sampling as the intervention will target adherence to medications that treat these risk factors.

Adult stroke survivors who met the inclusion criteria were contacted from this register, to identify interest in taking part in this particular research study.

6a.3.2.1 Participant inclusion criteria

Participants were considered for recruitment if they met the following inclusion criteria:

- Adults aged 18 or over
- Stroke survivors registered on the SLSR (carers of stroke survivors if participant requests their presence)
- Adults who have the capacity/capability of providing fully informed consent for the study (as indicated by a score of 8 or greater on the Abbreviated Mental Test)
- Able to speak English
- Living in south London
- Been prescribed at least one medicine for stroke prevention

Adults considered to not have cognitive impairment was indicated by a score of 8 or greater on the Abbreviated Mental Test (AMT), taken at the most recent follow up visit for the SLSR.

6a.3.2.2 Participant exclusion criteria

All participants were subject to the following exclusion criteria:

- Persons under the age of 18
- Persons deemed to have severe cognitive impairment (indicated by a score of 7 or below on the AMT)
- An inability to provide informed consent
- Persons with severe aphasia or other speech difficulties that would prevent them being able to take part in a verbal interview

Aphasia was assessed by an item on the National Institute of Health Stroke Scale (NIHSS). Participants are classified as: normal, mild aphasia, severe aphasia or mute.

6a.3.3 Topic guide development

For this study, a semi-structured interview topic guide was developed. The topic guide was developed with the support of Patient and Public Involvement (PPI) sessions, reported in more detail in Chapter 5. Within these sessions, participants were asked for input on the language that should be used to describe BCTs and what modes of delivery should be explored in interview.

The first design of the intervention (outlined in Chapter 5) identified potential behaviour change techniques (BCTs) that could be included in this intervention. The most feasible of these, as evaluated by APEASE criteria, were tested in this interview schedule. The possibilities of how the intervention should be delivered (including the modes of delivery and who should deliver the intervention) were also explored for acceptability.

The topic guide was designed with the intention that interviews would last approximately 45-60 minutes. The topic guide used for the 'patient' sample can be found in Appendix 4. As this was a patient sample, the language of the interview schedule was considered carefully. Removal of jargon, and low frequency words assisted in developing an appropriate schedule to be used for this sample. The topic guide was revised during the course of recruitment, removing or rephrasing questions that seemed difficult for participants to understand.

When conducting the interviews, it became apparent that exploration of some of the BCTs was somewhat abstract in nature, with participants finding it difficult to visualise what BCTs could look like in real life. As such, mock examples of BCTs were presented to participants in interviews (where face-to-face interviews took place). Questions that correspond to the 11 BCTs being explored for acceptability in this interview are presented in Table 16, along with a description of the mock examples presented to the participant where applicable. The examples presented to

participants can be found in Appendix 5. These enabled participants to better understand what the interviewer was trying to discuss.

Table 16. Table displaying the questions linked to BCTs, with mock examples shown to participants described.

BCT	Topic Guide Question(s) for Stroke Survivors	Mock Example Used (if applicable)*
Pros and cons (9.2)	<i>Would it be helpful to make a list of the pros and cons of taking the medicines? Why/Why not?</i>	A document with two heading. One to encourage patients to list positive things about their medicines and one to encourage patients to list reasons why they don't like taking their medicines
Action planning (1:4)	<i>Would it be helpful to make a detailed plan of exactly when and where you'd take each dose of medicine? Why/Why not?</i>	A written example of an implementation intention plan relevant to medicine taking
Self-monitoring of behaviour (2.3)	<i>Some people told us they sometimes found it hard to remember if they had taken their medicines on a specific day. Would having a system to make a note of each time when you take the medicine(s) be helpful? What makes you say that? Where would be the best place to make a note?</i>	An example of a calendar with a cross on it to show how a person could cross off when they take their medicine each day
Information about health consequences (5.1)	<i>Some people said they wanted more information about their medicines. What do you think of that idea?</i>	N/A

BCT	Topic Guide Question(s) for Stroke Survivors	Mock Example Used (if applicable)*
	<i>What sorts of information do you think would be useful?</i>	
	<i>Would information on why you are prescribed the medicine be helpful?</i>	
	<i>Would information on what most people experience when taking the medicine be helpful?</i>	
	<i>Would information about the possible benefits of the medicines be helpful?</i>	
	<i>Would information about medicine side effects be helpful?</i>	
Biofeedback (2.6)	<i>If you were given a blood pressure monitor to use at home, would that help you to know if the medicines are working? Can you tell me a bit more about that?</i>	N/A
Information about antecedents (4.3)	<i>If you made a note of what happened leading up to when you took or missed a dose of medicine would this be helpful? Why/Why not?</i>	N/A

BCT	Topic Guide Question(s) for Stroke Survivors	Mock Example Used (if applicable)*
Credible source (9:1)	<i>Would it make a difference to you who the information came from? In what way?</i>	N/A
Self-monitoring of outcome(s) of behaviour (2.4)	<i>Are there any things you do to tell/find out/see if your medicines are working?</i>	N/A
Prompts/cues (7:1)	<i>Would putting the medicines in an easy to spot place, such as next to tea bags, or by the sink, be a good way to help people to take them at regular times? What makes you say that?</i>	N/A
Habit formation (8:3)	<i>How do you think people could get themselves into the habit of taking their tablets?</i>	N/A
Social support (emotional) (3.3)	<i>Do your family or friends ever get involved with supporting you to take your <u>medicine(s)</u>? (if yes) what do they do? How do you feel about that?</i>	N/A

* See Appendix 5 for the mock examples shown to participants in interview

6a.3.4 Procedure

6a.3.4.1 Ethical considerations

National Health Service (NHS) England ethical approval to carry out this research was received from London - City & East Research Ethics Committee (Ref: 16/LO/1748). Research and Development approval was awarded from Research and Development Department at Guy's and St Thomas' NHS Foundation Trust. All study approvals can be found in Appendix 6 in line with the principles of research governance and the British Psychological Society's code of conduct.

Fully informed verbal or written consent was sought from all participants. The right to withdraw from the study, at any time, was highlighted to all participants. This was presented both in the information sheet provided, but also re-stated verbally prior to conducting the interview. The contact details of the research team were provided to all participants to enable them to ask questions following the research and to withdraw from the study following interview if they wished. A full debrief was given to participants at the end of the interview. Confidentiality of data was ensured by storing all data (both digital and paper formats) securely, complying with University and ethical procedures of data management. Electronic data was stored on a username and password protected computer in a locked, swipe access office. Paper copy data was stored in a locked filing cabinet in a locked, swipe access office. Participant anonymity was ensured by changing all identifiable information within the transcript and assigning numbers to each participant. Only the thesis author had access to any participant identifiable data within the thesis research team, and this was only of

those on the register that met inclusion criteria. Steps were taken to ensure participants were approached to take part in this research appropriately. As the patient population of this study are part of the SLSR, a wider research project being conducted, these participants have frequent contact with the SLSR research team, who update a notes section on the database to notify other researchers using the database of any issues or concerns. As such, participants who had recently taken part in a different study, had recently requested not to be contacted about research or who had recently been diagnosed with an additional medical condition such as cancer, were not approached for recruitment. If participants taking part raised any medical concerns during the interview, they were advised to seek help and support from their GP.

6a.3.4.2 Recruitment and consent

A list of eligible participants who met the inclusion criteria was generated from the SLSR. From this, small groups of 20-30 potential participants were created. The groups were created by purposely sampling participants with known risk factors of stroke, such as diabetes, hypertension, high cholesterol and atrial fibrillation, from the total list of eligible participants on the register. Participants identified to have risk factors were then randomly assigned to clusters of 20-30 participants. Letters were sent to one group of participants at a time, giving them study information and instructions on how to opt out of the study at that stage (see Appendix 7 for copies of the invitation letter and information sheet). If no contact was made with the research team to opt out, potential participants were contacted by phone to see if they had any questions about the study and to identify if they had any interest in taking part. If

insufficient numbers of participants were recruited from that round of recruitment, the next group of 20-30 potential participants would be contacted. This process was repeated (in this instance three times), until a sufficient number of participants had been recruited and interviewed. This was judged by the thesis author and identified when no new data was being elicited from interview, and thus data saturation was reached (Ritchie, Lewis, & Elam, 2003).

At the point of recruitment, participants were given the option to have a semi-structured interview over the phone, in their own home (where a researcher would travel and visit them) or they could come to the researchers place of work. This interview was scheduled to take place at a time convenient for the participant.

For those that opted for telephone calls, fully informed verbal consent was taken by the researcher reading through each point of the consent form (see Appendix 8) and the participant agreeing to each point. If the interview was conducted in person, fully informed written consent was obtained.

6a.3.4.3 The interview

Each semi-structured interview was always conducted in a quiet, private place: either in the participant's home or within a private meeting room. The interview was always conducted by a health psychology PhD candidate (author of this thesis) and lasted approximately 45-60 minutes, with an additional five minutes allocated for consent taking and questions. The interview began with some opening questions ascertaining

participant understanding of medications and perceived adherence. Following this, questions were asked introducing potential BCTs that could be used to support medicine taking and the best modes of delivery and person to facilitate. All interviews were audio recorded and transcribed verbatim. All transcription was completed by the thesis author, which assisted in high accuracy of transcription and familiarisation with data. Following the interviews, all participants were thanked for their time and informed that they would be sent a lay summary of the results. Two participants requested not to be sent the results summary.

Sample size calculations are not usually undertaken for qualitative studies. The final number of participants was contingent on the point at which saturation of themes generated was reached; that is, doing additional interviews would not produce greater insight into the acceptability of the proposed medication adherence intervention. The point of data saturation was identified by the thesis author, when no new comments, ideas or concepts were being elicited in interview (Ritchie et al., 2003). Specifically, application of the 10+3 principle reported by Francis and colleagues (2010) (Francis et al., 2010), facilitated the decision of when data saturation was reached. Francis and colleagues suggest the specification of an initial analysis sample (which was chosen to be ten for this study) and then a subsequent stopping criterion (which was three in this study). Thus, after the completion of ten interviews, once three further interviews have been conducted with no new emerging themes, this will be classified as the point at which data saturation was reached (Francis et al., 2010). Although this method was proposed for theory-based interview studies, it has since been applied to other types of qualitative research (Brown et al.,

2012; Whitaker, Macleod, Winstanley, Scott, & Wardle, 2015). Data saturation was reached once 16 participants had been recruited

6a.3.5 Data analysis

6a.3.5.1 Choice of qualitative analysis method

It has been argued that assessment of validity in qualitative research is appropriate, relating to the validity of representation, understanding and interpretation of the presented findings (Lewis & Ritchie, 2003). Ultimately, validity assessments in qualitative research aim to question the strength of research methods employed and the quality of analysis and interpretation of findings (Lewis & Ritchie, 2003). To adopt terms presented by Lewis and Ritchie (2003), validity of the qualitative analysis presented here can be considered in terms of validation (i.e. substantiating the validity of a finding or conclusion) and documentation (i.e. detailed reporting of the research methods, analysis and data interpretation to enable others to replicate) (Lewis & Ritchie, 2003). Generalisability of findings (i.e. the applicability of the findings to populations and settings beyond the study sample) is enhanced by detailed and transparent reporting of a study, and encompasses a form of external validation (Lewis & Ritchie, 2003).

Additionally, reliability is also considered to be an important concept in qualitative research. It is argued that there should be some element of replicability to qualitative research in order to draw wider inference from data and to provide incentive to act on this data (Lewis & Ritchie, 2003), especially in the context of changing health

service provision at a population level, not just a sample level. Once again, this links to the generalisability of findings and how this can be enhanced. Reliability of qualitative research can be improved by clearly reporting the research process (methods, data analysis approach and interpretation of findings) and by conducting checks of the quality of data and interpretation.

Framework analysis (Ritchie & Spencer, 1994) is a widely used qualitative analysis method, that uses matrix based analysis. This method offers a structured approach to data analysis, organising the data by key themes and emergent categories. The themes evolve throughout analysis of raw data. The resultant analysis produces a thematic framework consisting of main themes and subthemes. Each overarching theme will then be displayed in a matrix table, allocating rows to each participant and columns to each sub-theme. The matrix based reporting of data allows researchers to clearly see all participants included in analysis and all sub-themes derived from coding of the data (whether transcripts from interviews or observations from ethnography, for example). The matrix-based approach, allows analysts to move backwards and forwards between different levels of abstraction, whilst still keeping in mind the raw data. This supports comparisons across cases and between groups of cases if applicable (e.g. across healthcare professionals and between different groups of disciplines such as nurses, doctors etc.) (Spencer, Ritchie, Ormaton, O'Connor, & Barnard, 2014). Overall, framework analysis supports rigorous and transparent data management, whereby all stages of analysis are able to be conducted systematically (Lewis & Ritchie, 2003 pp. 220). This will allow for clear documentation of findings, enhancement of validity, as well as better reliability and

generalisability of findings. As such, this was the method of data analysis chosen for this study.

6a.3.5.2 Framework Analysis

Framework analysis is a useful tool for establishing a better understanding of patient experience and allows for a systematic approach to data analysis that is transparent and thorough (Smith & Firth, 2011). Framework analysis facilitates researchers to track their decisions about the data, enabling links between the original data source and presented findings to be transparent (Smith & Firth, 2011). The five steps followed in Framework Analysis to manage and analyse data are:

- 1) Familiarisation
- 2) Identifying a thematic framework
- 3) Indexing
- 4) Charting
- 5) Mapping and interpretation

More recently, Gale et al (2013) published research utilising framework analysis and added two additional steps to the process, resulting in seven steps (Gale, Heath, Cameron, Rashid, & Redwood, 2013). This process does not greatly differ from the more traditional five steps outlined above, but does provide a more prescribed step-by-step approach to the analysis process and as such was followed for this thesis.

The 7 steps were as follows:

- 1) Transcription

- 2) Familiarisation
- 3) Coding
- 4) Developing a working analytical framework
- 5) Applying the analytical framework
- 6) Charting data into the framework matrix
- 7) Interpreting the framework matrix.

Firstly, transcription took place of all the interviews. Transcription was verbatim. All transcribing was undertaken by the thesis author to ensure accuracy. Secondly, familiarisation involved reading the interview transcripts in order to gain an overview of the content. This process occurred whilst interviews were still being conducted. Transcription of the interviews enhanced the process of familiarisation. For the third stage, coding, transcripts were read line by line and salient issues, concepts or themes that emerged were underlined and summarised in the margins of the transcript. For the fourth stage, developing an analytical framework, overarching themes and sub-themes that emerged from the codes were developed to produce an analytical framework. These were consistently revised throughout the analysis process as additional themes arose from new transcripts being coded. Key parts of the text were then mapped into the chosen themes. For the fifth stage, applying the analytical framework, the framework, themes and sub-themes chosen were applied to all transcripts, also called indexing. The sixth stage, charting, entailed transporting the indexed data into pre-made charts. Each overarching theme had its own chart. Within the chart, each participant (or case) was represented by a row and each sub-theme (encompassed within a theme) was represented by a column. In the final

stage, interpretation, the charts were examined with a view to fulfilling the aim of this study.

To facilitate the process of coding transcripts and for data management, NVIVO (Version 11.4.2) was used.

6a.3.5.3 Rigour in this framework analysis

Reliability

Decisions of how to carry out the research enhanced reliability of findings from this study. Firstly, participants were given as much opportunity as possible to portray their experiences and discuss perceived relevant content. For example, although the interview was anticipated to last 45-60 minutes, no time constraints were placed on interview, so participants were able to continue beyond this time if they needed. A series of prompts were also developed throughout the process of data collection, to ensure that questions could be sufficiently rephrased if not understood initially. Also, participants were asked at the end of the interview if there was anything else they wanted to add to the interview, allowing them opportunity to describe their experience further if desired. The topic guide development is also reported and a copy of the topic guide provided in Appendix 4, enabling other researchers to replicate the development process.

Secondly, framework analysis allowed for systematic and comprehensive analysis. At several stages during analysis, including whilst coding and when deriving themes

and producing framework matrices, additional researchers confirmed interpretations and analysis decisions. As these researchers came from different disciplines also (one GP and one health psychologist) this further enhanced the process.

Validation

To enhance the external validity of findings, firstly multiple sources of data were accessed. Interviews took place with two different groups: stroke survivors and HCPs. Within one of the groups, HCPs, there were also multiple data sources obtained from nurses, GPs, Pharmacists and a physiotherapist, based in primary, secondary and community settings. Results from HCP interviews are reported in Chapter 6b, and results from stroke survivor interviews reported in this Chapter. Patterns of convergence in the findings, between different disciplines of HCPs, as well as between stroke survivors and HCPs (which will be reported in Chapter 7) was identified to ensure more confidence of the overall interpretations of data.

Secondly, an attempt was made to triangulate the data using triangulation through multiple analysis (i.e. using different observers to compare and check data collection and interpretation) (Lewis & Ritchie, 2003). The thesis author developed matrix tables from the framework analysis conducted. A GP and a health psychologist assessed these matrix tables to check the interpretation of the findings. As this checking process was conducted by individuals from different disciplines, this should enhance the external validity of the interpretation of findings reported.

As a method of assessing internal validity (i.e. what is claimed to be investigated is being investigated (Lewis & Ritchie, 2003)), co-coding of a proportion of transcripts was undertaken (in total 31% of transcripts). One coder (the thesis author) coded all transcripts. A second coder (a GP) co-coded 22% of the transcripts. A third coder (a health psychologist) co-coded 9% of the transcripts. The second and third co-coders did not code the same transcripts as each other. As the coding team came from different disciplinary backgrounds, this enhanced the rigour of this process.

Documentation

To enhance validity, clear reporting of methods of data collection and data analysis was presented in this chapter and Chapter 6b. A table of themes derived from analysis of each sample is also presented in Appendix 9. This will enable readers of this thesis to judge whether the interpretation of the data presented here is appropriate (Mays & Pope, 2000).

Generalisation

The findings presented here are being reported with sufficient detail to enhance generalisation of the results to a similar setting or population. For this analysis, generalisation is defined as a form of empirical generalisation, focused on the applicability of the findings to populations and settings beyond the sample presented in this study (Lewis & Ritchie, 2003). Specifically, the detailed and transparent reporting of findings should enhance the ability to generalise the findings to the wider stroke survivor population, and to other settings within the NHS, beyond the London based services that this study's sample interacted with. This research was conducted within south London, an area that encompasses an extremely diverse

population, reflected in the recruitment of the stroke survivors. HCPs were also recruited from a range of disciplines and within primary, secondary and community care teams. The diversity of samples should enhance generalisability from the findings of both stroke survivor (reported here) and HCP (reported in Chapter 6b) samples.

6a.4 Results

6a.4.1 Participants

A total of 16 stroke survivors were recruited for interview (56% men). Participants recruited had suffered stroke between 2007-2016 and ages ranged from 48-86 (Mean=66.46, SD=11.4). Seven interviews were conducted over the phone, with the remaining taking place in the participant's home. Of the nine participants interviewed at home, five were subject to a revised format of the interview, where visual examples of the BCTs were provided. In two interviews, family members and carers were present for part of the interview. Participant demographic information is presented in Table 17 below. There were no instances where participants withdrew after providing fully informed consent to take part. There was one instance where an interview had been arranged, but on the date of interview the participant was too unwell to take part. There was also one occasion where an interview had been arranged, but the participant felt unable to understand the consent procedure and was not interviewed. One participant reported not taking medicines and was identified as non-adherent. The remaining 15 reported as adherent to medicines.

Table 17. Stroke survivor demographic information.

Demographic variable	Sub-category	N (%)
Gender	Men	9 (56)
	Women	7 (44)
Education ^a	Primary	4 (25)
	Lower secondary	5 (31)
	Upper secondary	3 (19)
	Stage 1 tertiary	2 (13)
	Stage 2 tertiary	2 (13)
Ethnicity	White	6 (38)
	Black	8 (50)
	Other	2 (13)
Employment	Retired	11 (69)
	Unable due to illness	2 (13)
	Part time	2 (13)
	Unemployed	1 (6)
Residential	Private household alone	2 (13)
	Private household with other	11 (69)
	Other	1 (6)
Hypertension	Yes	12 (75)
	No	4 (25)
TIA	Yes	1 (6)
	No	14 (88)
	Unknown	1 (6)
AF	Yes	5 (31)
	No	10 (63)
	Unknown	1 (6)
Diabetes	Yes	4 (25)
	No	12 (75)
Hypercholesterolemia	Yes	5 (31)
	No	11 (69)

a- Primary=approx. 6 years in school, Lower secondary= 9 years in school ending aged 15-16, Upper secondary=additional 2-3 years post-secondary, First stage tertiary=3-5 years university, Second stage tertiary= research degree; TIA-Transient Ischaemic Attack; AF- Atrial Fibrillation

6a.4.2 Findings from framework analysis

Factors unique, or that contrast across different participants, will be indicated throughout the analysis. Participants are referred to by their study number. As per the framework analysis process, themes and sub-themes were derived during the analysis. This is presented in Appendix 9. To enhance clarity of reporting, and in order to demonstrate how the research questions were answered, quotes and discussion of the findings will be presented under each research question heading, rather than under theme headings. For research question 2 (acceptability of different BCTs), results are further broken down and presented separately for each BCT.

6a.4.2.1 Which medications should be targeted in the intervention?

It is important, first, to consider which medicines should be targeted in this intervention, and thus the focus of the BCTs. That is, should the BCTs, such as information about health consequences, be focused on only one medicine, such as a statin, or should it more broadly cover all stroke medicines. Previous input from a PPI group indicated that knowledge of medicines varies, suggesting that targeting stroke medicines as a whole may be more practical (see Chapter 5). To explore this further, participants in interviews were asked about their understanding of medication including the medicines being taking and the medication purpose.

Participant knowledge appeared to be variable. None of the participants could fluently list the medications (by actual name) without referring to a list (which some

participants had pre-prepared for interview). A number of participants could describe what some of their medicines were for.

“They are for the stroke, the blood pressure and the cholesterol and things like that” (P11).

However, at times participants could not remember all medicines and purposes, or chose not to remember.

“I don’t try to remember I don’t recognise what the pills are necessarily” (P8).

However, there were instances where participants described having limited understanding of medications. Often participants with the least understanding were those using a blister pack.

“My problem is that I’ve got a list of them but I don’t really understand” (P2).

Participants reported that it was easier to think about medicines in terms of the timing of dose (morning, afternoon and evening doses), as opposed to conceptualising each medication as the blood pressure, cholesterol and blood thinning medicine.

“I just I know, I just get up in the morning and I know that I’m supposed to be taking them at 7:30 or 7 o clock...and then midday and then the evening time” (P9).

6a.4.2.2 Which behaviour change techniques were or were not acceptable and why?

The following section presents each BCT in turn, describing the perceived acceptability with reasons why.

Pros and cons

Some participants spoke about the perceived utility of producing a pros and cons list of the medication to affirm the rationale behind prescribing and the purpose of the medication.

“Well it would be a useful thing to do, if you got it down onto black or white, why you’re taking them and what for” (P4).

“Its give you an insight of your illness, what is useful, what things you can do, what things you cannot do and why the medicine beneficial. Not just giving you medication like that” (P4).

One participant suggested that it would be useful to identify the side effects in this process and saw this as the key benefit to making a list of pros and cons.

“Yeah because of them, the side effects in our life is, that’s why we sometimes we don’t like to take some particular medicine” (P11).

Other participants expressed similar views, suggesting that the act of writing down side effects would allow better ability to identify the medicines causing side effects and to act upon this. Participants also described being able to better understand each specific medicine, rather than having a more general overview of medicines.

“If you taking something and like, you sort of get something new...straight away you have a change and you first, you try to do is to identify...which type, which one is causing the effects...so you can rule out, yeah you can rule out certain things” (P12).

“It’s, yeah, you’re taking more than one or worrying about more than one you know. They sort of blend in together in the end. It’s like sometimes if I check something I go back to the leaflet for that particular tablet you know what I mean, ‘cause it wouldn’t be relevant for the other ones as well you know, they’re not general are they, they’re sort of specific to the medicine you’re taking” (P5)

One participant expressed ambivalence about this BCT. Whilst they could see the utility of such a task, they were unsure if clinicians would have the time to discuss the identified pros and cons.

“I would like to discuss this with the GP, so that if there’s alternatives, which there probably is, they could point me to the alternatives...but the GP has ten minute with you...you could see what the alternatives are...you are aware there’s another patient waiting and you don’t want to ask another question” (P14)

However, some of the participants interviewed couldn’t see the relevance of an exercise like this. The consequence of having another stroke was so severe that the pros and cons to taking medications was irrelevant.

“Got to take me medicine 'cause they do me good” (P16).

“I know I’ve had that stroke, I have to take ‘em,...it’s now sort of drummed into my head that every day, apart from the odd one, I got to take ‘em” (P13).

Information about health consequences

At times during interview, participants referred to the current system of information provision, and what was felt to be provided at the time of medication initiation and across prescriptions. Some of the participants spoke about the patient information leaflet provided in the box of medicines and indicated that this information was useful. One participant had a previous career in medicine, which may have enhanced their ability to understand this information.

“Well because I’ve got a background in medicine...I can make sense of the paper handout that comes with the packet of medicines, so I’m still able to interpret what instructions mean” (P8)

Nonetheless, other participants, with a less specialist medical background, still perceived this information to be accessible.

“Well I think there’s quite a bit in the leaflet that comes with the medicine, I usually read that and that gives me all I need really, what it’s for, what they look like, what they do” (P5)

However, some of the participants did indicate that they chose not to read information provided to them.

“I am provided with most of the information, it’s just I haven’t, I just swallow them” (P2).

During the discussions of current information provision, participants described perceived limitations, indicative of areas of information provision that could be improved. There were instances when participants felt not all information was disclosed to them, whether from the manufacturer of the medicine or from HCPs.

“There were side effects that they did not put in the leaflet” (P10).

“I was started on a new pill which was very sedative...and he [the GP] hadn’t actually mentioned the fact it was going to be so sedative, so that that was the only instance where I felt the doctor should have either told me more or less” (P8)

In addition, participants expressed perceived barriers to accessing information.

Participants described difficulties in discussing medicines with other HCPs beyond the prescriber.

“The pharmacist, if you need any information from them, they won’t tell you because your doctor prescribe it to you” (P11).

Furthermore, although some participants felt that the information leaflets provided were useful, others described this form of information as difficult to use. Particularly, participants described the need to continually re-refer to the leaflet provided as the information was difficult to retain and recall.

“Have to go back to keep reading because it’s not all the while you can contain it” (P12).

Overall, participants were very positive about receiving information about their medications and were easily able to indicate what they would like to know. Of particular interest was medication side effects.

“Well it’s about getting information you know...because you need to know why you taking the medication...what’s the effect...effect it will get on you ...you need to know because sometimes you’re tired of taking medicine everyday” (P6)

One participant described the relevance of knowing side effects about medicines, even if these had not been experienced initially.

“In case you don’t know what could happen...and then because although some things new not react at the moment ...you never know sometime is after a period of time something could change” (P12)

Another participant also gave advice on how to enhance the accessibility of the information for patients, suggesting that the use of scientific jargon was not necessary.

“Not too scientific. Just say look, you got ta take warfarin because it thins your blood and your heart hasn’t got to work so hard” (P4).

When participants were reflecting upon the information they had been provided previously about their medicines for stroke, references were made to the timing of this information provision, indicating some potential opportunities for refinement in

the information provision process. Most notably, participants described how the primary focus, when in hospital, was to leave. Participants also described this point at discharge as a confusing time, which can directly impact the ability to retain and understand information provided.

“I think there was a brief discussion, I can't remember...in detail about it, I it was a, the whole business of having a stroke and then going into a hospital for a couple of days...I became rather confused...and I, my most chief aim was to get out of the bloody hospital fast” (P2)

“When you're coming out of hospital, you wait for your prescription and the nurse or the sister will say that's for that that's for that that's for that, and by the time you get out of there you're so confused, you've forgotten what she said. You're just waiting to get out” (P4)

In spite of the overall positive response to provision of more information about medications and the health consequences of taking the medicines, some participants warned of becoming overloaded with too much information. There may be a balance that has to be found between what is necessary and what is excessive. One of the participants who felt able to read and understand the patient information leaflet provided with medicines expressed this view and other participants also felt similar.

“I'm ok with it. I don't want to be bombarded with too much” (P5).

“You can get too involved in your medical details...so that you become obsessive about these things” (P2).

The participant with a background in medicine gave insight from their own experiences of information provision, further suggesting the need to strike a balance between the necessary and excessive. It was felt that provision of too much information could create more anxiety or worry.

“I have an understanding about the problems about listing side effects 'cause some are so rare...that you shouldn't be worrying your head about them” (P8).

Credible source

The majority of participants expressed a view that they wanted information or support to come from someone perceived to have more knowledge than the participant about the medicines.

“The doctors or anybody who's, you know, who knows much about medicines and things like that” (P11)

“I don't know nobody else to ask except for the GP...because he's there professional” (P6).

Participants views were explored regarding who should provide information. In these instances, as previously discussed above, there was not an explicit need for information to be provided by a specific person or HCP. The focus was on the skills, or credentials of the person delivering support, i.e. do they know more than the participant about medications.

“It wouldn't really matter where it came from, so long as it wasn't the man next door...as long as you know whoever lets me know knows more than I do” (P5).

“It don’t matter as long as they’re well informed...it doesn’t matter really who the information comes from...as long as we are made aware of these things” (P14)

The notion that the person providing information could also be re-accessed or revisited was appealing to participants.

“It’s good that if certain things, you can get back to that person and say look so and so is happening and that person...who have the experience in certain things can advise you” (P12)

Although, some participants conveyed reservation about certain sources of information having a preference for HCPs delivering support. For example, there was uncertainty about support being delivered by a charity, with the view that charities would not have specialist knowledge of medications.

“From the doctor or something, charity I don’t know, I don’t know whether they know much about medicines” (P11).

Self-monitoring of behaviour

Participants were asked about experiences of taking medications and whether strategies were employed to support adherence. At these points in the interview, participants often referred to strategies that enhanced self-monitoring of the behaviour, describing instances of missing doses prior to using the strategies. One of the discussed strategies was the use of a Dosette box (a multi-compartment compliance aid (MCA)).

“If there are somebody that for will forget, like I used to forget all the time, put it in a Dosette box” (P10).

The positive views of MCAs like the Dosette box continued throughout most interviews, even from participants who did not utilise this strategy. The strongest perceived benefit of the Dosette box was that it provided a means of confirming if medications had been taken, thus providing a level of reassurance and an ability to self-monitor adherence.

“I would take the medicine and I wouldn’t realise I have taken it ...and maybe I won’t take it, I will be saying I’ve taken it...so what I did was I found a Dosette box” (P10)

“As you miss a day as you look you can see oh I didn’t do yesterday, then you know” (P12),

“if I’m in doubt as to whether I’ve taken it, the simplest way to find out is to open the box and see what’s not been taken” (P8).

Participants who received a lot of support from others and had limited mobility also felt the Dosette box had utility.

“Mine has got date, so when I saw it I took it, yesterday I didn’t, I haven’t taken it this morning, so the dates helps a lot” (P11).

A MCA like the Dosette box was viewed positively even from participants who didn’t utilise this strategy.

“Come Tuesday if you’ve forgot and its Wednesday you think oh...its Wednesday today and I haven’t took Tuesdays” (P4).

Nevertheless, despite an overall acceptability of the Dosette box as a means of self-monitoring behaviour, some participants expressed reservations. For example, the formation of a Dosette box is such that all doses for one time in the day are missed together and this could encompass several different classes of medication. Participants described difficulty in singling out one medication when trying to identify the medication causing a side effect.

“If the children are here sometimes I let them google, but I don’t know which one or which is doing it” (P11).

More practically, participants described challenges in finding a MCA that could accommodate complex medication regimens for multiple conditions.

“I’ve never come across a box where what’s big enough 'cause I have so many” (P16)

Stroke survivors are often suffering from other co-morbid conditions and this is a potential difficulty with routinely issuing Dosette boxes to patients. Inhalers and other medicines, as well as some of the newer forms of anti-coagulants are not kept in MCAs.

Beyond the Dosette box, other forms of self-monitoring of adherence were discussed that participants currently employed to monitor medicine adherence. Most frequently, a calendar was viewed as a useful tool for self-monitoring behaviour.

“In my kitchen, when I take my tab, my medication, I put a tick on the calendar”
(P6)

“I would do it on a calendar you know, because I’ve got one, a calendar by the phone and I just, if anything I have to remember, I write on that” (P5)

However, strategies to self-monitor behaviour, such as marking doses taken on a calendar, were not consistently viewed as favourable. Participants described instances where distractions could prevent this behaviour being performed successfully.

“No, I have a calendar in front of your desk, yeah might help...but you might take it and you forgot to cross it...you went to look for a pen and something else took your attention, you completely forgot about, you didn’t do it” (P12)

Self-monitoring of outcomes of behaviour

Participants were asked more generally about perceptions of medication efficacy. During these discussions, participants found it difficult to identify ways of monitoring whether the medication was working, beyond forms of biofeedback (discussed below). Instead, participants expressed a perceived trust or assumed need of the medicines.

“You're going to try and see if it works, we're not doctors to say this is not that you know, so we try them” (P1)

“Because she [the wife] knows my medicines are important or I assume they’re important to my wellbeing” (P8).

This notion of trusting the treatment, negating any perceived need to self-monitor the outcomes of the behaviour, continued in other interviews.

“I programme myself to that one, I know my medication, I have to take if I want to stay alive, I have to take it” (P10),

“I don’t even know if they do me any good but...they give it to me so I take it” (P7)

“I don’t expect to be able to tell whether the drugs are working, it’s an act of faith” (P8).

These quotes are all indicative of an element of trust that the medicines are necessary, despite perceiving no way of assessing efficacy. It may imply that participants do not feel a need to know this information.

Not suffering further stroke was described by one participant to suggest that the medications may be effective.

“I wouldn’t know whether the drugs were working or not because I’ve got no way of telling, other than I haven’t had another stroke” (P8).

Overall, it seems apparent that the participants interviewed did not employ strategies to self-monitor the outcomes of behaviour (beyond biofeedback). Instead, participants had an implicit trust in the efficacy of the medication.

Biofeedback

The concept of participants' self-monitoring certain outcomes from taking their medicines, such as blood pressure and cholesterol, appeared acceptable to many of the interviewees. Generally, monitoring at home was considered to be more convenient and better than attending the GP surgery routinely to check. Many participants also described carrying out a form of biofeedback as well, making reference to measuring blood pressure periodically.

“Well if you do it at home then will be more helpful because you don't go to your doctor regularly...to say to have it done on a regular basis and you'd like to know that it is ok” (P12)

Participants who owned blood pressure monitors at home and chose to self-assess periodically, provided accounts of why. Reasons included symptom perception,

“Sometimes I let them children take the blood pressure for me if its high, just like that or if I'm having some headache” (P11)

and being able to provide the doctor with feedback,

“I do that every other day, I write it down in a little book up there and when I go to the doctor...I can give it to him” (P4)

One participant, also gave an account of the utility of having a blood pressure monitor at home, indicating that this would save on healthcare resource and time.

“Because I would be able to check it every day on my own...to go see the doctor you taking time that...you taking space from the doctor” (P6).

There were instances, where a participant, or family member present in the interview, was uncertain about the utility of forms of biofeedback. Participants gave accounts of not using monitors when at home, instead choosing to have blood pressure assessed by a HCP.

“I got one, someone gave me one, so I could use it to find it, but I choose to go to the doctors” (P1)

One participant, who had previously attended a cardiac rehabilitation group, indicated that biofeedback would not be appropriate for everyone, increasing anxiety in some.

“Lots of people are quite paranoid and I think it could make it worse with some people” (P5)

Prompts and cues

The participants were asked about strategies employed to support adherence. At this time, participants frequently referred to strategies that acted as a prompt or cue to behaviour.

“I put it in the table in front of me, so when I wake up I see my box waiting for me” (P10)

“So, I got them in that little glass, so as I say, when I open the door to get me coffee cup out, they're in front of me so I take them” (P4).

Pairing medicine taking with another salient daily routine to cue the behaviour was also commonly discussed.

“Easiest way is to take your pills at meal times” (P8).

Therefore, this implied a certain level of acceptance and feasibility to the BCT: prompts and cues.

Participants also described the utility of having a carer, where carers acted as a form of prompt to behaviour.

“I remember me tablets, she [the carer] remember come on take tablet” (P7),

“They [the carer] remind me, have you taken it or well let’s take my medicine” (P11)

On the whole, this BCT was viewed as acceptable. Participants either employed this type of strategy already, or could see the utility for others.

“That is a good idea, I say keep it out you know they can’t miss it...if ones there they go into that into that room or whatever, its right there in front of them, they not able to forget it” (P12)

“Definitely because I’ve got mine in the kitchen on the side, so when I come down make a cup of tea or get a drink they’re there, if they were in the bedroom I could sort of like have ad drink and easily forget” (P5)

There were occasions where participants did not feel this BCT would be acceptable. This was particularly pertinent when talking about strategies to address low mood, with participants expressing uncertainty about this BCT's utility in those circumstances.

“As I said, if a person is in a depressed state...whether it's in front of you or to the side or inside...they still can miss it, don't take it” (P12)

“If you're are depressed...if you put it next to your bed it will make no difference, if you're depressed you are depressed” (P6).

Action planning

Action planning was a BCT that appeared to divide opinion. Visualising, or conceptualising this BCT, appeared difficult for some participants, even when provided with an example in the face-to-face interviews. This impacted the perceptions of utility.

“Because sometimes you cannot change your pattern and that what cause you to miss something like that” (P12).

Nevertheless, most participants considered action planning to be acceptable. An example was provided, by one participant, of the plan employed by them.

“When I program 6 o'clock, I'll be watching the times 6 o'clock wherever I am, I've got it in my bag have my medication I will take it” (P10).

Participants generally viewed action planning as something that made the process of medicine taking less onerous.

“It just make[s] life easy for you” (P6)

This BCT was also described as useful for those who may have some level of cognitive impairment, or general difficulty in remembering and enacting the behaviour.

“They have to make plan if you know, if you don't know understand where to put your medicine take it if you head not working right”

(P3).

Some participants, and relatives present in interview, also indicated that beyond the basic principle of planning the behaviour, having the plan in a prominent place would in fact act as a further prompt or reminder to carry out the behaviour.

“If you have something in front of you, if you had like sort of like a plan, you could like pin to the wall in the kitchen or something or stick it on the wall and have it in front of you where you would see it, you know, once you get into a plan you wouldn't need it so much, but in the beginning when you start taking tablets, I think it is very confusing” (P5)

Habit formation

Once again, as with self-monitoring of behaviour and with prompts and cues, it was often the case that participants already utilised habits, thus at some point forming a habit, to support medication adherence. Therefore, participants frequently made reference to bespoke routines.

“I keep my tablets in the room there, after I get my cup of tea or so, I go and sit and take me tablets” (P3)

“I don’t miss it because in the morning, as soon as I get up, I drink a cup of water, go take a cup of tea...and I start with the medication straight away”
(P10)

“I’ve got a routine ...nowadays, well for a long time, I have breakfast Weetabix or something and as part of how you go on then your medication you get it you’re sort of one goes with the other one” (P16)

Information about antecedents

There were few instances where participants perceived this BCT to be acceptable. Participants who could perceive some utility of recording and identifying antecedents to behaviour, considered there was more purpose to identifying reasons for missing doses, as opposed to taking doses.

“If you write down sort of why and when it does help, because it’s you know, well I find anyway ‘cause I don’t work, I’m sort of like one day you know sort of blends into another, I wouldn’t remember after a week what day it was that I missed them...I think it is a good idea to keep a record of not so much when you take them but when you miss one or when you don’t feel like taking them and why” (P5)

Across most interviews, this BCT was not seen to be particularly acceptable. Participants often questioned whether others, who were finding it difficult to take their medicine, would be motivated to record antecedents to missing or taking doses.

“I shouldn’t think it’s would be helpful if you don’t take your medicines seriously, you gotta take it to get better” (P1).

One participant felt that this would be difficult to enact.

“I wouldn’t have the discipline self-discipline to do that” (P8).

Moreover, some participants felt that this type of BCT, if it was delivered in a way that required people to write down the antecedents, could exclude those with more severe impairments to mobility.

“It would be helpful but then you must think out of the box, thinking that not all people after stroke are able to use their hands. So, when they are not able to use their hands not helpful” (P6)

Social support (emotional)

During the interviews, participants described how low mood could present a barrier to adherence.

“One of the things that makes people don’t take their medication, as I said, is depression” (P6).

One participant disclosed a personal experience of low mood and later identified how this had been managed.

“There are of course times when I do get low and depressed and if that happens to me I tend to stop doing anything I...tend to just sit and withdraw when I’m depressed...so if I did miss the pills it would be one of those days where I didn’t feel like doing anything or going out I just wanted to opt out...I’ve had some professional help in dealing with the days when I’m withdrawn” (P8).

Participants were asked about the best methods to support medication adherence in patients with low mood. Participants responded by suggesting social support.

“Best be able to have someone you can talk to...really I think that is the best thing, if you have somebody you can turn to and talk to them you know and...someone who be, would able to say have you taken your medication and try and explain to them the difficulty in not taking it” (P12)

“Well I reckon they'd have to have someone around them...or to remind them every day, depending what time you take your tablets” (P13)

On a near unanimous basis, family members and other forms of social support were perceived to be beneficial to the participant for supporting medication adherence.

One participant had accessed numerous forms of social support including friends, work colleagues and by attending a series of groups, to support adherence, stroke recovery and generally to improve quality of life.

“All the empowerment I was getting from them [support network], that is why I'm standing today like this” (P10).

Frequently, social support was described in general, as opposed to relating directly to emotional support. Participants spoke about support in the form of reminders to take medicine.

“He [a friend] has to be calling me in the morning get up go and take your tablets” (P10).

“I never give them the chance to really get involved, but I know my wife, if say we goes out or something like that she will ask did you take your medications, so it really help, so she know I do take it daily” (P12)

“Even my son comes from school and he’s seen there is no tick on it [the calendar] he knows, he will come to me and say mummy you haven’t taken your medication go take your medication” (P6)

Another participant also described the importance of a social support network. In this instance, when support was not available, the participants access to services and the outside world was limited.

“So, if I don't have anybody I don't go” (P3).

Participants also spoke more broadly about social networks and the positive influences it had.

“She [the wife] rescued me completely with, when I had the stroke” (P2)

“Yes, my family, my children, every bodies very helpful. They look after me very well” (P15)

“I’ve got a short memory span, so my granddaughter does everything for me, now she’s moved in here you know, she lives here now but she does everything” (P4)

“At some point, I knew exactly what was what, now my memory’s not so good so I don’t always know exactly what I’m taking at any time, so I rely very much on my wife” (P8)

There was one instance, however, where a participant indicated a limitation to social support. The support of others was felt to be unwanted at times, especially when it forced a role reversal in a relationship.

“My daughter does [get involved] a bit, but then she’s turned into my mother (laughs). So she’ll say, have you taken them, have you taken everything, have you got to take anymore, but its more sort of like, it’s just ‘cause she cares you know, she wants to know I’m doing it right...she only comes once or twice a week so its bearable, I just have a laugh inside, I just think for twenty years I brought you up and now you’re telling me what I should be doing (laughter) like I’ve regressed” (P5)

Tailoring

When considering the delivery of these BCTs, it may be important to try to embed elements of tailoring into the intervention. Participants often mentioned in interview, how strategies had utility for some and not others and described how these ideas may need to be individualised to be acceptable.

“I think every individual is different the stroke affect them differently every individual” (P6)

“I think one thing that would suit me might not suit them” (P5).

When participants were asked about specific BCTs, there was hesitancy in some responses, once again expressing a need for tailoring or consideration of individuality.

“In some cases, yeah, put it next to the tea bags for some people, but people made differently” (P1).

“It couldn’t be a blanket...system that applies to everybody, so it would have to be err individualised to the patient” (P8).

6a.4.2.3 Where is it acceptable for the intervention to be delivered?

There were instances where participants described a willingness and ability to access healthcare from healthcare settings, listing off numerous settings like a GP surgery and hospitals. However, for most it was either within the GP surgery or within the home that was considered most acceptable, mainly as these were frequently accessed or more convenient for the participant.

“I think the first place you should turn to is your GP, who can give you a referral to some, you know the most appropriate people” (P12),

“At home... because I can’t move well, if I go out there I have to have someone to lean on, I can’t stand up by myself” (P3)

“in my house...because it’s convenient isn’t it” (P6).

Some participants expressed acceptability to access primary, secondary or community care settings.

“The government, the hospitals, the doctors, the pharmacy, somebody who can go to somebody else which is higher than them” (P9).

It was also discussed, by one participant, that newer systems in place made support more accessible, such as flexibility of GP surgeries to use telephone appointments. This indicated how the intervention could be delivered across settings, with patients accessing a facilitator based in a healthcare setting, but receiving phone calls in the home.

“Because now they do phone calls don’t they...they ring you back, it saves making an appointment” (P5).

There were times, during interview, where participants expressed uncertainty about accessing support from hospitals. Barriers such as parking and travel via public transport were discussed.

“I don’t think hospitals are very helpful” (P2).

“Hospitals they’re lovely, [but] they not got the time to go into things” (P16).

“If I was going to the hospital say at [names hospital] I’d have to get on a bus say like midday...can’t get the early morning bus ‘cause I don’t like packed buses now...since I had that stroke, I get a bit panicky with...too many people round me or if I’m crammed in” (P13)

“Getting about if you went to the hospital, I mean I drive but parking is a joke so I get a cab...so from here to [names hospital] there and back its 14 pound

seven pound there seven pound back, to [names another hospital] its ten twelve pound there...twelve pound back so it's a big expense and you can't park there" (P4)

6a.4.2.4 How should intervention components be delivered and by whom?

Who should provide information and support

Participants were asked, at several points during the interview, who should provide information, as well as who participants accessed for support when questions arose.

Most frequently, participants turned to the GP for support.

"Because if any of the signs come up I go quickly to my GP, I said this is what I'm experiencing" (P10)

"If I want to know anything I ask my GP, I don't go, I didn't go no further" (P9).

Some participants more explicitly stated that the GP would be the first accessed HCP, before seeking referral elsewhere.

"Well I would ask my GP...and if I'm not happy then I would ask him to refer me to someone else" (P12).

One participant indicated that the GP would be best placed to provide support, as they are a generalist and therefore have the most complete background on the patient.

"The GP, the family doctor would be the ideal person...'cause he or she should have the fullest picture about the patient" (P8)

Participants, also expressed acceptance of nurse led support, describing that there were noticeable changes in healthcare delivery with emphasis shifting from doctors to nurses providing services.

“That would have to come from a doctor or something like that, or maybe a high flying nurse or something like that. 'Cause nurses they can know as much as b***y doctors, if not more” (P16)

“So, doctors aren't doing all the information giving, in fact usually the relevant information now comes from a nurse, either in the practice or at the hospital...and I think that's a good source of information” (P8)

Although the GP was not identified as the most optimal HCP to deliver the intervention by one participant. This was mainly due to an awareness of the time pressures that GPs faced in current practice.

“I do think when you first, especially if you're not well and you know, you can't think straight, it's sort of like it's difficult, so I think yes extra support would be good and you don't always want to bother the doctor... 'cause they're busy...you could have a support somebody that you could phone if you were worried or you know, or they could phone and sort of check that you're doing it right, yeah I think it's a good idea the doctor you wouldn't so much do it because it's you know, you'd end up sort of like rining them all the time for different things” (P5)

The doctor-patient relationship appeared to be particularly important and perhaps the main influence for most participants who considered GPs as acceptable to deliver the intervention. Participants indicated that trust and support were notable qualities of the doctor-patient interaction.

“I trust my medical friends” (P2)

“And I won’t lie, my GP is very supportive” (P10)

The discussions also suggested trust in the GP to provide the perceived necessary information and to have open discussion.

“I don’t get me self in tangle with tablets because my doctor will let me know everything” (P7)

“I can sit and talk to my doctor, I can ask them anything” (P9)

However, in spite of this, participants described the perceived limitations of modern GP surgery structures, such that continuity to see the same GPs was not always feasible.

“The thing is you never seem to see the same doctor” (P16).

Participants expressed a preference for continuity, wanting to continue a long term relationship with one consistent GP.

“I have him [the GP] for years...long time, long time...if I will see, not feeling right, I go to him, he come to me” (P7)

“I just deal with them [the GP]...and it’s the same, it’s the same people I’ve been for many years” (P9)

Modes of delivery

In terms of acceptable modes of delivery, discussions were mostly focused on phone and face-to-face delivery. Delivery over the phone appeared to offer participants flexibility.

“By phone, really would be easiest if you could just ring somebody who knows your position sort of thing, so if you’re worried that minute or you done something wrong or something, but you know somebody you can check and put your mind at rest” (P5)

“Yeah on the phone or something, because maybe they want, the time that you need help you wouldn’t get anybody to help, so I would phone” (P11)

Face-to-face delivery offered a depth to the quality of the interaction that appeared important for some participants.

“Face-to-face is a more reassuring way of dealing with a problem” (P12)

“It’s much more receptive because I believe...I can speak with my voice, I can also speak with my body... my eyes and so on” (P14)

More generally, face-to-face delivery was the initial preference that participants suggested when asked how support should be received.

“For follow up nothing would beat, for me nothing would beat a face-to-face meeting” (P8).

“I’d rather see someone face-to-face than talk to someone on the phone because...like I said to you, I’m no good at listening on the phone anymore (P13)

“You’d have to come and see me and then...we talk about what’s went wrong or what is wrong...there is no other way because you can’t trust to go to people here there and everywhere, because things sometimes are different now” (P9)

However, there were more deviant accounts from participants. For example, one participant described the perceptions of group delivery and how this would be acceptable.

“I think it’s something that you know, it’s not everybody that will have the time to sit about and read...because I think sometimes it would be good to have a group discussion where we sit down and explain the negative and the positive side of the medication” (P10)

Another participant described a preference for written information as it was something that could be used for reference.

“Then you can have it to read and see what’s going on” (P3)

Participants discussed confidence in using smartphone technology. One participant presented thoughts on the utility of apps that allow multi-way conversations between people as a form of delivery.

“Whatsapp is a quick way to pass information” (P10).

Texting was also described as feasible and perceived to be a useful reminder or prompt.

“Text, I’m alright, what I think is a, what is a good idea you, they text you to remind ya about your hospital appointments” (P16).

One participant also felt that access to newer forms of digital technology, and subsequent interfaces (such as social media) had utility.

“very useful...social media has come at the right time really...to emerges and put into action some of the things we could not possibly do bef0re” (P14)

In spite of this, forms of digital technology were most often perceived as unacceptable to participants. Texting was probably the most acceptable of these methods, but computer based strategies such as email and internet pages were not acceptable to many participants interviewed.

“Good idea, but how many people got that information on the internet, not many are there” (P1),

“Well it would be good for me, but it’s not all the time I go in email...and most people don’t go in in the email all the time” (P10).

Participants also described a lack of access and familiarity with computers or devices that would prevent viewing emails and internet pages.

“I can't manage, I can't manage this new system, I don't want to manage this new system” (P3).

Two Participants conveyed difficulties with processing the use of and information from new technology. Viewing information in this form appeared to cognitively overload or burden participants

“I'm not sort of into that sort of thing [emailing], I mean my grandson my daughter showed me how to do it but I can't concentrate that well to do it on the computer” (P5)

“It's two years since I've had a stroke but actually my computer skills have got worse during that time, I do look at texts and email...but because I find I very quickly get overload...I often don't read the text, I read the heading and make a, try and make a decision whether it could possibly be relevant to me” (P8)

Written information was also perceived by one participant to be unacceptable, as it was inaccessible, requiring additional support from others to read material.

“They can send you letters but, I can read 'em, but I can't always take 'em in, so I have to get me sister to come round” (P13).

An identified limitation of the phone was the urgency at which a person should answer it, for those that have mobility issues.

“And sometimes the phone is far away from you, by the time you get to the phone it stops” (P6).

6a.5 Overview and discussion of findings

Semi-structured interviews were carried out with 16 stroke survivors in order to ascertain a stroke survivor perspective of the acceptability of intervention components. The purpose of the interviews was to establish 1) which medications to target with intervention, 2) what BCTs were acceptable to be delivered (from the 11 identified and described in Chapter 5), 3) where the intervention should be delivered and 4) how the intervention should be delivered (encompassing who should deliver and through which modes of delivery).

Overall, participant understanding of their medications was found to vary. This aligned with discussions from PPI, reported in Chapter 5. Therefore, it seems most realistic to target all stroke medicines in this intervention.

The BCTs considered to be acceptable by the majority of participants included: 1) information about health consequences, 2) credible source, 3) self-monitoring behaviour, 4) biofeedback, 5) prompts and cues, 6) habit formation, and 7) social support (emotional).

Participants already employed strategies to self-mentor behaviour and had developed bespoke systems using prompts and cues to develop a habit. As such, these BCTs were strongly favoured and appeared acceptable. Although, there were instances where participants felt these BCTs would not have utility for those with low

mood and were unsure that any strategy would be effective for this sub-group of stroke survivors.

In interviews participants suggested that more information was needed, and provided clear examples of the sorts of information that would be preferred (including medication purpose and rationale, side effects and justification of why medications are or are not changed over periods of time). Participants indicated that this information should come from someone perceived to be credible (i.e. someone that knows more about the medicine than the participant). Some participants did also indicate that the timing of delivery of information may affect capacity to retain what was delivered.

Forms of biofeedback, most frequently referring to blood pressure monitoring, were seen to be acceptable to participants. Although participants often visited a GP to get this feedback, self-monitoring blood pressure at home was also acceptable, sometimes preferable. This was reflected in discussions regarding a need for convenience, and self-monitoring at home was felt to be more suitable than attending a GP appointment. Also, participants sometimes showed awareness of limited resources, and felt that self-monitoring at home enabled HCP time to be reallocated to those with more urgent need. These findings are consistent with a plethora of literature advocating self-monitoring at home (see Chapter 5). A notable caveat to this however, is that some participants expressed concern that constant monitoring could create anxiety and they spoke about their own experiences of this. Delivery of this BCT could also produce an unintended side effect, creating more work and strain on healthcare systems.

Social support (emotional) was discussed a lot during interviews. However, social support was not always considered as a means for emotional support, rather participants considered it useful for practical support. For participants that had support, this network was often accessed and used to help adherence and attendance of appointments. However, some participants interviewed were more isolated, but found other strategies that negated the need for social support to facilitate adherence (such as the use of Doseette boxes or bespoke prompt systems). Therefore, whilst social support was welcomed and valued by most participants, it did not appear to be a necessary component to self-reported good medication adherence. Moreover, there were instances where this support was unwelcome. In these instances, an intervention that involved social support may not be acceptable.

The Doseette box was, on the whole, viewed very favourably by interviewees, with many participants using one on a daily basis. Some participants were provided with a MCA weekly, or monthly, from the pharmacist, but some self-managed a Doseette box, filling it on a weekly or fortnightly basis. Although the box itself can act as a salient prompt if kept in a prominent place in the home, participants did consider MCAs to be a means of self-monitoring behaviour. These devices also provided reassurance as to whether doses had been taken or missed.

Literature has previously presented some limitations of MCAs, such as the Doseette box. In a report from the Royal Pharmaceutical Society (RPS) in 2013, it was summarised that there was insufficient evidence to support the use of MCAs for improving patient adherence (RPS, 2013). Other barriers to use of MCAs included:

insufficient evidence to confirm stability of medicines when stored in these boxes, practical storage problems such as exposure to moisture, complication of medication regimens if not all medicines can be stored in the MCA, limitations in the amount of information that can be provided with the boxes and a potential to de-skill a patient in terms of knowledge about medicines (RPS, 2013). However, it was clear from the interviews that MCAs were considered acceptable and extremely useful devices to support adherence. There is emerging support for the use of such MCAs in the literature, although it is sparse. For example, one systematic review of eight studies, attempted to identify intervention strategies that supported medication adherence in an elderly population on multiple medications (George, Elliott, & Stewart, 2008). One study included in this review (Lee, Grace, & Taylor, 2006) (a six month observational study that rolled into a six month randomised controlled trial (RCT)) supported the use of MCAs, along with regular follow up to improve adherence. Results reported a mean relative increase of adherence in the intervention group of 55.5%. However, the limited evidence and varying quality of study designs included in George et al's. (2008) review prevent firm conclusions being drawn. This difficulty to draw firm conclusion across reviews assessing medication adherence and interventions has been identified in other reviews (Peterson, Takiya, & Finley, 2003; Roter et al., 1998). More RCTs, assessing the effectiveness of strategies such as MCAs, need to be conducted, and potentially meta-analysed to enable stronger conclusions to base recommendations upon.

There was some uncertainty for participants in the interviews about the BCTs action planning and pros and cons. There were instances where participants found it hard to conceptualise how these BCTs would be delivered, and sometimes conceived

delivery to produce a different effect than intended (i.e. action planning would be more useful as a form of prompt as opposed to helping to formulate a routine). Moreover, the notion of listing the pros and cons of medicines seemed a redundant task to some participants, as the perceived necessity of the medicines was so great. Any limitations to taking medicines were felt to be irrelevant. Overall, most participants considered these BCTs as acceptable. Pros and cons was perceived to have utility in shaping understanding of medicines, especially as a means to gaining more information about side effects. Action planning was seen to be a mechanism for support of routine development, particularly initially when there may be more confusion about the medications. Self-monitoring outcomes of behaviour was a BCT that also received some uncertainty. In this instance, however, the uncertainty surrounded how this could be done and participants did not seem to employ, or have knowledge of, strategies that could be used to monitor the outcomes of behaviour. This is, in part, because a lot of the outcomes of medications prescribed for stroke produce a form of biofeedback (cholesterol checks, blood pressure monitoring, assessment of International Normalised Ratios (INRs)). Moreover, participants often expressed an implicit trust that the medicines must be working, without feeling a need to have strategies to check. As most participants were often given forms of biofeedback as well, either through self-monitoring or through GP monitoring, this may have enhanced the participants perceived need to not self-monitor the outcomes of the behaviour.

There was one BCT (information about antecedents) that was found to be unacceptable by most participants. Participants questioned whether people would have the motivation, or as one participant phrased it, the 'self-discipline', to carry out

this BCT. Perhaps understandable, as enacting this BCT would require the performance of an additional behaviour, as well as medication adherence. Moreover, some participants had concerns that this BCT could exclude certain groups of participants from intervention, as it would require some ability to write down or record antecedents. As limb weakness and mobility impairment can be a common consequence of stroke, again this could present a limitation in delivering this BCT.

When considering the setting for intervention, participant views were quite consistent. Often participants referred to places where support was already received, identifying the home or GP surgery as the most acceptable locations. The considerable barrier for most, when considering accessing other clinics at a hospital for example, was travel. Participants would often rely on others to support attendance to appointments, which reduced the times that participants could attend. Furthermore, parking and public transport could be difficult to negotiate. This indicated a clear consideration moving forward with intervention development, such that limited travel where possible will be required. It may not be feasible to solely deliver an intervention within a patient's home, as this would be more labour intensive for NHS staff. Nonetheless, there may be useful modes of delivery that allow staff and patients more flexibility. A further discussion of this takes place in Chapter 7, where a final intervention design is presented.

When considering how the participants wanted the intervention delivered, two key aspects were discussed: firstly, who should deliver the intervention and secondly how the intervention should be delivered. When discussing who would be acceptable, participants most frequently referred to the GP as the first choice.

Participants often expressed good relationships with the GP and trust. However, participants were able to perceive limitations to the GP delivering an intervention, suggesting that they are an overstretched resource with less time. Also, with newer GP surgery configurations, patients lose a continuity of care deemed to be important. Nurses were perceived to be suitable qualified and good sources of support by some participants, identifying an additional HCP discipline that could be accessed to facilitate intervention delivery.

Generally, participant accounts of how information and support should be delivered were consistent. Face-to-face delivery was perceived to be the most acceptable. This mode of delivery was considered to add credibility, as well as enhance reassurance and rapport. Delivery via a telephone call was considered, by most, to be acceptable, particularly as it could enhance more frequent and flexible contact between HCP and patient. Whilst there were instances where participants could see the utility of smartphone technology, overall any form of digital technology (e.g. via email and internet) was unacceptable. As most participants reported finding it difficult to access or an unwanted form of communication, it is an unacceptable mode of delivery to consider moving forward with the intervention design.

6a.5.1 Strengths and limitations

A strength of this study was the flexibility of procedure, such that participants could be interviewed over the phone or in their own home. This significantly enhanced the recruitment process, enabling participants to take part more easily if mobility was a concern. Additionally, for participants with a mild level of speech impairment, the

ability to talk face-to-face in a familiar environment allowed for more rapport between interviewer and participant, and better understanding of answers during interview.

In addition, the application of framework analysis supported a systematic and rigorous analysis of the data, improving the reliability, validity and generalisability of findings. As the author of this thesis also transcribed all interview recordings, familiarity with the data was high. This further supported generation of the thematic framework that underpinned the analysis.

Although the flexibility to conduct interviews over the phone was a strength to this research, it also presents a potential limitation. Firstly, it can be more difficult to build rapport when not conducting interviews face-to-face. There are certain subtleties to a person's body language that can help an interviewer to discern understanding, and identify points of fatigue in an interview. As an example, one participant expressed, prior to starting the interview, that they suffer from fatigue and they start to slow down when doing the same task over a period of time. Being able to conduct the interview face-to-face allowed the interviewer to better interpret points of fatigue and imitate breaks during interview. Additionally, later revisions of the topic guide included visual aids to demonstrate BCTs for those in face-to-face interviews. This could not be provided for those receiving telephone interviews and could have had an impact on understanding of the more abstract components to the interview schedule (namely visualising BCTs).

A further limitation of this research may be that participants were sampled from the SLSR. As participants within the register have already consented to be included in the register, and also consented to be contacted about future research studies, it is likely that many of the participants on the register are familiar with research to some extent. This may suggest that these participants are more motivated to take part in research, creating a bias in the sampling. Measures were taken to limit this bias, by ensuring that participants who had recently (in the last year) taken part in research were not contacted about the study. Group members from the PPI sessions are also on the SLSR. In order to ensure that participants of this group were not overburdened they were not approached about recruitment.

A further challenge arose with topic guide development. At times, it was difficult to articulate certain questions in an easy to understand language. For example, it was found to be difficult to derive a question that asked about the provision of social support targeting emotion. As such, the question was asked more broadly in terms of social support received by participants. This meant that more general discussions of unspecified or practical social support took place. However, this information was not without utility and can be incorporated into the next stage of intervention development. Moreover, accounts were given from participants spontaneously about how social support can be utilised to help those with low mood, creating a rich, unprompted source of data.

6a.5.2 Reflections

This section provides a reflexive account of the experiences of conducting the interviews with the patient sample.

One of the key difficulties in interviewing the participants was ensuring understanding of the questions. Some of the BCTs that were being explored for acceptability were not necessarily employed by all participants. As such, questioning about these could feel somewhat abstract in nature and I found myself struggling to describe them in a more tangible way to participants. As a means of addressing this, the topic guide was revised throughout the recruitment period, changing language based on language use of the participants. Also, examples of certain BCTs were developed (and again revised as needed) to try to augment understanding. This was a very interesting process and it strongly facilitated the interviews held. Participants were much more able to visualise BCTs when viewing these examples and it enriched the responses given to these questions.

A further challenge arose as quite a few of the participants thought I was based in the hospital branch of the stroke team, as opposed to the university branch where I reside. This may have affected the power-dynamic in interviews if participants felt that I had an agenda to check up on their medicine taking, when in fact I was just interested in their experiences. Moreover, at times I was presented with difficult medical questions to answer, with one particular instance where the participant asked me on several occasions (as the interview was conducted over two phone calls) about a new anticoagulation medicine that they had concerns about. I became

mindful that participants may be agreeing to interview, in part, to access additional information and resource. As such, I enlisted support from academic GP colleagues and identified appropriate channels of advice to signpost participants to.

Overall, the process of engaging and building rapport with participants from varying backgrounds (both ethnic and socioeconomic) and with varying levels of physical and cognitive ability, was an extremely rewarding one. The difficulties and barriers that participants referred to during interview solidified the necessity for intervention development and made me appreciate the importance of identifying acceptability and stakeholder buy-in at several stages during intervention development.

6a.6 Implications of the findings for this thesis

It is important to consider the implications these findings have on the intervention development for this thesis. There were a number of BCTs perceived to be acceptable by participants, but not all BCTs were conceptualised in the same way by all. For example, some participants view action planning as acceptable, but more useful as a means of prompting behaviour. Moving forward with intervention development, it will be important to consider points such as this to ensure that BCTs align with participant expectations, but also are clearly operationalised and explained to ensure that BCTs are targeting the underlying determinants as intended.

Participant accounts in this study occasionally contradicted the literature. For example, the literature suggests that deployment of MCAs does not have significant

effect on medication adherence and there are a number of barriers to successful use. However, nearly all participants viewed these devices favourably with the majority of the sample using them currently. The Dosette box was perceived to be the single best way to self-monitoring behaviour. When the intervention is taken forward to pilot testing, it may be beneficial to closely assess the differences between those that utilise the Dosette box and those that do not, comparing overall medication adherence against perceived acceptability of the devices. It could be that people view a Dosette box as acceptable and perceive it to facilitate adherence, when in fact this is not the case. In contrast, it may be that, in this cohort of stroke survivors, a MCA has more benefit than in other chronic conditions.

Finally, it is worth considering the strong view held by participants against digital technology as a mode of delivery. Nearly all participants felt that this was unacceptable. Participants reported not having access or not wanting to access emails and internet pages and also described how viewing information in this format can quickly overload or be burdensome. Initial stages of intervention development had conceived delivery to be more digital technology based, as it was thought that this would be more acceptable to HCPs and reduce the time and resource needed for delivery. Digital technology may also offer more flexibility for patients to be able to receive intervention in the home. Nevertheless, findings from this study have made it apparent that this is not an acceptable solution. It may be pertinent to develop an intervention, with a view that there will be gradual shifts in the mode of delivery towards digital technology, once generations more familiar with technology start to access this type of support.

6b Chapter 6b: Assessing the Acceptability of a Preliminary Intervention Design Targeting Medication Adherence in Stroke Survivors: Healthcare Professional Views

6b.1 Abstract

Purpose

The aim of this study was to establish how acceptable a medication adherence intervention was to healthcare professionals (HCPs) using qualitative interviews.

Design

This study used a qualitative study design, administering semi-structured interviews.

Methods

Semi-structured, one-to-one interviews were undertaken with 19 HCPs (including nurses, pharmacists, general practitioners (GPs) and a physiotherapist) recruited via academic networks. A convenience sampling strategy was employed. Interviews were recorded, transcribed and analysed using framework analysis.

Results

Exploration of intervention component acceptability revealed that HCPs perceived information about health consequences, credible source, action planning, prompts and cues, habit formation, self-monitoring of behaviour, and social support (emotional) as acceptable behaviour change techniques (BCTs) to include in the intervention. Particularly, BCTs such as prompts and cues and habit formation were perceived to be acceptable as these were strategies patients often described using

to HCPs. Pros and cons received mixed views from HCPs. Whilst most HCPs could understand the utility of engaging in a reflective activity like this, most felt that facilitation would be too onerous for HCPs. Information about antecedents, self-monitoring of outcomes of behaviour and biofeedback were perceived to be unacceptable by most HCPs. Most notably, HCPs spoke about increased levels of patient anxiety and obsessive behaviours when engaging in biofeedback. HCPs all expressed a need for the intervention to be delivered within the National Health Service (NHS), with less clarity of which setting and which HCP should deliver the intervention. Verbal and written modes of delivery were perceived to be most facilitative to patients and most acceptable, with HCPs expressing concerns about use of digital technology in a cohort of stroke survivors.

Conclusions

This study investigated HCPs perceived acceptability of intervention components for an intervention. Exploration of this acceptability has supported refinement of the intervention design. However, the feasibility of the refined intervention design will need to be tested.

6b.2 Introduction

As discussed in Chapter 6a, recommendations from Medical Research Council (MRC) intervention development guidance (Craig et al., 2008) and NHS England (Strategy Unit - NHS England, 2013), advocate establishing the acceptability of an intervention design, not only with those receiving intervention but also with those delivering the intervention. As such, Chapter 6a and this chapter (6b) report on a study that explored the acceptability of the intimal intervention design (Chapter 5)

with patients (reported in chapter 6a) and healthcare professionals (HCPs; reported here).

6b.2.1 Aims of this study

To establish how acceptable a medication adherence intervention is to key stakeholders (HCPs), using qualitative interviews. Specifically, four research questions were explored:

1. Which medications should be targeted in the intervention?
2. Which BCTs are or are not acceptable and why?
3. Where is it acceptable for the intervention to be delivered?
4. How should intervention components be delivered and by whom?

6b.3 Methods

6b.3.1 Design

A qualitative study design was employed, with justification reported in Chapter 6a, Section 6a.3.1.

6b.3.2 Participants and setting

HCPs were recruited via academic networks at King's College London, employing a convenience sampling strategy.

6b.3.2.1 Participant inclusion criteria

All participants were included if they were:

- Adults aged 18 or over
- HCPs who work within a clinical or healthcare role and have had contact/worked with stroke patients
- Adults who have the capacity/capability of providing fully informed consent for the study, and are able to speak and understand English

6b.3.2.2 Participant exclusion criteria

All participants were excluded from the study if they were:

- Under the age of 18
- Deemed to have an inability to provide informed consent

6b.3.3 Topic guide development

A detailed overview of topic guide development can be found in Chapter 6a, Section 6a.3.3.

Although HCPs are likely to be more familiar with some of the ‘jargon’ terms of intervention development than stroke survivors may be, the topic guide language was still carefully considered in order to enhance clarity of questioning. For example, when asking about the BCT habit formation, the question was phrased as: “For this intervention we were thinking that the use of a systematic routine might help the patient with adherence - what are your thoughts on this?” and a question asking

about the BCT information about antecedents was phrased as: [previous question asked about self-monitoring of behaviour] “We could extend this further by asking patients to record what happened leading up to when they took or missed a dose of their medication as this could help to identify patterns in their behaviour. What are your thoughts on this?”.

The topic guide went through several revisions during the recruitment period, changing the order of the schedule or re-phrasing and replacing questions that were not easily understood by interviewees. The topic guide was designed with the intention that interviews would last approximately 45-60 minutes. During the recruitment process, a briefer 30 minute version of the interview schedule was designed to facilitate recruitment of nurses, as this was a more difficult to access group of HCPs. It was thought that a guaranteed brief interview would encourage participation. The HCP topic guide can be found in Appendix 10. Questions highlighted in yellow indicate the questions asked for the brief 30 minute interview schedule. Questions that corresponded to the 11 BCTs explored for acceptability in the interviews are presented in Table 18.

Table 18. Displaying the 11 BCTs explored in interview with corresponding topic guide questions.

BCT	Topic Guide Question(s) for HCPs
Pros and cons (9.2)	<i>The intervention could ask patients to make a list of pros and cons to taking their medicines to see if they could find more reasons to take the medicine than not. What do you think about this?</i>
Action planning (1:4) ¹	<i>The intervention could support the development of this routine by <u>asking patients to make specific plans identifying useful prompts in their home or activities in their daily routine that they link with taking their medicines.</u> Could this be helpful?</i>
Self-monitoring of behaviour (2.3)	<i>Some people also told us that it can be hard to remember if they had taken their medicines on a specific day. What are your thoughts on patients making a note of when they take a medicine (for example marking off on a calendar)? Could this be helpful?</i>
Information about health consequences (5.1)	<i>One thing other people said was that they wanted more information about their medicines. What do you think about this?</i>
	<i>What sorts of information do you think would be useful?</i>
Biofeedback (2.6)	<i>Conditions like hypertension are asymptomatic so patients have nothing tangible to tell them whether they have high blood pressure or not. If patients were given a blood pressure monitor and asked to check their blood pressure periodically, this could give them evidence that the medicines are working. What are your thoughts on this?</i>
Information about antecedents (4.3)	<i>[question follows on from self-monitoring of behaviour question] We could extend this further by asking patients to record what happened leading up to when they took or missed a dose of their medication as this could help to identify patterns in their behaviour. What are your thoughts on this?</i>

BCT	Topic Guide Question(s) for HCPs
Credible source (9:1)	<i>Where or who do you think the information should come from?</i>
Self-monitoring of outcome(s) of behaviour (2.4)	<i>What other ways could we show patients how their medicines are working, even if the underlying risk factor or condition is asymptomatic?</i>
Prompts/cues (7:1) ¹	<i>The intervention could support the development of this routine by asking patients to make specific <u>plans identifying useful prompts in their home or activities in their daily routine</u> that they link with taking their medicines. Could this be helpful?</i>
Habit formation (8:3)	<i>For this intervention we were thinking that the use of a systematic routine might help the patient with adherence- what are your thoughts on this?</i>
Social support (emotional) (3.3)	<i>Do you find that family members get involved with a patient's medicine taking? -Are they helpful? Why/why not?</i>

¹ These two BCTs were considered to quite significantly overlap in this context and so the question was amalgamated into one succinct question. This also facilitated a briefer interview schedule for the HCPs who were more difficult to recruit due to time constraints.

6b.3.4 Procedure

6b.3.4.1 Ethical considerations

All information on ethical considerations is reported in detail in Chapter 6a, Section 6a.3.4.1.

6b.3.4.2 Recruitment and consent

HCPs were initially contacted via letter/email (a copy of the invitation letter can be found in Appendix 11) inviting them to take part in the study and providing them with an information sheet (see Appendix 11) detailing all relevant study information. One week later, unless otherwise notified, the HCPs were contacted by phone or email to see if they had any questions and to ascertain if they were interested in taking part in the study.

Participants were offered to have the interview over the phone, at their place of work or where the research team for this thesis were based. If the interview was conducted over the phone, participants were asked to email a consent statement prior to interview: "I have read and understood the information sheet about the study 'A new medication adherence intervention for stroke survivors-What do you think?' and agree and am happy to participate". This indicated fully informed consent to take part. If interviews were conducted face-to-face, fully informed written consent was obtained (see Appendix 12 for a copy of the consent form).

6b.3.4.3 The interview

The same procedure was followed for interview with HCPs as with the patient sample. Please refer to Section 6a.4.4.3 in Chapter 6a for all interview procedures followed. For this study, data saturation (as defined in Chapter 6a, section 6a.4.4.3) was reached after 19 HCPs were recruited.

6b.3.5 Data analysis

Data analysis processes were the same for both stroke survivors (reported in Chapter 6a) and HCPs (reported here). The outline of data analysis can be found in Chapter 6a section 6a.3.5.

6b.4 Results

6b.4.1 Participants

A total of 19 HCPs consented to and participated in the semi-structured interview. The 19 participants consisted of nurses, general practitioners (GPs), pharmacists and a physiotherapist. The physiotherapist was recruited as they were based in a secondary care stroke team and able to prescribe medications to treat spasticity, and as such often discussed a broader range of stroke medications with patients. The HCPs came from a range of care pathways across primary, secondary and community care. No participants withdrew from the study. A breakdown of the disciplines each HCP represented is presented in Table 19 below.

Table 19. Table presenting the discipline HCPs were recruited from.

HCP Role	N (%)	Care Pathway		
		P	S	C
GP	5 (26)	✓		
Pharmacist	6 (32)			
Anticoagulation clinic	2 (11)		✓	
Stroke wards/stroke team	3 (16)		✓	
Community	1 (5)			✓
Nurse	7 (37)			
Practice	2 (11)	✓		
District	1 (5)			✓
Stroke Specialist	4 (21)		✓	
Physiotherapist	1 (5)		✓	

P-Primary care; S-Secondary care; C-Community care; GP-General Practitioner

As evident from Table 19, a range of HCPs involved in stroke patient management across care pathways were interviewed. An inclusive approach was taken during recruitment to ensure that any HCP who considered that they had a role in stroke patient medicine taking was recruited. Community pharmacists proved to be a challenging group to access and as such only one was interviewed for this research. Only one physiotherapist was interviewed also, as the skill to administer and prescribe Botox for spasticity is not widespread across physiotherapists, and no other physiotherapists approached during recruitment identified as contributing to stroke patient medicine taking. Nurses initially proved to be a difficult group to access and recruit, but following several attempts to recruit through academic networks, indicating that nurses were underrepresented in the sample at the time, many came forward with interest to take part and ensure that nurses' views were

represented. It was apparent that medication adherence was a particularly strong focus for this team.

To provide some context of where HCPs worked, some of the GPs and practice nurses recruited came from what would be considered a large GP surgery, employing two healthcare assistants, two practice nurses and ten doctors (some part time), with no onsite pharmacist. Other GPs interviewed did have a practice pharmacist. In terms of secondary care, nurses and pharmacist came from busy London hospitals, where on any given shift the ward team would consist of approximately four doctors (one consultant and registrar and two junior doctors), 13 nurses (one in charge, six qualified nurses and six nursing assistants), four to five physiotherapists, four occupational therapists and two speech and language therapists.

6b.4.2 Findings from framework analysis

Factors unique, or that contrast across different HCP professions, will be indicated throughout the analysis. Participants are referred to by their profession and study number.

6b.4.2.1 Which medications should be targeted in the intervention?

As with the stroke survivor interviews, it was important to first consider which medicines to target with the intervention, to establish HCPs perceptions on this aspect of intervention design.

Firstly, HCPs perceptions of patients understanding of medications were established. If understanding was perceived to be generally poor, it could be likely that patients would be unable to pick out that medication and it could prove difficult to monitor adherence accurately.

Generally, HCPs felt that patients' knowledge varied in understanding of medications. Some patients were considered to have very good knowledge and others felt to have very limited understanding.

“I find a lot of patients, you'll come and chat to them and they won't even have a clue, they just, you know, take the tablets as they're told by their doctors. Whereas, others are really engaged and they know about, you know, what their drugs they're on why they're on them and side effects and so on”

(HCP 12, Pharmacist)

Some HCPs referred to the demographics of patients and how, depending on the area the practice was based, variation of knowledge could be a direct result of language difficulties and health literacy.

“I think it's very variable, I work in a practice in a deprived multi-ethnic area. A lot of patients that I look after, English isn't their first language and I really always say that health literacy is a function of your overall literacy. So a lot of my patients I look after maybe don't really write in their own language let alone understanding, so for them the concept of illness and medications can be quite different” (HCP 6, GP)

When HCPs were asked, which medicines should be targeted with intervention, most felt that all stroke medicines should be targeted. Some of the HCPs spoke about the need to weight importance of each medication equally, and how focusing on just one could imply that one medication is more important than others for secondary prevention of stroke.

“Ideally you would target all of them because obviously they are all as important as each other” (HCP 1, GP).

“If you focus on one then they might only kind of be thinking, oh I only need to take this one you know, still kind of forget about the rest if you only focus on one tablet. I think it’s may be better to focus on all of them ‘cause they’re all kind of equally as important” (HCP 10, Nurse)

Pharmacists also felt that the number of medications a patient was on could affect the ease of only targeting one medication. One pharmacist discussed experiences of working with stroke survivors, referring to how patients described medicines.

“It would be difficult to single just one out especially if they were on quite a few” (HCP 3, Pharmacist).

“The AF population was very much that they didn’t see the anticoagulation as a special medicine, they very much saw it as part of all the other cardiac stroke medicines that they take”

(HCP 2, Pharmacist)

However, there were some HCPs who had reservations about targeting all medications, mainly on practical grounds of delivering the intervention and barriers to monitoring adherence.

“An intervention to target a whole group of medicines would be more difficult and more lengthy to do than if you were targeting a single medication”

(HCP 13, Pharmacist).

This was further expressed by a GP who suggested the medication perceived to be most important to target with intervention.

“I think it probably would be easier to target one medicine...blood pressure...I think that resonates more with patients I think statins cholesterol it there's too much ambiguity I think... blood pressure is the one that should be focused on”

(HCP 4, GP)

6b.4.2.2 Which behaviour change techniques were or were not acceptable and why?

The following section presents each BCT in turn, describing the perceived acceptability with reasons why.

Pros and cons

Generally, across HCP disciplines, there was consensus that this BCT could be acceptable. For example, one nurse felt that this BCT could provide an opportunity for a more patient centered approach.

“I think that’s a really good idea...because it personalises it”

(HCP 18, Nurse).

HCPs described how an exercise like this could provide patients with a more natural opportunity to discuss concerns, as patients may not always be routinely asked about this.

“That would be really interesting actually for them to write down, because I suppose we never really think to ask that and that’s more important than anything really, what they perceive to be benefits”

(HCP 1, GP)

“I think it’s definitely a good idea to have a reflective exercise like that because maybe patients haven’t actually been asked to or had the opportunity to reflect on why...they’re taking these medicines and why they don’t want to take their medicines” (HCP 13, Pharmacist)

In addition, the pros and cons list was perceived to provide patients with a better ability to make a decision about taking the medications.

“[The patient] may come to the conclusion that actually they don’t like the pros and the cons are too much...they’re more empowered to make a decision”

(HCP 19, GP).

An unexpected theme that arose from the interviews related to how certain BCTs could additionally provide benefit to HCPs, not just patients. This was not broadly

discussed across all interviews, but a pharmacist suggested that the pros and cons list could be utilised as a tool to imitate and guide the discussion about medication risk and benefits.

“It’s a good way of starting a discussion...and then you can use that as a focal point for your discussions” (HCP 2, Pharmacist).

A nurse also described how this discussion could provide feedback to the HCP about how to improve future practice.

“I think that would be important because if you feedback that to healthcare professional...then maybe there might something in our practice I mean there’s definitely something in our practice that we can do better: (HCP 16, Nurse)

Conversely, not all HCPs felt that pros and cons would be an acceptable BCT to deliver. It was raised that the pros and cons may not offer opportunity for personalisation of care (contradicting other HCP views) and that relationships with the facilitator of this BCT could impact utility.

“I just don’t know how much information you’d get out of that. I think you might get a few, sort of, interesting comments but I think the vast majority of them will have the same pros and cons” (HCP 3, Pharmacist)

“I can tell you now, unless you’ve got a good rapport and relationship with the people they won’t be honest they won’t tell you the real reason”

(HCP 5, Pharmacist)

One GP expressed uncertainty towards this BCT. Whilst, in principle, this BCT may have benefit to patients, the time constraints within healthcare would limit the ability to facilitate this.

“Letting patients come to their own conclusions about their medications. I guess that’s more supportive mechanism of doing it. I guess the tricky thing with it is it takes time” (HCP 19, GP)

Information about Health consequences

Overall, this BCT was perceived to be acceptable, with HCPs in general agreement that patients are likely not given enough information and do need to be provided with information about health consequences. There was consistency from all HCPs across disciplines about what information was perceived to be important to provide. HCPs considered that it was important to discuss the rationale behind prescribing and the purpose of the treatment, as well as explaining the benefits and risks of the medication.

“They do need to know what they’re taking and why they’re taking and what are the side effects and what do they do if they miss a dose, because all of that will help them self-manage” (HCP 16, Nurse)

“Basically, why they’re taking it, what the tablet does, any side effects to be aware of...and what to do if they do have any side effects”

(HCP 18, Nurse)

“You want to discuss. Yeah. what the aim of the medication is and what the benefits are and what are the risks if you don’t take it or the side effects of that as well” (HCP 9, Physiotherapist)

One GP went further to suggest that patients could benefit from being empowered to better understand their condition and how to monitor the risk factors of stroke.

“I wonder if the other stuff to do with monitoring of the medications is also really important for patients to understand. So again, its empowering them to know when they have to have a blood test for a particular medication when it will be due for a review and perhaps why reviews important” (HCP 19, GP)

This was important to present in the findings, as information about how to monitor outcomes of a behaviour is not the same as providing information about health consequences (i.e. positive and negative consequences to performing the behaviour). This highlighted the need to carefully operationalise and design information provision, if chosen to be included in the final intervention design. It will be important to enhance treatment fidelity by ensuring that those delivering the BCTs fully understand what each BCT is targeting and aims to do.

Some of the pharmacists gave more in depth accounts of what information on side effects was perceived to be important to convey.

“[I] Would probably maybe say a few side effects possibly but...if it’s a certain drug that has, you know, serious potential, you know, life threatening side effects, I’ll tell them about those that we need to monitor” (HCP 3, Pharmacist)

“I’d tell them obviously, what it’s for, how to take it and some of the common side effects, not all side effects, just if they are going to experience any common side effects and then usually...we give them a leaflet with our number on, so if they have got any other...questions they can always call us and discuss it with us” (HCP 11, Pharmacist)

On the whole, HCPs appeared to find it acceptable and appropriate to provide information on health consequences. This was mostly focused on the consequences of taking the medicines (i.e. the risk of side effects) but HCPs also gave accounts about wanting to convey the benefits of taking medication.

At times HCPs gave accounts of wanting to reinforce messages about the severity of stroke and why patients need to take their medicines.

“A clear description of...what the stroke was but also the consequences of stroke” (HCP 8, GP).

“This is what stroke could do to you, it, and put in a wheel[chair]. It’s bad to scare people but say what a stroke is, stroke will basically stop you functioning” (HCP 5, Pharmacist).

When discussions about information provision were taking place, HCPs offered insight into perceived limitations in current information provision. HCPs from all disciplines, typically felt that patients were not provided with enough information about the medications, or the information was not provided in the right manner.

“We haven’t quite got the information either at the right level or at the right time”
(HCP 17, Nurse)

The patient information leaflets (provided in the boxes of medication) were not seen favourably by one nurse.

“I know a lot of patients read the information leaflet...they kind of get freaked out sometimes when they read about potential side effects” (HCP 10, Nurse).

Pharmacists also described difficulties of providing information about medications on stroke wards in secondary care.

“I think the issue with information about medicines is it’s, I think it should be our responsibility as a pharmacist...but obviously in the ward environment...whoever’s managing the stroke ward is covering another ward as well. So, it’s hard to find the time to sit down and counsel patients properly”
(HCP 12, Pharmacist)

“But I feel sometimes we don’t necessarily do the best job of trying to provide that information throughout the admission... when you overload people with too much information at once you can’t retain all of that information that’s been given to you” (HCP 13, Pharmacist)

Credible source

On the whole HCPs suggested that information should come from perceived credible sources. The consistent theme was that it should come from someone who knows about and understands stroke medicines.

“Someone that knows what they are talking about and they can engage in that conversation and be very clear what are the benefits, what are the risks...whoever delivers it knows what’s going on with the patient and they’re able to identify the patients that need the support”

(HCP 2, Pharmacist)

“I think it can come from anyone really, I think if the patients feel that you’re confident in what you’re saying and what you’re teaching them”

(HCP 11, Pharmacist)

In some interviews, discussions of this concept were broadened further, suggesting that patient’s experiences could be very valid sources of information.

“Using like patient examples, so often if another patient says to another patient I found this medication useful I found this medication a problem, it’s just another way of getting the patient to hear the message as opposed to a healthcare to professional telling us”

(HCP 9, Physiotherapists)

Charities were also seen to be a credible source of information.

"Obviously charities are fantastic as well and the support groups that you get as well" (HCP 10, Nurse)

However, there were instances where HCPs showed concern when information was delivered by someone other than a HCP.

"I would say it needs to come from a healthcare professional...only because medico-legal aspects...yes anyone can give that information but you need to be sure that the information you're giving is correct" (HCP 4, GP)

Some HCPs also felt that sufficient training was important when providing information to patients about their stroke medicines.

"If patients go to like a charity, whether they've got healthcare trained professionals that would be able to answer those more clinical kind of questions...who's the right person to provide information and whether those people are trained enough to be able to give that information"

(HCP 13, Pharmacist)

Self-monitoring behaviour

There were no instances where a HCP explicitly stated that self-monitoring of behaviour was an unacceptable BCT. It was quite common across many of the HCPs discussions to refer to patient's own strategies of self-monitoring.

"Would be really beneficial because, yeah, the thoughts that people might not take them through fear that they've already taken them and I think people are probably more likely to not take them if they can't remember" (HCP 15, Nurse)

Often, HCPs would describe the perceived utility of a Dosette box when speaking about self-monitoring of behaviour. The Dosette box was seen as one of the most useful and acceptable tools to support self-monitoring of adherence.

“Then they know they’ve taken it and I get more and more patients onto them now, just particularly the elderly ones. Just for safety really, so that they don’t have that awful panic and think oh I don’t know if I’ve taken it or not that seems to be the best” (HCP 14, Nurse)

“Yes, some sort of a chart which they tick off...next to the medication, I not everyone who's had a stroke will want to use a Dosette box, but I think they're excellent” (HCP 8, GP)

There was also a perception by one GP that if patients needed to self-monitor adherence due to difficulties in re-emerging, then multi-compartment compliance aids (MCAs) such as a Dosette should be imitated anyway.

“I find that most, all the patients do that anyway, they sort of make a little list thing up...and they know when they’ve taken their medication, but I think if it’s coming to that point then they need a Dosette box, if you’re not remembering or if you’re not sure then you need a Dosette box really” (HCP 4, GP)

When HCPs were asked about what potential enablers to patient adherence were perceived to be, spontaneous accounts were given about MCAs that would assist in self-monitoring behaviour, such as the Dosette box. Particularly, the Dosette box was viewed as useful if patients had memory impairment.

“When patients are maybe going on lots of medications or they’ve got memory problems...I do really like to put patients on Dosette box, I’ve got a low threshold for doing that” (HCP 6, GP)

A pharmacist from an anticoagulation clinic and a community pharmacist also felt that the Dosette had benefits for patients self-monitoring adherence.

“Like a Dosette, but they lead it, they don’t get the community pharmacist to do it...so they pop them out themselves...they’re in control of it...just makes it easier for them to deal with it and help them to remember if they’ve taken it or not” (HCP 2, Pharmacist)

“The Dosette box is the best way to help someone because they can just look at their pack...and they’ve got memory problems that’s a really good tool too, so they can look inside it and they can say, oh I’ve had my morning dose I don’t need it anymore” (HCP 5, Pharmacist)

On the whole, self-monitoring of behaviour was felt to be acceptable by HCPs. However, there were instances where certain methods of self-monitoring were considered unacceptable. Some HCPs perceived that methods such as marking doses taken on a calendar could be too onerous for patients, adding an additional behaviour to carry out in addition to adhering to medications.

“They have to walk over to the calendar to do it and...if someone interrupts them then they you know, it something, it needs to be something easy to do” (HCP 2, Pharmacist).

There were no instances where HCPs felt it would be inappropriate or unacceptable for patients to self-monitor their behaviour. There was a general consensus amongst HCPs that it can be difficult for patients to remember when doses are taken. Though, there were contradictions from some HCPs, regarding perceptions of how best to self-monitor. Across most HCPs, self-monitoring through the use of a Doseette box was seen to be most favourable, as indicated in the quotes above. However, there were instances, particularly from pharmacists based in secondary care, where methods such as the Doseette box, were not seen to be an ideal approach to self-monitoring adherence.

“I mean it might help them remember if they take it and so on but you know, they kind of lose their familiarity of, you know, which medicines they’re on and why they’re taking it” (HCP 12, Pharmacist)

“Only certain tablets can go into a Doseette box and then you’ve got that confusion between, you might have some in the Doseette box and some that are not in the Doseette box” (HCP 13, Pharmacist)

A GP and nurse also described limitations to the Doseette box. These HCPs expressed concern about identification of individual medications from the Doseette and also questioned the assumption that using the box will automatically facilitate adherence.

“If they are trying to work out which one is giving them a side effect and you ask them to stop it and they’ve no idea which one” (HCP 1, GP).

“It doesn’t automatically mean you’re going to be compliant and you could still take too many. So, people with cognitive problems, it’s not actually always the thing that’s going to be best” (HCP 17, Nurse)

Self-monitoring outcomes of behaviour

For most outcomes of adherence to medications for stroke risk factor control, the BCT of biofeedback is more appropriate. However, there were instances where HCPs discussed providing evidence of outcomes of adherence more generally. It was felt that this feedback may not be as useful for the patient as it is for the GP.

“I almost feel like maybe we like chasing numbers because we are scientists and we like seeing trends but patients don’t have that view of it” (HCP 1, GP).

A more pertinent difficulty would be that a lot of the monitoring will not be purely carried out by the patient and thus not fulfilling the criteria for self-monitoring.

Biofeedback

There were instances where HCPs could see the utility of biofeedback as this could potentially demonstrate to the patient that the medications were working.

“So that’s kind of evidence that you can give to them you know. Your cholesterol was such and such and we started the medication and now it’s you know that, or hopefully its gone down and you can sort of show them that evidence” (HCP 10, Nurse)

Some discussions were positive about biofeedback, where HCPs could see the utility of monitoring blood pressure, for example. HCPs perceived that biofeedback could be empowering for the patient and provide good evidence of medication efficacy.

“You get like real time you know, a patient will get feedback around well for example, if they didn’t take their medication and the blood pressures higher then that’s kind of data that will help them” (HCP 6, GP).

“Taking control of their care...would definitely improve their adherence so yeah, so monitoring blood pressure I think would help and it would get patients a bit more excited about their own health as well”

(HCP 3, Pharmacist)

“For that group of patients whose blood pressure is dangerously high and they have no idea about it, I think to get that kind of feedback can’t be a negative thing and so I think it would just have to, there would be have to be some education” (HCP 15, Nurse)

Despite some appeal to this BCT expressed by some HCPs, there were many more accounts of limitations for both clinician and patient. Biofeedback was considered by some HCPs to create fixation over the readings or results.

“No not someone who’s had a stroke, no no no no no because then you’re just, then you’re making them a sick person because you’re putting this obsession on a on a number” (HCP 4, GP).

Others echoed this view.

“I’ve known some patients when they’ve got those machines at home, I’ve got patients that get a bit obsessed and sometimes they’re measuring their blood pressure like five times a day” (HCP 10, Nurse)

One pharmacist also showed concern that patients may use the feedback to independently alter the dosing of medications, assuming that high blood pressure reading could require higher doses of medications.

“I’d be concerned some patients would go the other way and sort of too intense with their blood, blood pressure target and maybe start to panic if it’s too high and, you know, might do silly things like double a dose of their antihypertensive without consulting anyone” (HCP 12, Pharmacist)

Action planning

A lot of the HCPs indicated strong perceptions of the benefit of action planning to support patient adherence. There were instances where the HCPs drew on previous experiences within practice to justify the perceived acceptability. HCPs also perceived this as a form of record keeping that could be useful for patient and clinician, in order to allow better monitoring of the suitability of the plan for the patient.

“We often set diaries or plans for patients, particularly patients that are likely to forget what they need to do...at the right time. So, I think that sounds like a good idea” (HCP 9, Physiotherapist)

“I think that will probably be a good idea, because I always, I know for me when I write things down it tends to stay in my mind a bit better...but then you’ve also got it on file to say, if you go back to follow them up, how are you getting on with that routine, is that routine working for you, if it’s not how can we change it to help you with to help you better remember your medicines”

(HCP 11, Pharmacist)

“I think that’s basically what we currently try and aim to do in general practice. I mean for me, I know that that’s exactly what I do, 'cause I’ll be like so look what’s your usual day, right so could you before you get up or walk to the newsagent to buy a newspaper, could you remember to always take the medication then that slots into that bit of your routine” (HCP 19, GP)

In contrast, there were occasional accounts reporting uncertainty about action planning. Particularly, these concerns focused on the practicalities of performing this task.

“It would just be how we do that with people who’ve got difficulty writing, reading”

(HCP 17, Nurse)

Prompts and cues

Once again, this BCT was generally viewed favourably across HCP disciplines.

There were no explicit views from HCPs that prompts and cues would be unacceptable.

“Even if it’s just having a post it note by the light switch you know, by your door or whatever just to remind you of things so yeah, no I think that’s a really good idea” (HCP 18, Nurse).

“If you say to them, well when you get up and brush your teeth if you put your tablets in your tooth paste cupboard or something, when you get up to brush your teeth you’ll then see your tablets and remember”

(HCP 11, Pharmacist)

“Sounds like a good idea, I think that would be a reasonable intervention to make, is, are there things that. They can link to their home environment to help support them with that defiantly”

(HCP 13, Pharmacist)

When HCPs were asked if they knew of, or were told about, anything that would enable patient adherence, a few HCPs discussed patients employing prompts or cues at home. Pharmacists were particularly familiar with patient accounts of using prompts or cues to aid adherence.

“I mean people have said you know, that they, it’s when a certain programme comes on in the morning they remember to take their medicines”

(HCP 3, Pharmacist)

“Some people, they lay their medicines out in a certain way when they’re at home so they know if it’s in that pile they take it in the morning, if it’s in that pile then they take it in the evening” (HCP 12, Pharmacist)

Habit formation

Once again, habit formation was another BCT positively perceived by HCPs from all disciplines. HCPs considered this to be a frequent strategy employed by patients who are perceived to adhere successfully.

“I mean patients, the ones that seem to be managing well, they have good habits and I think it’s just about developing yeah developing that habit and then just continuing really” (HCP 2, Pharmacist)

“For all patients on any chronic diseases with regular medications, that would be helpful” (HCP 8, GP)

“I think getting it as part of, that’s why I think like blister packs work quite nicely in terms of its, if it’s part of their routine and they don’t really have to think about it too much” (HCP 15, Nurse)

For this intervention development, the use of habit formation was conceptualised to support better adherence in times when a person is experiencing negative emotions. Although, on the whole, this BCT was felt to be acceptable and appropriate by HCPs, there was some ambivalence from one GP about habit formation’s utility for those experiencing low mood.

“I would say sort of a depressive episode, most people feel unable to concentrate, they feel everything’s on top of them. They don’t feel able to order their lives, so it may be of less help, it may be of more help I suppose, but it may be difficult for them to adhere to any routine in those sort of circumstance”
(HCP 8, GP)

Information about antecedents

This BCT received mixed responses during interview. This BCT had been conceptualised as asking patients to record what happened leading up to when they took or missed a dose, and this information would identify patterns that enhanced or reduced adherence. Some HCPs felt that this could be beneficial and acceptable.

“[It] Could potentially be useful, I mean they like diaries and things are useful around sort of pattern recognition” (HCP 6, GP).

“That sounds a good idea, yeah definitely, I mean you could see oh and also what their habits are throughout the day” (HCP 14, Nurse)

Some HCPs spoke about the perceived benefits this BCT could have for clinicians, not just for enhancing patient medication adherence.

“If you do get, patients actually do record that, then you might be able to see some sort of pattern and help” (HCP 10, Nurse)

“That would be a very, it would be a very interesting thing to test”
(HCP 8, GP)

Nonetheless, this BCT was not perceived favourably by most HCPs, with concerns that it would require patients to carry out a further behaviour to support adherence, something unlikely to be successful. In particular, GPs portrayed hesitancy about the utility of this BCT. The transient nature of people's daily routines might make the task of recording antecedents redundant.

"I don't think necessarily events that made them forget them would be that useful, as they'll change each time...and they'd always have to do those events anyway" (HCP 1, GP).

"I think it is acceptable, but if they didn't remember to take the tablet would they remember what happened just before" (HCP 4, GP).

Two of the other GPs interviewed also expressed concern that this would be a burdensome task for patients and that accuracy of recording information may be low.

"You don't want to make it too onerous that's the thing" (HCP 6, GP)

"People may sort of under underestimate how often they miss medication"
(HCP 8, GP).

"I personally don't think patients would be inclined necessarily to tell you the real reason why they've missed it" (HCP 3, Pharmacist)

Furthermore, the physiotherapist drew on previous experience of asking patients to record and self-monitor. They felt that the way this BCT should be operationalised and delivered would need to be altered. The physiotherapist suggested that patients would require more structure with completing this type of task. providing examples of answers to patients.

“Free text, we’ve found that they just don’t, they don’t respond to”

(HCP 9. Physiotherapist)

Social support (emotional)

Social support was an emergent dialogue across all HCPs interviewed. There were accounts of the perceived varying involvement of friends and families in patients’ medication taking.

“Some patients’ families do [get involved], some patients families don’t and that that can be for many reasons” (HCP 3, Pharmacist).

“They don’t get involved as much as they should” (HCP 16, Nurse).

HCPs were asked about how they would support patients experiencing low mood to be more adherent. HCPs discussed provision of emotional support and acknowledgement of patient feelings as strategies of support.

“I’d almost have to say like maybe thinking long term, that they had some form of counselling or support group...in the long term, so that they wouldn’t feel as stressed about their condition or that they felt a bit more supported and empowered to take their medication” (HCP 1, GP)

“I mean then you’re thinking about, again, a clinical nurse specialists or the lay support groups, expert patient groups who they can sort of, someone to sort of sympathies with them and people who may have been through the same condition” (HCP 8, GP)

“I think it’s being able to recognise that they are feeling that way...initially and trying, help get them into a support group” (HCP 11, Pharmacist)

“I mean I don’t know if them, recognising how they’re feeling and perhaps making sure they have someone to talk to at that time” (HCP 19, GP)

Social support was discussed and recognised to help patients in other ways beyond emotional support during times of low mood. Patients’ social networks were seen to be potential advocates, a means of reminding the patient and also as an ally when attending clinical appointments. HCPs were aware of this critical role, referring to inclusion of family members and carers in clinical processes.

“I do often involve the carers or the partners, so when whoever comes in with them...because they’re often primary caregivers for the individuals, particularly if there is an element of disability. So I think they’re often quite an important individual in the person’s sort of medication taking behaviour, at that moment in time” (HCP 2, Pharmacist)

“Who’s looking after them, because you really have to involve, if someone’s had a bad stroke and they’re requiring care/ So they’ve got functional deficit, disability, you really need to engage with their kind of social the social support network, social support network” (HCP 6, GP)

“We often will, you know, will come up with a customised regimen for patients with their medicines and discuss that with the family, linking that in with the kind of information that’s given on discharge and sometimes in those scenarios we give more information to the carers or family that are looking after the patients, as opposed to the patient” (HCP 13, Pharmacist)

“So, trying to get other family members or carers involved, so then they’re more engaged with the whole medication process and understand the importance of why they need to” (HCP 14, Nurse)

Conversely, there were some discussions from the HCPs of perceived limitations to the patients’ social network, considered to be disruptive to successful medication adherence.

“In instances where the patient...is completely fine, able to make their own decisions and that type of thing, maybe a family member might not be as beneficial as you would want...you know as they might have their own agenda” (HCP 3, Pharmacist)

“It’s actually their relatives that would question the [benefit of the medicines].
I’m looking, my mum doesn’t need that, there’s nothing wrong” (HCP 7, Nurse)

“Family and friends might say to them, so I’ve ha, sometimes people being
diagnosed, and then you can see their wife or husband’s in denial, say no you
don’t need that and that would actually affect them” (HCP 5, Pharmacist)

“I mean, I had a patient the other day whose son was, you know, not giving her
her medicines because he thought they were causing side effect”
(HCP 12, Pharmacist)

“Yeah and talking to friends you know, you often get the patients who, I’ve been
talking to my mum and she says that she felt really ill on this so I’m not taking
it” (HCP 14, Nurse)

Overall, however, social support, despite not being specifically for emotional support,
was viewed as acceptable and generally helpful. HCPs considered social support
networks to act as a means of reminder, and to provide motivational support for
patients.

“A lot of patients’ family members will remind them” (HCP 1, GP).

“Overall, I think involving family members is important and you know they can
be a motivational tool as well” (HCP 12, Pharmacist).

Another pharmacist spoke about the practical support that family members provide.

“Because they, you know, they are going to the pharmacy to collect it or they’re putting them out for the patient to take” (HCP 2, Pharmacist)

HCPs also described the benefits of the patients’ social network to their own practices, beyond directly supporting the patient with medication adherence. HCPs portrayed some of the aspects of care that family members can facilitate.

“Getting tablets out of the blister packs is difficult and again that’s where probably you would turn to family or carers” (HCP 11, Pharmacist)

One GP also discussed the utility of a social network for the HCP, but how this can have unintended consequences for the patient.

“In my experience, people, they only get involved in that they’ll raise concerns that someone’s not using medication. which is helpful...they’ll voice concerns which the patient may not want to be voiced or may not want to share”

(HCP 8, GP)

6b.4.2.3 Where is it acceptable for the intervention to be delivered?

On the whole, HCPS felt that the intervention would need to take place within the NHS in some capacity, predominantly for access to patients and for long term cost saving.

“It’s definitively something that needs to happen within the NHS and if anything, it’s because we would be able to cut medication costs if we actually realistically think about what medications people are going to take” (HCP 1, GP)

“The National Health Service is where all the patients are, so that is going to be the best place for you to do your intervention”

(HCP 13, Pharmacist)

One nurse, although generally finding it more acceptable for the intervention to link to the NHS, saw the benefit of delivery in the patient’s home, based on previous experiences of home visits with patients.

“I think directly in the patient’s home would be probably, maybe more benefit than in the surgery. I don’t know, because some patients, I think when, you see a big difference from when you see patients in surgery to when you see them in their own home...I think personally ‘cause you know they’re comfortable, they’re in their own environment, their own surroundings and then they’re a bit more at ease and relaxed rather than coming into the surgery” (HCP 10, Nurse)

Primary care was described as an appropriate intervention setting by one GP, contingent on the set up of the practice.

“If you had a larger practice, of course with the same practice pharmacy which many practices are now getting, then they will be ideally placed for this”

(HCP 8, GP).

One Pharmacist, based in an anticoagulation clinic also expressed this view.

“I think given that they receive their medicines in primary care, it seems sensible that it would be delivered in primary care because that’s...the time that

they're collecting their medicines from the GP and then from the community pharmacy" (HCP 2, Pharmacist)

However, HCPs provided some caveats about community pharmacies suitability as an intervention setting.

"I don't think that's the ideal scenario in this...setting just because it's not a health, it's very much a shop sort of setting, but if the setting changed so there was more health care orientated or looking then you could see that actually that might be a place where that could that type of intervention would be delivered, because they're collecting the medicines and it's a good time just to have that interaction" (HCP 2, Pharmacist)

This notion was somewhat contradicted by a community pharmacist, who felt that a community pharmacy could provide a middle ground between a clinical and more natural setting.

"You've got to make sure it's a valid setting. So, whether you do the initial one in a clinical setting then say to them afterwards, oh we'll just meet in this setting and that's why in the pharmacy we'd often we'd do we'd do our, we have consultation rooms, but we try to make them as natural as possible we try not to make things too clinical" (HCP 5, Pharmacist)

HCPs also provided accounts of secondary care health setting appropriateness for intervention delivery, partly because this may be the setting with most opportunity and resource.

“Anywhere where patients, you know, I don’t know if outpatient appointment clinic departments would be a good way because they’d be coming in anyway to see a consultant...post stroke so that might be a good opportunity to grab them then, particularly as that’s when their meds changed” (HCP 14, Nurse)

“But probably, you know, the focus still is pretty much on acute care and hospitalisation and that’s where all of the resources are still”

(HCP 9, Physiotherapist)

At times, HCPs made suggestions of settings that could be used beyond the NHS, although often the suggestions were concepts, as opposed to settings that they had seen interventions delivered within.

“Day centres and they’ll be a proportion that will have had a stroke in the past and I suppose that would, you know, if they consent, that would be somewhere you could get a group of patients together in quite an informal setting, so they might be more relaxed and willing to talk about their medications” (HCP 1, GP)

There were times during the interviews where HCPs referred to current service provision. These insights offered opportunity to understand service provision better and identify if there are any current care pathways or gaps in these pathways in which an intervention could be delivered.

“Pharmacists do precisely that. Run medication review clinics or discharge reviews for patients that are newly discharged or patients that just need a

medication review. There's a lot of pharmacists in GP surgeries now that are doing that service" (HCP 13, Pharmacist)

"But at the hospital, we would tend to see people 6 to 8 weeks after stroke and then unless there's anything outstanding probably not again" (HCP 17, Nurse)

"Because a lot of the chronic disease management will be done by other healthcare professionals, so a nurse prac the nurses would do all the diabetes like care planning, so they get 20 minutes half an hour...to give a patients a care, an in depth care plan where they'll look at, for example, asthma the inhaler technique or they'll look at the [medications] they'll look at compliance as part of that chronic disease care planning" (HCP 6, GP)

"So, I know at [names hospital] the patients will have a six week follow up...with the consultants and or the nurse specialist and then they'll often have a six month follow up which is a national directive, all stroke patients...I think the six month follow up will have a discussion about medications that they're on and patients will have the opportunity to talk about the medications they're adherent to. So, if you knew what they were on at six weeks and you could follow that up at six months that might be the better time" (HCP 9, Physiotherapist)

At times, the interviews developed into discussions of what HCPs perceive to be currently working well in healthcare.

"Because this is a nurse led clinic [Primary Care]. I think we do very much focus on the communication and when we're starting patients on new

medication, we give them information sheets and, you know, really talk to them about potential side effects, which again we've got more time" (HCP 14, Nurse)

"I mean, initially, having the pharmacist in the practice was a pilot project, just to see how it works, I don't know if your aware but not that many GP surgeries have a full time pharmacist...and actually not even many have one, sort of, one or two days a week or anything like that. So, it was a pilot project but actually it's been so well used and it's been so helpful to have the pharmacist there, both as a resource for patients but also for doctors" (HCP 19, GP)

"The Government's commissioned an NMS service...so someone starts a new medicine...if it's a new medicine, it's not on their records, you, I'd say to them is this a new chronic medication and they'll say yes, then what you do is you take their phone number or their address and then you'll phone them after 7 days and after 14 days to make sure they're ok with it...and then after 28 days and that's it and then basically they tell you if they've got any problems you tell the doctor" (HCP 5, Pharmacist)

HCPs did provide some insights into limitations of certain settings for delivering an intervention. For example, one HCP felt that, because of the clinical nature of secondary care, this setting could elicit anxiety.

"When you take them into a room, which has got a white door, is a hospital with signs and stuff...that setting it creates natural anxiety" (HCP 5, Pharmacist)

Moreover, one pharmacist based in secondary care said it was difficult to know when a patient was going to be discharged, which could lead to missing patients discharged early.

“Probably the biggest barrier is knowing when they’re going to be discharged because, you know, they’ll say oh no this patient’s discharge isn’t for another week and then on that on like the next day they’ll say well actually no they’re fine to go” (HCP 11, Pharmacist)

One GP also expressed concerns of utilising a setting external to an NHS clinical setting.

“I was just thinking of day centres or somewhere where people might attend but you could, then you’re sort of you’re risking breach of confidentiality or transferring information across to somewhere where it shouldn’t really be” (HCP 8, GP)

HCPs described views of some of the difficulties or limits of current services provided to patients within the NHS. For example, one pharmacist gave an account of experiences working in a community pharmacy, describing some of the perceived problems within this setting.

“But again, I know how busy the community pharmacies are and patients’ a lot of the time, if you I know when I’ve worked in community, if you say oh have you got ten minutes to talk about your medicines, a lot of them don’t want to do it at that point” (HCP 11, Pharmacist)

Furthermore, one pharmacist based on a stroke ward in secondary care provided some insights into the challenges faced in this setting.

“We try to provide patients information on their medicines at multiple stages during their admission...but traditionally what happens, which I don't necessarily agree with, is we often do a massive information dump at the point of discharge” (HCP 13, Pharmacist)

The perceived limitations of service provision in primary care was also discussed.

“A lot of patients, when you talk about the connection with the GP is very limited, they go to see them only when they've got another illness and otherwise the prescriptions are on a repeat” (HCP 17, Nurse)

“I often feel with the pressures of time in general practice, that I'm not spending enough time perhaps empowering the patient to understand why there on things” (HCP 19, GP)

At times, the discussions from HCPs brought to attention that there is a lack of continuity between care pathways, limiting HCPs ability to follow up with patients.

“But we actually don't have any method to ensure that that happens in the community” (HCP 15, Nurse)

Moreover, another nurse, based in secondary care, expressed concerns of ongoing support and monitoring when patients move into primary care services.

“They haven’t had the blood pressure checked by the GP since discharge you know. If we’ve asked for a renal profile because we’ve started a new ACE or something or apixaban in hospital, it’s probably not been done by the time they come back to clinic...if we’ve written it on the discharge summary one would often expect, perhaps unreasonably, that the GP would contact to see the patient but that usually doesn’t happen. It just doesn’t get done...it feels a bit like some of the pathway of care isn’t connected sufficiently” (HCP 17, Nurse)

A GP also spoke about a lack of continuity between primary and secondary care.

“I mean another barrier, the fact that obviously patient records are not universal, so...it’s not linked between primary and secondary care and between different practices” (HCP 8, GP)

Limitations of resource in the NHS was a consistent discussion from all HCPs. It seemed important for HCPs to express these limitations and raise awareness. Time was consistently expressed as a barrier from all disciplines and settings.

“Obviously for us in the ward based setting its always time”
(HCP 12, Pharmacist).

“I do think GPs do have a core role in doing that, it’s mainly about time and I think often encouraging compliance is something we do do, but we don’t give it as much attention as a lot, we could, and I think all these methods you’ve suggested are great, but it’s that time. So, if GPs had the time they would definitely do that but...at the moment we probably don’t” (HCP 19. GP)

The physiotherapist also described the perceived future realities of resource allocation in the NHS.

“The resources aren’t there and actually the resources probably may be less likely to be there over the coming years” (HCP 9, Physiotherapist).

During the interviews, some HCOs provided descriptions, advice and insights of implementing a new service into the NHS. HCPs gave advice on how to implement a new service into such a pressured system. HCPs suggested that any new scheme designed should fit into existing pathways of care.

“It would have to be something that really just is easily slotted not an existing service” (HCP 1, GP).

“I would suggest the best way is yeah, looking at piggy backing onto something that exists already...or changing the way we do things” (HCP 17, Nurse).

“So, the key thing would be, if you’re going to develop anything, you can’t, it’s not to add additional workload, you want to try and save workload either by automation...new technology...etc. with just occasional facilitation role if necessary if something’s flagged up”

(HCP 6, GP)

6b.4.2.4 How should intervention components be delivered and by whom?

Who should provide information and support

At times, some of the interviewed HCPs discussed the strengths in current service provision. References were made to people the HCPs perceived to be key within the system. Some HCPs felt that those who had more flexibility to visit patients within a community would be more acceptable as intervention facilitators.

“We’ve got a very good new community matron in our area and she’s really good and she, you know, she goes in and she can do a whole sort of holistic assessment of patients as well, and help them with so many things you know. Lots of social issues as well, so that could be good for stroke patients the matrons could go in do the intervention and they can follow up at various points” (HCP 10, Nurse)

“[Be]cause there are, pharm, certain pharmacists that can go out into the community...we’ve got a community team here who are able to go and follow up patients to see how they’re getting on with they’re medicines, or really carrying out like medicine use reviews, seeing if they’re still appropriate for the patient”

(HCP 11, Pharmacist)

Across all HCPs, accounts of their roles were very similar. HCPs perceived that they were there to assess clinical indicators, to ensure patients know what they’re taking and why, as well as being a point of contact for advice. Therefore, all HCPs felt they had a role to play in supporting patients with medication adherence.

“I think the GP’s main role would be talking about the indication of each medication, the pros and cons and actually coming up with a plan with patients

of which ones they are actually happy to take and which ones they realistically would decide that they wouldn't want to take. To actually just start from the beginning and accept that there's going to be some medications that they're just not, they don't feel like the risk, the pro risk balance is worth it and actually just stopping the non-compliance from the beginning" (HCP 1, GP)

"I think it's about explaining to them what their medications are for and the importance of taking them, but also making sure that we can give them as much support within the hospital, I that they sort of know when they should be taking and when they shouldn't be taking them, and sort of giving them as much advice as possible, but also as I say backing up that advice with something that they can reflect on and actually check" (HCP 15, Nurse)

"I often describe pharmaceutical care as 50 per cent of it is about getting the right medicines to the right patient and the right dose, and that's the job of say a clinical pharmacist, but the other 50 per cent is about the patient and how they're actually using and taking their medicines. If that 50 per cent doesn't work then you're wasting your time with the first 50 per cent"

(HCP 2, Pharmacist)

There was a perception, in some of the interviews from HCPs, that the power imbalance between patients and clinician could influence adherence. As such, this should be considered when deciding upon a potential facilitator of the intervention.

Nurses and pharmacists were considered by some HCPs to be less intimidating for patients to approach with concerns.

“We're not so much in the adult adult relationship when it comes to approaching, we're much on you know, whether the patient is taking the medication maybe in a ore parent child approach” (HCP 16, Nurse)

“That doctor patient relationship when you're a bit disempowered in hospital...[I] just hope that as pharmacy are talking to them about their medications at discharge or the nurse is going through it, that those are slightly less intimidating individuals and perhaps some of the doctors, if they feel that they can't say it” (HCP 17, Nurse)

“You've got to be careful, there's a power imbalance. If you go, if I go and say to them oh you should do this, they'll often just nod their head and say yeah” (HCP 5, Pharmacist)

A variety of HCPs were described as acceptable intervention facilitators, encompassing HCPs from primary care, to secondary care and the community. However, GPs were rarely suggested as a favoured intervention facilitator. More common suggestions were nurses, whether practice or clinical nurse specialists in secondary care, and pharmacists across care pathways.

“I think matrons are possibly better suited...and practice nurses...because, you know, the patient just gets booked in and you've got your allotted time so that's absolutely fine” (HCP 10, Nurse)

"[Be]cause you know we're [pharmacists] the experts in medicines and, you know, we should take the lead and, yeah, I think it should be us, like we should be involved in all aspects of medicine and make it our business"

(HCP 12, Pharmacist)

"Well it could be anybody, I think GP, nurse, practice pharmacist, I don't think it, I think the nurses and the practice pharmacist have more time"

(HCP 14, Nurse)

"Nurse specialist[s] in the acute setting I think, because that once again, secondary prevention going through all of that is a huge part of our role"

(HCP 18. Nurse)

"I think get as many people on board as possible within an MDT, to be able to make sure that it is well established and well followed through and you get the results that you want that" (HCP 3, Pharmacist)

"Sometimes it's better that the, you know, pharmacist, that's, their health skill is around medication and medication management and discussing benefits side effects etc., so I think a lot of that and NHS England is um funding a pilot of 1500 pharmacists in general practice so there's really going to be big expansion in those roles" (HCP 6, GP)

Nevertheless, one HCP expressed quite different views of who could facilitate the intervention based on reflections of the pressures within the NHS.

“I think with the way health is being provided and will be provided...it has to shift probably from healthcare professionals to family members, next of kin, carers, the voluntary sector” (HCP 9, Physiotherapist).

On occasion, HCPs explicitly spoke about certain clinicians they felt would not be suitable to deliver the intervention. One GP described how some carers are not allowed to physically give patients medications, just prompt taking of medications.

“In my experience, carers generally aren’t as qualified to help with medication decisions... and they usually change so often” (HCP 1, GP)

Another GP also spoke about perceived preferences that patients have of whom they seek advice and support from.

“It’s funny, patients don’t really like taking advice from pharmacists ‘cause they’re not a doctor, but they’re the ones that have more information so I trust the pharmacist with their drug knowledge you know” (HCP 4, GP)

Also, one GP provided a cautionary comment on expectations of GPs to deliver some of the BCTs discussed in the interview.

“I think we probably won’t get much result if you’re relying on the GPs to do it” (HCP 8, GP)

Modes of delivery

On the whole, HCPs felt that a form of verbal delivery, usually face-to-face, and a form of written information would be the best way to deliver any of the intervention components to patients. The reasons varied based on what they perceived patients to prefer, as well as how they themselves preferred to deliver the support. HCPs also, at times, expressed an understanding of the limitations to using face-to-face delivery over and above less labour intensive methods, but still, in general, felt that this would be the most acceptable method of delivery.

“[[face to face] I think that would work the best, it is a lot more labour intensive...you could do it in groups I suppose very small groups” (HCP 1, GP)

“I think it’s probably verbally but then having obviously written literature to kind of back it up...I just think that people take it in, you know, when they’re face to face with someone and they can see them and they can talk to them...I know obviously you can talk to somebody on the phone, but I just think it’s more personable when you’re face to face, I feel like patients would take it on board better” (HCP 10, Nurse)

“I think it’s always good to have an initial consultation face to face with patients...but I think like follow ups from then on would probably be good with just over the phone, but then it’s always asking the patients how they would like to be followed up perhaps...I always think that it’s good to talk to someone face

to face initially... I think you can gauge better from a patient whether they're going to take their medicines or not" (HCP 11, Pharmacist)

Some HCPs described how technology could have a place in delivery of support.

"To be able to supplement some of the verbal information that's been given...value both written and verbal information and that written information isn't necessarily in terms of leaflets you know, that can be things that are online or signposting" (HCP 13, Pharmacist)

"I don't think we use technology enough, so I think there's lots of technological sort of way you could do it using video and things to show them" (HCP 19, GP)

"I think people are used to a responding to text straight away or, email someone might just sit on it but text if you send a text, you'd probably find you're going to get a response quicker" (HCP 5, Pharmacist)

"I'd say the winning thing would be using smart phones, that could be with the carers to have some smartphone technology...for the patient they're looking after of for the individual person themselves to have a promoting" (HCP 6, GP)

One pharmacist also drew on their experience of cardiac rehabilitation groups to advocate for group settings as a good mode of delivery of support.

“I used to do cardiac rehab sessions and what always used to strike me about those sessions is when you get a group of 10 15 patients who’ve recently had an event together, the interaction between them is very fruitful”

(HCP 2, Pharmacist)

Generally, HCPs expressed some perceived reservations about some of the technology based modes of delivery, particularly as the cohort of stroke patients tend to be slightly older.

“I don’t know how much the cohort of patients, that will have had a stroke, will be using a mobile phone and know how to look at messages: (HCP 1, GP)

“I don’t think anything on the computer is always great... I know there are older people that, you know, are quite computer savvy and you know they’ve got emails and stuff but I think for a lot of them they don’t” (HCP 10, Nurse)

Additionally, some HCPs discussed perceived concerns about the use of a phone call as a mode of delivery.

“Most people prefer face to face and it’s easier to kind of, you know, you can gauge kind of what the patients thinking to what you’re saying, like, you know, you can pick up if they’re looking concerned about something...and invite them to ask questions, whereas its quite hard to do that over the phone sometimes:

(HCP 12, Pharmacist)

One GP also described reservations about written information.

“Written information, it’s always usually an overload of information and it’s something which can be postponed for another time” (HCP 8, GP)

Tailoring

Nearly all the HCPs felt that tailoring the support delivered, and tailoring the mode of delivery to patients’ preferences would be important. There was only one instance from one GP, where it was felt tailoring would create a lot of work, and not be acceptable. In all other cases, tailoring was seen as acceptable.

“You don’t want to inconvenience the patient...and that’s the hardest thing, so it might be a case you give them an option in the beginning” (HCP 5, Pharmacist)

“Again, every patient is different...there are some patients that actually talking on the phone and maybe putting out a leaflet in the post is going to be fine, but for some patients they might need to be in the home with them having that face to face conversation, they might have more questions” (HCP 10, Nurse)

“I guess it’s any strategy that’s tailored towards the patient, so if you know some people like to be told what to do by a healthcare professional, some people like that information...via a website, paper copies”

(HCP 9, Physiotherapist)

6b.5 Overview and discussion of findings

Semi-structured interviews with 19 healthcare professions were conducted to establish 1) which medications to target with intervention, 2) what BCTs were acceptable to be delivered, 3) where the intervention should be delivered and 4) how the intervention should be delivered (encompassing who should deliver and through which modes of delivery).

Firstly, in terms of what to deliver in the intervention, it was identified that most HCPs thought all medicines for stroke should be targeted by the intervention, as opposed to just one medicine. Findings from the qualitative interviews with stroke survivors also suggested that stroke medicines as a whole should be targeted (reported in Chapter 6a), as stroke survivors reported varying understanding and ability to identify the different medications.

The BCTs considered to be acceptable by the majority of HCPs (and this was generally across disciplines and care pathways) included: 1) information about health consequences, 2) credible source, 3) action planning, 4) prompts and cues, 5) habit formation, 6) self-monitoring of behaviour and 7) social support (emotional). Particularly, strategies such as the use of prompts and cues and habit formation were perceived to be extremely acceptable. HCPs often gave accounts of these being facilitative to adherence prior to being asked about the specific BCT within the interview. The support of these BCTs also adds to discussions from the stroke survivors, reported in Chapter 6a, who also felt that these BCTs were acceptable.

Self-monitoring of behaviour was one of the BCTs with nearly unanimous support. Most HCPs suggested the use of a Dosette box as a means to assist patients in self-monitoring. However, there were instances, particularly from some of the pharmacists interviewed, where Dosette boxes were not viewed favourably. The Dosette was thought to potentially de-skill a patient from knowing deciphering between different medications. Also, as not all medications can go into the Dosette, this could cause more confusion. In these instances, self-monitoring through other means, such as ticking off on a calendar, was still felt to be acceptable.

There were BCTs that elicited more uncertainty from the HCPs. For instance, pros and cons were viewed divergently by HCPs across all disciplines, with some seeing the potential utility of this BCT to support patients making informed decisions and personalising their healthcare. Others felt that this would take too much time to deliver, and that it may be challenging to get patients to be honest about what they feel would be a pro or con to taking the medications. It may be that this BCT could be utilised in the intervention, but operationalised differently. For example, patients could be prompted to engage in this self-reflective exercise prior to attending an appointment or having time with a clinician. Then the clinician can ask the patient about what they discovered and utilise this risk versus benefit framework as a facilitator to structure discussion. If patients were initiating this process alone, this may allow for a quicker delivery of this BCT.

BCTs that generated much discussion, but on the whole, were perceived as unacceptable to deliver included: self-monitoring of the outcomes of behaviour,

biofeedback and information about antecedents. Firstly, all of the BCTs would require patients to carry out an additional behaviour on top of adhering to medicines, such as writing down antecedents to missing medicine doses or checking blood pressure weekly. This, in itself, may be too onerous for patients. Although there is evidence to suggest the utility of patient's self-monitoring their blood pressure (presented in Chapter 5), HCPs across disciplines spoke about how this was not acceptable. It was felt that asking patients to self-monitor their blood pressure could create a lot of anxiety and put patients under too much pressure. HCPs, in a few of the interviews, also expressed concerns about patients becoming obsessive with monitoring, taking their blood pressure too often and potentially resulting in them not taking their medicines as prescribed.

In terms of where the intervention should be delivered, there was no consensus across HCPs or from within one discipline. That being said, all HCPs felt it would be appropriate and acceptable to deliver the intervention somewhere within the NHS, in contrast to other settings such as day centres or in the patient's home. Whether from secondary care on stroke wards, or working within a primary care practice or community pharmacy, time was a substantial constraint to the settings. Practice nurses and community pharmacists did refer to having longer appointments with patients, as well as services such as the new medicines service and medication use reviews. During the admission to a stroke unit at the time of stroke and prior to discharge from the admission, information provision was often described as taking place, but HCPs felt that this provision was not enacted in the most effective way, contemplating whether the timing or format of information provision needed to change. This could present an opportunity for intervention here, in order to enhance

a service that is already more routinely delivered. HCPs often spoke about difficulties of time and prior knowledge of discharge to be able to appropriately provide information to patients. It may be the case that refinement of how this information is delivered could enhance this service and ensure patients feel that they are receiving sufficient information about their medicines. Potentially, the use of other modes of delivery, beyond face-to-face discussion with a patient, could enable more frequent time points to provide information on the health consequences of taking information and allow the same message to be reinforced during the admission. Written leaflets, or the provision of a medicines booklet, or videos of HCPs talking about the medicines and providing information about medication purpose, rationale and risks could offer alternative modes of delivery that require less clinician facilitation and time. Strategies such as this could also give scope for family members visiting to access this information and ask questions to HCPs, when they may not have otherwise had the opportunity to do so. Moreover, if the patients have more time to consider the information given, prior to speaking directly with a HCP, they may have more opportunity to generate and ask questions addressing any concerns. The clearest message from HCPs was that implementation of an intervention would need to slot into existing service provision, and not increase workloads for HCPs.

In terms of how this intervention should be delivered, both who should deliver the intervention and the mode of delivery were considered. Perceived appropriate facilitators of this intervention again varied. However, there were few instances where a GP was identified as an acceptable intervention facilitator, mainly because of the time constraints inherent in their role. Practice and clinical specialist nurses and community and hospital ward based pharmacists were often more frequently

referred to as a good facilitator. This supports the stronger views expressed for intervention setting, where nurse led clinics and pharmacies were seen as acceptable settings for intervention delivery.

In terms of mode of delivery, there were some positive views of digital technology, most strongly favouring smartphones and text based intervention. However, many of the HCPs felt that a lot of stroke patients wouldn't use or necessarily have access to devices like smartphones and computers. This was strengthened by the fact that nearly all HCPs felt the best mode of delivery was verbal support, most often face-to-face, supplemented with written information that the patient can refer back to. In this instance, the more traditional methods of delivery, despite being more labour intensive, were the more acceptable ones, both in terms of what HCPs perceived patients would prefer, but also in terms of how HCPs preferred to conduct their own clinics.

6b.5.1 Strengths and limitations

A strength of this study was the inclusion of a broad range of health clinicians from multiple care pathways. This ensured a more realistic understanding of the NHS across care pathways and from within different disciplinary teams. This will hopefully enhance the interpretation of the results such that a more implementable intervention is developed.

A potential limitation of this study is the choice to recruit via academic networks. Although this provided the research team with an effective and more rapid recruitment strategy, all HCPs interviewed represented health services within London and surrounding south London. These health services are likely not representative of all health services across the UK, and may not be representative of all health service from within London. Most notably, the population of south London is extremely diverse and as such HCP interactions with patients will be drawn from experiences of a population that may not be generalisable to all stroke survivors, and all HCPs in the same roles. None of the HCPs interviewed worked in more rural settings, and this is likely to bias the views and thus the findings towards a system that will work more readily in a large city. Transport links and proximity to an NHS premises are likely to be better and more realistic in a city such as London. HCPs perceived that the intervention needs to be delivered within the NHS. A HCP based in a rural setting may perceive a NHS premises as less acceptable than other community based settings, which would be easier to commute and access. It would be important in further work to discuss intervention components with HCPs from a more diverse range of settings, if the intervention was intended to be implemented in settings beyond health care in London. A final noteworthy consideration, about the sampling method, is that the thesis author works within a stroke research team, that is highly motivated to engage in research projects about stroke and very familiar with emerging literature in this field which could impact and improve service provision and patient care. As such, HCPs were all recruited via this team and are much more likely to have an academic as well as clinical perspective of medication adherence in stroke. If a different recruitment strategy had been used, HCPs may have been recruited who were less familiar with emergent research and directives in stroke care

and they may have provided more specific accounts of experiences on the front line, without also providing inferences about implementations of research. There were often times in interviews, where HCPs provided opinion of BCTs, setting or modes of delivery, based on their knowledge of delivering research in these settings and based on their understanding of current literature, as opposed to appraising the intervention components based on perceived acceptability of implementations into routine healthcare. These interviews still provide HCP perspectives that are important and useful in decision making and intervention design, but may be biased somewhat by a more specialist knowledge of stroke from both a clinical and academic perspective.

Moreover, as with the stroke survivor interviews (Chapter 6a), telephone interviews present a slight limitation. This method of interviewing was offered to increase the likelihood of recruitment and to facilitate quicker interviews within a working day if necessary. However, the rapport between participant and interviewer is more difficult to develop over the phone. To respond to this, the interview schedule began with questions considered to be 'opening questions' that may be easier to elicit conversation and flow with the participant. The interviewer (thesis author) also attended team meetings and met with participants where possible prior to recruitment and interviewing in order to try to alleviate some of the challenges of conducting interviews over the phone.

6b.5.2 Reflections

This section provides a reflexive account of the experiences of conducting the interviews with HCPs.

One of the challenges of carrying out these interviews was the time pressures that the HCPs were subject to, even when working within the academic setting, as opposed to their clinical setting, on the day they took part in the interview. This often meant that interviews were conducted over lunch breaks and that there was a certain element of haste in all HCP discussions. There were few occasions where a HCP was able to talk for more than 40 minutes. As such it may mean that some of the explanations to answers, and depth to the content of the interviews, is affected. For example, questions about modes of delivery were asked towards the end of the interview schedule. There were times where interviews were not finished, and so these questions were not asked. Although inferences were often made throughout interviews when discussing BCTs of how to deliver them (i.e. through which modes of delivery) discussions could not take place to explore the reasons why. One HCP spoke frequently during the interview about the perceived utility of apps and internet pages for delivery of an intervention, but the interview was ended early and so I was unable to ask how they thought patients liked to receive information, and whether they had found that patients who have had a stroke engage well with these digital technologies. However, it did create a sense of reality to the perceptions from HCPs that there are time pressures limiting their ability to carry out many of the things they feel they should be doing in day-to-day patient care.

During some of the interviews, HCPs would turn to me to ask what current stroke services were providing, or what was currently happening in certain care pathways. This was an unusual situation to manage, as I had entered the interview with a mind-set that the HCPs were the experts in the room, able to provide me insights on the NHS and delivery of services. This form of question asking by HCPs forced a sense of role reversal, one that I was not necessarily able to fill. There was the potential, in these circumstances, for the rapport and flow of the interview to be lost. Instead it provided a sense of confirmation, between myself and the interviewee, that stroke service pathways were not particularly clear and that there was extreme variability, making it very difficult to draw definitive conclusions to the questions I was asking.

As the HCPs were recruited via my academic network they were aware of my position as a PhD candidate, and that this was a study to inform my thesis. This was likely to affect the interview process. It might be the case that HCPs perceived me to be less experienced and knowledgeable of this topic area and the challenges faced ahead. Certainly, during one interview a HCP heavily focused on describing the challenges of conducting research within primary care and secondary care settings, as opposed to talking about barriers in current service provision or limitations of resources within the NHS. Furthermore, as I have an educational background in health psychology and had extensively read literature on intervention development, operationalisation of BCTs and pre-existing interventions delivered to stroke survivors to target medications adherence prior to conducting this qualitative study, it is inherent that I would have brought my own biases to the interview. The way I phrased questions and the way I described BCTs to HCPs, if asked in interview to elaborate further, would likely be biased to the way I perceived these components to

be realistically operationalised. Others may form different views of how best to realise an intervention component and therefore may have elicited different responses of acceptability towards these intervention components.

Finally, it is worth reflecting on some of the difficulties I experienced with recruitment. Whilst GPs and pharmacists were more forthcoming and interested in taking part in the interviews, nurses proved to be a difficult group to access. It was only when several messages were sent around academic networks indicating that nurses were severely underrepresented in my sample that nurses were encouraged to take part and ensure their views were heard. Within my sample, however, I have more secondary care based nurse than district and community nurses. These were teams of nurses that were spoken about as important for some patients in terms of medication adherence support. It could be that this difficulty in recruitment is reflective of some teams of nurses feeling more burdened by the day-to-day clinical role, and as such unable to take part in external activities such as this research study.

6b.6 Implications of the findings for this thesis

It is important to consider the implications of the findings from this study for the intervention development that is taking place in this thesis. There were several BCTs that were viewed as acceptable by HCPs. The operationalisation of and training given to deliver these BCTs will be really important to consider. For example, presented in the findings above was an instance where a HCP responded to a question about provision of information about health consequences, but in fact

described aspects of monitoring behaviour and behavioural outcomes. These types of discussions highlighted the need to ensure that HCPs delivering the intervention are sufficiently trained to understand what the purpose of delivering the BCT is and how to deliver this BCT. The strongest consideration that came across in interviews was constraints on the NHS. Although HCPs felt that the intervention would be best suited to being delivered in the NHS (within an NHS setting and by HCPs considered to be suitably qualified), they were extremely aware of time and financial pressures that would present difficulty in implementing new services. On several occasions, HCPs recommended incorporating the intervention into existing services and care pathways, to ensure ease of implementation and more likely buy-in from key stakeholders. This will be essential to consider in the next chapter of this thesis, which presents recommendations for a final intervention design to be piloted and tested for feasibility in the future.

Furthermore, BCTs such as self-monitoring of behaviour, were perceived to be acceptable, with most suggesting the Dosette box as a good tool to enhance this. However, there were instances where HCPs described a Dosette box as a limitation, with the potential to de-skill patients. Therefore, it will be important to consider whether the ease and benefits that the Dosette box provides outweighs the concerns of some HCPs. Stroke survivors all described a perceived acceptability of the Dosette (discussed in more detail in Chapter 6a). Stroke survivors often described this as the single best method to monitor adherence and as a tool that had improved their adherence. It may be the case that a compromise should be employed, where some patients make up their own Dosette boxes if capable, and others that are less able have them provided and delivered by the pharmacy.

Finally, this intervention development is arising at a time where there is a cross-over between generations, from one more unfamiliar with digital technology to one that has been using technology much more frequently in day-to-day life. Whilst a few HCPs gave accounts of the utility of technology in intervention delivery, providing scope for patients to self-manage more and HCPs to facilitate less, it was generally felt that the majority of stroke survivors would not be able to fully utilise technology at this time. The Office of National Statistics (ONS) for the UK reported that daily use of a computer was increasing. For example, for those over the age of 65 (an age group more likely to have suffered stroke), the percentage of this population using a computer increased from 9% in 2006 to 51% in 2017 (ONS, 2017). For instance, in those aged 65 years and over smartphone ownership went from 5% in 2012 to 18% in 2015. This could suggest a discrepancy between the HCP views of stroke survivors use of digital technology and the reality of their use. That being said, often stroke survivors interviewed reported digital technology as unacceptable. Although they often had access to a computer or smartphone, they found accessing information and support overwhelming through this medium. Therefore, it seems appropriate at this stage of development to consider more traditional modes of delivery with a view in the future to start to remove more onerous modes of delivery, such as multiple face-to-face consultations, in favour of apps and Internet based platforms.

7 Chapter 7: Improving Medication Adherence in Stroke Survivors: The Refined Intervention Design

7.1 Chapter overview

This chapter presents the final refinement of the design of the intervention to target medication adherence in stroke survivors. Drawing on the findings of Chapters 6a and 6b, a refined intervention is presented that is considered to be acceptable and potentially implementable within the relevant context. Critical reflections on this design process are discussed.

7.2 Refining the intervention design

In order to fulfil the final objective of this thesis (presented in Chapter 1), the design of the intervention is refined and presented below. The refinement utilised results from Chapters 5, 6a and 6b in order to propose a final, refined intervention that is considered to be most acceptable and likely to be implementable within the current healthcare system in the United Kingdom (UK).

7.2.1 Patient and Public Involvement (PPI)

Findings from the qualitative studies presented in Chapters 6a and 6b were discussed with the same PPI group of stroke survivors and carers as described in chapter 5. The purpose of this was to establish if members of the group understood

and agreed with the thesis author's interpretation of findings from the qualitative studies (presented in 6a and 6b).

Participants were provided with a broad summary of the findings about the most acceptable behaviour change techniques (BCTs; e.g. Information about health consequences, prompts/cues, habit formation) and asked about their impressions of suitable settings and how the intervention should be delivered (modes of delivery and intervention facilitators). Participants of the group all consented to having the discussion recorded, through which verbatim transcripts were produced. No participant data was included on the transcript, and recordings were deleted once a checked transcript was produced. Thus, quotes presented below reflect an accurate account of what was said by group members.

The discussion within the PPI group, facilitated by the thesis author, was broader than within interviews. The discussions between facilitator and group participants were focused on findings from the qualitative study reported in Chapter 6a and b, namely:

- 1) The broad clusters of BCTs (information provision, habit formation) perceived to be acceptable by healthcare professionals (HCPs) and stroke survivors
- 2) The perceived acceptable settings for intervention delivery
- 3) The perceived acceptable intervention facilitators and modes of delivery

BCTs

Participants within the PPI group agreed with the finding that more information is needed about medications. One participant described how they have to seek further information themselves, by accessing search engines.

“I get the same problem what I do now I just Google it and get the information”
and went on to say,

“Google is the best place to get that information at the moment, sorry. Because the doctors or the pharmacists, they haven’t even got the time”.

Participants also agreed with comments from HCPs within the interviews, suggesting that current provision of information is not always optimal. Some participants referred to the limitations of the patient information leaflet inside the medicines box, stating,

“They frighten you to death actually”.

PPI group members also agreed with the types of information that should be provided (i.e. the purpose and rationale of the medication, how long this will be prescribed for), forming consensus that this information should be reinforced at several time points.

When discussing the BCTs that support habit formation, participants of the group agreed about the acceptability of these and referred to their own strategies they currently employed to support medication adherence. Participants described the importance of carers to prompt behaviour,

“My carer remind me you know to take my medication”
the use of alarmed prompts,

“I’ve got one of these tablet, my tablet machine, alarms like morning midday evening”

and linking medicine taking to daily activities,

“I just got everything when I’m drinking my tea or water I just take”,

as enablers to adherence.

Setting

One of the attendees in the room supported findings on the suitability of secondary care as an intervention setting.

“You’re going down to the hospital pharmacy to pick up your meds...after you’ve just been discharged. Ok, these are your meds, these are the leaflets to help you understand and then maybe have, yeah, and email address to contact say”

Another participant challenged the acceptability of a general practitioner (GP) surgery as an intervention setting. They expressed concerns with the newer configuration and access to appointments with the same clinician. A lot of attendees in the room indicated their agreement with this comment.

“Never seen my doctor...since...this new thing where you have different doctors. These doctors don’t know you, I want continuity. Doctor I used to have knew me and when they, when you phone up to have a appointment to see a doctor, there’s a strange face and this person doesn’t know they looking at computer they don’t know you”

Mode of delivery

Once again, there was much concordance between the PPI group and the interview findings regarding mode of delivery. Whilst there were some people in the room who felt confident to access computers, and Google information for example, others spoke about the desire to have written information,

“You’ve got that in written form so, A, it’s helpful for people like me with a bad memory, but also if you have somebody who's supporting you, whether it’s a spouse or a carer”.

This reflected the HCPs view in the qualitative study, who consistently suggested that both verbal and written forms of information delivery were most acceptable.

Intervention facilitators

In general, discussions in the PPI group supported findings from stroke survivors and HCPs, with less consensus on who potential intervention facilitators should be.

One group attendee described the GP and pharmacist as a potential facilitator saying that,

“I think I’m very lucky, I’ve got a super GP and a super pharmacy”.

In contrast to this statement, and to findings from interviews with HCPs who felt that pharmacists were one of the best placed HCPs to deliver information and support, one group attendee said that they would not seek information from a pharmacist,

“These pharmacists, they don’t, they’re not interested”.

Overall, the discussions that took place within the PPI group helped to identify group understanding and agreement with the thesis author's interpretation of findings from the qualitative studies. On the whole, agreement with findings from the qualitative study was good and appeared to align with the groups own views on how to best support medication adherence.

7.2.2 Overall perceived acceptability of the intervention components

The following section considers an overall judgement of the acceptability of individual intervention components, including BCTs, settings and modes of delivery, across both patient and HCP samples, before bringing together findings from both these groups to reach a final conclusion. Overall acceptability within groups (stroke survivors and HCPs) was judged by the thesis author in the following ways:

- 1) Where there were more views expressed about a components acceptability than its unacceptability, it was judged to be acceptable to that group (i.e. >50% of views expressed component acceptability)
- 2) If the component was generally viewed to be acceptable (against criterion 1), but a caveat was given, a judgement of the impact of the caveat was made against a) the practicality of implementing into the service and b) the likelihood that the caveat would be experienced with or without the addition of this proposed intervention (e.g., if the caveat of time constraints was expressed, then an intervention component was found to be unacceptable, as the addition of the intervention would only add further to these constraints and

would be more challenging to get buy-in and be implemented into current services)

Overall acceptability, encompassing both groups views, was judged by the thesis author in the following ways:

- 1) If an element of the intervention was considered to be unacceptable to either HCPs or stroke survivors or both, it was not considered further for intervention development.

Table 20 presents the settings that were explored and indicates those that were perceived to be acceptable and unacceptable for this intervention. Table 21 presents the 11 BCTs explored in the interviews, and indicates those that were considered to be acceptable and unacceptable. Table 23 presents the modes of delivery that were felt to be acceptable and unacceptable by the key stakeholders. A discussion of who should facilitate the intervention is also presented. Each table displays patient acceptability, then HCP acceptability, before presenting the overall deemed acceptability for this intervention across all stakeholders. Following each table, the possibilities for this intervention will be presented, before indicating the final choice, intended to be the most acceptable and implementable.

7.2.2.1 The intervention setting

Table 20 summarises the settings that were seen to be acceptable and unacceptable to the key stakeholders. Overall, the individual's home was the most preferable setting for stroke survivors, at times also expressed as the best setting by HCPs. In

general, HCPs agreed that the intervention should be delivered within the NHS, but there was a clear view that the GP clinics were not an acceptable setting, predominantly because of time pressures. However, other clinics within primary care (such as nurse led clinics), as well as practice pharmacies and within secondary care were seen as acceptable.

Judgements on acceptability were made against the criteria presented above, in Section 7.2.2. For example, in instances where time pressures were identified as a caveat to an otherwise potentially acceptable intervention component, it was considered unacceptable. The implementation of an intervention, even one that mirrored existing pathways of care, would only add further to the time constraints, as HCPs would be asked to carry out something additional to their routine care. This would further cause strain on the service provision, limit the likely buy-in from key stakeholders (the HCPs) and hinder the implementation of the intervention. In contrast, if the caveat of travel was expressed, then the intervention component was viewed to be acceptable. As it is an intention to implement this proposed intervention into existing pathways of care (as this was advised by many of the HCPs interviewed to enhance intervention implementation), participants receiving the intervention (stroke survivors) will not be asked to attend additional appointments, beyond those which they would be requested to attend under usual care conditions. Therefore, the intervention would not create additional pressure on stroke survivors to travel, more than would usually be expected.

Table 20. Overall perceived acceptability of potential intervention settings across both HCP and stroke survivor stakeholders.

Setting	Stroke Survivors: Acceptable/Unacceptable (reason)	HCPs: Acceptable/Unacceptable (reason)	Overall Acceptability
Secondary care: stroke unit	Acceptable (but travel is a concern)	Acceptable (if intervention was brief)	Acceptable
Secondary care: outpatient clinics	Acceptable (but travel is a concern)	Acceptable (Clinical nurse specialists felt they had more time)	Acceptable
Primary care: GP clinics	Acceptable (most likely healthcare setting the patients accessed)	Unacceptable (time pressures)	Unacceptable
Primary care: Practice nurse clinics	Acceptable (but travel is a concern)	Acceptable (nurses felt they had more time)	Acceptable
Community: Pharmacy	Acceptable (healthcare setting patients most likely to access)	Acceptable (felt pharmacists had most expertise)	Acceptable
Community: District nurses visits	Acceptable (as it would provide support in the home)	Unacceptable (time pressures)	Unacceptable
Community: Patient home	Acceptable (preferred setting)	Acceptable (benefit to seeing person in own environment, but would have to be delivered by teams that more routinely do home visits)	Acceptable

GP-General Practitioner

The possible pathways of care that already exist in the NHS were considered. The interviewed HCPs particularly spoke about the importance of implementing the intervention into pre-existing pathways of care, in order to limit the burden on staff, have the least impact on cost and time and therefore be more feasible. Moreover, stroke survivors viewed travelling to health appointments as acceptable if necessary, providing the clinic was accessible, and if care could not be carried out in their home. Below, each setting (primary, secondary or community care) will be discussed in turn, with consideration of the pre-existing pathways of care.

Primary Care

Primary care settings could encompass two key clinics within the current NHS care pathways: 1) a GP run clinic or 2) a practice nurse run clinic. Each clinic is subject to different constraints.

A GP appointment is usually restricted to 10 minutes. Stroke survivors are usually discharged from hospital with a two week supply of medications necessary for secondary prevention of stroke. Therefore, the patients are likely to access a GP appointment within two weeks following discharge from hospital to get a new prescription. Beyond this, subsequent clinical need (e.g. the patient requests an appointment to discuss a medical concern), assessment of Quality and Outcomes Framework (QOF) indicators (including blood pressure and anticoagulation), or prompting of a medication review (conducted annually) are likely to guide contact between GP and patient.

Briefly, QOF consists of three main domains or components (Clinical, Public Health, Public Health - Additional Services). The domains consist of a series of achievement measures, otherwise known as indicators. The QOF provides a score of the overall quality of a GP surgery through a points system, whereby the aim is to deliver high quality care across a range of areas to score more points (NHS digital, 2018). As there is a financial reward linked to the number of points scored, it may be the case that HCPs within GP surgeries initiate patient contact in order to fulfil a QOF indicator and score more points.

Appointments with practice nurses, are typically longer than a GP appointment, often lasting between 15-20 minutes. There are no specific time points post-stroke in which a patient will definitely have an appointment with a practice nurse. However, in many GP practices, the practice nurses are allocated QOF duties, meaning that they may check and manage some of the QOF outcomes and instigate more frequent appointments with patients who have poor blood pressure control for example, or conduct annual assessments of QOF indicators.

Both settings on the whole were perceived to be acceptable by patients, with a caveat that travel was a consideration and would be more difficult for those with mobility impairments, less access to social support or limited ability to access public transport to attend appointment. For HCPs, practice nurses were seen to have more time to interact with patients than a GP. All GPs

interviewed for the qualitative study reported in Chapter 6b, were explicit about time constraints that would make it very challenging for them to deliver an intervention to patients. For this reason, a practice nurse appointment within a GP surgery may be a more appropriate setting than a GP appointment in a GP surgery.

Secondary Care

Secondary care pathways for stroke patients generally involve interaction within three key settings: emergency/urgent care, a stroke ward and an outpatient follow up clinic. Data gathered in interviews with HCPs from secondary care, and informal conversations that took place between local secondary care services (with consultants, registrars and clinical nurse specialists who worked across stroke wards and outpatient clinics) and the thesis author supported this. Although stroke services are not consistently configured the same across the UK, and as such may encompass different types of service provision (e.g. this service delivered a responsive outpatient clinic receiving referrals from the ward to follow up with discharged patients and referrals from GPs of suspected stroke patients who were missed by secondary care), conversations were kept more general to ensure the best overview of stroke care was ascertained.

Emergency/urgent care settings such as accident and emergency were felt to be too time pressured, unpredictable (in terms of when admissions would

come in and which staff would respond to the admission), and patient time in this setting is too rapid for further consideration.

One of the challenges of intervention delivery on a ward is time. It was made explicit by ward based HCPs that time pressures were extremely demanding and make the provision of current, standard care practices difficult. Moreover, patients made reference to the timing of care, often indicating that in the initial stages of stroke, when on a stroke ward, they were focused on discharge and potentially less engaged in other information and support delivered to them. However, this setting does present an appropriate time to deliver certain intervention components, such as planning a habit formation, ensuring that patients attempt to build a habit from the moment they leave the hospital and enter their home environment. Moreover, it is one of the key times in the patients stroke recovery where they will be started on new medications or have pre-existing medications changed. As such, it would be difficult to ignore such a critical time point in the patients stroke care. In addition, the difficulties faced currently, to provide the right information for patients in an accessible way on the ward might present an opportunity for intervention, such that this process is refined to support delivery and enhance efficiency. Stroke survivors and HCPs did also suggest that it was an acceptable setting for intervention, with many HCPs confirming that the ward multi-disciplinary teams (MDTs) play an important role in medication management for stroke patients.

At the point of discharge, guidance suggests that patients should be followed up at six weeks, six months, twelve months and annually thereafter as set out by the National Stroke Strategy (2007) (DH, 2007). It is not the case that this guidance is consistently followed. Data from the 2015 Stroke Sentinel National Audit Programme (SNNAP) indicated that only an average of 16% of patients received the proposed six month review within London (London Stroke Strategic Clinical Leadership Group, 2015; RCP, 2015). Moreover, not all services appear to commission the six month review, with data revealing that ten London based CCGs were not commissioning the review at present (London Stroke Strategic Clinical Leadership Group, 2015). There also appears to be a lack of clarity on who should provide the reviews at each time point, with guidance often not specifying a specific team, rather just suggesting a desired set of skills (London Stroke Strategic Clinical Leadership Group, 2015).

Currently, it is typical for the six week follow up to take place in secondary care, in an outpatient style clinic. The clinicians involved in this review could include a stroke consultant or registrar, clinical nurse specialists and dieticians. Nurses involved in these clinics, who were interviewed, identified themselves as well placed to provide stroke related care and potentially brief interventions at this time, with scope to follow up by phone. Therefore, it is evident that within a secondary care setting patients do have some consistent contact with a stroke specialist team, in at least the acute phase of stroke and six weeks post discharge from a ward. Also, there may be scope for some

members within the team to make contact with patients and follow up over the phone.

Community

The community setting offers broad scope to deliver interventions in multiple locations. For example, the intervention could be delivered in a person's home by trained HCPs. Alternatively, stroke survivors can access community and practice pharmacies and receive intervention in these settings and from these teams. Another community setting could include one beyond the NHS, for example within a council community centre or a day centre.

Community pharmacies and practice pharmacies offer similar strengths to primary care settings, as patients often access these routinely to collect repeat prescriptions. Pharmacists interviewed also identified themselves as the medication experts, and well placed to deliver interventions about medications. There are also services offered in these settings, into which an adherence intervention could be embedded (such as the New Medicines Service (NMS) and Medication Use Reviews (MURs)). However, as in primary care, the interventions within these settings would be delivered when a patient is post-discharge from hospital, and therefore for some BCTs (such as habit formation) initiation would be delayed until after the patient has been home. Once again there could be difficulties with delivery of the intervention, as patients can spontaneously access community pharmacists making it challenging to plan delivery of the intervention for when patients access the

pharmacy. Additionally, patients do not have to consistently collect prescriptions from the same pharmacy, making it difficult to maintain rapport and contact for follow up time points in an intervention. Although, the provision of delivery services, which most pharmacies offer, could limit the variability in where patients order repeat prescriptions.

During one of the interviews, a pharmacist based in secondary care discussed colleagues in the community who were able to go out and visit or call patients to follow up on medications. They described this as a new service offered in neighbouring London boroughs, not a service that is necessarily delivered across all regions of the UK, or indeed all boroughs of London. That being said, a service such as this could provide scope for embedding the intervention, as well as allowing for evaluation and expansion of such services if found to be effective. It would also support pharmacists to build and retain their business. This service is likely to be more bespoke to this area of London, as assessment of guidance for community services does not suggest that this is a typical expectation of pharmaceutical services (Health and Social Care Information Center, 2015). However, the New Medicine Service (NMS), has been implemented as an advanced service since 2011 (Elliott et al., 2015). This service has similarities to the one described above as secondary care pharmacists can refer patients started on new medicines (including anti-hypertensives and anti-platelet/anticoagulant agents) and the community pharmacists are then able to follow up with the patient over the phone or face-to-face over several occasions. This service has been evaluated and results showed a significant increase in patients' adherence of 10% when compared

to standard practice (Elliott et al., 2015). Although this scheme is incentivised through financial reward for pharmacists that adopt the scheme, introducing elements of bias in wanting to run such a service, newer initiative like this may provide potential pathways for intervention. In addition, although not all pharmacies have to provide the service, there are over 11,688 pharmacies in the UK (Health and Social Care Information Center, 2015) that could potentially deliver a scheme such as the NMS, providing the potential to capture many patients with stroke, and providing foundations for an expansion of the delivery of intervention. The notable caveat to this though, is that the service is only provided for patients started on new medications, such as an anti-hypertensive. Many people who suffer stroke are likely to already be on medications for stroke risk factors prior to admission to a stroke unit. Continuation of these medications, post discharge from admission, would not qualify them for accessing this service. As such, there is the potential to miss patients who would benefit from intervention via this service and setting.

Stroke survivors often described the home as the most preferable intervention setting for them, mainly as it was most convenient. Currently, however, in the NHS there are very few services that routinely visit all patients frequently at home. There are some community teams such as the community pharmacists referred to above, and also teams of district nurses for example. Although the individual's home is evidently the most acceptable for stroke survivors, and interventions could be in part delivered over phone, thus allowing the patient to receive intervention at home, some face-to-face contact was considered to be important by most stroke survivors and by HCPs. Teams, such as district

nurses, do not necessarily visit all stroke patients, instead only those that are considered to be housebound, and unable to travel and access nurses at the practice. District nurses were described by other HCPs as an extremely useful but limited resource, facing some of the more extreme time constraints. Of course, services beyond the NHS could potentially deliver the intervention, either in the patient's home or in other community settings such as a community centre, or day centre. As such, it is unlikely that an intervention could be fully delivered in an individual's home, and built into pre-existing pathways of care.

HCPs stated that the intervention should be carried out within the NHS and described concerns about non-clinical sectors delivering interventions in case they lacked knowledge to answer all questions and deal with all issues that could arise. Of course, HCPs could potentially work in tandem to charities or a voluntary sector to enable delivery of the intervention within a community setting external to the NHS. HCPs may hold biases about the utility of the NHS as a setting, because it is likely that they have trained and worked in these settings for the majority of their careers, considering the necessary expertise to only be provided by NHS staff as they have not been exposed to other, more novel deliveries of healthcare. As there is increasing financial pressures on the NHS, and jobs may be continually at risk, HCPs may also have an interest to inflate the view that the NHS is a necessary setting for intervention delivery, particularly as this could attract funding and help to maintain current job roles and staffing levels. In spite of this, as this would likely add additional workload to the HCP, and this is not something that was

discussed as currently delivered, it may be the case that even this solution is perceived to be unacceptable by HCPs.

Transitions between care pathways

The most common pathways of care for a patient will encompass transition between primary, secondary and community care. For example, stroke treatment is likely to begin within secondary care, possibly on a specialist stroke ward such as a hyper-acute stroke unit (HASU), or within a stroke unit that can provide inpatient rehabilitation.

Early Supported Discharge (ESD) is another service or intervention offered to patients who are able to have their care transferred from inpatient setting to community settings. This enables patients to receive rehabilitation therapy at home, without compromising the intensity and level of expertise given to patient care. Although, this is a not a service that is appropriate for all stroke patients, and the decision of who received ESD is made by the MDT, supported by discussions with the patient's relevant support networks where applicable (NICE, 2013). However, this pathway was not discussed throughout HCP interviews. As only certain patients qualify for ESD, and most likely patients with less impairment or those with stronger support networks, this may not be the best pathway of care to deliver the intervention within. Therefore, the use of an ESD pathway may lead to a lot of patients not being offered intervention.

For the patients, not on the ESD pathway, once discharged from secondary care, the patient will then be required to access primary care two weeks later for a repeat prescription of their stroke prevention medications. This is most likely to be an appointment with a GP. From this point, repeat prescription renewal may be set up and the patient may not further interact with a GP unless requested. The patient will simply request and pick up/have delivered, a repeat prescription from their practice or other community pharmacist.

Taking into consideration the comments of some HCPs in the interviews, describing a lack of continuity between pathways of care and difficulty in communication between some primary and secondary care teams, transition between multiple care pathways can present difficulties for patients, HCPs and the implementation of an intervention. If the intervention was designed, such that delivery spanned across multiple pathways of care, it could be difficult to create a succinct and implementable intervention, as the connection between these pathways appears disjointed. As a caveat to this, some secondary care pharmacists referred to a community team of pharmacists (as described in the section above), which were relatively new and unique to some boroughs of London. Moreover, the NMS has been introduced into community pharmacies. By having these teams in place, or by implementing an NMS into a community pharmacy, community pharmacy teams can receive requests and feedback from secondary care pharmacists and go into the community to follow up with patients regarding their medications. The more nuanced services, such as these, could offer some scope to implement the intervention into this cross over of pathways (between secondary and community care). This could also provide grounds for future recommendation

of service improvement, should it be found to be effective. However, as these teams are only running in certain boroughs of London at present, feasibility assessment would be required to test whether the cross over between secondary and community pharmacy teams was appropriate and achievable in the current NHS.

Whilst not all transitions are currently perceived to be effective i.e. between secondary care teams and GPs, some newer systems offer scope to implement an intervention that will be more feasible (between secondary care and community pharmacy).

Choice of setting

Three settings seem most appropriate:

- 1) Secondary care: Initial interaction on stroke ward. Follow up at six weeks. Second follow up at six months (if delivered by this team).
Scope for Stroke specialist nurses to make phone calls at additional time intervals or for community pharmacists to make phone calls/home visits at additional time intervals i.e. two weeks post discharge.
- 2) Primary care: Capture patients at the two week post discharge time frame. Cardiovascular risk factor management can be delivered by practice nurses who are well set up to have several interactions with patients early on and for follow up, face-to-face and on the phone.
However, the boundaries of when patients will interact with the practice nurse are less clear than in the secondary care pathway.

- 3) Community: Capture patients started on new medications via the NMS or when patients come to collect a prescription. Practice pharmacists and other community pharmacists, when issuing prescriptions, are well set up to have several interactions with patients early on and for follow up, face-to-face and on the phone. However, the boundaries of when patients will interact with the pharmacists are less clear than in the secondary care pathway.

On balance, the first option, within secondary care, appears to offer the most structured pathway to intervene. It also enables early contact with the patient, right at the beginning of their medicine taking post-stroke. It is worth highlighting, however, that patients discharged from hospital may have already been on medications for stroke risk factor prevention prior to their stroke. Medication regimens that patients are discharged from hospital with could encompass pre-existing medications, new medications, or new doses or classes of medications that had been previously taken. Additionally, this intervention setting appears most appropriate as early contact with the patient will be preferable. This is because some of the acceptable BCTs, such as habit formation, will benefit from early initiation.

7.2.2.2 The Behaviour Change Techniques (BCTs)

Overall, there was consistency between HCPs and stroke survivors' perceptions. The BCTs perceived to be most acceptable were often ones that successful adherers employed already and that stroke survivors

spontaneously spoke about in interview. For example, forms of habit formation, planning, use of prompts and cues and employing social support were strategies commonly used by those who felt they had good control of their medication regimen and were able to adhere well. There was no BCT that was categorically dismissed in all interviews across patient and HCP groups, but there was substantial uncertainty across interviewees for the BCTs of self-monitoring outcome of behaviour, biofeedback and information about antecedents.

Judgements of BCT acceptability were made against the criteria presented above, in Section 7.2.2. For example, greater than 50% of comments provided about information about antecedents found this BCT to be unacceptable from both HCP and stroke survivor groups. In addition, biofeedback was viewed as unacceptable in the HCP group, as the perceived limitations of this BCT would limit the likely buy-in of potential intervention facilitators (i.e. that patients could become anxious or obsessive of monitoring). The subsequent anxiety created could in fact add to strain on resources if patients were then requesting more frequent appointments with a HCP. In addition, it was felt that this BCT could cause unintended side effects of the intervention (i.e. patients could alter the doses they take of medication without consulting a HCP and not follow the prescribed instructions) affecting the adherence of that person. In contrast, information about health consequences was perceived to be acceptable, even in the HCP group, as although this intervention component would require some time to deliver, it is something that is already routinely delivered to some extent in all healthcare

settings, and was perceived to be a necessary component to prescribing a medication to a patient. The intervention offers scope to enhance this process of information provision, as opposed to add additional aspects of healthcare delivery to current services.

Table 21. Overall perceived acceptability of potential BCTs across both HCP and stroke survivor stakeholders.

BCTs	Stroke Survivors: Acceptable/Unacceptable (reason)	HCPs: Acceptable/Unacceptable (reason)	Overall Acceptability
Information about health consequences (5.1)	Acceptable	Acceptable (but consider methods that impact least on time of HCPs)	Acceptable
Self-monitoring of behaviour (2.3)	Acceptable (preference to monitor with Doseette box)	Acceptable	Acceptable
Biofeedback (2.6)	Acceptable	Unacceptable (although there could be benefits for some, could cause more distress for anxious patients)	Unacceptable
Information about antecedents (4.3)	Unacceptable (unlikely to remember to record information)	Unacceptable (were not sure patients would remember to record information)	Unacceptable
Credible source (9:1)	Acceptable	Acceptable	Acceptable
Self-monitoring of outcome(s) of behaviour (2.4)	Acceptable (however lacked awareness of what could be measured)	Unacceptable (regular assessments would put too much strain on current health care)	Unacceptable
Pros and cons (9.2)	Acceptable	Acceptable (if facilitate by HCP)	Acceptable
Prompts/cues (7:1)	Acceptable	Acceptable	Acceptable
Action planning (1:4)	Acceptable (although mainly seen to be useful as could provide a written prompt)	Acceptable	Acceptable

BCTs	Stroke Survivors: Acceptable/Unacceptable (reason)	HCPs: Acceptable/Unacceptable (reason)	Overall Acceptability
Habit formation (8:3)	Acceptable	Acceptable	Acceptable
Social support (emotional) (3.3)	Acceptable	Acceptable	Acceptable

BCTs- Behaviour Change Techniques; HCP-Healthcare Professional

Of the BCTs found to be acceptable across HCP and patient groups, it was considered possible for these BCTs to be clustered into three broader categories of intervention components presented below. Table 22 presents the BCTs in their categories, along with the taxonomy definition of the BCT, from the 93 BCT taxonomy version 1 (BCTTV1) (Michie et al., 2013). The three broader categories of BCTs were:

- 1) Considering consequences of adherence
- 2) Establishing a habit
- 3) Self-monitoring of medication adherence

Social support (emotional) was also an acceptable BCT. However, not all patients spoken to had access to strong social support networks. As such, the support provided by relatives and carers will not be discouraged, and where possible, family members would be included in the process. Nevertheless, in an effort to avoid unintentional exclusion of patients who do not have access to a strong social support network, this BCT will not be an essential component delivered.

Table 22. BCTs to be delivered in the intervention, with definition.

Category and BCTs	Definition
Considering Consequences of Adherence	
Information about health consequences (5.1)	<i>Provide information (e.g. written, verbal, visual) about health consequences of performing the behaviour</i>
Credible source (9.1)	<i>Present verbal or visual communication from a credible source in favour of or against the behaviour.</i>
Pros and cons (9.2)	<i>Advise the person to identify and compare for wanting (pros) and not wanting to (cons) change the behaviour.</i>
Establishing a Habit	
Action planning (1.4)	<i>Prompt detailed planning of performance of the behaviour (must include at least one of context, frequency, duration and intensity). Context may be environmental (physical or social) or internal (physical, emotional or cognitive)</i>
Prompts and cues (7.1)	<i>Introduce or define environmental or social stimulus with the purpose of prompting or cueing the behaviour. The prompt or cue would normally occur at the time or place of performance.</i>
Habit formation (8.3)	<i>Prompt rehearsal and repetition of the behaviour in the same context repeatedly so that the context elicits the behaviour.</i>
Self-monitoring Medication Adherence	
Self-monitoring behaviour (2.3)	<i>Establish a method for the person to monitor and record their behaviour(s) as part of a behaviour change strategy.</i>

Component 1:

Considering consequences of adherence will combine three BCTs:

information about health consequences, credible source and pros and cons.

A specific focus in the design of this intervention will be how the information is delivered. Many HCPs suggested that it may not be what information is

provided to the patient that needs to change, but instead the timing and how that information is provided, so that it is most accessible to that patient at that time.

Previous evaluations of information provision within interventions to change health related behaviour have shown mixed effectiveness, which are reported in more detail in Chapter 5.

Component 2:

Establishing a habit will combine BCTs: habit formation, prompts/cues and action planning.

A habit, in health psychology, can be defined as a phenomenon in which behaviour, resulting from learned cue-behaviour associations, is prompted automatically by situational cues (Wood & Neal David, 2009). Moreover, habits are thought to form through the repetition of a behaviour in a specific context (Lally, van Jaarsveld Cornelia, Potts Henry, & Wardle, 2010). As such, in this intervention, asking patients to identify consistent prompts or stimuli in their environment and a plan to place medications next to the prompts, should allow for a repetition of a behaviour, prompted via this stimulus. Thus, facilitating habit formation. This has been further supported in a recent article aimed at policy makers, which advocated the use of BCTs such as those presented above, to facilitate habit formation in interventions aimed at health behaviour change (Wood & Neal, 2016).

As habits form, reliance on motivational processes or the need for a person to attend to what they are doing decrease, and the behaviour becomes a more automated process (Lally, Wardle, & Gardner, 2011). As such, it was felt that habit formation would be a suitable intervention component to support medicine taking on the whole. This may also support individuals experiencing low mood to more successfully take their medicines regularly, as it could be argued that more automated processes such as habits are less interfered with by the effect low mood has on reflective processing and motivation (e.g. Hofmann, Friese, & Strack, 2009).

Component 3:

Self-monitoring medication adherence was perceived to be an acceptable, and often already applied method to facilitate adherence. Stroke survivors were explicit that the Dosette box was the best method of self-monitoring. HCPs generally agreed with this notion, with only a few contradictions. However, often when the Dosette box was perceived as unacceptable, this was because it was considered to de-skill a patient from being able to identify medications, rather than its unsuitability to be used as a tool for self-monitoring behaviour. Therefore, it seems appropriate to recommend or issue each patient within this intervention a Dosette box in order to enable self-monitoring of behaviour.

7.2.2.3 How to deliver the intervention

Modes of delivery

Both stroke survivors and HCPs consistently expressed the view that digital technology (e.g. smartphones, emails) was not acceptable. A few stroke survivors felt that smartphone technology could be accessible and useful. Similarly, some HCPs spoke about the potential utility of smartphone and Internet technology to give patients better access to information and to limit the amount of human facilitation an intervention would require. However, most HCPs questioned whether a cohort of stroke survivors would have access to, or routinely use technology. Most stroke survivors interviewed confirmed this, stating that they did not know how to use these devices and some said that, since their stroke, it was too difficult to take in all the information from these formats. Instead, verbal and written support were consistently described as most acceptable across both groups. Verbal face-to-face delivery was perceived as preferable across both groups, but phone delivery was described as acceptable as it could reduce time and cost.

Table 23. Overall perceived acceptability of potential modes of delivery across both HCP and stroke survivor stakeholders

Mode of Delivery - How	Stroke Survivors: Acceptable/Unacceptable (reason)	HCPs: Acceptable/Unacceptable (reason)	Overall Acceptability
Face-to-face	Acceptable	Acceptable	Acceptable
Phone	Acceptable (but not as ideal as face-to-face)	Acceptable (but not as ideal as face-to-face)	Acceptable
Written	Acceptable	Acceptable	Acceptable
Email	Unacceptable (some had difficulty cognitively processing emails)	Unacceptable (most felt texts were more appropriate than email)	Unacceptable
Text	Unacceptable (although most preferable digital mode of delivery)	Unacceptable (although most preferable digital mode of delivery)	Unacceptable
Internet	Unacceptable (some had difficulty cognitively processing information from websites)	Unacceptable (few instances where HCPs could identify utility for a typically older cohort of patients)	Unacceptable

In terms of how this intervention should be delivered, consensus was clear across patient and HCP samples. Verbal delivery, supplemented with written information was seen as the best methods of delivery, ideally, verbal delivery would be face-to-face, however additional follow ups over the phone in order to save time and provide more flexible and convenient delivery of an intervention were considered acceptable.

Whilst some digital technologies were seen as acceptable by a few participants in the interviews, the majority did not perceive these methods to be acceptable or practical. Some stroke survivors did refer to use of a smart phone and features such as Whatsapp, but this was not common across all patients. Also, some HCPs noted the potential utility of digital technology in order to reduce the amount of facilitation required from clinicians and increase patient self-management. However, most stated that stroke survivors would not confidently use technology such as text, email and the Internet.

One suggestion, that was only mentioned by one interviewee, a HCP, was the use of video. This mode of delivery had not been considered prior to interview and thus was not explored within the qualitative study. In spite of this, it does offer an interesting mode of delivery that could be implementable and useful, especially in pressured NHS environments. For example, information delivery about medication risks and benefits could be recorded by a HCP, providing broader and generic information about medicines, watched by patients on a ward prior to discharge, instead of the HCP having to do this with each patient

in person. This video may then prime patients to ask questions and have better knowledge of their medications before a clinician comes to speak to them about their medicines. As such, the interaction between clinician and patient on the ward may be shorter, freeing up more time to tailor the information provided in person.

Intervention facilitators

In terms of the person who should deliver the intervention, patients often referred to those that they interacted most often with in the health system (GP and pharmacist). This directly contrasted the majority of HCP views, who identified GPs as the one type of clinician too busy to facilitate the intervention, despite being well placed to do so. Beyond GPs delivering the intervention, opinion varied greatly across HCPs, who described nurses, pharmacists and other HCP teams as potential facilitators. A consistent perception across HCPs and patients, though, was a need for the support to be delivered by someone credible who had sufficient training. In this instance, as the most likely setting will be secondary care, nursing and pharmacy teams would be the most feasible intervention facilitators.

7.2.3 The final proposed intervention

In this section, the final proposed intervention setting, BCTs and mode of delivery will be operationalised to present the final proposed design of this medication adherence intervention.

Tailoring

Tailoring within an intervention offers opportunity to make a service more person centred and addresses the individual needs of a person. Guidance for designing behaviour change interventions also often recommend elements of tailoring, not only in terms of tailoring for different contexts the intervention may be implemented into (Craig et al., 2008), but also tailoring to meet individual needs (NICE, 2014a). Meta-analyses of interventions that have applied tailoring (such as tailoring of health messages) found an overall sample size-weighted mean effect size was $r = 0.074$, indicating that tailored messages were effective in encouraging health behaviour change (Noar, Benac, & Harris, 2007). A meta-analysis of web-based behaviour change interventions also found positive results in support of tailoring reporting significantly greater improvement in health outcomes as compared with control conditions both at post-testing, $d = .139$ [95% CI = 0.111, 0.166] and at follow-up, $d = .158$ [95% CI = 0.124, 0.192] (Lustria et al., 2013). Moreover, both HCPs and stroke survivors interviewed for the qualitative study in this thesis (Chapters 6a and 6b) referred to the importance of tailoring the intervention.

In this intervention, aspects of the BCTs delivered will be tailored based on individual need. Intervention facilitators will establish this need through question asking and tailor delivery accordingly. Moreover, the types of information delivered will be contingent on the medicine regimen for each participant. Specifically, two BCTs will have elements of the delivery tailored: delivery of information about health consequences and self-monitoring of

behaviour. There are two aspects of the delivery of information about health consequences that will be tailored:

- 1) The written information packs will be tailored according to the medicine regimen of the participant. This aspect of information provision will not be generic about all stroke medications, but instead written information will only be provided about the specific drug classes the participant has been prescribed (e.g. anti-hypertensives, anti-platelet agents or combinations of medications).

- 2) The intervention facilitator will elicit understanding of medications (identifying if patients understand the benefits and risks of taking the medications) and tailor information provision appropriately to either focus more strongly on increasing the participant understanding of the necessity of the medications, or by providing more detailed information about medication side effects and what to do if these are experienced. Timings of when this tailored aspect of the intervention will be delivered is presented in the logic model and proceeding sections below. Stroke survivors and HCPs interviewed often spoke about a perceived lack of understanding of the side effects, and sometimes a lack of understanding about the rationale and purpose of the medications. In one instance a stroke survivor described stopping taking a medication when a family member read through the potential side effects and became concerned. Perhaps if understanding about side effects was enhanced further, a more informed decision between HCP and stroke survivor could have been reached to continue or stop the medication. A decision was made not to use a

standardised and validated measure, such as the Beliefs about Medicine Questionnaire (BMQ) (Horne et al., 1999) to elicit beliefs about necessity of medications and concerns about medications. This is due to the practicality of delivering such a measure in a highly time constrained setting, where participants could have varying cognitive, speech and physical abilities post stroke.

Self-monitoring of the behaviour will always be supported with a Dosette box. However, participants in the study will either have the Dosette box set up for them by the pharmacist each prescription, or the participants will be given a Dosette at the point of discharge and instructed on how to set it up each week to facilitate adherence. The decision of who is provided with the pre-set up Dosette box from pharmacy will be solely contingent on patient need and ability, and in line with current service provision (i.e. those who would receive this anyway will be given the Dosette box).

Of course, the inclusion of tailoring can present challenges of treatment fidelity. Measures taken to evaluate treatment fidelity are presented in the discussion section below.

Logic Model

Building upon the proposed logic model presented in Chapter 5, this has now been revised to reflect the findings from Chapters 6a and 6b and presents a

full operationalisation of the BCTs that are intended to be delivered. The revised logic model is presented in Table 24 below.

Table 24 presents the main phases of the intervention, the settings in which each phase will take place, the BCTs that will be delivered and how these are operationalised. The mode of delivery and the intended intervention facilitator are also presented. The identified settings and time points for delivery of the intervention have been carefully selected to ensure that, if the intervention was deemed effective in supporting and enhancing medication adherence, it would be realistically implementable into current pathways of care and deliverable by HCPs in these settings.

Table 24. Presenting the logic model and summary of the proposed intervention components, settings and timings for the final intervention design.

BCT	Determinants BCT targeting	Operationalisation of BCT	Mode of delivery	Dose	Facilitator
Phase 1: Secondary care (HAS-U/Stroke unit/other acute care ward) prior to discharge					
Information about health consequences (part 1)	<p>Knowledge (e.g. understanding about medications)</p> <p>Beliefs about consequences (e.g. concerns about medications)</p>	<p>Film HCP speaking generally about stroke medications.</p> <p>-Why patients need to take them (benefits e.g. reduces risk of stroke)</p> <p>-These are life-long regimens</p> <p>-Types of medications people are typically prescribed (the 'What' e.g. people are often given medications to lower cholesterol and reduce blood pressure)</p>	Verbal (video)	Video (lasting no more than 10 minutes)	HCA/nurse/pharmacist can ask patient to view video
Information about health consequences (part 2)	<p>Knowledge (e.g. understanding about medications)</p> <p>Beliefs about consequences (e.g.</p>	<p>Discussion about specific medicines prescribed to patient, repeating some information covered in the video about:</p> <p>-Medication purpose</p> <p>-Medication rationale</p>	Verbal (Face-to-face)	Conversation length will be contingent on number of patient questions and HCP time	Nurse

BCT	Determinants BCT targeting	Operationalisation of BCT	Mode of delivery	Dose	Facilitator
	concerns about medications)	-Medication side effects (with signposting of what to do if experience side effect and where to go with questions)			
Information about health consequences (part 3)	Knowledge (e.g. understanding about medications) Beliefs about consequences (e.g. concerns about medications)	Brief information about each medication patient is prescribed discussing: -What medication is for -Benefits of the medication -it's a lifelong medication -What the side effects are -Where to go with questions	Written	One page per medication class prescribed	Book given by nurse
Credible Source	Knowledge (e.g. understanding about medications) Beliefs about consequences (e.g. concerns about medications)	Relates to information about health consequences - information will be delivered by a HCP whether it is through video or verbal.	Verbal (Video and face-to-face)	Doses relate to BCT information about health consequences	Nurse

BCT	Determinants BCT targeting	Operationalisation of BCT	Mode of delivery	Dose	Facilitator
Pros and cons	<p>Knowledge (e.g. understanding about medications)</p> <p>Beliefs about consequences (e.g. concerns about medications)</p>	Participant are prompted to think about the pros and cons of being on medications and carry out a reflective exercise weighing the risks and benefits for them	Verbal (video)	Video (lasting no more than 10 minutes)	Reflexive exercise undertaken by patient to prompt question asking
Action planning/ Prompts and cues	Emotions (e.g. anxiety)	<p>When receiving face-to-face information about health consequence, patients will also be asked to develop an action plan by identifying salient prompts/cues at home (that are personal to them) and making a plan to link medicine taking with this.</p> <p>This will be written down in the information pack that patients are given and attached to the patient file.</p>	Verbal (face-to-face)	Conversation length will be contingent on number of patient questions and HCP time	Nurse

BCT	Determinants BCT targeting	Operationalisation of BCT	Mode of delivery	Dose	Facilitator
Self-monitoring behaviour	<p>Knowledge (e.g. understanding about medications)</p> <p>Beliefs about consequences (e.g. concerns about medications)</p> <p>Emotions (e.g. anxiety)</p>	<p>Patients started on a Dosette box to facilitate self-monitoring of behaviour,</p> <p>The Dosette box will be explained to the patient at discharge (how it works, how to use it)</p>	N/A	Presented with Dosette box (less than 5 minutes)	Nurse
Phase 2: Patients home, 7-14 days following discharge					
Action planning/ Habit formation	Emotions (e.g. anxiety)	HCP will ask patient how they find the action plan. Barriers identified will be addressed (e.g. a new plan will be formed with a new prompt to link medicine taking to if original plan does not work in practice). This can be semi-scripted to facilitate consistent delivery	Verbal (phone call)	10 minutes	Nurse

BCT	Determinants BCT targeting	Operationalisation of BCT	Mode of delivery	Dose	Facilitator
Information about health consequences	<p>Knowledge (e.g. understanding about medications)</p> <p>Beliefs about consequences (e.g. concerns about medications)</p>	<p>HCPs will talk through the written information the patient is provided to ensure consistent messages are delivered. This will include:</p> <ul style="list-style-type: none"> -What medication is for -Benefits of the medication -it's a lifelong medication -What the side effects are -Where to go with questions 	Verbal (phone call)	10 minute	Nurse
Self-monitoring of behaviour	<p>Knowledge (e.g. understanding about medications)</p> <p>Beliefs about consequences (e.g. concerns about medications)</p> <p>Emotions (e.g. anxiety)</p>	Ask patient how they are finding the Dostette box for self-monitoring behaviour. Ask if patient has noticed missing any doses over the last 7/14 days	Verbal (phone call)	5 minutes	Nurse

Phase 3: Secondary care (out-patient clinic) 6 week follow up

BCT	Determinants BCT targeting	Operationalisation of BCT	Mode of delivery	Dose	Facilitator
Action planning/ Habit formation	Emotions (e.g. anxiety)	HCP will ask patient how they find the action plan. Barriers identified will be addressed (e.g. a new plan will be formed with a new prompt to link medicine taking to if original plan does not work in practice). This can be semi-scripted to facilitate consistent delivery	Verbal (face-to-face)	(if needed) 5 minutes	Nurse
Information about health consequences	Knowledge (e.g. understanding about medications) Beliefs about consequences (e.g. concerns about medications)	HCPs will talk through the written information the patient is provided to ensure consistent messages are delivered. This will include: -What medication is for -Benefits of the medication -it's a lifelong medication -What the side effects are -Where to go with questions	Verbal (face-to-face)	10 minutes	Nurse
Self-monitoring of behaviour	Knowledge (e.g. understanding about medications)	Ask patient how they are finding the Dosette box for self-monitoring behaviour. Ask if patient has noticed missing any doses	Verbal (face-to-face)	5 minutes	Nurse

BCT	Determinants BCT targeting	Operationalisation of BCT	Mode of delivery	Dose	Facilitator
	Beliefs about consequences (e.g. concerns about medications) Emotions (e.g. anxiety)				

HAS-U- Hyper acute stroke unit; HCP- Healthcare professional; BCT- Behaviour change technique; HCA – Healthcare assistant

7.2.4 Description of the final, refined intervention design

7.2.4.1 Phase 1

This phase will be delivered in secondary care whilst the patient is receiving treatment for stroke in hospital. The most likely timing of delivery of this phase will be close to the point of discharge, as the medication regimen that patients are to be discharged with will have been confirmed.

The following BCTs are intended to be delivered by the nurse on the ward.

This is because the nurse will be present both on the ward at discharge and when the patient attends the six week follow up appointment.

Information about health consequences will be provided in 3 ways:

- 1) Verbal (video)
- 2) Verbal (face-to-face between patient and HCP)
- 3) Written

Firstly, video delivery of this information will be assessed for feasibility. The video will provide information on: medication purpose, medication rationale, medication duration (lifelong), potential side effects and action to take if these are experienced. A summary of different medication types (antihypertensive, anticoagulation, anti-platelet and cholesterol lowering agents) will be covered in the video and patients told that they might not be prescribed all types of medicines. The video will record a clinician (nurse or pharmacist) from the ward describing the information about health consequences of the medications prescribed for stroke risk factor control. Within the video, patients

will also be prompted to engage in a reflective task, considering the pros and cons that they perceive to taking the medications and encouraged to ask questions to a nurse or pharmacist about the pros and cons of the medications.

The video element of this phase is a more challenging component of the intervention to operationalise. Digital technologies such as iPads are still not readily available on most NHS wards in secondary care. Optimally, the video would be viewed through an iPad which would be purchased for the ward. It will be important to explore the likelihood of enacting this, but it may be likely that this is not possible in all settings or within all services. Often, however, on the stroke wards and within rehabilitation inpatient settings, the wards have day rooms that patients can access. It is not uncommon for these day rooms to have televisions. As such, there may be scope for the ward staff to play the video for a group of patients due to be discharged in the next couple of days, via this television in the day room. This would offer the benefit of using resources that are already available on the ward. It could also reduce time spent setting up the video for patients to view, if the video viewing was routinely done once a day, for example, in the day room. However, there could be the potential for this to increase time pressures on staff if it is particularly difficult for patients to access these rooms. Another alternative would be to host the video on a website and utilise technologies such as an iPad again, or smartphone technologies that visitors of patients may have to view and play the video. This would be the least likely option however, as it

would be extremely contingent on patients' receiving frequent visitors who have access to internet enabled smartphones.

Secondly, patients will have the opportunity to have a face-to-face discussion about the content of the video and ask questions. A nurse is one of the HCPs who routinely provides patients with medications and information at discharge. As such, they will deliver this intervention component. The information provided will be the same as the video, but this time tailored to the specific medications the patients is being discharged with. During this discussion patients will be asked to develop an action plan and facilitated to identify salient cues in the daily routines that will help remind them to take their medicines. This process adapted the methods presented by Sniehotta et al., (2006) in a study testing brief planning interventions encouraging cardiac patients to engage in regular physical exercise (Sniehotta, Scholz, & Schwarzer, 2006). Participants will be asked to consider when, where and how they would take their medications, attempting to link it with a daily activity or prompt and formulate an action plan to write down. For participants who are unable to write (due to physical impairment following stroke), the facilitator can support this step by writing the plan for them.

Finally, at this time patients will be provided with a pack, or book, containing written information for the specific medications they are prescribed. The action plan will be written down and added to this pack. The written information will be simplified, one page per type of medicine (antihypertensive, anticoagulant etc.) and will summarise key messages, as well as give information on who to

contact should the patient have any interim questions. There are multiple usual systems in place of where to signpost patients. These systems vary hospital to hospital but typically encompass phone numbers to speak to pharmacists.

Participants taking part in the intervention will be started on a Dosette box, or provided with one to make up each week (contingent on need) in order to help them to self-monitor adherence. The MDT on the stroke ward will assess whether patients receive a Dosette box set up for them from the pharmacist, in instances where they have cognitive impairment or other difficulties that mean they qualify for this routine service under usual care. Otherwise, patients will be given a Dosette box and instructed on how to fill it each week in order to support adherence and help them to self-monitor their adherence.

7.2.4.2 Phase 2

Phase 2 will consist of a follow up phone call between 7-14 days post discharge. This time was chosen as patients are given a two week supply of medicines from the hospital, when discharged, and then need to have a new prescription issued by primary care. As HCPs interviewed in the qualitative study referred to some patients not fully understanding that they had to continue medications beyond the two week time frame, this will provide opportunity for the participant to be reminded to collect a new prescription and continue the medication regimen. This phase of the intervention will be carried

out by the nurse who delivered the first phase of the intervention and will consist of a telephone call to the participant.

At this time, information about health consequences will be delivered again to reinforce the messages delivered in Phase 1. The delivery of this information will be tailored by the nurse eliciting understanding of medications (identifying if patients understand the benefits and risks of taking the medications) and then tailoring information provision appropriately. If patients report not understanding why they are on the medications or questioning why they need to take a medication, for example for cholesterol, when their cholesterol levels are in normal range, the facilitator will focus information delivery around the benefits and rationale of the medications and describe how the medications work to reduce stroke risk factors. If the patient describes concerns about medications such as the side effects, the facilitator will focus the information delivery around the risks of taking the medications, how common these risks are, what to do if side effects are experienced and who to tell if side effects are experienced. The information provided will be structured from the written information that patients were provided when discharged, in order to ensure consistency of the messages given.

In addition, at this time, the action plan identified in the first stage will be discussed, identifying any barriers to carrying out the behaviour as planned, and revising the plan collaboratively if needed. This approach ensures that the action plan developed is suitable for the participant.

7.2.4.3 Phase 3

Phase 3 will take place in the six week follow up appointment in an outpatient clinic in secondary care. This will be delivered by the nurse and will consist of a face-to-face discussion.

Tailored delivery of information about health consequences will be given. This will be carried out in the same way as in Phase 2.

The action plan suitability will be discussed at this time following the same format as Phase 2.

7.3 Discussion

7.3.1 Evaluation of the proposed intervention

The proposed, refined intervention design will first need to be assessed for feasibility, before a fully powered randomised controlled trial (RCT) can be conducted to assess the intervention effectiveness to improve medication adherence. Feasibility studies are important in order to identify any challenges or risks to the conduct of a fully powered trial (RDS, 2017). Feasibility trials can be used to explore a range of challenges relating to: refinement and delivery of the intervention, the setting, conduct, or to ensure the main trial

has the potential to change practice and is acceptable to patients and health care professionals.

For the intervention presented here, a feasibility trial would be used to assess the following:

- 1) Feasibility of recruitment and consent processes
- 2) Estimation of rates of recruitment and retention of participants
- 3) Stroke survivors' adherence to intervention components (using the Doseette box/developing and enacting action plans)
- 4) Treatment fidelity of delivery of the intervention components (especially tailored aspects) by intervention facilitators
- 5) Stroke survivor and HCP perspectives and willingness to be involved
- 6) Feasibility of delivering the intervention components within this setting
- 7) Feasibility of information provision via a video

Evaluation of outcomes of the intervention could also be assessed to establish the time needed to collect and analyse this data. For example, medication adherence could be assessed. Not all patients admitted to hospital with stroke are on medications prior to admission. This would make it challenging to establish a baseline adherence measurement for all participants at Phase 1. Therefore, medication adherence will be measured instead at Phase 2 and Phase 3 during this feasibility study. The feasibility study could assess whether it is realistic to administer a valid, structured measurement tool in this context, in preparation for designing a fully powered

RCT. The Medication Adherence Report Scale (MARS; (Horne, 2004)) encompasses five items relating to taking medication each scored 1-5. The individual item scores are totalled to give an overall adherence score. The wording of the MARS was chosen to reduce social desirability bias by presenting missing doses as normal. The MARS has been used to assess medication adherence for multiple chronic condition and has shown good reliability and validity (e.g. Horne, 2004; O'Carroll et al., 2013). An alternative approach to measurement, as participants in the study will have been provided with a Dosette box to self-monitor their own adherence, would be to ask participants "How do they find using the Dosette box?" (to identify ease of use and perceived utility) and "Have you noticed missing any doses in the past week?" (in order to take a self-report of adherence). It may be identified that this is a more feasible approach to assessment of adherence.

Some of the underlying determinants of behaviour targeted by BCTs in this intervention relate to beliefs about the consequences of taking medications and to understanding of medication. Therefore, the Beliefs about Medicines Questionnaire (BMQ) (Horne et al., 1999) will be employed. This questionnaire has been developed to assess a person's beliefs in general about medications and their specific beliefs about the medications they have been prescribed. The specific subscale of the BMQ (BMQ-specific) could be utilised to ask about a person's beliefs about their stroke medications. The BMQ-specific has two five-item subscales. One subscale represents the beliefs about the necessity of medications (necessity). The other subscale

represents the concerns or beliefs about the risks and negative effects of taking the medications (concerns). These subscales have shown good validity and reliability in samples with long-term conditions such as diabetes and asthma (Horne & Weinman, 1999). The could be delivered during Phase 1 and Phase 3 to see if the baseline beliefs change during the intervention.

Moreover, formation of habits could be assessed during the feasibility study, again at Phases 2 and 3. Habit strength can be measured using the Self-Report Behavioural Automaticity Index (SRBAI), a subscale of the Self-Report Habit Index (SRHI). The SRBAI has been chosen because it is a parsimonious and brief 4-item measure, shown to have construct validity (Gardner, 2015; Gardner, Lally, & Wardle, 2012) as well as internal reliability and convergent validity with the SRHI (Gardner, Abraham, Lally, & de Bruijn, 2012). The measure is brief and as such should be feasible to deliver within pressured time constraints.

In order to facilitate the planning, design and potential implementation of an intervention, the Reach, Efficacy/Effectiveness, Adoption, Implementation, and Maintenance (RE-AIM) framework can be used (Klesges, Estabrooks, Dzewaltowski, Bull, & Glasgow, 2005). This framework encourages consideration of elements that relate to public health impact of interventions.

Reach (i.e. the percentage of the target population that can be included) of the proposed intervention should be high. Although not all patients who suffer stroke are admitted to hospital, a large majority are, including those who have short stays on the ward. As such, this intervention offers the best opportunity to reach as many patients as possible. If the intervention commenced in primary care or in the community, it is likely that the transient nature of such clinics, as well as the spontaneous and reactive nature (i.e. it is difficult to know when a patient will access this service) would mean that reach would be reduced. Patients could of course be invited in for an appointment, but typically appointment making is driven by patient instigation or clinical need.

Efficacy and effectiveness of the intervention are important to consider, but not possible at this stage of intervention development. The intervention would require feasibility testing prior to moving forward to a fully powered trial of its impact on adherence. Often feasibility studies are too small (and thus underpowered) to be able provide definitive evidence of effectiveness or efficacy (RDS, 2017).

Adoption (i.e. the proportion of eligible settings and intervention staff included or excluded by the chosen intervention design) was considered for this intervention. The decision to try to implement the intervention into an existing pathway of care, as well as the use of video technology, written information and telephone follow ups, enable the highest likelihood of adoption. The intention of all these decisions was to limit the impact the delivery of

intervention would have on the process of current routine care, and not to substantially increase the amount of time a clinician needs to spend with a patient. On the contrary, delivery of some of the information via a video, and priming patients to ask questions before consultation with a HCP may in fact save time at the initial information provision prior to discharge (as routine care includes information provision prior to discharge currently).

Implementation, in this framework, refers to the time and financial costs of implementing the intervention, as well as the extent to which intervention components can be delivered as intended. As with efficacy/effectiveness, this element of the framework could not be fully assessed here as the intervention has not yet been delivered. However, it is hoped that the choice of intervention components, the settings and timing of delivery, as well as the conscious decision to mirror a pre-existing pathway of care for intervention delivery will reduce the financial expense and enhance the ability to be successfully implemented into the NHS.

Treatment fidelity (i.e. continued assessment, monitoring, and enhancement of the reliability and infernal validity (Borrelli, 2011)) should also be assessed. This intervention, particularly as it encompasses elements of tailoring, does pose fidelity challenges, and in this instance, would refer to the degree to which a treatment (i.e. the intervention components) are delivered as intended. Treatment fidelity is important because it can facilitate theory testing, can improve retention of participants and monitoring of fidelity can

improve fidelity of implementation (Borrelli, 2011; Johnson-Kozlow et al., 2008). Adhering to the Nation Institute for Health's Behaviour Change Consortium framework of treatment fidelity, five domains of fidelity can be considered: Study Design, Provider Training, Treatment Delivery, Treatment Receipt, and Treatment Enactment. Firstly, fidelity to study design will be considered by having study protocols reviewed by experienced colleagues in the research team. The inclusion of a PPI group, at earlier stages of this intervention development and in future stages will also enhance fidelity. Fidelity to intervention delivery will be monitored by a series of observations during training and by asking intervention facilitator to complete a checklist after each participant contact, reporting the length of contact and the components delivered. It would be challenging to video record or observe delivery of the intervention, as time pressures will mean that Phase 1 and Phase 2 of the intervention will be delivered more spontaneously, when there is sufficient time, as opposed to more predictably by booking an appointment. It could also be challenging to ask nurses to audio record sessions as it would require them to carry additional equipment on the ward. Although the assessment of delivery is important, it may be unjustified to introduce video and audio recording approaches in this context. The fidelity of the training provided to intervention facilitators will be enhanced by attempting to standardise delivery; using the same trainers for all sessions and using standardised training materials (e.g. the same role plays for each training session). Learning styles will be accommodated for by using a mixture of methods in training: talking with slides, group activities and role play. Feedback will be provided to help assessment of skill acquisition. Refresher

training sessions will be offered periodically to those who indicate need or to those who appear to require one (e.g. via assessment of the checklist). Visits will be made to the teams providing the intervention to build relationships and confidence of teams to report any deviations in the delivery of the intervention. It is also important to consider the receipt of the treatment by the participant, that is checking understanding and ability to use the skills or recommendations discussed (e.g. do participants understand why they are making an action plan and can they follow this once at home). To support good treatment receipt, any written materials will be provided in an easy-to-understand language that accounts for varying levels of health literacy. The provision of information in this intervention is going to be repeated in written and different verbal formats. Self-monitoring data is also being collected periodically, checking utility of the Dosette box as a strategy for self-monitoring behaviour, and the two follow-up phases will provide opportunities to check understanding of information provided and assess utility of the action plans. This element of the intervention will also allow for assessment of treatment enactment.

Once again maintenance (referring to sustained effect of the intervention on the targeted population as well as sustained delivery of the intervention beyond the research period) cannot be considered here as the intervention has not yet been delivered. The three main phases of the intervention run from discharge to six weeks later, allowing for a short duration assessment of initial maintenance of adherence. However, as there are national directives

advocating that patients should receive a six month review post stroke (e.g. DH, 2007; London Stroke Strategic Clinical Leadership Group, 2015), there may be scope within current NHS pathways to ensure longer term assessment of maintenance of intervention effect.

7.3.2 Reflections on the intervention development process

This Chapter brings together findings from across the thesis in order to present an evidence-based and theory driven intervention development. Below a series of strengths to the process along with encountered limitations are discussed.

One of the partial limitations arises with the systematic review. Six (6/14) TDF domains in the TDF were not tested by the literature. It is unknown whether these domains were not tested in other unpublished literature, or whether there are inherent measurement and methodological issues that make it harder to assess certain domains. As such, there is a risk that this intervention does not target all potential determinants of medication adherence. However, the review did establish domains more influential to adherence that have since been applied to develop the intervention. Future testing will establish the effect the intervention has on adherence, based on this underlying evidence and theory.

The process of mapping and selecting BCTs thought to best target certain domains of the TDF was largely based on expert consensus. As discussed in Chapter 5, steps have been taken to broaden the evidence base used. Moreover, the application of such methods provided strong foundations for earlier stages of intervention development and elicited the initial 'tool box' of BCTs to be explored for acceptability. Future testing of the intervention will be able to provide more concrete evidence for the utility of this systematic approach to intervention development, and add validity to the expert consensus literature.

In addition, the process of intervention development was not fully prescriptive, which has strengths and limitations. This can present difficulty when operationalising some of the BCTs found to be appropriate for inclusion in the intervention. It can also be difficult to access previous literature to adapt successful methods of operationalisation, as clarity and transparency in reporting can be poor (Hoffmann et al., 2014) and often BCTs are not clearly reported. For example, pros and cons was difficult to operationalise sufficiently to describe in the interviews for the qualitative study (Chapters 6a and 6b). Pros and cons could have been suggested as a self-reflective exercise that the person undertook on their own, or it could have been a written task where a list of pros and cons is produced. This could also then be derived with facilitation from a HCP supporting a person to identify the pros and cons they perceive to taking medication. As such, the question remained quite broad in interview and operationalisation was strongly led by the perceptions of acceptability by the interviewees. This resulted in this

intervention component becoming a reflective task undertaken by the patient in order to empower the participant to ask questions and augment later interactions with HCPs. In spite of this, the lack of systemisation, at certain points of intervention development, allowed for creativity and flexibility of the intervention design and consideration of the context in which the intervention is being delivered in to. This gives the intervention designer scope to consider the intended context of intervention delivery to support plausible implementation. For instance, the inclusion of a video mode of delivery was derived through consideration of time constraints within the NHS. This is a key strength of this process.

To align with intervention reporting checklists, such as TIDieR (Hoffmann et al., 2014), transparent reporting of the operationalising of intervention constructs has been presented here to in order to begin addressing some of the confronted difficulties within this intervention development. This will contribute to the literature base by allowing for clearer evaluation of the intervention components and implementation, better reflection of how the components were operationalised to be delivered in context and will better inform future intervention development.

8 Chapter 8: Thesis Conclusions and Implications of the Findings

8.1 Chapter overview

The overarching aim of this thesis was to develop a theory driven and evidence-based intervention, targeting medication adherence in stroke survivors. This final chapter appraises the extent to which this aim was met along with a discussion of the implications of the thesis research findings. The first part of this chapter will present a summary of the thesis findings in relation to each of the research objectives outlined in Chapter 1. A discussion of the strengths and limitations of this thesis will also take place. The second part of this chapter reflects upon and considers the psychological, theoretical and methodological contributions and implications for medication adherence in stroke survivors. This is followed by a discussion of future research directions and an overall conclusion.

8.2 Summary of the research presented in this Thesis

Objective 1: To identify psychological determinants that influence medication adherence in stroke survivors, establishing the magnitude of this relationship where possible

A systematic review was undertaken (Chapter 4) to identify psychological determinants of medication adherence in stroke survivors. Heterogeneity of the data, including varying measurement methods of medication adherence, collection of data at varying time points and application of different statistical

tests to assess the influence of determinants on adherence meant that meta-analysis could not be conducted. Therefore, pooled effect sizes of the magnitude of the relationship between determinants and medication adherence could not be generated. However, data was analysed in a way that would facilitate meeting this objective, by identifying the most common and most frequently tested determinants that had significant associations with adherence across the included study samples. Identified determinants were mapped into domains of the Theoretical Domains Framework (TDF), described in more detail under the next objective. Domains were considered more influential when: 1) a larger proportion of the tested determinants had significant associations with adherence and, 2) where significant associations were found in a higher proportion of the samples in which at least one determinant from the domain was tested. The findings showed that determinants such as *concerns about medications*, *beliefs about the necessity of medications*, *understanding of medications* and *negative emotions* (such as anxiety) had the strongest influence on medication adherence.

Objective 2: To map these psychological determinants into a theoretical framework (the Theoretical Domains Framework (TDF)) to facilitate systematic and evidence-based selection of intervention components (including behaviour change techniques (BCTs))

The psychological determinants identified in the systematic review (Chapter 4) were mapped into the TDF (Cane et al., 2012). This was to facilitate understanding of medication adherence and to allow for a more holistic overview of the behaviour. The determinants identified to be most influential in

the review mapped into three (of the total 14) domains of the TDF, 'Knowledge', 'Beliefs about consequences' and 'Emotions'.

These domains formed the theoretical underpinning of an intervention development guided by the Behaviour Change Wheel (BCW) (Michie et al., 2014), which facilitated evidence-based and theory driven selection of intervention components (intervention functions, policy categories and BCTs) (Michie et al., 2013). This process is reported in Chapter 5. The resultant initial intervention development identified 11 component BCTs that could be considered further for the intervention design. As many of the previous interventions developed to target medication adherence in stroke survivors have shown limited or no effectiveness, it is hoped that this systemised process, driven by underlying theory to guide targeting of the influences of behaviour will provide better foundations for intervention. To my knowledge, this is the first intervention developed to target medication adherence in stroke survivors that has combined use of the TDF and BCW to underpin the design process and guide evidence-based selection of intervention components.

Objective 3: To explore acceptability of the selected intervention components with key stakeholders

Acceptability of the 11 component BCTs identified in the initial intervention design (Chapter 5), along with potential modes of delivery, intervention settings and intervention facilitators, was explored with stroke survivors and

healthcare professionals (HCPs), reported in Chapters 6a and 6b respectively.

The qualitative semi-structured interview data revealed many similarities both within groups and between groups concerning the perceived acceptability of intervention components and other design features. For instance, strategies already employed by the stroke survivors, or reported to be used by stroke survivors to the HCPs, were amongst the most acceptable BCTs (including use of prompts and cues, self-monitoring behaviour (via a Domette box) and habit formation). Moreover, the most acceptable modes of delivery were forms of verbal and written strategies reported by both stroke survivor and HCP groups. Digital technology, although employed by a very small number of stroke survivors and seen to have potential benefit by HCPs, was on the whole rejected as an acceptable mode of delivery.

In contrast, differences of opinion arose between stroke survivors and HCPs for some intervention components and elements of design. For example, stroke survivors felt there would be benefit to monitoring blood pressure (a form of biofeedback), particularly if this could be self-monitored in the home. On the other hand, HCPs described concerns about encouraging self-monitoring of blood pressure, fearing a patient could become disproportionately concerned about target achievement which itself could generate greater anxiety. Furthermore, whilst HCPs expressed a clear view that the GP was a type of clinician who would not be appropriate to deliver the

intervention due to the time constraints they experience, GPs were the clinician most frequently referred to by stroke survivors as the professional who they would turn to for help and support.

Perceived acceptability by the stakeholders (stroke survivors and HCPs) was viewed to be an important aspect of the intervention design process, as it would facilitate future buy-in from stakeholders and implementation of the intervention in future stages of intervention testing.

Objective 4: To refine intervention design based on perceived acceptability of intervention components

The findings of the qualitative studies (Chapters 6a and 6b) contributed to the refinement of the intervention design (reported in Chapter 7). Of the 11 potential BCTs identified in the initial intervention design (Chapter 5) a resultant seven were perceived to be acceptable by both groups of stakeholders and incorporated into the intervention design. Delivery of the intervention within a National Health Service (NHS) setting was viewed as essential by HCPs and acceptable by stroke survivors, with secondary care pathways offering the most structured and implementable setting for an intervention, supported by realistic facilitators for the intervention.

The intervention design remained theory driven and evidence-based. Checks were undertaken to ensure that focus on BCTs perceived to be more acceptable in the qualitative study, and a decision to not include BCTs

considered to be less acceptable, still resulted in an intervention design that had at least one BCT targeting each of the identified determinants.

8.3 Strengths and limitations of this thesis

The strengths and limitations of each of the studies conducted in this thesis (Chapter 4, 5, 6a, 6b and 7) are discussed within each respective chapter. In this section, the overall strengths and limitations of the thesis are considered.

There are two strengths to this thesis that provide a direct contribution to the field of health psychology and understanding of medication adherence in stroke survivors.

Firstly, the structure of this thesis enhances the contribution this thesis makes to knowledge and the literature base. Chapters 2, 3 and 4 provided foundations for understanding the behaviour of medication adherence in stroke survivors, augmented by application of a theoretical framework (the TDF). The TDF was used to facilitate interpretation of findings from the systematic review in Chapter 4. This was, to my knowledge, the first time that the TDF has been applied to support a more holistic understanding of the influences on medication adherence in stroke survivors, allowing consideration of both reflective and more automatic influences on behaviour. This initial theory based interpretation of findings then became a central aspect to the intervention development that took place in Chapter 5, to derive

intervention components that were selected based on this evidence and theory driven understanding of medication adherence in stroke survivors. Exploration of the acceptability of intervention components was undertaken in the qualitative study presented in Chapters 6a and 6b, which supported a final refinement of the intervention design. The final, refined design was once again considered against the original evidence base and theoretical underpinnings to ensure that components utilised in the final design still targeted the identified influences on medication adherence. Therefore, the application of the TDF, a comprehensive psychological theoretical perspective, was instrumental throughout the thesis.

Secondly, this doctoral thesis has identified three key TDF domains ('Knowledge', 'Beliefs about consequences' and 'Emotions') influential to medication adherence in stroke survivors. Application of the BCW and exploration of acceptability of intervention components has identified seven BCTs (Information about health consequences, credible source, pros and cons, self-monitoring of behaviour, action planning, prompts and cues, habit formation) considered to likely target the underlying determinants of behaviour and be acceptable to implement into the intended context, the NHS. The methods within each study were selected to enhance rigorous and transparent reporting of findings in order to facilitate more certainty of this above mentioned contribution to knowledge. In Chapter 4, the choice was made to apply a systematic review method for identification of the psychological determinants of medication adherence. Supported by the Preferred Reporting items of Systematic Reviews and Meta-Analysis

(PRISMA) (Moher et al., 2009), systematic reviews provide clear and replicable methods. This facilitates rigorous searching of the literature, comprehensive assessment of findings and clear presentation of the strengths and limitations of the collated evidence and data, but also of the review methods itself. Chapter 5 employed the BCW as a guide for intervention development that supports intervention design linked to an underlying evidence base and theory (as advocated by guidance from the Medical Research Council (MRC; Craig et al., 2008)). Again, this facilitates transparent reporting of all decision making, enabling others to follow the process, with a full appreciation of how the final intervention design was derived. Application of the BCT Taxonomy V1 (BCTTV1) (Michie et al., 2013) further enhanced this transparency by using a consistent language to describe the active components of the intervention (the BCTs). Chapters 6a and b employed framework analysis as the method of qualitative analysis. This approach advocates clear documentation of analysis and findings to enhance validation, generalisability and potential reliability. This transparent approach also aids researchers to understand the interpretations of the findings. The decision to employ such systematic and transparent methods of reporting findings adds strength to the thesis. This provides insight into interpretation of findings and clarity to the intervention development, such that the links between the underlying theory and resultant intervention components can be understood and more readily tested.

A number of limitations of this thesis warrant attention. Firstly, generalisability of the findings from the qualitative studies may be limited. For instance, in the

qualitative study, samples of stroke survivors were derived from the South London Stroke Register (SLSR) and samples of HCPs were recruited through academic networks of the thesis author. The SLSR captures an admittedly ethnically diverse sample of stroke survivors, but it is a sample who have all experienced stroke care within south London, as opposed to services beyond this area. In addition, this is a sample of participants who have already taken part in research (by the very act of being on the register) and are more familiar with being contacted about research and potentially taking part in additional research studies. Of the sample researched in this thesis, 15 out of the 16 also reported being adherent to medication, and as such the views of intervention component acceptability may not reflect those who find it more difficult to adhere to medications. HCPs all worked clinically in services in or neighbouring south London. The reflections and perceptions given from these participants may not be generalisable to healthcare services beyond London. Future research should explore acceptability of intervention components with key stakeholders based in a range of locations across the United Kingdom (UK) in order to facilitate the development of an intervention that is likely more generalisable and therefore implementable into a multitude of NHS services across the country. A purposeful inclusion of both adherent and non-adherent stroke survivors would also enhance future research. That being said, there seemed to be considerable variability in the reported healthcare services provided from the HCPs, even within south London. The Sentinel Stroke National Audit Programme (SSNAP) data, reporting on the process of care received by patients with stroke across England, Wales and Northern Ireland supports this finding. Data in the SNNAP rates the quality of care received by

patients on a scale of A (the best standard of care received) to E (the hospitals do not meet high standards of care received by patients). Nationally, the scores varied greatly across England, Wales and Northern Ireland for overall SSNAP level. When comparing services regionally, across London, services still varied on overall SSNAP level, ranging from scores of A-D (RCP, 2017). This disparity of scores were greater when assessing results for individual domains of the SSNAP. For instance, receipt of specialist assessments and whether a patient was seen by clinicians across a multi-disciplinary team (e.g. seen by a nurse, pharmacist, occupational therapist and other specialist teams) reported scores ranging between A-E both nationally and across individual London services (RCP, 2017). An important learning point from this may be to establish, prior to interview, where the HCPs perceive their service to sit within the NHS, i.e. does it reflect a service that is more typically provided throughout the country, or does it incorporate a structure that is more nuanced than other services known to them or that they have worked in.

Secondly, there were a number of decisions made, throughout the course of the thesis, that ultimately rested upon the judgement of the thesis author. These decisions were discussed with other researchers, in an attempt to ensure that the decision making process was robust and well informed. Nevertheless, there were a few decisions for which, upon reflection, different choices could have been made. For example, at the time the initial intervention development was undertaken (reported in Chapter 5), certain BCTs were discounted through evaluation against the Affordability,

Practicality, (Cost-)Effectiveness, Acceptability, Side effects and Equity (APEASE) evaluative criteria. Whilst there was justification for this at that time, evidence gathered from the qualitative interviews and further consideration of the implementation of the intervention might now lead to a consideration of alternatives. To demonstrate, the BCT salience of consequences (5.2) was originally excluded as it was not considered practical and could potentially have unwanted side effects if this strategy was employed to demonstrate the health consequences of non-adherence to medications. However, qualitative interviews identified the potential utility of sharing the positive experiences of adhering to medications in a more salient way than just providing information about health consequences. A stroke survivor and some HCPs referred to patient groups (either specifically for support after stroke or for cardiac-rehabilitation) and the empowerment and benefit these were perceived to have when patients shared their experiences. Salience of consequence (5.2) could therefore be operationalised to provide positive patient experiences of adherence to medications (i.e. the positive consequences of taking medications). Although the provision of groups may still not be very practical to implement into the context of the NHS (with limitations in space and resource), patient stories describing the positive consequences they have found from taking their medications (e.g. “I don’t feel fearful of having another stroke anymore, I understand what my tablets are for and that they reduce my risk of stroke, I just want to get on with my life now”) may be a way of operationalising this BCT in an acceptable, practical and affordable way. Recent literature has provided a degree of support for the use of this BCT in other populations. For example, a Delphi exercise reported

by Vestjens et al. (2015) to assess the most and least promising BCTs to reduce concerns of falling in an elderly population, identified salience of consequences as one of the least promising BCTs to use (Vestjens, Kempen, Crutzen, Kok, & Zijlstra, 2015). In contrast, initial intervention development work, by Fulton and colleagues (2016), to develop an app to increase uptake and attendance to the NHS Stop Smoking Service identified this BCT as having potential utility (Fulton, Brown, Kwah, & Wild, 2016). Cadogan and colleagues (2016) also identified this BCT as potentially useful (as assessed against APEASE criteria) in an intervention targeting appropriate prescribing and dispensing of polypharmacy in primary care (Cadogan, Ryan, & Hughes, 2016). Therefore, although more evidence is needed to show the effectiveness of this BCT in an intervention, there may be scope for this BCT to be acceptably and effectively delivered in the context of medication adherence in stroke.

8.4 Reflections and implications of this thesis

8.4.1 Contributions to knowledge of the psychological determinants of medication adherence in stroke survivors

The systematic review in Chapter 4 identified psychological determinants considered to be more influential to medication adherence. Understanding of medications, beliefs about the necessity of medications, concerns about medications and negative emotions were among some of the more influential determinants. This supports previous literature (e.g. DiMatteo et al., 2000;

Horne et al., 2013; Koenig et al., 2007) and is discussed in detail in the discussion section of Chapter 4.

A focus on the psychological determinants of behaviour could be criticised for being narrow and ignoring other possible determinants of behaviour beyond the psychological, particularly as the TDF was the theoretical framework used to enhance understanding of medication adherence and used to map identified determinants. The TDF is considered to be more holistic than any one theory of health behaviour, and encompasses domains that move beyond rational, deliberative factors to the physical environment and more impulsive influences of behaviour (Hagger, 2016; Hollands et al., 2016). However, a focus on the psychological determinants was considered to be justified here in order to best develop understanding of adherence and to offer most scope for intervention development. Firstly, the review still enabled identification of the more automatic or less conscious influences of behaviour (such as emotions). The TDF was selected to underpin this thesis on the basis that it facilitated consideration of these more impulsive or automatic factors. In addition, psychological determinants of behaviour are perceived to be more amenable to change. Whilst it may be interesting to identify that factors such as age influence adherence, these factors are less amenable to change and provide less scope for intervention. Moreover, some of the likely factors to influence medication adherence, such as those found in a broader review by Al AlShaikh and colleagues (2016), could be difficult to target with intervention, or less important to target under some healthcare systems. For example, cost of medication was found to be associated with reduced medication adherence

in Al Shaikh and colleagues (2016) systematic review (Al AlShaikh et al., 2016). Different determinants have varying degrees of relevance or importance to different healthcare systems. Complex political and economic factors may inhibit the ability to intervene with medication cost. Furthermore, in the UK many of the stroke survivors will be above the age of 60, and eligible for free prescription, reducing the relevance of this determinant in this healthcare setting.

8.4.2 Reflections on the application of theory to this topic

The use of psychological theory provided a systematic method for designing an intervention targeting medication adherence in stroke survivors. To my knowledge, this is the first study to use both the TDF and BCW to underpin an intervention development targeting medication adherence in stroke survivors.

Ogden (2016) has argued that theory variability is necessary for the 'health' of a discipline and that integrated frameworks, such as the TDF, may reduce creativity and are yet to be tested, with proper attempts made to falsify them (Ogden, 2016).

For this thesis, I argue that the TDF and BCW have provided useful tools for intervention development. Whilst it should be acknowledged that the TDF has yet to be tested for the inter-relationships between domains and behaviour, systematic linking of evidence, theory and intervention components enhances

the clarity of reporting and is unlikely to limit the creativity and skill involved. Application of the BCW is not a fully prescriptive process.

Decisions about which intervention functions to consider, which BCTs to include and how this relates to policy were contingent on the opinion of the thesis author, augmented by input from multi-disciplinary researchers and consideration of previous literature. Instead, it could be argued that this process supported multi-disciplinary working to draw on expertise and input from researchers with specialist knowledge of theory, intervention development and healthcare services. Pragmatic decision making about the potential affordability, practicality and acceptability of intervention components rested upon the decisions of skilled, trained researchers who utilised their expertise to derive a final, potentially more implementable intervention design. Finally, the process allowed for a 'tool box' of potential intervention components to be systematically selected. However, the resultant operationalisation of intervention components was contingent on the applied expertise of the intervention designer to weight and balance the current evidence of effective intervention components, perceptions of acceptability from stakeholders and the realities of implementation into the intended context.

In Chapter 3, a notable limitation of the TDF was that there are overlaps in the constructs that load onto TDF domains. This questions whether the TDF functions as a parsimonious theoretical framework, with clearly

operationalised and testable domains. Overlap of constructs within domains influences the likely results of analysis testing the independent contributions of domains to the prediction of behaviour. This construct overlap can lead to collinearity (i.e. the total variance in behaviour explained by the two domains together will be less than the sum of variance explained by each of the two domains). This could result in a reduced ability to identify which determinants were effectively targeted by intervention components.

Certainly, there were instances during the research conducted in this thesis where this presented some difficulty and supported this limitation. For example, when coding determinants into the TDF domains, there were instances where two domains were perceived as appropriate to map the determinant into. In response, careful discussion of the presented definitions of the TDF domains (Cane et al., 2012) had to be employed where discrepancies arose between coders. There was an element of subjective interpretation which made it challenging to always reach agreement easily. At later stages of intervention development however, the systematic process advocated by the BCW was not affected by the lack of discrete boundaries between TDF domains.

There was an instance where a determinant identified in the systematic review could not be mapped into the TDF domain (EQ-5D score). This was, in part, due to the way quality of life was assessed and reported in the primary study included in the systematic review. However, findings such as this also

offer insight into potential revision of the TDF. It may be that the granularity of domains is not sufficient, and currently domains are too broad to incorporate determinants such as this.

8.4.3 A systematic approach to developing a medication adherence intervention for stroke survivors

The intervention is designed so that the links between the intervention components (including BCTs) and the determinants of behaviour are clear. Recently, Ogden (2016) argued that this systematic approach to intervention development can be detrimental. Specifically, it has been suggested that the likelihood of effectively reducing participant variability (e.g. interventions are effective at changing behaviour for some people and not others) is limited by gaps inherent in the translational process of moving from coding a protocol (of BCTs/intervention components) to a resultant behaviour (Ogden, 2016). In contrast, others have noted that these systems (such as the BCTTV1) facilitates ease of interpretation and subsequent implementation of interventions into practice (Johnston, 2016). It was considered important to synthesise evidence and identify what is already known, as there can be no innovation without reproducibility (Johnston, 2016).

The adherence intervention developed will need to undergo feasibility and pilot testing to establish potential effectiveness and implementation. However, there is evidence from other areas of behaviour change that following this process of intervention development has led to the creation of interventions that were feasible and acceptable when put into practice. In research

targeting breast feeding behaviour, the BCW was utilised to underpin the intervention development. Feasibility testing found the intervention to be both feasible and acceptable (Paranjothy et al., 2017). This study employed a non-randomised multi-site before-and-after study design with process evaluation assessing outcomes including: feasibility of recruiting, feasibility of delivering the proposed Motivational Interviewing-based intervention (including assessment of fidelity), acceptability of the study materials and feasibility and acceptability of recruitment methods. In addition, other interventions developed using the BCW, have shown feasibility and acceptability in health behaviours such as safer sex, with some evidence to support intervention effectiveness (Bailey et al., 2016; Free et al., 2016). This will further enhance the literature base to support use of the BCW in intervention design.

As guidance from the MRC (Craig et al., 2008) and NHS England (Strategy Unit - NHS England, 2013) both advocate exploration of intervention acceptability with key stakeholders, qualitative interviews with a range of healthcare professionals (GPs, nurses, pharmacists and a physiotherapist) and stroke survivors was undertaken in this thesis. This enhanced the findings of this research. Particularly, it was interesting to observe the contradictions within groups of stakeholders (e.g. nurses Vs. GP Vs. pharmacist), between groups of stakeholders (i.e. stroke survivors Vs, HCPs) and where the discussed perceptions sat within the current literature base. It was considered important to try to establish a balance of views from those who would potentially receive and deliver the intervention, to ensure development of the most acceptable and therefore more likely feasible and implementable

intervention. One of the most notable findings from applying this method of acceptability testing, was the consistency between HCP and stroke survivor views of the Dosette box as a useful tool for supporting self-monitoring of adherence. This contrasted with the literature which suggests that there was insufficient evidence to support the use of the Dosette box and other multi-compartment compliance aids (RPS, 2013), discussed in more detail in Chapter 6a. Practical storage problems of medications within the box and the potential to de-skill a patient from being able to identify their medications were some of the notable limitations presented in the literature. The ability to compare lived experience from those interviewed in the qualitative study against peer reviewed literature undoubtedly influenced the final intervention design presented here. It is hoped that a final intervention design, more strongly weighted to incorporate stakeholder views (HCPs and stroke survivors) will enhance future buy-in from stakeholders and better implementation of the intervention.

8.4.4 Patient and public involvement and peer review

Following good research practice, patients and the public were involved with this research process, including supporting development of the topic guide used for interviews and to check and establish patient and public interpretations of research findings. The use of patient and public involvement (PPI) is a strength in this thesis, and a valuable experience for the thesis author. Insights into the type of language appropriate to use in the interview schedule were invaluable to enhance the qualitative study in this thesis.

Moreover, agreement from the PPI group members of the interpretation of results from the qualitative study ensured more confidence in the refinement of the final intervention design proposed.

8.4.5 Recommendations for future research

The studies in this thesis have laid foundations to conduct feasibility testing and pilot testing of this intervention. Specifically, the feasibility study will assess:

- Feasibility of recruitment and consent processes (and estimates of recruitment rates/participant retention)
- Stroke survivors' adherence to the intervention components
- Fidelity of delivery of the intervention components by intervention facilitators
- Stroke survivor and HCP perspectives and willingness to be involved
- Feasibility of delivering the intervention components within the NHS
- Feasibility of information provision via video delivery

A more in depth summary of the intended evaluation and treatment fidelity of this intervention can be found in Chapter 7. The feasibility study will be important in order to test the current intervention design and refine it if necessary.

As the intervention has been systematically developed to select intervention components, based on the underlying theory and evidence base, careful

assessment can be undertaken to test if certain BCTs have effect on determinants of behaviour. The feasibility study could employ a prospective study design in order to be able to assess medication adherence over the duration of the study and habit formation. More detailed descriptions of the outcomes that will be measured in the intervention are reported in Chapter 7 but will be briefly outlined below.

Study features recommended for the next stage of intervention development

- Employ a prospective study design to enable assessment a habit formation
- Assess medication adherence through use of the Medication Adherence Report Scale (MARS) and by asking patients whether they have noticed missing any doses (self-monitored with the Dosette box) during Phase 2 (7-14 days post-discharge from a stroke unit) and Phase 3 (six weeks post discharge)
- Assess study participants beliefs about consequences and understanding of medications with the Beliefs about Medicines Questionnaire (BMQ) administered at Phase 1 (prior to discharge from the stroke unit) and at Phase 3 (six weeks post discharge)
- Assess habit strength with the Self-Report Behavioural Automaticity Index (SBARI), at Phase 2 and Phase 3 of the intervention delivery

8.4.5.1 Additional recommendations of future research

Furthermore, as identified above, decisions made at the time of intervention development have not remained static, and some of the BCTs that had previously been ruled out may, in the light of what was learnt from the qualitative study, now have been considered as potential intervention components. Further research might explore acceptability of some of these other BCTs with key stakeholders in order to maximise the number of BCTs that could be considered for intervention design in the future.

One challenge encountered was that certain groups of HCPs were difficult to access through the chosen recruitment strategy and due to substantial pressure of working conditions within the NHS. As this pressure on the NHS will be unlikely to subside, further research should consider recruitment strategies and research methodologies that maximise the likelihood that certain groups of HCPs (such as district nurses in this thesis) are able to participate in research. This was of particular importance here, as district nurses were often referred to by other HCPs as possessing an important role in supporting patient medication adherence, but only one district nurse could be recruited for interview. Several attempts were made to recruit district nurses, but this proved to be a difficult to access group to advertise the study to (with very few academic networks to this team of clinicians) and their perceived time constraints made it challenging to recruit them into the study. Future research might benefit from tailoring recruitment strategies to enhance the likelihood of recruiting district nurses. Stakeholder acceptability and buy-in

is essential to support feasible implementation of interventions and as such it is critical to attempt to explore these views with as many relevant people as possible within the constraints of the research budget and timelines.

8.5 Overall conclusion

This thesis provides initial support for the use of the TDF and BCW to underpin an intervention development to enhance systematic use of evidence base and theory to select intervention components. The next stage of this research will be to begin feasibility testing of the intervention within the intended context. This will be important to assess multiple elements of feasibility such as feasibility in recruitment, acceptability of study materials and fidelity of the intervention delivery from the intervention facilitators.

It is important to consider that not all stroke survivors will want to adhere to their medications, for a multitude of reasons (such as the trade-off between experiencing side effects of medications and the risk of stroke from non-adherence). Moreover, adherence to medications for stroke risk factor control does not provide complete protection against the risk of a further stroke.

Individuals who adhere to their medications can still have a further stroke.

During the course of this doctoral research, media coverage has proliferated over the negative consequences of statin use. Participants in the PPI groups, and even a stroke survivor in interviews who had a background in medicine, remarked on the dangerous influence media can have on perceptions of medications. It should be highlighted that the aim of an adherence

intervention is to offer patients the opportunity for informed adherence (Horne et al., 2005). Therefore, interventions should enhance understanding in order to facilitate patients to make informed decisions about their own health management.

Within some of the interviews with HCPs, and also within informal conversations with HCPs on the frontline of the NHS, it was evident that there is interest to enhance stroke survivors' adherence to medications and a reflection that more can be done. In spite of the ever-growing body of literature considering influential factors and interventions to improve adherence in a range of health conditions, there appear to be few initiatives to enhance medication adherence in usual-care in an NHS setting. One of the central interventions that does seem to be delivered in healthcare, provision of information about health consequences, was consistently criticised by both stroke survivors and HCPs as not being sufficient and often provided at the wrong time, in the wrong manner. This identifies a clear opportunity for change and intervention, and promotes the need for health psychology knowledge and expertise to support enhanced delivery of information and to further develop interventions to target medication adherence in stroke survivors.

Overall, the work presented in this thesis has attempted to gain a better understanding of the influences upon medication adherence in stroke survivors, through application of the TDF, something currently novel in this

field of literature. This work formed the foundations of a novel intervention development, which applied the BCW to support a systematic, evidence-based and theory driven intervention development, facilitating selection of intervention components. Assessment of the acceptability of BCTs with key stakeholders has supported the refinement of an intervention design advocating the provision of information about health consequences, the development of a habit and self-monitoring of behaviour through strategies such as a Dosette box. This doctoral research has now formed solid foundations for future work to test the feasibility of this intervention within the UK's health service.

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Appendices

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Psychological Determinants of Medication Adherence in Stroke Survivors: a Systematic Review of Observational Studies

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Abstract

Background Medications targeting stroke risk factors have shown good efficacy, yet adherence is suboptimal. To improve adherence, its determinants must be understood. To date, no systematic review has mapped identified determinants into the Theoretical Domains Framework (TDF) in order to establish a more complete understanding of medication adherence.

Purpose The aim of this study was to identify psychological determinants that most influence stroke survivors' medication adherence.

Methods In line with the prospectively registered protocol (PROSPERO CRD42015016222), five electronic databases were searched (1953–2015). Hand searches of included full text references were undertaken. Two reviewers conducted screening, data extraction and quality assessment. Determinants were mapped into the TDF.

Results Of 32,825 articles, 12 fulfilled selection criteria ($N = 43,984$ stroke survivors). Tested determinants mapped into 8/14 TDF domains. Studies were too heterogeneous for meta-analysis. Three TDF domains appeared most influential.

Negative emotions ('Emotions' domain) such as anxiety and concerns about medications ('Beliefs about Consequences' domain) were associated with reduced adherence. Increased adherence was associated with better knowledge of medications ('Knowledge' domain) and stronger beliefs about medication necessity ('Beliefs about Consequences' domain). Study quality varied, often lacking information on sample size calculations.

Conclusions This review provides foundations for evidence-based intervention design by establishing psychological determinants most influential in stroke survivors' medication adherence. Six TDF domains do not appear to have been tested, possibly representing gaps in research design. Future research should standardise and clearly report determinant and medication adherence measurement to facilitate meta-analysis. The range of determinants explored should be broadened to enable more complete understanding of stroke survivors' medication adherence.

Keywords Systematic review · Stroke · Medication adherence · Psychological determinants

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Introduction

Stroke is the second leading cause of death in developed countries [1] and can lead to life-altering consequences [2]. Guidelines recommend the use of medication for secondary prevention of stroke [3–5]. These medications target stroke risk factors such as high blood pressure and high serum cholesterol values. The medications prescribed for stroke risk factor control have shown good efficacy in the literature and reductions in the rate of stroke recurrence per annum [6, 7], with cumulative reductions in relative risk by as much as 75%

[8]. Nonetheless, adherence rates to stroke prevention medications remain suboptimal [e.g. 9, 10].

For the purpose of this review, medication adherence is defined as “the extent to which the patient's action matches the agreed recommendations” [10]. Among individuals with long-term conditions, 33–50% of patients were non-adherent to long-term medications [10]. Among stroke survivors, a recent systematic review reported a pooled prevalent non-adherence rate of 30.9% (95% CI 26.8–35.3%) [11]. A better understanding of the underlying reasons for suboptimal adherence will enable more informed intervention development. Therefore, the aim of this systematic review was to identify psychological determinants that influence medication adherence in stroke survivors.

Current evidence has considered the role of psychological, demographic, system, biological and other factors when trying to understand medication adherence. Determinants, such as beliefs about medication, presence of other comorbid conditions, age and lack of clinical symptoms have been previously identified as influential in stroke survivors' medication adherence [12–15]. The negative consequences of taking medications, including unpleasant side effects and drug interactions, as well as difficulty accessing the prescribing clinician or pharmacy and issues with prescription costs, could also contribute to non-adherence [e.g. 11, 16–18]. Moreover, current interventions have had limited success at effectively improving medication adherence [e.g. 19]. Some determinants of medication adherence, such as age, gender or stroke type [11], are not easily modified. Therefore, a better understanding of the modifiable determinants of medication adherence is required to facilitate the design of behaviour change interventions. Psychological determinants, defined as determinants of, or relating to, the mind or mental processes, also relating to or affecting a person's emotional state [20], are one type of potentially modifiable determinant. Considerable research effort has been made to link psychological determinants to the behaviour change techniques (BCTs) likely to change each one [21, 22]. This could facilitate adherence intervention design. Consequently, the current review focused on identifying the strongest psychological determinants of medication adherence in stroke survivors and considered the quality of the primary studies.

Many theories of the psychological influences on behaviour have been developed (e.g. Theory of Planned Behaviour [23] and Health Belief Model [24, 25]). However, such theories of health behaviour have been subject to a number of criticisms, including not always operationalising the constructs clearly, not considering the context in which a behaviour occurs and an over emphasis on rational, deliberative determinants. As there is considerable unexplained variance in adherence, the addition of further predictor variables should enhance the theories (see [26]). In partial response to the latter two criticisms, the Theoretical Domains Framework (TDF) has been developed [27, 28].

The TDF was developed via an expert consensus approach. Behaviour change professionals identified constructs from many major behaviour change theories. The identified constructs were clustered using open and closed sort tasks, grouping similar constructs together to form, what the authors termed, a domain. After revisions, 14 key domains were established (Knowledge; Skills; Social/Professional role and identity; Beliefs about capabilities; Optimism; Beliefs about consequences; Reinforcement; Intentions; Goals; Memory, Attention and Decision processes; Environmental context and resources; Social influences; Emotions; and Behavioural regulation [28]). The TDF provides more comprehensive coverage of influences on behaviour than any single theory of behaviour and was therefore used as a theoretical framework in this review. A further advantage of the TDF is that the domains can be mapped to BCTs that are thought to be most likely to change each type of determinant [28, 29].

The aim of this systematic review was to identify psychological determinants that influence medication adherence in stroke survivors. The secondary aim was to establish the magnitude of the relationships between the psychological determinants and stroke survivors' medication adherence. To our knowledge, there has not yet been a review, which has mapped identified determinants into the TDF in order to establish a more complete understanding of medication adherence in stroke survivors.

Methods

This review includes studies focused on people with a clinical diagnosis of stroke (ischaemic or haemorrhagic) and prescribed medications that targeted stroke risk factors for secondary prevention. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were followed [30]. The systematic review protocol was prospectively registered on PROSPERO (CRD42015016222).

Search Strategy and Selection Process

The search targeted literature investigating psychological determinants of medication adherence in stroke survivors. A multi-method search was undertaken using combined terms for stroke AND adherence AND psychological determinants and a combination of subject heading and free text searching where applicable (See Supplement 1 for tailored search strategy). Sources included MEDLINE, EMBASE, PsycINFO, CINAHL, Web of Science (inclusive of conference proceedings) and reference lists of included full text articles. The search was limited to English language as this was the only fluent language understood by the review team. The inception date of the search was 1953 because literature

regarding “compliance” in healthcare started to appear from the early 1950s [31]. Eligibility and selection of relevant articles were assessed by first conducting title/abstract review and then by assessing full texts according to predefined inclusion/exclusion criteria. COVIDENCE software was used to manage this process. The selection process, data extraction and quality assessment were performed independently by two reviewers (EC, MF). A third reviewer resolved conflicts and cross-checked data extraction (AJW). Reviewer EC extracted data from all included full texts. Reviewer MF extracted data from a proportion (10%) of the full texts and extracted all subjective and outcome data from the remaining texts (90%). If reviewers required more information, the authors were contacted. Seven of the 19 authors contacted responded. Figure 1 displays the PRISMA diagram of the search and selection process.

Criteria for Study Inclusion and Exclusion

Inclusion criteria:

- Studies with a sample of stroke survivors or mixed transient ischaemic attack (TIA)/stroke survivors

who were ≥ 18 years of age and had been prescribed medication(s) that targeted at least one stroke risk factor

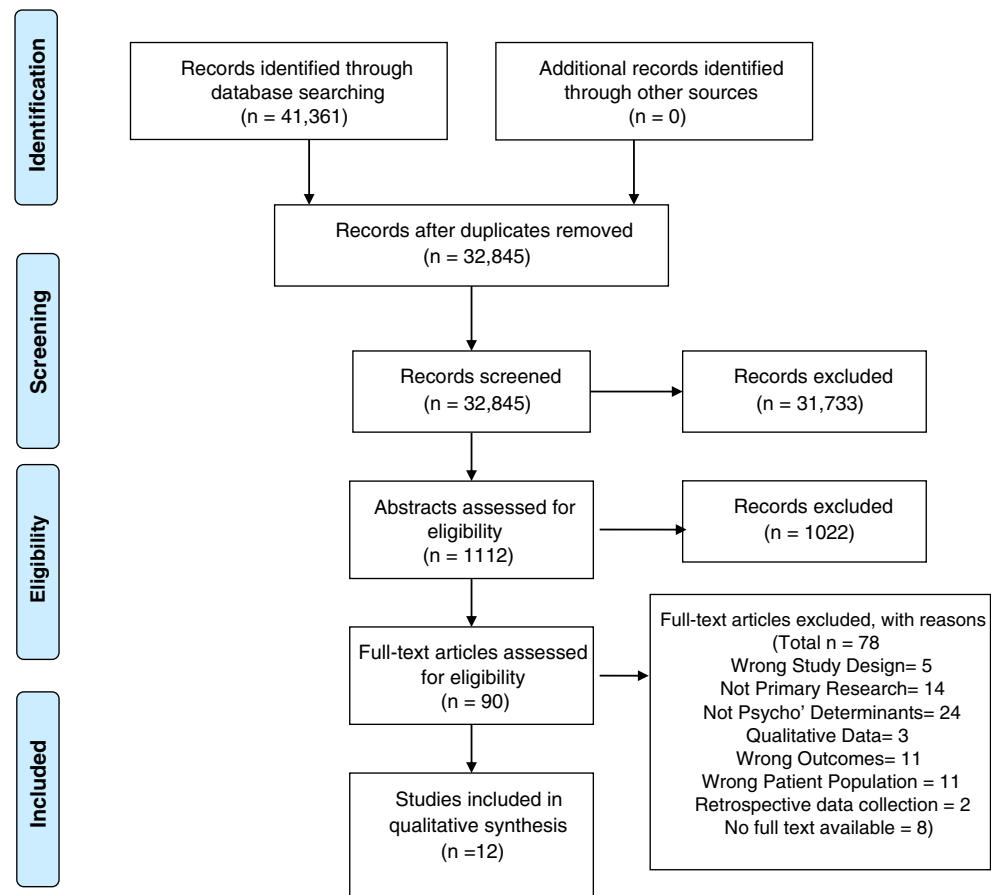
- Primary research studies with quantitative research designs measuring at least one psychological determinant and medication adherence

Exclusion criteria:

- Studies with a sample of stroke survivors <18 years of age
- Mixed condition samples where stroke only data could not be obtained
- Reviews (systematic, narrative or meta-analytic), studies applying retrospective data collection and qualitative study designs

Randomised control trials (RCTs) were not explicitly excluded from the search strategy, but only one RCT identified was relevant to the review research question [32]. The RCT had been informed and was a sequel to an observational study identifying psychological determinants [13]. Therefore, for this review, the inclusion of the observational study design was considered most appropriate.

Fig. 1 PRISMA diagram



Data Extraction and Analysis

Data Extraction

Data extraction was completed using a proforma developed for this review, in accordance with Cochrane guidance [33]. The data extracted included: (1) participant clinical and demographic characteristics, (2) study design and methods, (3) adherence measures, (4) identified psychological determinants and (5) statistical information.

Analysis

Summary data from each full text were extracted. The analysis within this review focused on the effect sizes of the relationship between medication adherence/persistence and the determinants given. Data collection methods from the included papers were too heterogeneous to allow for a meta-analysis. The determinants were grouped into the relevant TDF domains. To identify which domains were most influential to adherence, assessment of the domains with a higher number of tested determinants with significant associations was carried out. The number of papers and samples that a determinant was tested in was also extracted and used to establish domains with the most influence on medication adherence. Domains were considered more influential when a larger proportion of the tested determinants had significant associations with adherence and where significant associations were found in a higher proportion of the samples in which at least one determinant from the domain was tested.

Quality Assessment

Quality assessment was conducted independently by two reviewers (EC, MF) using the 13-item checklist designed by Walburn and colleagues [34] to appraise studies of attitudes to medicines. The checklist assesses items such as a priori aims, definition/size of population under investigation, sample size calculations and justification that the sample is representative of population. The checklist is not intended to provide a defined cutoff study quality score, below which studies should be excluded from analysis. Instead, using the checklist facilitated qualitative consideration of the impact of study design features on findings.

Determinant Mapping

Two coders (EC and SJB), with qualifications in Health Psychology (MSc, PhD and MSc), independently mapped the identified psychological determinants into TDF domains. Domain definitions were taken from the most recent version of the TDF at the time of this review [28]. One coder (MA), a qualified general practitioner with experience in mental health

research, resolved disputes. Determinants were coded into the most suitable domain, or domains if it was agreed that the determinant fitted into more than one, or not coded if none of the domains seemed appropriate. Where possible, the wording of the items used to measure a determinant was checked to ensure domains were coded in line with what was measured, rather than simply the label given to a determinant by the study authors. Cohen's kappa for agreement between the two coders [35] was $k = 0.69$ (SE = 0.07 [95% CI = 0.56–0.82]), indicating substantial agreement.

Results

A search from inception until November 2015 produced a total of 32,845 articles (duplicates removed). Titles and abstracts were screened, producing 90 full texts to assess. Following assessment of full texts, 12 papers reporting on seven samples met inclusion criteria (Fig. 1).

Study Characteristics

Detailed study characteristics can be found in Table 1. The 12 papers were derived from seven samples, with another two of the papers posing a potential for overlap. Therefore, results will now be considered by displaying the number of papers ($x/12$) and number of samples ($x/7$), relevant to each factor. Most studies (9/12, 5/7) assessed medication adherence. Three of the twelve studies (2/7 samples) assessed medication persistence [40, 43, 44]. The total sample size was 43,984 (range 25 to 21,077). Research was conducted in four countries (USA, Australia, Sweden and UK) across three continents. Settings for participant recruitment included hospital (5/12, 4/7) [39–41, 43, 44], community (6/12, 2/7) [36–38, 42, 45, 46] and an outpatient setting (1/12, 1/7) [13]. The reported stroke subtypes included ischaemic (6/12, 5/7) [13, 39–41, 43, 44], haemorrhagic (3/12, 3/7) [39, 40, 42] and TIA (6/12, 2/7) [37, 38, 43–46], with the majority of papers reporting samples with mixed subtypes (75%). In seven papers (3/7 samples), the stroke subtype was either undefined or only some of the sample's stroke subtypes were defined.

Time periods between measurement of determinants and adherence varied, with 6/12 papers, 2/7 samples using cross-sectional designs [36–38, 41, 45, 46] and follow-up time frames for prospective studies of 5–6 weeks (1/12, 1/7) [13], 3 months (2/12, 2/7) [42, 43], 12 months (2/12, 2/7) [39, 44] and 24 months (1/12, 1/7) [40]. A range of questionnaire items (validated and non-validated) was used to measure psychological determinants. Some papers did not clearly describe how determinants were measured.

Table 1 Summary of each included full text article

Author/country	Design	Participants	Number	Medication adherence measure	Psychological determinants	Psychological determinant measure	Key findings [95% CI]	P values	% of max quality score ^a
Sample 1 Bushnell (2010) / USA [43]	Prospective	Ischaemic stroke (1712) and TIA (465)	2177	Comparison- discharge vs. current medications (measured by modified MMAQ)	Understanding how to refill medications Understanding why medications are being taken EQ-5D score Receiving medication instructions Understanding medication side effects Understanding why medications are being taken	Unclear from paper Unclear from paper EuroQoL-5D The Primary Care Assessment Survey Unclear from paper Unclear from paper	OR 1.64 [1.04–2.58] OR 1.81 [1.19–2.76] OR 2.33 [1.24–4.38] OR 1.43 [1.13–1.81] OR 1.29 [1.02–1.63] OR 1.49 [1.03–2.17]	$P = 0.03$ $P = 0.006$ $P = 0.009$ $P < 0.003$ $P = 0.032$ $P = 0.036$	61.5 61.5
Sample 2 Edmondson (2013) / USA [45]	Cross-sectional	TIA and undefined stroke	535	8 item MMAQ	PTSD symptoms Specific concerns Depressive symptoms Likely PTSD Possible PTSD Depressive symptoms High concerns about medications	PCL-S BMQ (specific) PHQ-8 PCL-S PCL-S PHQ-8 Modified BMQ Specific Concerns (X4 items) Modified BMQ Specific Concerns (X4 items) Necessity	OR 1.02 [1.00–1.05] OR 1.17 [1.10–1.25] OR 1.02 [0.97–1.08] OR 2.69 [1.71–4.23] OR 1.86 [1.27–2.74] OR 1.12 [0.88–1.42] OR 5.09 [2.81–9.24] OR 1.23 [0.79–1.91]	$0.1 > p > 0.05^c$ $p < 0.05^c$ $p > 0.05^c$ $p < 0.05^c$ $p < 0.05^c$ $p > 0.05^c$ $p < 0.001$ $P = 0.36$	90.9 90.9 90.9
Kronish (2012) / USA [36]	Cross-sectional	Undefined stroke	535	8 item MMAQ	Low perceived need of medications Low knowledge of stroke risk factors	NV-Qx1 State 3 most important things would recommend to others to lower stroke risk Adapted Trust in Doctors Scale (x3 items)	OR 1.30 [0.84–2.01]	$P = 0.23$	90.9
Kronish (2013) / USA [46]	Cross-sectional	TIA and undefined stroke	600	8 item MMAQ	Perceive discrimination due to race, ethnicity, education, or income Necessity beliefs Concerns	NV-5 point Likert scale Adapted BMQ Specific Adapted BMQ Specific	OR 1.79 [1.14–2.81] $\beta = 0.25$ [0.07–0.42] $\beta = -0.81$ [-0.96 to -0.66]	$P = 0.01$ $P < 0.01$ $P < 0.001$	72.7
Phillips (2014) / USA [37]	Cross-sectional	TIA (284) and undefined stroke (316)	600	8 item MMAQ	Affective illness items	NV-Q x1 Level of worry about future stroke	$r = -0.27$, $p = 0.001$ $\beta = -0.14$, $R^2 = 0.02$ (F(1, 564) = 12.33)	$P < 0.001$	72.7
Phillips (2015) / USA [38]	Cross-sectional	TIA (284) and undefined stroke (316)	600	8 item MMAQ	Cognitive illness items Affective treatment items	NV-Q x2 How well blood pressure and cholesterol is controlled BMQ Specific Concerns (x3 items)	$r = 0.29$, $p = 0.001$ $\beta = 0.18$, $R^2 = 0.03$ (F(1, 564) = 22.16) $r = -0.40$, $p = 0.001$ $\beta = -0.31$, $R^2 = 0.08$ (F(1, 564) = 56.71)	$P < 0.001$ $P < 0.001$ $P < 0.001$	72.7
Sample 3 Coetsee (2008) / Australia [39]	Prospective	Ischaemic (14) and haemorrhagic (11) stroke	25	Q1 and 2 on TAS Pill Counts	Cognitive treatment items (Partner) Emotional dyscontrol Language skills Memory	BMQ-specific necessity (x3 items) + NV-...How much do you think medicines can help prevent strokes?'' EFQ EFQ EFQ	$r = 0.12$, $p = 0.01$ $\beta = 0.13$, $R^2 = 0.02$ (F(1, 564) = 11.62) $r = -0.66$ $r = -0.44$ $r = -0.54$	$P < 0.01$ $P < 0.001$ $P < 0.001$	84.6

Table 1 (continued)

Author/country	Design	Participants	Number	Medication adherence measure	Psychological determinants	Psychological determinant measure	Key findings [95% CI]	P values	% of max quality score ^a
Sample 4 O'Carroll (2011) /UK [13]	Prospective	Ischaemic stroke	180	Urine samples MARS	Planning and organisation	EFQ	$r = -0.52$	$P < 0.001$	76.9
					Anger	ESDQ	$r = -0.63$	$P < 0.01$	
					Emotional dyscontrol	ESDQ	$r = -0.76$	$P < 0.001$	
					Helplessness	ESDQ	$r = -0.64$	$P < 0.01$	
					Inertia	ESDQ	$r = -0.61$	$P < 0.01$	
					Fatigue	ESDQ	$r = -0.52$	$P < 0.01$	
					Indifference	ESDQ	$r = -0.54$	$P < 0.01$	
					EUPHORIA	ESDQ	$r = -0.51$	$P < 0.01$	
					(Partner) Emotional dyscontrol	ESDQ	$r = -0.51$	$P < 0.001$	
					(Partner) Inertia	ESDQ	$r = -0.51$	$P < 0.01$	
					Anxiety	HADS	$r = -0.74$	$P < 0.001$	
					Specific necessity	BMQ Specific	$r = -0.53$	$P < 0.01$	
					Care received at home	Questions in TAS	$r = 0.53$	$P < 0.01$	
					Specific medication concerns	BMQ Specific	$\beta = -0.254$	$P < 0.01$	
					MMSE score	MMSE	$\beta = 0.000$ NS	$P > 0.05^c$	
Perceived benefit of medication	NV-Adapted Q _s ^d	$\beta = 0.273$	$P < 0.001$						
RMBT score	RMBT	$\beta = 0.167$ NS	$P > 0.05^c$						
Risk perception of further stroke	NV-Visual analogue 0–100 scale	$\beta = -0.044$ NS	$P > 0.05^c$						
Sample 5 Glaser (2010) /Sweden ^b [40]	Prospective	Ischaemic and undefined stroke	21,077	Data Linkage- Riksstroke with the Swedish Prescribed Drug Register	Illness perceptions-acute/chronic timeline	IPQ	$\beta = 0.002$ NS	$P > 0.05^c$	69.2
					Illness perceptions- treatment control	IPQ	$\beta = -0.021$ NS	$P > 0.05^c$	
					Specific necessity	BMQ specific	$\beta = -0.022$ NS	$P > 0.05^c$	
					Desire for medications now	NV-Adapted Q _s ¹	$\beta = -0.140$ NS	$P > 0.05^c$	
					HADS total	HADS	$\beta = 0.064$ NS	$P > 0.05^c$	
					Support of next of kin	Items from the Riksstroke Register	AH: OR 1.13 [1.02–1.25]	$P \leq 0.001$	
							S: NS	$P > 0.05^c$	
							AP: NS	$P > 0.05^c$	
							W: OR 0.98 [0.76–1.26]	$P \leq 0.05$	
							AH: OR 0.86 [0.76–0.98]	$P \leq 0.02$	
							S: OR 0.69 [0.59–0.80]	$P \leq 0.001$	
							AP: OR 0.79 [0.70–0.89]	$P \leq 0.001$	
							W: NS	$P > 0.05^c$	
							AH: OR 0.88 [0.79–0.98]	$P \leq 0.001$	
							S: OR 1.12 [0.98–1.28]	$P < 0.09$	
		AP: OR 0.92 [0.83–1.02]	$P \leq 0.04$						
		W: NS	$P > 0.05^c$						
		AH: NS	$P > 0.05^c$						
		S: NS	$P > 0.05^c$						
		AP: NS	$P > 0.05^c$						
		W: NS	$P > 0.05^c$						
Sample 6 Sjölander (2011) /Sweden ^b [41]	Prospective	Ischaemic stroke (men: 9331; women: 9016)	19,347	Prescription refills	Self-reported depression	Items from the Riksstroke Register	Men: PR 0.96 [0.88–1.05]	$P > 0.05^c$	69.2
					Self-reported bad general health	Items from the Riksstroke Register	Women: PR 1.00 [0.93–1.08]	$P > 0.05^c$	
					Dissatisfied with care	Items from the Riksstroke Register	Men: PR 0.99 [0.90–1.09]	$P > 0.05^c$	
							Women: PR 0.97 [0.89–1.06]	$P > 0.05^c$	
							Men: PR 0.92 [0.74–1.14]	$P > 0.05^c$	
							Women: PR 0.93 [0.75–1.16]	$P > 0.05^c$	
		Men: PR 0.99 [0.89–1.10]	$P > 0.05^c$						

Table 1 (continued)

Author/country	Design	Participants	Number	Medication adherence measure	Psychological determinants	Psychological determinant measure	Key findings [95% CI]	P values	% of max quality score ^a
Sample 7 Sjlander (2013) /Sweden [42]	Cross-sectional	Haemorrhagic (40) and undefined stroke (538)	578	MARS	Specific necessity Specific concerns General overuse General harm General benefit	Items from the Riksstroke Register BMQ BMQ BMQ BMQ BMQ	Women: PR 0.99 [0.90–1.10] OR 0.90 [0.83–0.98] OR 1.12 [1.05–1.21] OR 1.29 [1.14–1.45] OR 1.12 [1.01–1.24] OR 0.77 [0.68–0.87]	$P > 0.05^c$ $P = 0.079$ $P < 0.001$ $P < 0.001$ $P = 0.038$ $P < 0.001$	84.6

NS not significant, *MMAQ* Morisky Medication Adherence Questionnaire, *MARS* Medication Adherence Report Scale, *TAS* Treatment Assessment Schedule, *BMQ* Beliefs About Medicines Questionnaire, *PCL-5* Modified PTSD Checklist-Specific to stroke/mini stroke, *EQ-5D* EuroQoL-5D, *PHQ-8* 8-item Patient Health Questionnaire Depression Scale, *EFQ* Everyday Functioning Questionnaire, *ESDQ* The Emotional and Social Dysfunction Questionnaire, *HADS* The Hospital Anxiety and Depression Scale, *MMSE* The Mini-Mental State Examination, *RMBT* The Rivermead Behavioural Memory Test, *IPQ* The Illness Perception Questionnaire, *NV* non-validated, *AH* anti-hypertensives, *S* statins, *AP* anti-platelets, *W* warfarin

^aPercentage of Maximum quality score (see supplementary Material 3 for full quality scoring table)

^bPotential overlap of samples as same data source was utilised across different dates

^cExact *P* values not reported in original paper;

^dTrewby, P. N., Reddy, A. V., Trewby, C. S., Ashton, V. J., Brennan, G., & Inglis, J. (2002). Are preventive drugs preventive enough? A study of patients' expectation of benefit from preventive drugs. *Clin Med.*, 2(6), 527–533

Measurement of Adherence

A variety of methods were used to measure medication adherence (Supplement 2). These included the use of self-report measures such as the Medication Adherence Report Scale (MARS) and more objective methods such as conducting pill counts and monitoring prescription refills. In total, seven different methods were applied (3 subjective, 4 objective), either alone or in conjunction with another. Six articles (50%, 5/7 samples) named the specific medications being assessed for adherence. Of these, five considered antiplatelet, anti-hypertensive, cholesterol-lowering and anti-coagulant medications [39–41, 43, 44] and one assessed adherence to antiplatelet, anti-hypertensive and cholesterol-lowering medications [13].

Quality Assessment

Study quality was varied (Supplement 3). Checklist scores ranged from 8 to 10 (mean = 9.3) out of a possible 13. All included studies reported explicit a priori aims, a sample definition and size, inclusion/exclusion criteria, a response/dropout rate where applicable and whether the research was independent of routine practice. However, only two studies gave a sample size calculation [13, 42]. In addition, although seven studies stated the response/dropout rate [13, 39–44], which ranged from 56 to 96%, only two provided justification for these rates [13, 39]. There was no clear justification of sample representativeness in four studies [13, 39, 43, 44]. In addition, the majority of included studies had designed questionnaires or interview schedules purposely for the research derived from validated and non-validated measures. Three studies did not make the original questionnaire available or provide sufficient information on how all determinants were measured [13, 43, 44], and four studies did not justify the reliability/validity of the measures used [40, 41, 43, 44].

Determinant Mapping

There were 48 distinct determinants measured across the 12 papers, reporting on seven samples. The most common determinants (6/12 papers, 4/7 samples) were variations of *concerns about medications* and *beliefs about necessity of medications*. Five of 12 articles (4/7 samples) also assessed *depression* as a determinant of medication adherence. Over half the tested determinants were only measured in one study. Table 2 displays the identified determinants from the review mapped into TDF domains. Determinants tested in the papers could be mapped into 8/14 domains. There were no tested determinants that mapped into ‘Social/Professional role and identity’, ‘Optimism’, ‘Reinforcement’, ‘Goals’, ‘Environmental context and resources’ and ‘Behavioural regulation’. One tested determinant, *quality of life* (as measured by increments of 10% in EuroQoL-5D score) could not be

Table 2 Determinants mapped into the theoretical domains framework

Domain	Description ^a	Determinant
Knowledge	<i>An awareness of the existence of something</i>	Receiving medication instructions
		Understanding why medications are being taken
		Understanding medication side effects
		Low knowledge of stroke risk factors
		Understanding how to refill meds
		Self-perceived general health
		Self-reported bad general health
		Planning and organisation
Skills	<i>An ability or proficiency acquired through practice</i>	Language skills
Social/Professional role and identity	<i>A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting</i>	
Beliefs about capabilities	<i>Acceptance of the truth, reality, or validity about an ability, talent, or facility that a person can put to constructive use</i>	Cognitive illness items Helplessness
Optimism	<i>The confidence that things will happen for the best or that desired goals will be attained</i>	
Beliefs about consequences	<i>Acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation</i>	Concerns about medications
		Affective illness items
		Beliefs about necessity
		Perceived benefit of medication
		Cognitive treatment items
		Affective treatment items
		Risk perception of risk of further stroke
		Beliefs about benefit
		Beliefs about overuse
		Beliefs about harm
Reinforcement	<i>Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus</i>	Illness perceptions-acute/-chronic timeline
		Illness perceptions-treatment control
Intentions	<i>A conscious decision to perform a behaviour or a resolve to act in a certain way</i>	Desire for medication now
Goals	<i>Mental representations of outcomes or end states that an individual wants to achieve</i>	
Memory, Attention and Decision processes	<i>The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives</i>	MMSE score RMBT score Patient memory
Environmental context and resources	<i>Any circumstance of a person's situation or environment that discourages or encourages</i>	

Table 2 (continued)

Domain	Description ^a	Determinant
Social influences	<i>the development of skills and abilities, independence, social competence, and adaptive behaviour</i> <i>Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours</i>	Support of next of kin
		Low trust in personal doctor
Emotions	<i>A complex reaction pattern, involving experiential, behavioural, and physiological elements, by which the individual attempts to deal with a personally significant matter or event</i>	Perceived discrimination on account of race, ethnicity, education or income
		Dissatisfied with care
		Dissatisfied with support
		Satisfaction with hospital care/support
		Care received at home
		Inertia
		Inertia (rated by partner)
		Emotional dyscontrol (rated by partner)
		Emotional dyscontrol
		Anger
Behavioural regulation	<i>Anything aimed at managing or changing objectively observed or measured actions</i>	PTSD symptoms (Self-reported)
		Depression/depressive symptoms
		Low mood
		Fatigue
		Indifference
		Euphoria
		Inertia
		Inertia (rated by partner)
		HADS total
		Anxiety
Helplessness		
Affective Illness Items		

PTSD post-traumatic stress disorder, HADS The Hospital Anxiety and Depression Scale, MMSE The Mini-Mental State Examination, RMBT The Rivermead Behavioural Memory Test

^a Definitions as stated in Cane et al. 2012 who utilised the definitions from the American Psychological Associations' Dictionary of Psychology

mapped into the TDF, as no definition seemed appropriate. Only four determinants (*patient reported* and *partner reported inertia*, *patient helplessness* and *affective illness items*) were considered to fit within two separate TDF domains (see Table 2 for determinant mapping). All other determinants sat discretely within one domain. A total of 33 distinct determinants, corresponding to seven TDF domains, significantly influenced adherence/persistence behaviour (Table 3). Each domain will now be discussed in turn (for numerical details of observed associations and *p* values, see Table 1).

'Knowledge'

Seven distinct determinants mapped into this domain. Two determinants did not have a significant effect on adherence

Table 3 Table showing the number of significant determinants (and their negative or positive influence on adherence) within each domain

Domain	Total no. of determinants tested across all papers	No. of determinants significantly associated with better adherence	No. of determinants significantly associated with worse adherence	No. (%) of determinants tested not significantly related to adherence	No. of the 12 papers reporting a test of at least one determinant from this domain	No. of the 7 samples in which at least one determinant from this domain was tested	No. (%) of samples in which determinants were tested and at least one had a significant association with adherence
Knowledge	7	4	1	2 (29%)	5	4	3 (75%)
Skills	2	0	2	0 (0%)	1	1	1 (100%)
Beliefs about capabilities	2	1	1	0 (0%)	2	2	2 (100%)
Beliefs about consequences	12	4	5	3 (25%)	7	4	4 (100%)
Intentions	1	0	0	1 (100%)	1	1	0 (0%)
Memory, attention and decision processes	3	0	1	2 (67%)	2	2	1 (50%)
Social influences	9	2	3	4 (44%)	4	4	3 (75%)
Emotions	15	0	13	2 (13%)	7	4	3 (75%)

(*self-reported bad general health and low knowledge of stroke risk factors*). Five significantly influenced medication adherence/persistence. Generally, greater knowledge was associated with better adherence/persistence. Four significant determinants (*receiving medication instructions, understanding how to refill medications, understanding why medications are being taken and understanding medication side effects*) were all related to adherence in this manner. *Self-perceived general health* also had a significant effect on adherence, with poorer *self-perceived general health* associated with poorer medication persistence.

'Skills'

Two distinct determinants tested (*patient language skills* (reported by a partner) and *patient planning and organisation skills*) mapped to this domain. Both determinants had a significant effect on adherence, with poorer skills associated with worse adherence.

'Beliefs about Capabilities'

Two distinct determinants were tested, both significantly influencing medication adherence. *Patient helplessness* had a negative impact on adherence. Rating oneself as more helpless was related to poorer adherence. *Cognitive illness items*, assessing patients' perceived control over stroke risk factors, had a positive impact, with positive responses indicating higher perceived risk factor control related to better self-reported adherence.

'Beliefs about Consequences'

Twelve distinct determinants were mapped to this domain. Three tested determinants were not found to have a significant effect on medication adherence (*illness perceptions* relating to acute/chronic timelines of a condition, *illness perceptions* referring to treatment control and *perceived risk of further stroke*). Four determinants had a significant positive influence on medication adherence. Greater *perceived necessity of medications* was related to increased adherence (in 2/5 papers). Greater *perceived benefit of medications* (measured in two ways) was related to increased adherence. Higher scores on *cognitive treatment items* (derived from items from the specific necessity subscale of the Beliefs about Medications Questionnaire (BMQ) plus a question regarding how much patients thought their medications could prevent stroke) were related to better self-reported adherence.

Five determinants significantly negatively influenced adherence. When patients had greater *concerns about medications*, *beliefs about medication overuse* and *beliefs about harm from medication* adherence was worse. In addition, worse adherence was related to *affective treatment items*, concerning worries about medications and *affective illness items* concerning worries about stroke.

'Intentions'

One determinant (*desire for medications now*) was tested, but not found to have a significant effect on adherence.

'Memory, Attention and Decision Processes'

Three distinct determinants were tested of which two were not significant (*Mini Mental State Exam (MMSE) score* and *Rivermead Memory Behavioural Test (RMBT) score*). In contrast, *Patient memory* (measured by the Everyday Functioning Questionnaire (EFQ)) significantly influenced medication adherence. Poorer reported memory or memory deficits were related to poorer adherence.

'Social Influences'

Nine distinct determinants were tested and mapped into this domain. Four (*low trust in personal doctor*, *dissatisfaction with care*, *dissatisfaction with support* and *satisfaction with hospital care/support*) did not have a significant effect on medication adherence/persistence. Two determinants had a significant positive influence on medication adherence/persistence. *Increased support from the next of kin* was related to better persistence with anti-hypertensive and warfarin medications. Moreover, higher levels of *care received at home* were associated with better adherence. In contrast, three determinants negatively influenced adherence. Greater *perceived discrimination due to race, ethnicity, education or income* increased odds of non-adherence. In addition, both *patient-rated* and *partner-rated inertia* influenced adherence negatively. Increasing levels of inertia appeared to relate to increased non-adherence.

'Emotions'

Fifteen distinct determinants were tested. Two determinants (*(self-reported) depression/depressive symptoms* and *Hospital Anxiety and Depression Scale (HADS) total score*) were not significantly associated with medication adherence. Thirteen determinants had a significant negative influence on adherence/persistence. Adherence/persistence was poorer when patients had greater *patient-reported* or *partner-rated emotional dyscontrol* (measured via two different measures); *post-traumatic stress disorder (PTSD) symptoms*; more *anger*; greater *patient-reported* or *partner-rated inertia*; more *fatigue, euphoria, indifference, anxiety, low mood*; and higher perceived *helplessness* or scores on *affective illness items* (concerning worries about stroke).

Discussion

The purpose of this review was to identify psychological determinants that influence medication adherence in stroke survivors. Forty-eight distinct determinants were assessed in 12 articles representing seven samples. The identified determinants were mapped into TDF domains, in order to develop a

theoretical understanding of how these determinants influence medication adherence and to inform future work. Based on this review, the 'Emotions' (at least one significant determinant in 3/4 samples in which they were tested, 86% of tested associations statistically significant), 'Knowledge' (at least one significant determinant in 3/4 samples in which they were tested, 79% of tested associations statistically significant) and 'Beliefs about consequences' domains (at least one significant determinant in 4/4 samples in which they were tested, 75% of associations statistically significant) appear to have the strongest influence on medication adherence. The TDF has enabled a holistic approach to understanding medication adherence that will be important in future intervention development.

Within the Emotions domain, emotional distress such as 'anxiety', 'PTSD' and 'emotional dyscontrol' was found to have an influence on medication adherence. Similar findings have emerged in recent literature, corroborating this finding. For example, Gentil and colleagues (2012) assessed anti-hypertensive medication adherence in community-living older adults, finding that adherence was lower when participants had an anxiety or depressive disorder [47]. In addition, a large American study ($n = 1342$) found a significant association between the presence of mental health conditions (anxiety/depression) and difficulty taking anti-hypertensive medications [17].

Within the 'Knowledge' domain, *understanding why medications were being taken* and *understanding medication side effects* were found to have influence on medication adherence. Previous literature has found to be similar. A prospective cohort study interviewing 130 stroke survivors and 85 caregivers found large gaps in stroke survivor and caregiver knowledge. For example, 52% of patients were unable to name stroke risk factors. This sample also demonstrated suboptimal health behaviours, with 28% of the patients reporting non-adherence [48]. More recently, a qualitative study identifying barriers to medication adherence with stroke survivors, caregivers and general practitioners in the East of England found similar results [49]. Knowledge of stroke and medication was identified as a patient-level barrier to adherence of secondary prevention medication [49].

Within the 'Beliefs about consequences' domain, both *concerns about medication* and *beliefs about the necessity of medication* were the most common determinants with influence. This is commensurate with previous research. In a meta-analytic review assessing the influence of necessity beliefs and concerns on adherence in patients with long-term conditions, higher adherence was related to increased beliefs about necessity of treatment. Likewise, poorer adherence was associated with increased concerns about treatment [50]. Moreover, recent research suggests interventions targeting perceived necessity and concerns about medications increase stroke survivors' medication adherence [32, 51]. Therefore, those beliefs appear to play a causal role in adherence.

Quality of Included Studies

All 12 included studies gave clear descriptions of sample demographics, inclusion/exclusion criteria and sample size. Moreover, although there was disparity in the range of sample sizes (25–21,077), there was a pooled sample of 43,984 stroke survivors. These samples were derived from four countries across three continents. In light of this, it can be assumed, with a certain level of confidence, that the reviews findings are generalizable to stroke survivors from developed, western cultures.

There were no defined cutoffs for quality assessment scores. Nevertheless, assessment of the individual items, for each paper, was important to identify gaps in research quality. Only two papers reported a sample size calculation. This is problematic when meta-analysis is not possible, as the finding that some determinants tested did not significantly influence adherence may be due to small sample sizes and underpowered studies, rather than genuine lack of relationships. Moreover, three studies did not make the original questionnaire available or provide sufficient information on measurement of determinants [13, 43, 44]. As several studies used tailor-made questionnaires, including a mix of non-validated and validated scales, it would be helpful to future systematic reviewers to make the full questionnaires available.

Additionally, there were only seven discrete samples of participants across the 12 papers. Two papers [43, 44] reported on the same sample, followed up at different time points. Five papers [36–38, 45, 46] used the same sample of trial participants' baseline data, with each paper testing different combinations of determinants that might influence medication adherence. We have therefore presented not only the number of determinants tested that were found to be significant but also the proportion of samples in which a type of determinant was both tested and found to be a significant predictor. Given the relatively small number of independent samples included in this review, and the partial coverage of the TDF domains in the included studies, there remains a need for further, well-designed studies of the predictors of medication adherence in stroke survivors.

The secondary aim of this review, to establish the magnitude of the relationships between determinants and behaviour, could not be achieved, as study design choices were too heterogeneous to permit meta-analysis. Measurement of medication adherence was inconsistent across included papers, with different self-report or objective measures chosen, assessing adherence at a number of different time points. This has been identified as an issue in previous research attempting to synthesise data regarding medication adherence [e.g. 19]. All methods of adherence measurement have limitations. Electronic, objective monitoring may be the best currently available option, but nevertheless can be reactive and is costly. Prescription data provides information about medication

possession, but not whether medication was taken, while self-report measures are subject to recall and social desirability biases. The majority of studies in the review used self-report measures. Future research might usefully further explore psychological and other predictors of adherence to stroke secondary preventive medication using objective adherence measurement.

It could be suggested that the varying methods of medication adherence measurement add strength to the findings in this review. For example, the determinant *concerns about medications* was measured across five studies (3/7 samples) [13, 37, 42, 45, 46], with a significant relationship identified between this determinant and medication adherence. Across the five studies, medication adherence was measured by three different self-report and one pill count method. Irrespective of the measurement method, a significant relationship was found, thus strengthening the conclusion that there is a relationship between determinant and behaviour.

Limitations

The number of papers that met final inclusion criteria was small. Authors were contacted ($N = 19$) to request more information or manuscripts relating to data that had previously been presented at conferences or where no full text access could be found, but only seven responded. Other systematic reviewers have reported a similar issue [52].

In spite of the rigorous method applied to determinant mapping, there is still an element of subjectivity in the process. The task relies on interpretation of TDF domain definitions and descriptions of scales provided in the primary studies.

No determinants were mapped into six TDF domains. However, other research has highlighted the importance of some of these domains in sustained behaviour change. For example, Nicholson and colleagues (2014) identified the importance of 'Environmental context and resources' with the engagement of physical activity in stroke survivors [53]. The limited breadth of domains tested through this review may represent a 'file drawer' problem or limitations in the study designs. This may also be in part due to the inclusion of only psychological determinants, which could be less likely to map into some TDF domains. In particular, the search strategy would have retrieved studies that assessed the association of stroke survivors' perceptions of their environmental context and resources with adherence, but not studies simply testing whether the presence or absence of different environmental and contextual features influenced adherence. Factors such as prescription costs and health insurance coverage also need to be considered. However, non-adherence remains an issue even in healthcare systems providing universal healthcare coverage and prescriptions free of charge (e.g. 13). Therefore, understanding psychological determinants of adherence remains an important issue to inform intervention

design. Despite efforts in the search strategy to access a variety of literature, the 12 selected papers were all identified from the peer-reviewed literature; none were found in the ‘grey’ literature, which could result in publication bias. Future work should aim to measure a broader range of psychological determinants that influence medication adherence in stroke survivors to enhance a more holistic understanding of this behaviour.

Conclusions

The findings from this review have identified psychological determinants, amenable to change, that influence medication adherence in stroke survivors. ‘Beliefs about Consequences’, ‘Knowledge’ and ‘Emotions’ were the most influential domains. As the TDF underpins the Behaviour Change Wheel, a framework for intervention development, future work can systematically identify the intervention functions and BCTs that target the determinants within each domain. In doing so, there is a greater chance that medication adherence will be enhanced as the intervention will be grounded in both a theoretical understanding of the behaviour and will be applying evidence into practice. Future research should strive for clarity and transparency to support pooling of data, most specifically focused on consistency of medication adherence measurement and testing of a broad range of determinants using standardised measures.

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Compliance with Ethical Standards

Authors’ Statement of Conflict of Interest and Adherence to Ethical Standards Authors Elise Crayton, Marion Fahey, Mark Ashworth, Sarah Jane Besser, John Weinman and Alison J. Wright declare that they have no conflict of interest. All procedures, including the informed consent process, were conducted in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000.

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Appendix 2
Tailored Search Strategies

CINAHL (EBSCO interface 1953- November 2015)

Step Number	Search Terms
S1	(MH "Cerebral Ischemia+") OR (MH "Stroke+")
S2	(MH "Intracranial Hemorrhage+")
S3	(MH "Stroke Patients")
S4	TI (cva* OR stroke* OR poststroke* OR post-stroke* OR post stroke*) AND AB (cva* OR stroke* OR poststroke* OR post-stroke* OR post stroke*)
S5	TI (cerebrovascular* OR cerebral vascular) AND AB (cerebrovascular* OR cerebral vascular)
S6	TI (cerebral OR cerebellar OR brain* OR vertebrobasilar) AND AB (cerebral OR cerebellar OR brain* OR vertebrobasilar)
S7	TI (infarct* OR ischemi* OR ischaemi* OR thrombo* OR apoplexy OR emboli*) AND AB (infarct* OR ischemi* OR ischaemi* OR thrombo* OR apoplexy OR emboli*)
S8	S6 AND S7
S9	TI (cerebral OR intracerebral OR intracranial OR brain* OR cerebellar OR subarachnoid) AND AB (cerebral OR intracerebral OR intracranial OR brain* OR cerebellar OR subarachnoid)
S10	TI (accident* OR hemorrhag* OR haemorrhag*) AND AB (accident* OR hemorrhag* OR haemorrhag*)
S11	S9 AND S10
S12	S1 OR S2 OR S3 OR S4 OR S5 OR S8 OR S11
S13	(MH "Medication Compliance")
S14	(MH "Treatment Refusal") OR (MH "Patient Compliance+") OR (MH "Patient Dropouts")
S15	TI (adhere* OR nonadhere* OR non-adhere*) AND AB (adhere* OR nonadhere* OR non-adhere*)
S16	TI (complian* OR noncomplian* OR non-complian*) AND AB (complian* OR noncomplian* OR non-complian*)
S17	TI ((refusal OR refuse*) N3 (medicine* OR medication* OR drug* OR prescription* OR tablet* OR pharmaceutical*)) AND AB (

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Step Number	Search Terms
	(refusal OR refuse*) N3 (medicine* OR medication* OR drug* OR prescription* OR tablet* OR pharmaceutical*)
S18	TI ((medicine* OR medication* OR drug* OR prescription* OR tablet* OR pharmaceutical*) N3 (dropout* OR drop-out* OR drop out*)) AND AB ((medicine* OR medication* OR drug* OR prescription* OR tablet* OR pharmaceutical*) N3 (dropout* OR drop-out* OR drop out*))
S19	TI ((medicine* OR medication* OR drug* OR prescription* OR tablet* OR pharmaceutical*) N3 (stop* OR abandon*)) AND AB ((medicine* OR medication* OR drug* OR prescription* OR tablet* OR pharmaceutical*) N3 (stop* OR abandon*))
S20	TI (persist* OR concordan* OR accept* OR co-operat* OR cooperat* OR co operat* OR conform* OR medicine taking) AND AB (persist* OR concordan* OR accept* OR co-operat* OR cooperat* OR co operat* OR conform* OR medicine taking)
S21	S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20
S22	TI (knowledg* OR awareness OR understand* OR information) AND AB (knowledg* OR awareness OR understand* OR information)
S23	TI (skill* OR abilit* OR expertise OR competen* or capabilit* OR response efficacy) AND AB (skill* OR abilit* OR expertise OR competen* or capabilit* OR response efficacy)
S24	TI ((social N (role or identity)) OR (professional N (role or identity OR confidence)) OR identity) AND AB ((social N (role or identity)) OR (professional N (role or identity OR confidence)) OR identity)
S25	TI ((belief* N2 capabilit*) OR self-efficacy OR self-confiden* OR perceived competence OR self-esteem OR empowerment OR perceived behavioral control OR perceived behavioural control OR self-control OR self control OR performance) AND AB ((belief* N2 capabilit*) OR self-efficacy OR self-

Psychological Determinants of Medication Adherence in Stroke Survivors

Step Number	Search Terms
	confiden* OR perceived competence OR self-esteem OR empowerment OR perceived behavioral control OR perceived behavioural control OR self-control OR self control OR performance)
S26	TI (optimis* OR positiv* OR hopefulness OR assurance OR pessimis* OR negativ*) AND AB (optimis* OR positiv* OR hopefulness OR assurance OR pessimis* OR negativ*)
S27	TI ((belief* N2 (consequence* OR cost*)) OR (outcome N (expectations OR expectancies)) OR risk perception* OR perceived benefit* OR anticipated emotion* OR necessity belief* OR concern* OR response cost* OR coping appraisal OR perceived vulnerability OR perceived likelihood) AND AB ((belief* N2 (consequence* OR cost*)) OR (outcome N (expectations OR expectancies)) OR risk perception* OR perceived benefit* OR anticipated emotion* OR necessity belief* OR concern* OR response cost* OR coping appraisal OR perceived vulnerability OR perceived likelihood)
S28	TI (reinforce* OR support OR reward* or incentive* or punish* or consequen*) AND AB (reinforce* OR support OR reward* or incentive* or punish* or consequen*)
S29	TI (intent* OR intend* OR plan* OR motivation OR health motivation OR pre-contemplation OR contemplation OR preparation OR maintain* or behavior termination OR behaviour termination OR confiden* OR temptation OR consciousness raising OR dramatic relief OR self-reevaluation OR environmental reevaluation OR self-liberation OR helping relationships OR counterconditioning OR reinforcement management OR stimulus control OR social lineation) AND AS (intent* OR intend* OR plan* OR motivation OR health motivation OR pre-contemplation OR contemplation OR preparation OR maintain* OR behavior termination OR behaviour termination OR

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Step Number	Search Terms
	confiden* OR temptation OR consciousness raising OR dramatic relief OR self-reevaluation OR environmental reevaluation OR self-liberation OR helping relationships OR counterconditioning OR reinforcement management OR stimulus control OR social lineation)
S30	TI (goal* OR action planning OR target setting) AND AB (goal* OR action planning OR target setting)
S31	TI (memory OR attention OR decision* OR judgement* OR cogniti*) AND AB (memory OR attention OR decision* OR judgement* OR cogniti*)
S32	TI ((environmental N (context OR resource* OR stressor)) OR material resource* OR facilitat* OR barrier* OR salient event* OR opportunit*) AND AB ((environmental N (context OR resource* OR stressor)) OR material resource* OR facilitat* OR barrier* OR salient event* OR opportunit*)
S33	TI ((social OR group OR collective OR shared) N (influence* OR norm* OR pressure* OR conform* OR comparison* OR identity OR conflict* OR support)) OR ((subjective OR descriptive) N3 norms) OR modelling OR observational learning) AND AB ((social OR group OR collective OR shared) N (influence* OR norm* OR pressure* OR conform* OR comparison* OR identity OR conflict* OR support)) OR ((subjective OR descriptive) N3 norms) OR modelling OR observational learning)
S34	TI (emotion* OR feelings OR emotional representation* OR mood OR depress* OR fear OR anxiety OR ((positive OR negative) N affect)) AND AB (emotion* OR feelings OR emotional representation* OR mood OR depress* OR fear OR anxiety OR ((positive OR negative) N affect))
S35	TI (behavioral regulation OR behavioural regulation OR normalisation OR normalization OR self-monitoring OR self monitoring OR self-regulation OR self regulation OR symptom perception OR

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Step Number	Search Terms
	social messages OR illness representation* OR treatment control OR ((approach OR avoidance) N coping)) AND AB (behavioral regulation OR behavioural regulation OR normalisation OR normalization OR self-monitoring OR self monitoring OR self-regulation OR self regulation OR symptom perception OR social messages OR illness representation* OR treatment control OR ((approach OR avoidance) N coping))
S36	TI (patient* N3 (attitude* OR acceptance* OR satisfaction)) AND AB (patient* N3 (attitude* OR acceptance* OR satisfaction))
S37	(MH "Attitude to Health+") OR (MH "Health Beliefs") OR (MH "Health Knowledge")
S38	(MH "Attitude to Illness")
S39	(MH "Patient Satisfaction")
S40	(MH "Social Identity") OR (MH "Self-Efficacy")
S41	(MH "Emotions+")
S42	(MH "Intention")
S43	(MH "Ajzen's Theory of Planned Behavior")
S4	(MH "Ajzen-Fishbein Theory of Reasoned Action")
S45	(MH "Attitude to Risk")
S46	(MH "Self Regulation")
S47	S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28 OR S29 OR S30 OR S31 OR S32 OR S33 OR S34 OR S35 OR S36 OR S37 OR S38 OR S39 OR S40 OR S41 OR S42 OR S43 OR S44 OR S45 OR S46

EMBASE Classic + EMBASE (OVID interface 1953-2015 Week 44)

Step Number	Search Terms
S1	exp cerebrovascular disease/
S2	((cva\$ or stroke\$ or poststroke\$ or post-stroke\$ or post stroke\$) adj6 (people or patient\$ or inpatient\$ or outpatient\$ or adult\$ or survivor\$ or victim\$ or individual\$ or client\$ or population\$ or community or subject\$)).tw.
S3	(cerebrovascular\$ or cerebral vascular).tw
S4	(cerebral or cerebellar or brain\$ or vertebrobasilar).tw.

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Step Number	Search Terms
S5	(infarct\$ or isch?emi\$ or thrombo\$ or apoplexy or emboli\$).tw.
S6	4 and 5
S7	(cerebral or intracerebral or intracranial or brain\$ or cerebellar or subarachnoid).tw.
S8	(accident\$ or h?emorrhag\$).tw.
S9	7 and 8
S10	1 or 2 or 3 or 6 or 9
S11	exp patient compliance/
S12	(adhere\$ or nonadhere\$ or non-adhere\$).tw.
S13	(complian\$ or noncomplian\$ or non-complian\$).tw.
S14	((refusal or refuse\$) adj3 (medicine\$ or medication\$ or drug\$ or prescription\$ or tablet\$ or pharmaceutical\$)).tw.
S15	((medicine\$ or medication\$ or drug\$ or prescription\$ or tablet\$ or pharmaceutical\$) adj3 (dropout\$ or drop-out\$ or drop out\$)).tw.
S16	((medicine\$ or medication\$ or drug\$ or prescription\$ or tablet\$ or pharmaceutical\$) adj3 (stop\$ or abandon\$)).tw.
S17	(persist\$ or concordan\$ or accept\$ or co-operat\$ or cooperat\$ or co operat\$ or conform\$ or medicine taking).tw.
S18	(knowledg\$ or awareness or understand\$ or information).tw.
S19	(skill\$ or abilit\$ or expertise or competen\$ or capabilit\$ or response efficacy).tw.
S20	((social adj (role or identity)) or (professional adj (role or identity or confidence)) or identity).tw.
S21	((belief\$ adj2 capabilit\$) or self-efficacy or self-confiden\$ or perceived competence or self-esteem or empowerment or perceived behavio?ral control or self-control or self control or performance).tw.
S22	(optimis\$ or positiv\$ or hopefulness or assurance or pessimis\$ or negativ\$).tw.
S23	((belief\$ adj2 (consequence\$ or cost\$)) or (outcome adj (expectations or expectancies)) or risk perception\$ or perceived benefit\$ or anticipated emotion\$ or necessity belief\$ or concern\$ or response

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Step Number	Search Terms
	cost\$ or coping appraisal\$ or perceived vulnerability or perceived likelihood).tw.
S24	(reinforce\$ or support\$ or reward\$ or incentiv\$ or punish\$ or consequen\$).tw.
S25	(intent\$ or intend\$ or plan\$ or motivation or health motivation or pre-contemplation or contemplation or preparation or maintain\$ or behaviour termination or confiden\$ or temptation or consciousness raising or dramatic relief or self-reevaluation or environmental reevaluation or self-liberation or helping relationships or counterconditioning or reinforcement management or stimulus control or social lineation).tw.
S26	(goal\$ or action planning or target setting).tw.
S27	(memory or attention or decision\$ or judgement\$ or cogniti\$).tw.
S28	((environmental adj (context\$ or resource\$ or stressor\$)) or material resource\$ or facilitat\$ or barrier\$ or salient event\$ or opportunit\$).tw.
S29	((social or group or collective or shared) adj (Influence\$ or norm\$ or pressure\$ or conform\$ or comparison\$ or identity or conflict or support)) or ((subjective or descriptive) adj norms) or modelling or observational learning).tw.
S30	(emotion\$ or feelings or emotional representation\$ or mood or depress\$ or fear or anxiety or ((positive or negative) adj affect)).tw.
S31	(behavio?ral regulation or normali?ation or self-monitoring or self monitoring or self-regulation or self regulation or symptom perception or social messages or illness representation\$ or treatment control or ((approach or avoidance) adj coping)).tw.
S32	(patient\$ adj3 (attitude\$ or acceptance\$ or satisfaction)).tw.
S33	exp patient satisfaction/
S34	exp patient attitude/
S35	exp social status/
S36	exp self concept/
S37	exp "Theory of Planned Behavior"/

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Step Number	Search Terms
S38	exp "Theory of Reasoned Action"/
S39	exp emotion/
S40	social support/
S41	exp illness behavior/
S42	11 or 12 or 13 or 14 or 15 or 16 or 17
S43	18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41
S44	10 and 42 and 43

Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R) (1953-Week 44 2015)

Step Number	Search Terms
S1	exp Cerebrovascular Disorders/
S2	(cerebrovascular\$ or cerebral vascular).tw.
S3	((cva\$ or stroke\$ or poststroke\$ or post-stroke\$ or post stroke\$) adj6 (people or patient\$ or inpatient\$ or outpatient\$ or adult\$ or survivor\$ or victim\$ or individual\$ or client\$ or population\$ or community or subject\$)).tw.
S4	(cerebral or cerebellar or brain\$ or vertebrobasilar).tw.
S5	(infarct\$ or isch?emi\$ or thrombo\$ or apoplexy or emboli\$).tw.
S6	4 and 5
S7	(cerebral or intracerebral or intracranial or brain\$ or cerebellar or subarachnoid).tw.
S8	(accident\$ or h?emorrhag\$).tw.
S9	7 and 8
S10	1 or 2 or 3 or 6 or 9
S11	exp Patient Compliance/
S12	exp Treatment Refusal/
S13	exp Patient Dropouts/
S14	(complian\$ or noncomplian\$ or non-complian\$).tw.
S15	(adhere\$ or nonadhere\$ or non-adhere\$).tw.
S16	((refusal or refuse\$) adj3 (medicine\$ or medication\$ or drug\$ or prescription\$ or tablet\$ or pharmaceutical\$)).tw.
S17	((medicine\$ or medication\$ or drug\$ or prescription\$ or tablet\$ or pharmaceutical\$)

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Step Number	Search Terms
	adj3 (dropout\$ or drop-out\$ or drop out\$)).tw.
S18	((medicine\$ or medication\$ or drug\$ or prescription\$ or tablet\$ or pharmaceutical\$) adj3 (stop\$ or abandon\$)).tw.
S19	(persist\$ or concordan\$ or accept\$ or co-operat\$ or cooperat\$ or co operat\$ or conform\$ or medicine taking).tw.
S20	11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19
S21	(knowledg\$ or awareness or understand\$ or information).tw.
S22	(skill\$ or abilit\$ or expertise or competen\$ or capabilit\$ or response efficacy).tw.
S23	((social adj (role or identity)) or (professional adj (role or identity or confidence)) or identity).tw.
S24	((belief\$ adj2 capabilit\$) or self-efficacy or self-confiden\$ or perceived competence or self-esteem or empowerment or perceived behavior?ral control or self-control or self control or performance).tw.
S25	(optimis\$ or positiv\$ or hopefulness or assurance or pessimis\$ or negativ\$).tw.
S26	((belief\$ adj2 (consequence\$ or cost\$)) or (outcome adj (expectations or expectancies)) or risk perception\$ or perceived benefit\$ or anticipated emotion\$ or necessity belief\$ or concern\$ or response cost\$ or coping appraisal\$ or perceived vulnerability or perceived likelihood).tw.
S27	(reinforce\$ or support\$ or reward\$ or incentiv\$ or punish\$ or consequen\$).tw.
S28	(Intent\$ or intend\$ or plan\$ or motivation or health motivation or pre-contemplation or contemplation or preparation or maintain\$ or behavior?r termination or confiden\$ or temptation or consciousness raising or dramatic relief or self-reevaluation or environmental reevaluation or self-liberation or helping relationships or counterconditioning or reinforcement management or stimulous control or social lineation).tw.
S29	(goal\$ or action planning or target setting).tw.

Psychological Determinants of Medication Adherence in Stroke Survivors

Step Number	Search Terms
S30	(memory or attention or decision\$ or judgement\$ or cogniti\$).tw.
S31	((environmental adj (context\$ or resource\$ or stressor\$)) or material resource\$ or facilitat\$ or barrier\$ or salient event\$ or opportunit\$).tw.
S32	((social or group or collective or shared) adj (influence\$ or norm\$ or pressure\$ or conform\$ or comparison\$ or identity or conflict or support)) or ((subjective or descriptive) adj norms) or modelling or observational learning).tw.
S33	(emotion\$ or feelings or emotional representation\$ or mood or depress\$ or fear or anxiety or ((positive or negative) adj affect)).tw.
S34	(behavioral regulation or normali?ation or self-monitoring or self monitoring or self-regulation or self regulation or symptom perception or social messages or illness representation\$ or treatment control or ((approach or avoidance) adj coping)).tw.
S35	(patient\$ adj3 (attitude\$ or acceptance\$ or satisfaction)).tw.
S36	exp Patient Satisfaction/
S37	exp Attitude to Health/
S38	exp Social Identification/
S39	exp Self Efficacy/
S40	Intention/
S41	exp Emotions/
S42	Social Support/
S43	21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42
S44	10 and 20 and 43

psycINFO (OVID interface 1953-November week 1 2015)

Step Number	Search Terms
S1	exp Cerebrovascular Accidents/
S2	exp Cerebrovascular Disorders/
S3	((cva\$ or stroke\$ or poststroke\$ or post-stroke\$ or post stroke\$) adj6 (people or patient\$ or inpatient\$ or outpatient\$ or adult\$ or survivor\$ or victim\$ or individual\$

Psychological Determinants of Medication Adherence in Stroke Survivors

Step Number	Search Terms
	or client\$ or population\$ or community or subject\$)).tw.
S4	(cerebrovascular\$ or cerebral vascular).tw.
S5	(cerebral or cerebellar or brain\$ or vertebrobasilar).tw.
S6	(infarct\$ or isch?emi\$ or thrombo\$ or apoplexy or emboli\$).tw.
S7	5 and 6
S8	(cerebral or intracerebral or intracranial or brain\$ or cerebellar or subarachnoid).tw.
S9	(accident\$ or h?emorrhag\$).tw.
S10	8 and 9
S11	1 or 2 or 3 or 4 or 7 or 10
S12	exp Treatment Compliance/
S13	exp Treatment Dropouts/
S14	exp Treatment Refusal/
S15	(complian\$ or noncomplian\$ or non-complian\$).tw.
S16	(adhere\$ or nonadhere\$ or non-adhere\$).tw.
S17	(persist\$ or concordan\$ or accept\$ or co-operat\$ or cooperat\$ or co operat\$ or conform\$ or medicine taking).tw.
S18	12 or 13 or 14 or 15 or 16 or 17
S19	(knowledg\$ or awareness or understand\$ or information).tw.
S20	(skill\$ or abilit\$ or expertise or competen\$ or capabilit\$ or response efficacy).tw.
S21	((social adj (role or identity)) or (professional adj (role or identity or confidence)) or identity).tw.
S22	((belief\$ adj2 capabilit\$) or self-efficacy or self-confiden\$ or perceived competence or self-esteem or empowerment or perceived behavio?ral control or self-control or self control or performance).tw.
S23	(optimis\$ or positiv\$ or hopefulness or assurance or pessimis\$ or negativ\$).tw.
S24	((belief\$ adj2 (consequence\$ or cost\$)) or (outcome adj (expectations or expectancies)) or risk perception\$ or perceived benefit\$ or anticipated emotion\$ or necessity belief\$ or concern\$ or response cost\$ or coping appraisal\$ or perceived vulnerability or perceived likelihood).tw.

Psychological Determinants of Medication Adherence in Stroke Survivors

Step Number	Search Terms
S25	(reinforce\$ or support\$ or reward\$ or incentiv\$ or punish\$ or consequen\$).tw.
S26	(intent\$ or intend\$ or plan\$ or motivation or health motivation or pre-contemplation or contemplation or preparation or maintain\$ or behavior termination or confiden\$ or temptation or consciousness raising or dramatic relief or self-reevaluation or environmental reevaluation or self-liberation or helping relationships or counterconditioning or reinforcement management or stimulus control or social lineation).tw.
S27	(goal\$ or action planning or target setting).tw.
S28	(memory or attention or decision\$ or judgement\$ or cogniti\$).tw.
S29	((environmental adj (context\$ or resource\$ or stressor\$)) or material resource\$ or facilitat\$ or barrier\$ or salient event\$ or opportunit\$).tw.
S30	((social or group or collective or shared) adj (Influence\$ or norm\$ or pressure\$ or conform\$ or comparison\$ or identity or conflict or support)) or ((subjective or descriptive) adj norms) or modelling or observational learning).tw.
S31	(emotion\$ or feelings or emotional representation\$ or mood or depress\$ or fear or anxiety or ((positive or negative) adj affect)).tw.
S32	(behavioral regulation or normali?ation or self-monitoring or self monitoring or self-regulation or self regulation or symptom perception or social messages or illness representation\$ or treatment control or ((approach or avoidance) adj coping)).tw.
S33	(patient\$ adj3 (attitude\$ or acceptance\$ or satisfaction)).tw.
S34	exp Treatment Barriers/
S35	exp Health Knowledge/
S36	exp Client Attitudes/
S37	exp Health Attitudes/
S38	Ability/
S39	exp Social Identity/
S40	exp Self Efficacy/

Psychological Determinants of Medication Adherence in Stroke Survivors

Step Number	Search Terms
S41	Self Control/
S42	Intention/
S43	exp Reasoned Action/ or Planned Behavior/
S44	exp Emotional States/
S45	Risk Perception/
S46	Social Support/
S47	Self Regulation/
S38	Illness Behavior/
S49	exp Observational Learning/
S50	19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49
S51	11 and 18 and 50

WEB OF SCIENCE (1953-November 2015; inclusive of conference proceedings)

Step Number	Search Terms
S1	TS=((cva* or stroke* or poststroke* or post-stroke* or "post stroke*")) AND TS=((NEAR6 people or patient* or inpatient* or outpatient* or adult* or survivor* or victim* or individual* or client* or population* or community or subject*))
S2	TS=((cerebrovascular* or "cerebral vascular"))
S3	TOPIC: ((cerebral or cerebellar or brain* or vertebrobasilar))
S4	TS=((infarct* or ischemi* or ischaemi* or thrombo* or apoplexy or emboli*))
S5	#4 AND #3
S6	TOPIC: ((cerebral or intracerebral or intracranial or brain* or cerebellar or subarachnoid))
S7	TS=((accident* or hemorrhag* or haemorrhag*))
S8	#7 AND #6
S9	#8 OR #5 OR #2 OR #1
S10	TOPIC: ((complan* or noncomplan* or non-complan*))
S11	TS=((adhere* or nonadhere* or non-adhere*))
S12	TS=((persist* or concordan* or accept* or cooperat* or cooperat* or "co operat*" or conform* or "medicine taking"))

Psychological Determinants of Medication Adherence in Stroke Survivors

Step Number	Search Terms
S13	TOPIC: ((refusal or refuse*)) AND TOPIC: ((NEAR3 medicine* or medication* or drug* or prescription* or tablet* or pharmaceutical*))
S14	TS=((medicine* or medication* or drug* or prescription* or tablet* or pharmaceutical*)) AND TS=((NEAR3 dropout* or drop-out* or "drop out*"))
S15	TOPIC: ((medicine* or medication* or drug* or prescription* or tablet* or pharmaceutical*)) AND TOPIC: ((NEAR3 stop* or abandon*))
S16	#15 OR #14 OR #13 OR #12 OR #11 OR #10
S17	TOPIC: ((knowledg* or awareness or understand* or information))
S18	TS=((skill* or abilit* or expertise or competen* or capabilit* or "response efficacy"))
S19	TOPIC: (((Social NEAR (role or identity)) or (professional NEAR (role or identity or confidence)) or identity))
S20	TS=(((belief* NEAR2 capabilit*) or self-efficacy or self-confiden* or "perceived competence" or self-esteem or empowerment or "perceived behavioral control" or "perceived behavioural control" or self-control or "self control" or performance))
S21	TOPIC: ((optimis* or positiv* or hopefulness or assurance or pessimis* or negativ*))
S22	TS=(((belief* NEAR2 (consequence* or cost*)) or "outcome expectations" or "outcome expectancies" or "risk perception*" or "perceived benefit*" or "anticipated emotion*" or "necessity belief*" or concern* or "response cost*" or "coping appraisal*" or "perceived vulnerability" or "perceived likelihood"))
S23	TOPIC: ((reinforce* or support* or reward* or incentiv* or punish* or consequen*))
S24	TS=((Intent* or intend* or plan* or motivation or "health motivation" or pre-contemplation or contemplation or preparation or maintain* or "behavior termination" or "behaviour termination" or confiden* or temptation or "consciousness raising" or "dramatic relief" or self-reevaluation or "environmental reevaluation" or self-liberation or "helping

Psychological Determinants of Medication Adherence in Stroke Survivors

Step Number	Search Terms
	relationships" or counterconditioning or "reinforcement management" or "stimulus control" or "social lineation"))
S25	TS=((goal* or "action planning" or "target setting"))
S26	TOPIC: ((memory or attention or decision* or judgement* or cogniti*))
S27	TS=(((environmental NEAR (context or resource* or stressor*)) or "material resource*" or facilitat* or barrier* or "salient event*" or opportunit*))
S28	TS=(((social or group or collective or shared) NEAR (Influence* or norm* or pressure* or conform* or comparison* or identity or conflict or support) or ((subjective or descriptive) NEAR norms) or modelling or "observational learning"))
S29	TS=((emotion* or feelings or "emotional representation*" or mood or depress* or fear or anxiety or ((positive or negative) NEAR affect)))
S30	TS=(("behavioral regulation" or "behavioural regulation" or normalisation or normalization or self-monitoring or "self monitoring" or self-regualtion or "self regulation" or "symptom perception" or "social messages" or "illness representation*" or "treatment control" or ((approach or avoidance) NEAR coping)))
S31	TOPIC: ((patient*)) AND TOPIC: ((NEAR3 attitude* or acceptance* or satisfaction))
S32	#31 OR #30 OR #29 OR #28 OR #27 OR #26 OR #25 OR #24 OR #23 OR #22 OR #21 OR #20 OR #19 OR #18 OR #17
S33	(#32 AND #16 AND #9)

Appendix 3. Data extraction proforma

Paper Information		
Author		
Date		
Title		
Journal		
Grey/ Peer Reviewed?		
Study Design/ Methodology		
Type of Study Design		
	Cross-section	
	Cohort/ prospective	
	Case-Control???	
Country Study Conducted in		
Setting for Recruitment of Participants		
Data collection time points		
Length of Follow Up (if applicable)		
Clinical/ Demographic Characteristics		
Number of participants		
Age (Mean/ SD/ Range)		
Proportion of male: female		
Social Economic Status		
	Education (list types and n)	
	Occupation (list types and n)	
Marital status (list types and n)		
Living status (list types and n)		
Ethnicity of population (e.g. terms study used and n)		
Type of Stroke		
	Ischaemic (n)	
	TIA (n)	
	Haemorrhage (n)	
	Sub Arachnoid Haemorrhage (n)	
	(listed as) Unidentified (n)	
	Not given (n)	
Time Since Stroke Onset		
Number of Previous Strokes		
Lasting Clinical Effects Following Stroke		
	Disability	

Appendix 3. Data extraction proforma

	Cognitive Impairment	
	Speech impairment (e.g. aphasia)	
Aspects of the Medication Regimen		
	Names	
	How many	
	Frequency/ Time to be Taken	
Co-morbid Conditions Reported (with name)		
Clinical Features to Which Stroke Prevention Therapy is targeted		
	Blood Glucose	
	Cholesterol lowering	
	BP lowering	
	Anti-Platelet/ Anti-Coagulant	
	Not Stated	
Adherence		
Definition (relevant for data analysis)		
Data Collection Method		
	Self-completed Q'nnaire	
	Proxy- completed Q'nnaire	
	Interview	
	Survey	
	Other	
Measurement Method		
Duration measured for/ time intervals when measured		
Proportion of sample adherent/ non-adherent		
Psychometric Properties of Measurement Method (if N/A state whether non-validated, single item measure etc)		
Psychological Determinants		
Definitions		
Data Collection Method		
	Self-completed Q'nnaire	

Appendix 3. Data extraction proforma

	Proxy- completed Q'nnaire	
	Interview	
	Survey	
	Other	
Measurement Method		
Psychometric Properties of Measurement Method (if N/A state whether non-validated, single item measure etc)		
Statistics		
Type of Analysis		
Reported statistic (relationship between the psychological determinant and adherence behaviour)		
	Correlation coefficient (95% confidence interval/ p value)	
	Regression Coefficient (95% confidence interval/ p value)	
	Percentage of variance explained by model (if applicable)	
	Covariates controlled for (what were they?)	
	Events per ratio calculated?	
	Internal/ external validation of the model?	
	Mean belief score (& SD + n) of adherent group Vs. non-adherent group	
	Other reported statistics	

Appendix 4: Topic Guide-Stroke survivors

IRAS: 205714

Medicines
What medicines do you take? Prompts- any pills/tablets, inhalers, sprays...
How long have you been taking those medicines for?
What are the <u>medicines</u> for?
How often are you supposed to take your <u>medicines</u> ? Prompts- Do you have any you take in the evening? How about lunchtime? Are there any you only take when you feel particularly unwell?
How easy is it to know what health problem each medicine is for? Prompts- e.g. their stroke or their diabetes What makes you say that?
Is it easier to think about the medicines you take in terms of what time of day you take them? Prompts- Such as “my morning medicines, lunch time medicines or evening medicines....?”
Do you ever find that you miss any doses? Can you tell me a bit more about that?
Do you ever find that you vary taking your medicines in ways that fit you and your lifestyle? Can you tell me more about that?
Have there been times since you started taking these <u>medicines</u> when you would have liked some extra support to help you take them regularly? Prompts- Can you tell me a bit more about that time? What was happening?
Intervention Components

Appendix 4: Topic Guide-Stroke survivors

IRAS: 205714

Are there any things you do to help you take your medicines regularly?

Prompts-what kinds of things do you do to help you take them regularly?

We have been working with some stroke survivors to develop a programme to support them taking their medicines regularly. I would like to run some ideas past you to see what you think of them.

Capability

Some people said they wanted more information about their medicines.

What do you think of that idea?

What sorts of information do you think would be useful?

Would information on why you are prescribed the medicine be helpful?

Prompt- (what makes you say that?)

Would information on what most people experience when taking the medicine be helpful?

Prompt- (what makes you say that?)

Would information about the possible benefits of the medicines be helpful?

Prompt- (what makes you say that?)

Would information about medicine side effects be helpful?

Prompt- (what makes you say that?)

Would it make a difference to you who the information came from? In what way?

Prompts- What would you think of getting information from...

Charities (e.g. Stroke Association),

GP?

a researcher?

Motivation

Some people told us that having concerns about medicines made them reluctant to take them.

Appendix 4: Topic Guide-Stroke survivors

IRAS: 205714

Would having a chance to discuss these concerns, with someone such as a qualified health professional be useful? Why/why not?

In the future, if you ever wanted support with medicine taking.....

Would it be helpful to make a list of the pros and cons of taking the medicines? Why/Why not?

Are there any things you do to tell/find out/see if your medicines are working?

If you were given a blood pressure monitor to use at home, would that help you to know if the medicines are working? Can you tell me a bit more about that?

Prompt- How did you end up with your blood pressure monitor?

How do you think people could get themselves into the habit of taking their tablets?

Would putting the medicines in an easy to spot place, such as next to tea bags, or by the sink, be a good way to help people to take them at regular times? What makes you say that?

Would it be helpful to make a detailed plan of exactly when and where you'd take each dose of medicine? Why/Why not?

Some of the people we spoke to said that when they felt stressed or depressed, they were less likely to take their medicines regularly.

Is that something that has ever happened for you?

Prompt- can you tell me a bit more about that?

What do you think would help people/you to take medicines more regularly when *they/you* are feeling stressed?

Do you think putting the medicines in an easy to spot place (like next to the tea bags) might help people take them more regularly when feeling stressed?

(IF NOT ALREADY USED) What do you think about being given a pill box to help you take your medicines regularly?

Appendix 4: Topic Guide-Stroke survivors

IRAS: 205714

What do you think would be the best ways to keep track of how often medicines are being taken?

Some people told us they sometimes found it hard to remember if they had taken their medicines on a specific day.

Would having a system to make a note of each time when you take the medicine(s) be helpful?

What makes you say that?

Where would be the best place to make a note?

Prompts- in a diary, marking off on a calendar, using your phone?

If you made a note of what happened leading up to when you took or missed a dose of medicine would this be helpful? Why/Why not?

Opportunity

Do your family or friends ever get involved with supporting you to take your medicine(s)?

(if yes) what do they do?

How do you feel about that?

Prompt- Would it be helpful if they did (more)?

Is there anyone else who helps you with medicine taking?

Or is there anyone (else) you would like to help you?

Prompts- partner, child, sister, brother, friend, GP, nurse, , pharmacist

Intervention Facilitators

If you ever want more support with your medicines, who would you ask?

Is there anyone (else) you would like to ask?

(if no one) If you ever have a question about your medicines what do you do?

Prompts- What about a GP or other doctor?

Prompts- other HCP facilitators: pharmacists, nurses,

Prompt - academic: what about a researcher from a university?

Appendix 4: Topic Guide-Stroke survivors

IRAS: 205714

Prompts – social - family members, carers, friends,
Setting
Where would be the most convenient place to get support with taking <u>medicines</u> if you needed it? Why? Prompts- what would you think of getting support at: ... home, GP surgery, pharmacy, university site Prompts- is travel a factor, do you feel more comfortable there, more credible? Privacy?
Modes of Delivery
We were wondering if face-to-face support would be helpful. What are your thoughts? What are your thoughts on receiving support over the phone? Do you have an email account that you access on a weekly basis? What would you think of providing a medicine taking support programme through Emails?- What makes you say that? Do you use the internet? (if so) How often? What would you think of a website that helped people to take their medicines more regularly? Do you have a mobile phone that you feel confident to use for text messaging? What would you think of providing this new support programme through text messages?- Could this work for you or others?
Closing Questions
Is there anything else you would like to tell us?

Appendix 5: Mock examples

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

Appendix 5: Mock example

My Plan for taking my medicines regularly

If it is: First thing in the morning

And I am: In the Kitchen

And I: Am making a cup of tea

Then: I will take my tablets

My Stroke Medicines Pros and Cons

It's good to take my medicines because:

- 1.
- 2.
- 3.
- 4.
- 5.

I don't like taking my medicines because:

- 1.
- 2.
- 3.
- 4.
- 5.

Appendix 6: Ethical and R&D Approval

RE: 16/LO/1748 [IRAS 205714]

[REDACTED]

Reply all |

Tue 22/11/2016, 14:11

Crayton, Elise

Ethics-qual

Hi Elise,

Thank you for forwarding on the emails regarding the HRA review and apologies for the delay in getting back to you.

As both the REC and HRA have confirmed that the study does not require HRA review, we have saved these emails on our database and you can begin recruitment for the study.

Please do not hesitate to get in touch if you have any questions.

Many thanks and best wishes,

[REDACTED]

[REDACTED]

R&D Facilitator (non-commercial team)

NIHR GSTFT/KCL Biomedical Research Centre
Research & Development Department
Guy's & St Thomas' NHS Foundation Trust
16th Floor, Tower Wing
Guy's Hospital
Great Maze Pond
London SE1 9RT

[REDACTED]

| W: www.guysandstthomas.nhs.uk/

Guy's and St Thomas' and King's College London working together with our partners to deliver better health through research www.guysandstthomasbrc.nihr.ac.uk



Health Research Authority

London - City & East Research Ethics Committee

Bristol Research Ethics Committee Centre
Whitefriars
Level 3, Block B
Lewins Mead
Bristol
BS1 2NT

Telephone: 02071048033/53

Please note: This is the favourable opinion of the REC only and does not allow you to start your study at NHS sites in England until you receive HRA Approval

28 October 2016

Dr Alison Wright
Lecturer in Health Psychology
King's College London, Department of Primary Care and Public Health Sciences,
Division of Health and Social Care Research, 5th Floor Addison House
Guy's Campus, LONDON SE1 1UL

Dear Dr Wright

Study title: Assessing the Acceptability of a Medication Adherence Intervention for Stroke Survivors
REC reference: 16/LO/1748
IRAS project ID: 205714

Thank you for your letter of 26th October 2016, responding to the Committee's request for further information on the above research and submitting revised documentation.

The further information was considered in correspondence by a Sub-Committee of the REC. A list of the Sub-Committee members is attached.

We plan to publish your research summary wording for the above study on the HRA website, together with your contact details. Publication will be no earlier than three months from the date of this opinion letter. Should you wish to provide a substitute contact point, require further information, or wish to make a request to postpone publication, please contact the REC Manager, [REDACTED] nrescommittee.london-cityandeast@nhs.net.

Confirmation of ethical opinion

On behalf of the Committee, I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form, protocol and supporting documentation as revised, subject to the conditions specified below.

Management permission must be obtained from each host organisation prior to the start of the study at the site concerned.

Management permission should be sought from all NHS organisations involved in the study in accordance with NHS research governance arrangements. Each NHS organisation must confirm through the signing of agreements and/or other documents that it has given permission for the research to proceed (except where explicitly specified otherwise).

Guidance on applying for NHS permission for research is available in the Integrated Research Application System, www.hra.nhs.uk or at <http://www.rdforum.nhs.uk>.

Where a NHS organisation's role in the study is limited to identifying and referring potential participants to research sites ("participant identification centre"), guidance should be sought from the R&D office on the information it requires to give permission for this activity.

For non-NHS sites, site management permission should be obtained in accordance with the procedures of the relevant host organisation.

Sponsors are not required to notify the Committee of management permissions from host organisations

Registration of Clinical Trials

All clinical trials (defined as the first four categories on the IRAS filter page) must be registered on a publically accessible database within 6 weeks of recruitment of the first participant (for medical device studies, within the timeline determined by the current registration and publication trees).

There is no requirement to separately notify the REC but you should do so at the earliest opportunity e.g. when submitting an amendment. We will audit the registration details as part of the annual progress reporting process.

To ensure transparency in research, we strongly recommend that all research is registered but for non-clinical trials this is not currently mandatory.

If a sponsor wishes to contest the need for registration they should contact [REDACTED], the HRA does not, however, expect exceptions to be made. Guidance on where to register is provided within IRAS.

It is the responsibility of the sponsor to ensure that all the conditions are complied with before the start of the study or its initiation at a particular site (as applicable).

Ethical review of research sites

NHS sites

The favourable opinion applies to all NHS sites taking part in the study, subject to management permission being obtained from the NHS/HSC R&D office prior to the start of the study (see "Conditions of the favourable opinion" below).

Approved documents

The final list of documents reviewed and approved by the Committee is as follows:

<i>Document</i>	<i>Version</i>	<i>Date</i>
Evidence of Sponsor insurance or indemnity (non NHS Sponsors only) [KCL Insurance Policy 2016-17]	1	01 August 2016
Interview schedules or topic guides for participants [Healthcare Professional Topic Guide]	1.0	19 July 2016
Interview schedules or topic guides for participants [Patient Topic Guide]	1.0	19 July 2016
Letters of invitation to participant [Healthcare Professional Invitation Letter]	1.1	25 October 2016
Letters of invitation to participant [Patient Invitation Letter]	1.1	25 October 2016
Other [Participants 'Wish to Receive Results' Form]	1.0	19 July 2016
Other [Working Safely at King's_Lone Working Page 9]	1.0	07 September 2016
Other [Lone Working Policy]	1.0	25 October 2016
Other [Ethical Review Response Letter]	1.0	26 October 2016
Participant consent form [Healthcare Professional Consent Form]	1.1	25 October 2016
Participant consent form [Patient Consent Form]	1.1	25 October 2016
Participant information sheet (PIS) [Healthcare Professional Information Sheet]	1.1	25 October 2016
Participant information sheet (PIS) [Patient Information Sheet]	1.1	25 October 2016
REC Application Form [REC_Form_08092016]		08 September 2016
Referee's report or other scientific critique report [Scientific Justification Report]	1	22 June 2016
Research protocol or project proposal [Study Protocol]	1.0	07 September 2016
Summary CV for Chief Investigator (CI) [Alison Wright CV Chief Investigator]	1.0	18 August 2016
Summary CV for student [Elise Crayton CV]	2	17 August 2016
Summary CV for supervisor (student research) [Mark Ashworth CV]	1	22 June 2016

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

After ethical review

Reporting requirements

The attached document “*After ethical review – guidance for researchers*” gives detailed guidance on reporting requirements for studies with a favourable opinion, including:

- Notifying substantial amendments
- Adding new sites and investigators
- Notification of serious breaches of the protocol
- Progress and safety reports
- Notifying the end of the study

The HRA website also provides guidance on these topics, which is updated in the light of changes in reporting requirements or procedures.

User Feedback

The Health Research Authority is continually striving to provide a high quality service to all applicants and sponsors. You are invited to give your view of the service you have received and the application procedure. If you wish to make your views known please use the feedback form available on the HRA website:

<http://www.hra.nhs.uk/about-the-hra/governance/quality-assurance/>

HRA Training

We are pleased to welcome researchers and R&D staff at our training days – see details at <http://www.hra.nhs.uk/hra-training/>

16/LO/1748

Please quote this number on all correspondence

With the Committee’s best wishes for the success of this project.

Yours sincerely

A handwritten signature in black ink, appearing to be 'ML', written over a white background.

Chair

Email: nrescommittee.london-cityandeast@nhs.net

Enclosures:

*List of names and professions of members
who were present at the meeting and those who submitted written
comments
“After ethical review – guidance for
researchers”*

Copy to:



Guy's and St Thomas' NHS Foundation Trust

London - City & East Research Ethics Committee

Attendance at Sub-Committee of the REC meeting in correspondence

Committee Members:

<i>Name</i>	<i>Profession</i>	<i>Present</i>	<i>Notes</i>
[REDACTED]	GP (REC Chairman)	Yes	
[REDACTED]	Senior Clinical Lecturer in Sports and Exercise Medicine	Yes	

Also in attendance:

<i>Name</i>	<i>Position (or reason for attending)</i>
[REDACTED]	REC Manager

Monday, 12 November 2018

Appendix 7: Invitation letter and information sheet for stroke survivors

Dear **[insert participant name]**,

A new medicine taking programme for stroke survivors- What do you think?

My name is Alison Wright and I'd like to invite you to take part in a new research study. The study is funded by a grant from the Division of Health and Social Care Research at King's College London. The research is being organised by a PhD researcher and her supervisory team at King's College London.

We are asking you to take part because:

1. You agreed to be listed in the South London Stroke Register (SLSR)
2. You live in South London
3. You possibly take medicines to help to prevent another stroke.

We have come up with an idea for a new medicine taking programme. Our aim is to find out your views and opinions about this new programme. We want to find out if stroke survivors think the new programme will be practical and relevant, and what effects how likely they are to use it. Therefore, we would like to interview stroke survivors to hear their views.

We're looking for participants who:

- Live in South London
- Are happy to talk about their view and experiences in English

- Have been prescribed at least one medicine for stroke prevention

We are sending you an information sheet with this letter to explain more about why we are doing the project, and what is involved. Please read the sheet and discuss it with others if you wish. We will then call you in a couple of weeks to see if you have any questions and if you are interested in taking part. If you do not want us to follow up via phone you can opt out by either:

- 1) Emailing elise.crayton@kcl.ac.uk
- 2) Phoning **020 7848 8732**. There is an answerphone service on this number. If you would prefer not to speak to us directly, call us outside of office hours (9am-5pm) and leave an answerphone message
- 3) Texting "No Study and your name" to **07785 386 956**

If you decide to take part and you are eligible, a researcher will contact you to find out where and when you would like the interview. This could be over the phone or face-to-face, either in your own home or in a private room at King's College London.

We are happy to give you more information or explain anything that is unclear. You can contact us by phone on 020 7848 6605 or by e-mailing alison.wright@kcl.ac.uk.

Thank you for considering taking part in this study.

Yours sincerely,

Alison Wright

A New Medicine Taking Programme for Stroke Survivors- What Do You Think?

Overview

We would like to invite you to take part in a research study looking for your views/opinions about a new medicine taking programme designed to support stroke survivors.

WHY are we doing this?

- We've got some ideas for a new programme to support people to take their medicines regularly
- We want to see if it will be used by and relevant to stroke survivors.

WHAT would I need to do?

- ✓ Tell us a time and place to interview you
- ✓ Tell us about your experiences of taking medicines
- ✓ Tell us your views on our ideas for this new programme

WHO can get involved?

- Stroke survivors on the South London Stroke Register
- Carers/close relatives

Please read on to find out full study information.

Participant Information Sheet

Assessing the Acceptability of a Medication Adherence Intervention for stroke Survivors

Invitation

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. Do 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.

Please do ask us if there is anything that is not clear. We'll call you in about two weeks (unless you've opted out) to check if you have any questions and if you would like to take part.

Part 1

What is the purpose of this study?

We've come up with some ideas for a new medicine taking programme to support stroke survivors. We want to ask you some questions and find out your views and opinions about these ideas. This will help us to make sure that the programme

is relevant and realistic for stroke survivors and is something you think will work well.

Why have I been invited?

We contacted you because:

- You agreed to be listed in the South London Stroke Register (SLSR)
- You live in South London
- You probably have been prescribed medicines to help prevent another stroke.

Do I have to take part?

It is up to you to decide whether to join the study. If you agree to take part you are free to withdraw at any time, without giving a reason. This would not affect the standard of care you receive.

What will I have to do?

We want to find out your views and opinions about a new medicine taking programme aimed to help stroke survivors. The programme is still in design stages at the moment, so it would be great to talk through some of our ideas with you and see what you think. We will do this by having an interview with you that should last no longer than one hour.

This study will involve:

- Talking to a researcher from King's College London about your experiences of taking medicines

- She will ask about any methods you use/know of that help you take your medicines
- She will ask about your views on possible ways to help people with stroke to take their medicines regularly
- Recording the interview for the purpose of transcribing it

We would like to talk to people who take their medicines regularly and those who may miss doses.

Anything we talk about is completely confidential. We hope that you will feel comfortable to answer the questions as fully as possible. However, do not worry if you do not want to answer some of the questions.

We can either do the interview over the phone (at a time that suits you) or we can have a face-to-face discussion (at your home or in private room at King's College London).

A carer/relative is welcome to join the interview if you would like them to come. The questions in the interview will be directed to you but you carer/relative will be welcome to answer any questions as well if they wish.

What are the possible benefits of taking part?

There may be no benefit however:

- You might find talking about your experiences helpful
- Your views will be invaluable to us to help with designing the programme

- Your answers will make sure we design a programme relevant and meaningful to stroke survivors

Could anything go wrong?

You may find you do not want to answer some questions if they feel a little bit personal. However, you can miss any questions you do not wish to answer or withdraw at any time during the study. Contact details are given later in part 2 of this information sheet if you wish to withdraw after the study has taken place.

Also all data will be anonymous. No names or identifiable information would ever be published or shared.

What if there are any problems?

Any concerns or complaints that you may have about the study will always be addressed. The detailed information on this is given in Part 2.

Will my taking part in this study be kept confidential?

We will handle all information about you confidentially. The details are included in Part 2.

If you are considering participation, please read the additional information in Part 2 before making any decision.

Part 2

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

You may withdraw from this study at any given time, during the interview or afterwards. If you choose to withdraw all documents identifiable to you will be destroyed. There are no consequences to withdrawing from this study.

What if there is a problem?

Complaints

If you have a concern about any aspect of this study, you should ask to speak to the researchers who will do their best to answer your questions. During the study a researcher will be present to answer any questions. If you have questions after you have taken part you can contact the research team

- Alison Wright alison.wright@kcl.ac.uk **020 7848 6605**
- Elise Crayton elise.crayton@kcl.ac.uk **020 7848 8732**

If you remain unhappy and wish to complain formally, you can do this through the Research Ethics Office at King's College London. Details can be obtained from the King's College London website:

<http://www.kcl.ac.uk/innovation/research/support/ethics/contact.aspx>

Harm

In the unlikely event that something does go wrong and you are harmed during the research due to someone's negligence, then you may have grounds for a legal action for compensation against King's

College London, but you may have to pay your legal costs. The normal National Health Service complaints mechanisms will still be available to you (if appropriate).

Will my taking part in this study be kept confidential?

All information collected about you during this study will be kept strictly confidential, and only the research team will have access to this information. After we have typed out and checked a record of what was said, we will delete the recording so you cannot be identified by your voice. When we publish the results of this study, including the use direct quotes from anyone involved in the interview, we will not include your name or any other identifying characteristics.

Involvement of your family doctor (GP)

Your GP will not be contacted about you taking part in this study.

What will happen to the results of the research study?

Results of this study will be written up in a PhD thesis as part of a doctoral research project. Publication of the study is planned to share what we learn. Also, we enlisted support from a stroke patient group who attend meetings to hear about current research. They will be updated on the results of the project. Again no identifiable or confidential personal information would be presented with any results of this study. If you are unhappy to have your results of this study published or shared, please let us know and you will be withdrawn. A summary of the results of this study will be sent to all participants at request. If you would like the results you will be asked to complete a separate form (Receive Results Form) providing your

name and address, so that this information can be stored securely and separately from other study information. The results collected from this study may be used to support future research and could be shared with other researchers. These results would always have no identifiable or confidential personal information presented with them.

Who has reviewed the research study?

All research in the NHS is looked at by independent group of people, called a Research Ethics Committee, to protect your interests. This study has been reviewed and given favourable opinion by the **London - City & East Research Ethics Committee**.

Further information and contact details

If you have any queries or concerns about research in general or questions surrounding this research project and your participation then please consult the King's College London website <http://www.kcl.ac.uk/innovation/research/index.aspx> or contact the Chief Investigator Alison Wright alison.wright@kcl.ac.uk 020 7848 6605 or Elise Crayton elise.crayton@kcl.ac.uk 020 7848 8732, a member of her research team.



Appendix 8: Stroke survivor Consent form

Participant Number:

CONSENT FORM

Title of Project: Assessing the Acceptability of a Medication Adherence Intervention for stroke Survivors

Name of Researcher: Elise Crayton

Please initial box

- 1. I confirm that I have read the information sheet dated 25.10.2016 (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 that the information collected about me will be used to support other research in the future, and may be shared anonymously with other researchers.

- 4. I understand that the interview will be recorded to help the researcher remember what was said and that the recording will be deleted once a checked, written transcript is produced.

- 5. I understand that the results of this study might be published, including the use direct quotes from anyone involved in the interview, but the quotes will not include my name or any other identifying characteristics.

- 6. I understand that, during this research, information disclosed by me that is criminal in nature or any other information that is required to be disclosed by law, will be passed on to the relevant authorities.

- 7. I agree to take part in the above study.

Name of Participant Date Signature

Name of Person Date Signature
taking consent

Appendix 9: Tables of themes from framework analysis

Stroke survivor themes and Sub-themes

Theme	Sub-theme
A patient's social and care networks	Acceptance of patient role in doctor-patient relationship Consequences of social support Expectations of information provider HCPs involving family in patient care Importance of HCP-patient communication and trust Utility of care networks Utility of social support
Delivery of an intervention	HCPs as experts Individualising healthcare Limitations in modes of delivery Limitations of healthcare settings and barriers to access Preferred intervention settings Preferred modes of delivery Timing of support and information provision Who should provide information and support
Enhancing adherence	Current information provided Desired or useful information External influences on adherence Motivation to seek information Patient strategies and perceived enablers of adherence Positive perceptions of BCTs Positive perceptions of the Dosette box/blister pack Suggestions for addressing low mood non-adherence

Theme	Sub-theme
Limitations of intervention	Consequences of too much information Limitations of current information provision Limitations of the Dosette box/blister pack Perceived barriers to adherence Perceived limitations of BCTs
Navigating the healthcare system	A patient driven process Continuity of care Limitations in current healthcare provision Perceived limitations of current prescribing Strengths in current healthcare systems Treatment beyond medication Uncertainty about prescription
Patient management of condition	Difficulty in self management Frequency of medicine dose important Maintaining independence Managing concerns Patients taking charge Preference to not self-monitor risk factors Rationale for self monitoring risk factors Suggestions for self-monitoring
Patient understanding of stroke and medicines	Ability to understand information provided Assumed need or benefit of medication Concerns about medication Consequences of stroke Patient conceptualisation of medicines and regimen

Theme	Sub-theme
	<p data-bbox="810 255 1197 286">Patient trust in treatment</p> <p data-bbox="810 309 1321 340">Perceptions of medication efficacy</p> <p data-bbox="810 362 1197 394">Prior knowledge of stroke</p> <p data-bbox="810 416 1305 483">Understanding of stroke and risk factors</p>

HCP themes and Sub-themes

Theme	Sub-theme
Barriers and limitations in supporting adherence	Limitations of Dosette/blister Limitations of current information provision Limits of feedback for patients Perceived barriers to adherence Uncertainty about BCTs
Delivery of an intervention	Delivery of support Implementing new services Influence of contexts Intervention facilitators Intervention setting Limitations of modes of delivery Limitations of settings Limitations to perceived facilitators Limitations to tailoring-same approach for all Sources of information and support Tailoring support delivered to the patient Timing of service provision Which medicines to target
Enhancing adherence	Making information accessible Managing concerns about medicines Methods to support low mood Perceived benefit of BCT to HCP/carer/ family Perceived enablers to patient adherence Perceived important information to give Positive perceptions of BCTs Providing evidence or feedback Reinforcing the message Scope for change in current HCP

Theme	Sub-theme
	service provision
Influential relationships	Being supportive HCPs involving family members HCPs perceived role Imbalance in doctor-patient relationship Limitations of patients social networks Patient honesty Patient-practitioner communication Patient care networks Patient social networks Utility of patient social network Utility of social network to HCP
Patient self-management of medications	Empowering patients HCP expectations of patient adherence Interventions delivered by service (not usual care) Patient choice Patient seeking own information Patient trust in treatment Patient taking control Patterns of non-adherence Variation in patient motivation
Pressures on the system	Barriers to implementing new services Current service provision Friction between care pathways and service providers Friction between patient wants and HCP duty HCP monitoring adherence Impact of guidelines and legislation Limitations of continuity between care pathways

Theme	Sub-theme
	<p>Limitations in current service provision</p> <p>Limitations of resources</p> <p>Medico-legal pressures</p> <p>Strengths in current service provision</p> <p>Suggestions to improve service provision</p>
<p>Understanding stroke and medications</p>	<p>Consequences to patient not understanding</p> <p>HCP perceptions of stroke severity</p> <p>Patient understanding of risk of non-adherence</p> <p>Perceived patient understanding of medication</p> <p>Perceptions of patient understanding of stroke</p> <p>Variations in patient understanding of medications</p>

Introduction

Medicines

In general, what do you think patients know or understand about their medicines?

Prompts- names of meds, what they are for/what they do, understanding of risks

Based on this, do you think it makes sense to only target one medicine with the intervention, like statins, or to broadly target all stroke medicines the patient is taking?

How confident are you that patients are adherent to their medicines?

How do you know?

When do you think stroke patients tend to start being non-adherent to medicines?

Prompts- quickly, within the first month, tailors off over time, completely varies?

(Based on answer) Do you think this would be the best time to recruit patients to

take part in our intervention?

Would there be other times (moments) that patients might benefit from our intervention? When would these be?

Prompts- immediately post discharge, one year, when the patient requests input?

Intervention Components

HCPs own ideas

What strategies have patients told you about or have you come across that seem to help them to take their medicines regularly?

Prompts- routines, habits, reminders, social support, goals

What sorts of things have you found, or have patients told you about that make it harder for them to adhere to their medication regimen?

Prompts- disruption to routine (going on holiday), family member/carer not coming to help anymore, new information about meds causes concern...

We have been working with some stroke survivors to get their help to develop a programme (intervention) which supports taking medicines. I would like to run

some ideas past you to see if you think they would be potentially helpful or not.

Capability

One thing other people said was that they wanted more information about their medicines. What do you think about this?

What sorts of information do you think would be useful?

Prompts- side effects, benefits of medicines, efficacy of meds

What if the information was tailored?

Where or who do you think the information should come from?

Prompts-Charities (e.g. Stroke Association), GP, Pharmacist, Patients comments....

Motivation

A few of the stroke survivors we informally spoke to said they were less likely to take their medicines when they had concerns about them. What would be a good strategy to address this issue?

Would discussing these concerns, with someone such as a yourself or another HCP

be a good thing? Why/why not?

Prompts- nurses, consultant, pharmacist, GP...

Would it be helpful to discuss the good things about the medicines and why these medicines are prescribed? Why/Why not?

Prompts-What information would be realistic?

The intervention could ask patients to make a list of pros and cons to taking their medicines to see if they could find more reasons to take the medicine than not.

What do you think about this?

Conditions like hypertension are asymptomatic so patients have nothing tangible to tell them whether they have high blood pressure or not. If patients were given a blood pressure monitor and asked to check their blood pressure periodically, this could give them evidence that the medicines are working. What are your thoughts on this?

What other ways could we show patients how their medicines are working, even if

the underlying risk factor or condition is asymptomatic?

Some of the people we spoke to said that when they were feeling stressed they were less likely to take their medicines. What do you think would help people to take their medicines regularly when they were feeling stressed?

Prompts- e.g. use of the systematic routine/habit would override this?

For this intervention we were thinking that the use of a systematic routine might help the patient with adherence- what are your thoughts on this?

Prompts- e.g. put tablets near tea bags so take at same time daily

The intervention could support the development of this routine by asking patients to make specific plans identifying useful prompts in their home or activities in their daily routine that they link with taking their medicines. Could this be helpful?

Some people also told us that it can be hard to remember if they had taken their medicines on a specific day. What are your thoughts on patients making a note of when they take a medicine (for example marking off on a calendar)? Could this be

helpful?

Prompts- in a diary, marking off on a calendar, using your phone?

We could extend this further by asking patients to record what happened leading up to when they took or missed a dose of their medication as this could help to identify patterns in their behaviour. What are your thoughts on this?

Prompts- e.g. the phone rings (miss), have their morning tea (take)....

With some conditions, nurses are now developing care plans with patients to outline how to manage their conditions (such as asthma)-Would this be useful for stroke patients also? Why/Why not?

Opportunity

Do you find that family members get involved with a patient's medicine taking?
-Are they helpful? Why/why not?

Is there anyone else you have heard of that get involved with the stroke survivors medicine taking?

Are they helpful?

Prompts- friends, carers, other HCPs

Is there anyone you think would be good to get involved with patient's medicine taking (that don't currently)? Who are they?

Intervention Facilitators

What do you feel your role is in supporting patients to take their medicines?

Who else might have a role in supporting patients to take their medicines?

Prompts- other facilitators - pharmacist, family members, carers, friends, nurses, practical considerations, implementation considerations, time constraints etc.

Prompt Q- Who is the best person to facilitate this intervention?

Setting

Are there any service constraints or NHS barriers that are important to consider when developing this intervention?

(If yes) What are they?

Would it be realistic to carry out this intervention in a NHS site?

Are there any other locations that you think would be well suited to carrying out a medication adherence intervention?

Prompts- home, GP surgery, pharmacy, university site

Modes of Delivery

What ways do you think patients like to receive information or support?

Prompts- face-to-face, over phone, written information

Could text messaging be a good way to deliver the intervention? Why/why not?

What about emailing? Why/why not?

Or face-to-face? Why/why not?

Or through telephone calls? Why/why not?

Closing questions

How important do you think it is to increase adherence to medications in stroke?

Appendix 10: Topic Guide-HCPs

IRAS: 205714

How important do you think adherence to medications is in other conditions like asthma, HIV, heart conditions etc.?

Is there anything else you would like to tell us?

Thursday, 29 March 2018

Appendix 11: HCP invitation letter and information sheet

Dear colleague,

A new medication adherence intervention for stroke survivors- What do you think?

My name is Alison Wright and I'd like to invite you to take part in a new research study. The study is funded by a grant from the Division of Health and Social Care Research at King's College London. The research is being organised by a PhD researcher and her supervisory team at King's College London.

We are asking you to take part because:

1. You are part of an academic division within King's College London
2. You hopefully have experience in a clinical role
3. You hopefully have interacted with stroke patients when in the clinical role

We have come up with some ideas for a new medication adherence intervention. Our aim is to find out your views and opinions about this new programme. We want to find out if the new intervention will be practical and relevant, and feasible to implement within the healthcare system. Therefore, we would like to interview healthcare professionals to hear their views.

We're looking for participants who:

- Work in clinical practice in a healthcare role (GP, pharmacist, nurse etc.)
- Work or are affiliated to an academic network within King's College London
- Are happy to talk about their view and experiences in English

We are sending you an information sheet with this letter to explain more about why we are doing the project, and what is involved. Please read the sheet and discuss it with others if you wish. We will then follow up via phone or email to see if you have any questions and if you are interested in taking part. If you do not want us to follow up via phone or email you can opt out by:

- 1) Emailing elise.crayton@kcl.ac.uk
- 2) Phoning **020 7848 8732**. There is an answerphone service on this number. If you would prefer not to speak to us directly, call us outside of office hours (9am-5pm) and leave an answerphone message.

Version 1.1 25-10-16
IRAS: 205714



Department of Primary Care and Public Health
Sciences
Division of Health and Social Care
5th Floor, Addison House
Guy's Campus
London
SE1 1UL
Phone: 020 7848 6605

If you decide to take part and you are eligible, a researcher will contact you to find out where and when you would like the interview. This could be over the phone or face-to-face, either in your work place or in a private room at King's College London.

We are happy to give you more information or explain anything that is unclear. You can contact us by phone on 020 7848 6605 or by e-mailing alison.wright@kcl.ac.uk.

Thank you for considering taking part in this study.

Yours sincerely,
Alison Wright

A New Medication Adherence Intervention for Stroke Survivors- What Do You Think?

Overview

We would like to invite you to take part in a research study looking for your views/opinions about a new medication adherence intervention designed to support stroke survivors.

WHY are we doing this?

- We've got some ideas for a new intervention to support people to take their medicines regularly
- We want to see if it will be used by and relevant to stroke survivors.

WHAT would I need to do?

- ✓ Tell us a time and place to interview you
- ✓ Tell us about your experiences of working with stroke survivors
- ✓ Tell us your views on our ideas for this new intervention

WHO can get involved?

- Any healthcare professional who has worked with stroke survivors and is affiliated to King's College London

Please read on to find out full study information.

Participant Information Sheet

Assessing the Acceptability of a Medication Adherence

Intervention for stroke Survivors

Invitation

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. Do 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.

Please do ask us if there is anything that is not clear. We'll contact you via phone or email in a week's time (unless you have opted out) to check if you have any questions and if you would like to take part.

Part 1

What is the purpose of this study?

We've come up with some ideas for a new medication adherence intervention to support stroke survivors. We want to find out your views and opinions about these ideas. This will help us to make sure that in a future project, our final design is relevant and realistic for stroke survivors and is likely to be feasible in the healthcare system.

Why have I been invited?

We contacted you because:

- You are based in an academic team within King's College London
- You hopefully are still a practicing healthcare professional
- You have hopefully worked with stroke survivors

Do I have to take part?

It is up to you to decide whether to join the study. If you agree to take part you are free to withdraw at any time, without giving a reason. This would not affect your role in any way.

What will I have to do?

We want to find out your views and opinions about our ideas for a new medication adherence intervention aimed to help stroke survivors. We will do this by having an interview with you that should last no longer than one hour.

This study will involve:

- Talking to a researcher from King's College London about your experiences of working with stroke patients and/or prescribing and monitoring their medicines
- She will ask about any methods patients have told you about that help them to take their medicines
- She will ask about your views on possible ways to help people with stroke to take their medicines regularly
- Recording the interview for the purpose of transcribing it

Anything we talk about is completely confidential. We hope that you will feel comfortable to answer the questions as fully as possible. However, do not worry if you do not want to answer some of the questions.

We can either do the interview over the phone (at a time that suits you) or we can have a face-to-face discussion (in private room at King's College London).

What are the possible benefits of taking part?

There may be no benefit however:

- You might find talking about your experiences helpful
- Your views will be invaluable to us to help with designing the programme
- Your answers will make sure we design a programme relevant and meaningful to stroke survivors and practical within the healthcare system

Could anything go wrong?

You may find you do not want to answer some questions if they feel a little bit personal. However, you can miss any questions you do not wish to answer or withdraw at any time during the study. Contact details are given later in part 2 of this information sheet if you wish to withdraw after the study has taken place.

Also all data will be anonymous. No names or identifiable information would ever be published or shared.

What if there are any problems?

Any concerns or complaints that you may have about the study will always be addressed. The detailed information on this is given in Part 2.

Will my taking part in this study be kept confidential?

We will handle all information about you confidentially. The details are included in Part 2.

If you are considering participation, please read the additional information in Part 2 before making any decision.

Part 2

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

You may withdraw from this study at any given time, during the interview or afterwards. If you choose to withdraw all documents identifiable to you will be destroyed. There are no consequences to withdrawing from this study.

What if there is a problem?

Complaints

If you have a concern about any aspect of this study, you should ask to speak to the researchers who will do their best to answer your questions. During the study a researcher will be present to answer any questions. If you have questions after you have taken part you can contact the research team

- Alison Wright alison.wright@kcl.ac.uk **020 7848 6605**
- Elise Crayton elise.crayton@kcl.ac.uk **020 7848 8732**

If you remain unhappy and wish to complain formally, you can do this through the Research Ethics Office at King's College London. Details can be obtained from the King's College London website:

<http://www.kcl.ac.uk/innovation/research/support/ethics/contact.aspx>

Harm

In the unlikely event that something does go wrong and you are harmed during the research due to someone's negligence, then you may have grounds for a legal action for compensation against King's College London, but you may have to pay your legal costs. The normal National Health Service complaints mechanisms will still be available to you (if appropriate).

Will my taking part in this study be kept confidential?

All information collected about you during this study will be kept strictly confidential, and only the research team will have access to this information. After we have typed out and checked a record of what was said, we will delete the recording so you cannot be identified by your voice. When we publish the

results of this study, including the use direct quotes, we will not include your name or any other identifying characteristics.

What will happen to the results of the research study?

Results of this study will be written up in a PhD thesis as part of a doctoral research project. Publication of the study is planned to share what we learn. Also, we enlisted support from a stroke patient group who attend meetings to hear about current research. They will be updated on the results of the project. Again no identifiable or confidential personal information would be presented with any results of this study. If you are unhappy to have your results of this study published or shared, please let us know and you will be withdrawn. A summary of the results of this study will be sent to all participants at request. If you would like the results you will be asked to complete a separate form (Receive Results Form) providing your name and address, so that this information can be stored securely and separately from other study information. The results collected from this study may be used to support future research and could be shared with other researchers. These results would always have no identifiable or confidential personal information presented with them.

Who has reviewed the research study?

This study has been reviewed and given favourable opinion by the **London - City & East Research Ethics Committee.**

Further information and contact details

If you have any queries or concerns about research in general or questions surrounding this research project and your participation then please consult the King's College London website <http://www.kcl.ac.uk/innovation/research/index.aspx> or contact the Chief Investigator Alison Wright alison.wright@kcl.ac.uk 020 7848 6605 or Elise Crayton elise.crayton@kcl.ac.uk 020 7848 8732, a member of her research team.



Appendix 12: HCP consent form

Participant Number:

CONSENT FORM

Title of Project: Assessing the Acceptability of a Medication Adherence Intervention for stroke Survivors

Name of Researcher: Elise Crayton

Please initial box

1. I confirm that I have read the information sheet dated 25.10.2016 (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 that the information collected about me will be used to support other research in the future, and may be shared anonymously with other researchers.
4. I understand that the interview will be recorded to help the researcher remember what was said and that the recording will be deleted once a checked, written transcript is produced.
5. I understand that the results of this study might be published, including the use direct quotes from anyone involved in the interview, but the quotes will not include my name or any other identifying characteristics.
6. I understand that, during this research, information disclosed by me that is criminal in nature or any other information that is required to be disclosed by law, will be passed on to the relevant authorities.
7. I agree to take part in the above study.

Name of Participant Date Signature

Name of Person Date Signature
taking consent