Using Psychological Theory to Develop and Test a tool for the Implementation of Evidence Based Practice: the Case of Hand Hygiene Practice

Judith Dyson

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THESIS CONTAINS

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> *"To be able, under all circumstances to practice five things constitutes perfect virtue; these five things are gravity, generosity of soul, sincerity, earnestness and kindness."* (Confucius, Chinese Philosopher, 551-479 BC).

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Abstract

Background: The example of evidence based practice used for this research was hand hygiene. The aim of this research was: to develop and test a theory-based diagnostic instrument to accurately and prospectively assess the barriers and levers to hand hygiene practice to inform subsequent tailoring of implementation strategies.

Study One: A qualitative study was carried out with health care practitioners (n=70) and recent hospital patients (n=25) to identify barriers and levers to hand hygiene in secondary care. A thematic analysis resulted in a list of 100 barriers and levers to hand hygiene.

Study Two: A two round modified Delphi survey was administered to assess the fit of barriers and levers to hand hygiene to domains of the British Psychological Society theoretical framework. Expert participants were recruited from the fields of Infection Prevention and Control (n=11) and Health Psychology (n=10). Consensus was achieved on the fit of 99 of 100 barriers and levers to the framework.

Study Three: Studies one and two informed the construction of a questionnaire-style diagnostic instrument designed to identify barriers and levers to hand hygiene. Health care practitioners (a total of 470) from four NHS hospital trusts completed questionnaires in three rounds which allowed the instrument to be refined using psychometric testing principles. The result was a 35 item instrument demonstrating good levels of reliability and validity.

Study Four: The instrument was used to carry out a feasibility study to assess whether theoretically based interventions could be tailored according to assessed barriers and levers to hand hygiene and to establish the potential effectiveness of such an approach. Barriers and levers to hand hygiene were assessed with 19 junior doctors in an NHS hospital trust. It was identified that such an approach was feasible and hand hygiene audits indicated the potential effectiveness of such an approach.

Conclusion: The literature suggests that implementation strategies need to be theoretically based and tailored to assessed barriers and levers to hand hygiene. This study took a step forward in addressing these findings using the example of hand hygiene.

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Abbreviations

BPS	British Psychological Society
CHD	Chronic Heart Disease
CJ	Cath Jackson
CFA	Confirmatory Factor Analysis
CMIN	Minimum discrepancy (equivalent to χ^2/df)
DF	Degrees of Freedom
DH	Department of Health
EBP	Evidence Based Practice
FC	Francine Cheater
GP	General Practitioner
HCAI	Health Care Associated Infection
HCC	Healthcare Commission
HCW	Health Care Worker
HH	Hand Hygiene
HPA	Health Protection Agency
ICU	Intensive Care Unit
IPC	Infection Prevention and Control
IPS	Infection Prevention and Control Society
JD	Judith Dyson
LINks	Local Involvement Networks
MD	Executive Medical Director
MRC	Medical Research Council
MRSA	Methicillin Resistant Staphylococcus Aureus
NHS	National Health Service
NICE	National Institute of Health and Clinical Excellence
NRES	National Research Ethics Service
nICU	Neonatal Intensive Care Unit

PPI	Patient and Public Involvement
RCT	Randomised Controlled Trial
RL	Rebecca Lawton
RMSEA	Root Mean Square Error of Approximation
SHREC	School of Healthcare Research Ethics Committee
TPB	Theory of Planned Behaviour
WHO	World Health Organisation

Publications and Presentations

Publications

DYSON, J., LAWTON, R., JACKSON, C., CHEATER, F., Does the use of a theoretical approach tell us more about hand hygiene Behaviour? The barriers and levers to hand Hygiene. *Journal of Infection Prevention*, 12(1), 2011.

Presentations

DYSON, J., JACKSON, C., LAWTON, R., CHEATER, F., Developing an instrument to test the Barriers and Levers to Hand Hygiene, and update, Oral Presentation, *Hull and East Yorkshire Hospitals NHS Trust, Infection and Control Conference*, October 2010.

DYSON, J., JACKSON, C., LAWTON, R., CHEATER, F., A Comparison of Research Methods for Assessing Barriers and Levers to Hand Hygiene Practice, *Oral Presentation, 6th International Conference of Mixed Methods Research, Boston, USA*, July 2010.

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DYSON, J., CHEATER, F., JACKSON, C., LAWTON, R., Implementing evidence Based Practice; Hand Hygiene, *Oral Presentation, Infection Prevention Society Branch Meeting,* April 2008.

CHAPTER ONE INTRODUCTION

1.1. Introduction to thesis

This thesis presents a series of studies contributing to the development of a theory based instrument designed to assess the barriers and levers to hand hygiene. In this chapter, the background to the study is presented. This is followed by the aims and objectives of the research and an overview of the thesis content.

1.2. Background

The implementation of evidence based practice

The delay in implementing research findings into health care practice is a long recognised problem (Haines and Jones, 1994, Grimshaw et al., 2002, Grol and Grimshaw, 2003b). The effectiveness of interventions to change practice has been widely investigated but despite a large number of systematic reviews available it is not possible to conclude that any one implementation strategy is more useful than another (Grimshaw et al., 2004b). This literature does however illustrate two reasons why interventions may not work:

1. There is a need for accurate assessment of barriers and levers to implementation (Grimshaw et al., 2004b) and a tailoring of implementation strategies accordingly (Grimshaw et al., 2004b, Baker et al., 2010);
2. There is an absence of a theoretical basis informing implementation interventions used (Michie et al., 2005).

This research aims to address these two issues.

Behaviour change theory

Psychological theory provides a framework to further understanding and showing relationships between psychological variables such as beliefs, attitudes and the behaviour in question, in this case adopting best practice (Bonetti et al., 2005). A number of behaviour change models have been developed, for example, the transtheoretical model of behaviour change, a "readiness to change" model (Prochaska and DiClemente, 1983), the Theory of Planned Behaviour, a motivation theory that focuses on the role of intention toward a behaviour, a strong intention to carry out any behaviour making the likelihood of the behaviour greater (Ajzen, 2002) and social cognitive theory which suggests that individuals learn from the observation and behaviour of others and behaviour is reinforced by factors such as

rewards from others (for example praise) (Bandura, 2004). It is suggested that one of the reasons for the lack of recommended theoretical basis for informing implementation interventions is due to behaviour change theory being largely inaccessible for researchers in the field of health care due to its complexity and the overlap of theories (Robertson et al., 1996, Michie et al., 2005). This problem was addressed by Michie et al. (2005) who identified an agreed set of key theoretical constructs for use by researchers in the field of implementation of evidence based practice, the British Psychological Society (BPS) framework. This framework was selected as the theoretical basis for this research and will be described in detail in Chapter 2.

Hand hygiene as an example of evidence based practice

The context in which the study was situated was hand hygiene. Hand hygiene is the washing of hands with soap and water or the use of an alcohol based hand gel (World Health Organisation (WHO), 2004). In the UK it is estimated that there are 300,000 cases of Healthcare Associated Infections (HCAI) every year (National Audit Office, 2004). Approximately 5000 deaths per year are caused by HCAI in the UK and hand hygiene has been identified as the primary measure to reduce HCAI (WHO, 2007). There have been increasing numbers of government led initiatives and policies in relation to hand hygiene practice yet compliance by health care practitioners remains low at around 50% (Boyce, 2001, Aiallo and Larson, 2002, Boyce and Pittet, 2002, National Audit Office, 2004, World Health Organisation, 2007). Hand hygiene is a procedure that is undertaken by all practitioners and is clearly important with regard to patient safety. It was therefore chosen as the example of evidence based practice used for the purposes of this research.

1.3. Aim

To develop and test a theory-based diagnostic instrument to accurately and prospectively assess the barriers and levers to hand hygiene practice to inform subsequent tailoring of implementation strategies.

1.4. Objectives

1. To identify barriers and levers to hand hygiene practice in secondary care;

2. To compare the use of a theoretically based question schedule with a non-theoretically based schedule in identifying barriers and levers to hand hygiene practice;

3. To compare research methods used to identify barriers and levers to hand hygiene practice;

4. To assess the value of including patients in the identification of barriers and levers to hand hygiene practice;

5. To assess the fit of barriers and levers to hand hygiene to domains of the British Psychological Society theoretical framework (Michie et al., 2005);

6. To develop and test the reliability and validity of a diagnostic instrument designed to assess barriers and levers to hand hygiene;

7. To compare barriers and levers to hand hygiene according to NHS hospital trust, occupational group and area of work;

8. To assess whether theoretically based interventions can be tailored according to barriers and levers to hand hygiene identified using the instrument developed as part of this programme of research.

1.5. Overview of the thesis

There are six further chapters in this thesis after this introductory chapter.

Chapter 2 presents a critical review of the current literature. Following an introduction to the chapter and the methods of the literature review four sections are presented. The first section reviews the literature with regard to changing clinical practice, the implementation strategies that are currently used and the evidence with regard to the effectiveness of these. Following this the evidence relating to the barriers and levers to evidence based practice is presented. This is followed by a review of literature examining the use of theory in changing behaviour and in particular the use of a theoretical approach in the implementation of evidence based practice. Following this a review of the literature relating to the importance of hand hygiene is presented as this is the example of evidence based practice used for the purpose of this research. Finally the barriers and levers to hand hygiene practice specifically are presented.

Chapter 3 presents a cross sectional, semi structured qualitative study that addressed objective one, to identify barriers and levers to hand hygiene practice in secondary care. Health care practitioners working in hospitals (n=70) and recent hospital patients (n=25) were recruited to the study. Participants were asked to identify barriers and levers to hand hygiene practice. A thematic analysis was carried out which resulted in a comprehensive list of 100 barriers and levers to hand hygiene practice which fit within a model of twelve themes and 30 sub-themes. The themes were: *"environmental"*, *"social/cultural"*, *"knowledge/skills"*,

"improvement strategies", *"professional"*, *"consequences"*, *"motivation"*, *"habit/routine"*, *"attitude"*, *"memory"*, *"emotion"*, *"incentives"*. The barriers and levers identified in this study, supported and extended those identified in review of the literature and formed the items for the instrument developed in study 3 (reported in Chapter 5).

The theoretical framework chosen for this research was the BPS framework (Michie et al., 2005). However, this framework is comparably new and therefore not yet widely used. To date no study has directly compared the findings from interviews using the BPS framework to those not employing this model. In order to make such a comparison, half of participants were questioned using a schedule based on the BPS theoretical framework, half were questioned using a schedule based on the literature. This allowed objective two to be met, to compare the use of a theoretically based question schedule with a non-theoretically based schedule in identifying the barriers and levers to hand hygiene. A greater number of participants questioned using the theoretically based schedule identified the themes *"emotion"*, *"habit/routine"* and *"incentives"* than those questioned using the atheoretical schedule.

A number of research methods have previously been used to assess barriers and levers to evidence based practice (Baker et al., 2010). However, no literature was identified that compared, or discussed the merits or otherwise of research methods used for this purpose. Therefore, three research methods were used in this study, interviews, focus groups and questionnaires. This allowed objective three to be met, to compare research methods used to identify barriers and levers to hand hygiene practice. There were different strengths and weaknesses identified with each of the three research methods used. Questionnaire data tended to identify the barriers and levers to hand hygiene, focus group and interview data tended not only to identify these but also explain why they posed barriers or levers.

A review of the literature identified only two studies where patients were involved in research assessing barriers and levers to evidence based practice. Both of these studies suggest that such an approach may be of value (Flottorp and Oxman, 2004, Peters et al., 2003). It was therefore decided to involve patients as participants in this study and objective four was addressed, to assess the value of including patients in the identification of barriers and levers to hand hygiene practice. Patients identified all of the themes and all but four sub-themes reported by health care practitioners.

Chapter 4 presents a modified two round Delphi survey. This was carried out to fulfil objective five, to assess the fit of barriers and levers to hand hygiene to the domains of the BPS framework. Experts in the fields of Infection Prevention and

Control and Health Psychology were asked to categorise each of the 100 barriers and levers to hand hygiene identified in study one to the domains of the BPS framework (Michie et al., 2005). The result was consensus achieved on 99 of these 100 barriers and levers.

Chapter 5 reports the three phases of the development and testing of a diagnostic instrument to satisfy objective six, to develop and test the reliability and validity of a diagnostic instrument designed to assess barriers and levers to hand hygiene. The items for the instrument were based on the barriers and levers to hand hygiene identified in the qualitative study presented in Chapter 3 that were then categorised to the BPS framework (Michie et al., 2005) in the Delphi study presented in Chapter 4. A sample of practitioners from three NHS hospital trusts in the north of England completed questionnaires which allowed the instrument to be refined using psychometric testing principles. The result was a 35 item instrument that tested well with regard to validity and reliability.

Data collected in the second round of instrument testing were examined to fulfil objective seven, to compare barriers and levers to hand hygiene according to NHS hospital trust, occupational group and area of work. There were a number of significant differences in barriers and levers to hand hygiene according to occupational group; there were fewer differences according to NHS hospital trust and the type of work place.

Chapter 6 presents a small feasibility study designed to address objective eight, to assess whether theoretically based interventions can be tailored according to barriers and levers to hand hygiene identified using the instrument developed and reported in Chapter 5. A group of junior doctors (n=19) in an NHS hospital trust in the north of England were asked to complete the instrument assessing barriers and levers to hand hygiene. Because these barriers and levers have been linked to the theoretical domains of the BPS framework (Michie et al., 2005), this meant that following analysis of responses, strategies to improve hand hygiene could be tailored according to the domains within which participants identified barriers (or the absence of levers) to hand hygiene. These tailored interventions were implemented. Hand hygiene audit results demonstrated an improvement in practice for doctors for the months that the questionnaires were distributed and the interventions took place and subsequently.

Chapter 7, The findings from each of the four empirical studies included in this thesis were discussed in full detail in Chapters 3, 4, 5 and 6. Therefore, in this final chapter, the aims, the objectives and an overview of the thesis are first summarised. Following this the key findings of the four studies are briefly presented. A summary of the strengths and limitations of each study is then

presented. Implications for practice and future research follow this and finally, conclusions are made.

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

This Chapter presents a critical review of the literature achieved through a scoping review, the purpose of which is to draw together the background literature relevant to the topic of interest in this thesis. In the case of the implementation of evidence based practice this was considered to be particularly important due to the extent of the literature and in particular the large number of systematic reviews that already exist on this topic (including Grimshaw et al. 2004, Dijkstra et al. 2006, Wensing et al. 2006, Thompson et al. 2007. A scoping review aims to provide an overview of the existing literature, using systematic methods, but is not a systematic review and therefore does not claim to identify all the existing studies in a particular topic area. (Hart, 1998). Davis et al. (2008) explored the nature of scoping reviews within the nursing literature. They found them to be valuable in terms of their ability to extract the meanings of diverse bodies of evidence, however they found them variable in terms of methodological rigour. The authors suggest explicit and transparent identification of the procedure of such a review as a way to address this limitation. The scoping review reported here aimed to adopt these recommendations.

The literature resulting from the scoping review is presented in three sections as follows.

1. First the literature with regard to ***changing clinical practice*** is presented. This includes implementation strategies and the evidence with regard to the effectiveness of these and the barriers and levers to Evidence Based Practice (EBP).

2. This is followed by a review of literature examining the use of theory in changing behaviour and in particular the use of a ***theoretical approach in the implementation of EBP.***

3. Following this a review of the literature relating to the importance of ***hand hygiene*** is presented including a summary of the relevance of ***health care associated infections.*** Compliance with hand hygiene practice is considered and finally the barriers and levers to hand hygiene complete the review of the literature.

2.2. Methods

Searches were carried out from November 2007 to January 2011.

2.2.1. Data bases

The following electronic data bases were searched for all three sections of the literature review: MEDLINE (1996 onwards), Cochrane library (all), EMBASE (1996 onwards), CINAHL (1982 onwards), psychINFO (1985 onwards), the department of health website (all), NICE website (all), EPOC website (Cochrane Effective Practice and Organisation) (all), bibliographies and references of papers retrieved were searched for additional possible citations.

In addition to this when reviewing the literature relating to hand hygiene the following data bases were also searched: WHO (World Health Organisation) website, National Audit Office website (all), Centres of Disease Control and Prevention website (all), Health Protection Agency website (all), National Resource for Infection Control (RNIC) website (all), Healthcare Commission website (all), Infection Prevention Society website (all), Department of Health website, National Patient Safety Agency website (all) and internet searches using a general browser (Google).

2.2.2. Search terms

Changing clinical practice

The following search terms were used: Implementation, innovation, practice guideline, guidelines, chang$, adoption, "evidence based practice", EBP, dissemination, "continuing education", "patient mediated" intervention, "tailored intervention", "audit and feedback", reminder, outreach, "educational material", "opinion leader", "multifaceted intervention", organisational, "integrated care", "professional role", "financial incentive", innovation, intervention, barriers, facilitators, levers, compliance, "professional identity", culture, leadership, funding, MDT, "multidisciplinary team", "hand hygiene", "hand washing", safety, "patient safety".

A theoretical basis for the interventions used to implement EBP

The following search terms were used: implementation, "evidence based practice", innovation, dissemination, change, coping strateg$, self-efficacy, behaviour, emotion, capabilit$, control, confidence, esteem, optimism, pessimism, motivation, attitude, intention, beliefs, memory, attention, "social norm$", "peer pressure", "role model$", identity, commitment, conflict, habit, affect, stress, emotion, anxiety, "theory of planned behaviour", "learning theory", "adult learning theory", "diffusion of innovation", "transtheoretical model".

Hand hygiene and health care associated infections

The following search terms were used: Infection control, cross infection, MRSA, "clostridium difficile", C$ diff$, "nosocomial infection", HAI, "hospital acquired infection", infection, HCAI, "health care associated infection", history, historic, "hand hygiene", handwashing, "hand washing", handrub, "alcohol gel", "cross infection", "nosocomial infection", "infection control", "infection prevention" compliance, safety, "patient safety".

The terms listed in each of the sections above were combined with the Boolean operator "or" but each of the three sections were reviewed separately and not combined. The literature was then organised around key thematic headings and the results are presented below.

2.3. Results

2.3.1. Changing clinical practice

Background

David Sackett was one of the first proponents of EBP in the early 1990s; he defined evidence based medicine as:

> *"the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individuals. The practice of evidence based medicine means integrating individual clinical expertise with the best available external clinical evidence from systematic research"* (Sackett et al., 2000, pp 71).

A systematic review of the literature (between 1987 and 1997) with regard to quality of health care in the USA found large gaps between the care patients receive and the care they should receive according to research evidence (Schuster et al., 1998). Indeed, this literature review demonstrated that between 50 and 70% of people received recommended care and up to 30% of people received care that was contraindicated (Schuster et al., 1998). A study of primary care in the UK found that only 40% of patients receive care adhering to guidelines for prescribing (Freemantle, 2000). More recent studies suggest that between 30 and 40% of patients do not receive care according to best practice and between 20 and 25% receive care that is harmful (Eccles et al., 2005).

The delay in implementing research findings into practice is a long recognised problem (Haines and Jones, 1994, Grimshaw et al., 2002, Grol and Grimshaw, 2003b, Grol and Wensing, 2004). It has been suggested that EBP can be considered a proxy measure for patient outcomes (Foxcroft and Cole, 2003). That is, if care shown to be effective is delivered to patients, positive health outcomes should result.

The implementation of EBP is clearly important, primarily from the perspective of offering patients optimal care; however it has also become high on the political agenda in recent years for a number of reasons. The Department of Health document "Standards for Better Health Care" (Department of Health, 2004) promotes the use of EBP through the use of guidelines for a number of extended reasons to improving patient care; namely to ensure services are provided that are safe, of good quality, are fair, responsive to patients needs and are delivered equitably.

Traditionally, dissemination of research findings was through publication in peer reviewed journals (Grimshaw et al., 2002). This was considered unsatisfactory as professionals have limited time to read and do not necessarily have the skills to appraise published research (Grimshaw et al., 2002). It has been estimated that in order to keep abreast of the latest research findings through the reading of journal articles it would be necessary for general medicine physicians to read 19 articles per day 365 days a year, by contrast, the actual time reported to be available for such activity is estimated to be less than an hour per week (Sackett et al., 2007). In order to try to make research more accessible to health care practitioners, systematic reviews and best practice guidelines are commonly produced. The National Institute of Health and Clinical Excellence (NICE) and the Scottish Intercollegiate Guidelines Network (SIGN) were set up for this purpose (Grimshaw et al., 2004a). In 1993 the Cochrane collaboration was founded as an international independent organisation dedicated to producing and disseminating systematic reviews of healthcare interventions (http://www.cochrane.org/).

It was expected (hoped) that these national guidelines on best practice would lead to rapid and systematic uptake of EBP and improve the care patients receive by promoting the evidence on effective interventions (Grimshaw et al., 2002). However, although guidelines are produced the dissemination of these to practitioners and the effects on practice have been limited (Grimshaw et al., 2004b, Rycroft-Malone et al., 2004).

There is an abundance of evidence to show that dissemination of guidelines alone is insufficient in changing clinical practice (Cheater and Closs, 1997, Oxman, 1995, Bero et al., 1998, Grimshaw et al., 2004a, Grimshaw et al., 2004b). Consequently, over the years a number of strategies have been developed to improve the uptake of research findings. Research has been carried out investigating into the extent to which different methods increase the implementation of research findings (Oxman, 1995, Bero et al., 1998, Grimshaw et al., 2004a, Cheater et al., 2005, Wensing et al., 2005a). These methods are now presented.

2.3.2. Effectiveness of methods used to implement EBP

A number of systematic reviews have been carried out investigating the effectiveness of interventions to change practice. The evidence is collated at the level of the individual practitioner, the team and the organisation within which they work. This evidence will be presented here to provide an overview of the subject. Although there is a degree of overlap in the systematic reviews (where similar time periods were used reviews included many of the same primary studies), not all reviewers often come to the same conclusions due, predominantly, to differences in methodology in terms of how the reviews were carried out. Furthermore, some reviewers have focused in depth on specific techniques for implementation (e.g. opinion leaders, audit and feedback), the majority of the literature is in relation to secondary care, though some reviews focus on areas of primary care and a number of reviews focus on specific occupational groups (e.g. nurses). Some focus on practitioners' behaviour as a sole outcome measure, others investigate patient health outcomes.

The most commonly used methods to implement EBP that have been investigated are; written educational materials, outreach visits, opinion leaders, patient mediated interventions, audit and feedback, reminder systems, targeted interventions, computerised support systems, conferences and workshops and multifaceted approaches. Each approach will now be discussed in turn. The systematic reviews included in this scoping review, their scope and key findings are summarised in Figure 2.1. These 24 reviews include studies ranging in date between 1995 and 2010 and investigate a range of interventions and professional groups.

Techniques will each be discussed in turn with specific regard to their known effectiveness in terms of changing practitioner behaviour and, where evidence exists, the associated health outcomes. These will be grouped according to the individual health care practitioner, the team and the organisation within which they work.

Figure 2.1. Systematic Reviews related to implementing EBP

Study (in end date order)	**Target Professional group studied**	**Outcome measures studied**	**Results: Techniques found to be effective**	**Results: Techniques found to be ineffective**	**Results: Techniques for which the evidence was found to be inconclusive**	**Summary**
Oxman et al. 1995, systematic review of literature (1970-1993)	All health care providers (except students)	Provider performance and any patient health outcome	Conferences where practice needs were assessed, outreach visits, multifaceted interventions	Educational materials, conferences generally	Opinion leaders, audit feedback and reminder systems	"No magic bullets". A range of interventions that if properly used could lead to improvements in care.
Wensing et al. 1998 systematic review of the literature 1980-1994	General practitioners	General practitioners' behaviour	Multifaceted interventions, feedback, financial incentives			Knowledge is necessary pre-requisite but insufficient to achieve change.
Bero et al. 1998, overview of all systematic reviews (1966 -1995)	Health care professionals	Professionals' behaviour and patient health outcomes	educational outreach, reminders, multifaceted approaches, interactive educational meetings	Educational materials, didactic educational meetings	Audit and feedback, opinion leaders, local consensus, patient mediated interventions	Complex and variable methods and different contexts make generalisation difficult: need to consider individual barriers to change
Worrall et al. 1997, systematic review of the literature (to 1995)	Health care professionals in primary care	Patient health outcomes			Clinical guidelines	Little evidence to suggest guidelines improve clinical outcomes in primary care
Thomas et al. 1999, systematic review of literature (1975 - 1996)	Nurses, midwives, health visitors and prof's allied to medicine	Professionals' behaviour and patient health outcomes	Clinical guidelines in changing practice			Clinical guidelines useful in changing nurses' practice and outcomes of care but evidence scarce

Davis and Taylor-Vaisey (1997), systematic review of literature (1990-1996)	Health care professionals	Professionals' behaviour and patient health outcomes	Audit and feedback, reminder systems, multifaceted interventions	Conferences, written information		Producing guidelines without attention to adopting these is not worthwhile
Walton et al. 2001 systematic review of literature (1979 to 1996)	Prescribing health care professionals (mainly Drs)	Patient health outcomes and prescribing behaviour	Computer information support systems re prescribing in secondary care			Computers lead to better prescribing and better patient outcomes
Gosden et al. 2000, systematic review of the literature - effects of payment (to 1997)	Physicians		Fees for service effective in physicians applying EBP			Different payment systems influence physicians performance
Dijkstra et al. 2006, systematic review of literature (1966 - 1998)	Health care professionals	Professionals' behaviour	Educational materials, reminders, feedback and revision of professional roles	Educational meetings and patient mediated interventions	Organisational factors	"No magic bullets"
Grimshaw et al. 1999, overview of systematic reviews (to 1998)	Health care professionals	Professionals' behaviour	Multifaceted interventions, tailored interventions, educational outreach	Educational material,	Audit and feedback, opinion leaders	Passive dissemination generally ineffective, active approaches more effective but more costly
Grimshaw et al. 2004, systematic review (1966 – 1998)	Health care professionals	Professionals' behaviour and patient health outcomes	Educational materials, patient mediated interventions, audit and feedback, reminders improved practitioner performance		Educational meetings	Incomplete evidence base therefore tentative suggestions of what works
Chaix-Couturier et al. (2000) systematic review of literature relating to incentives (to 1999)	Doctors	Doctors' Behaviour	Financial incentives			Financial incentive improves compliance in doctors resulting in patient health targets

Wensing et al. 2005 systematic review of reviews to 2000	Organisations	Professionals behaviour and patient health outcomes	Integrated care in chronic disease, computerised knowledge management		Changing professional roles	Some organisational strategies may be useful in some settings
Bahtsevani et al. systematic review of guidelines to 2002	Health care professionals	Professionals' behaviour			Written guidelines	Information necessary prerequisite but alone not enough
Grol and Grimshaw 2003 review of reviews (to 2003)	Health care professionals	Professionals' behaviour	Interactive small meetings, educational outreach for prescribing, reminders, computerised decision support systems for prescribing, financial, multifaceted		Educational materials, conferences, opinion leaders, feedback, patient mediated interventions	Need to use strategies that target barriers to change
Foxcroft and Cole (2003), systematic review organisational infrastructure	Nurses				Organisational infrastructure	Lack of evidence in nurses
Wensing *et al* (2006) systematic review of systematic reviews organisation (1993 – 2003)	Health care professionals		Multidisciplinary team working, integrated services, computerised reminders and enhancing of professional role in secondary care		Enhancing the role of nurses in primary care	Need to consider the context before applying findings
Garg et al. 2005 systematic review (to 2002) on computerised clinical support systems	Health care professionals	Professional practice and patient health outcomes	Computerised support systems on professional practice	Computerised support systems on patient outcomes		May become more effective in this era of computerisation of medical records

Kawamoto et al. (2005) systematic review of literature re computerised clinical support systems (up to 2003)	Health care professionals	Professional practice and patient health outcomes	Systems that are automatic	Systems where the physician had to initiate their use		Successful if they incorporate the "right features" including being automatic and not relying on physician initiation
Rycroft-Malone et al. 2004, review of the literature (to 2004)	Nurses	Professional practice	In nurses; degree educated, local library, evident link between the research and practice. Generally; project facilitator, opinion leader.	In nurses, research incongruent with nurses' beliefs, lack of authority to effect change.	Short courses for nurses.	
Doumit et al. 2007 review of literature on opinion leaders (up to 2005)	Health care professionals	Professional practice and patient health outcomes	Opinion leaders on changing professional practice		Opinion leaders in changing health outcomes	Opinion leaders can effect professional practice as much as educational material, audit, multifaceted interventions
Thompson et al. 2007, systematic review (up to 2006)	Nurses	Professional practice and patient health outcomes	Educational meetings combined with an opinion leader	Educational meetings		Lack of evidence in nurses
Robertson and Jochelson 2006 systematic review (1995-2006)	Health care professionals	Professional practice and patient health outcomes	Small interactive meetings, outreach visits, computer reminders, multifaceted interventions, financial incentives	Educational materials, large scale meetings,	Audit and feedback, opinion leaders,	Findings differ across different environments and within different health care professional groups
Baker et al. 2010 systematic review (up to 2010)	Health care professionals	Professional practice			Tailored interventions	Tailored interventions can change professional practice

Techniques used at the level of the individual health care practitioner, the team or the organisation

Multifaceted Interventions is a term used within the literature to refer to two or more interventions being used together. This can operate at an individual level or equally at the level of the team or the organisation.

Multifaceted interventions were found to be consistently more effective in changes in professional performance compared to single interventions in achieving EBP (Grimshaw et al., 2004b, Robertson and Jochelson, 2006). Wensing and Grol (2005) suggest that this may be due to multifaceted interventions addressing more barriers to change than single interventions alone. However, the evidence in relation to multifaceted interventions influencing health outcome was inconclusive (Grimshaw et al., 2004b, Robertson and Jochelson, 2006).

Grimshaw et al. (2004b) carried out analyses to determine whether the number of interventions influenced the effectiveness of multifaceted interventions and found no clear relationship between number of interventions and effect size. It is not yet possible to suggest which combinations work best (Wensing and Grol, 2005).

Tailored interventions may be defined as:

> *"use of personal interviewing, group discussion or a survey of targeted providers to identify barriers to change and subsequent design of an intervention that addresses identified barriers."* (Grimshaw et al. 2004, pp 8).

Tailored interventions can be at an individual level or equally at the level of the team or the organisation. There is a general consensus within the literature that the choice of implementation intervention should be guided by evidence of the impact on changing professional behaviour, recognition of external barriers to change and the characteristics of the message to be disseminated (Bero et al., 1998, Oxman, 1995, Grimshaw et al., 2004b, Bahtsevani et al., 2004). Oxman et al. (1995) offered an analogy that just as there is a need to target a specific drug prescribed to the patient and illness there is a need to target implementation interventions based on the identification of barriers to change.

Although identified as a key issue by many reviewers only one review was found that assessed the effectiveness of tailored interventions. Baker et al. (2010) systematically reviewed the literature (to October 2009) to establish the effectiveness of tailoring strategies employed to effect change within the context of specific assessment of barriers. Outcome measures were professional performance and health care outcomes. Twenty six studies were included in the review and of these 12 were suitable for meta-analysis. The authors were able to conclude that

interventions tailored to assessed barriers are more likely to improve practice than no intervention or dissemination of guidelines alone.

Techniques used at the level of the individual health care practitioner

Written Educational Materials as a strategy is defined as:

"Distribution of published or printed recommendations for clinical care, including clinical practice guidelines, audio-visual materials, and electronic publications." (Grimshaw et al., 2001, pp S 44).

Grimshaw et al. (2004b) found written materials had a modest effect on improving clinician's practice. Another systematic review, using meta-analysis technique, found educational material to be effective in changing professional practice (Dijkstra et al., 2006).

A review by Bahtsevani et al. (2004) included studies using qualitative methods. They found that written guidelines were unsuccessfully implemented where there was a lack of skills, expertise and resources which must also be addressed as part of any implementation strategy. Other reviewers agree that written materials are a necessary prerequisite to behaviour change by raising awareness and increasing knowledge (Grimshaw et al., 2001, Robertson and Jochelson, 2006). Written educational materials therefore appear to have a modest effect of changing practice.

Educational outreach visits can be defined as:

"the use of a trained person who met with providers in their practice settings to give information with the intent of changing the provider's practice." (Grimshaw et al., 2004, pp 8).

Outreach visits have been found to be effective in reducing inappropriate prescribing, increasing the delivery of preventative services and in dealing with common conditions (Grimshaw et al., 2004b). Educational outreach visits were found to be more effective when combined with other interventions but there is little evidence comparing areas where outreach has taken place, most of the studies have been conducted in primary care and there was also no evidence that repeated visits resulted in greater success (Grimshaw et al., 2004b).

Opinion leaders may be defined as:

"authorities who use their respected influence to promote behaviour change" (Robertson and Jochelson 2006, pp 13).

Opinion leaders are most commonly involved in changing behaviour by attending outreach visits in clinical departments (Bero et al., 1998). Overall the effectiveness of opinion leaders in changing professional practice has been found to

range between ineffective to substantial (Oxman, 1995, Bero et al., 1998). More recent review of the literature supports these earlier findings, that is, the effect of opinion leaders' remains variable (Robertson and Jochelson, 2006). Doumit et al. (2007) also found mixed results but was able to calculate an effect size of 10% in reducing non compliance with guidelines overall. The effect of opinion leaders in implementing EBP is therefore uncertain.

Patient mediated interventions relates to information to patients through mass media, patient educational materials and advertising and the subsequent effect this has on clinician's behaviour (Dijkstra et al., 2006).

Oxman et al. (1995) found most studies that included patient mediated interventions on clinician behaviour focused on patient educational materials. These were successful in changing clinician performance only when combined with other interventions such as outreach visits or physician education. Dijkstra et al. (2006) reviewed the literature on patient mediated interventions and found no statistical significance. Grilli et al. (2002) found mass media campaigns resulted in increasing requests from patients for medication and increased service utilisation. The evidence of patient mediated intervention is inconclusive (Oxman, 1995, Grilli et al., 2002).

To summarise, patient mediated interventions appear to have some impact on patients' consulting behaviour and requests for prescriptions but there is no convincing evidence to date of their effect on changing professionals' clinical behaviour.

Audit and feedback is:

> *"Any summary of clinical performance of healthcare over a specified period." "May have been obtained from medical records, computerised databases or observations from patients."* (Grimshaw et al., 2004, pp 8).

The effectiveness of audit and feedback and reminder systems ranged from ineffective to moderately effective in changing practitioners' behaviour in most of the early systematic reviews found on the subject (Oxman, 1995, Bero et al., 1998). More recently, reviews have found some positive effect of audit and feedback on professionals' behaviour. All studies reviewed by Grimshaw et al. (2004) reported improvements in care given to patients but the effects were modest. Dijkstra et al. (2005) carried out a systematic review of the literature and meta-analysis. They found significant improvements in professional behaviour. Audit and feedback was found to be particularly effective in relation to ordering appropriate tests for patients and as part of preventative programmes (Grol and Grimshaw 2003). Effectiveness is enhanced when feedback is given promptly, by a person who is respected and if

the clinician is involved in a discussion about the results rather than just receiving the information on paper (Robertson and Jochelson 2006). To summarise, recent reviews suggest that audit and feedback can be effective in changing professional behaviour.

Reminder systems are defined as:

"Manual or computerized. Any intervention that prompts the health care provider to perform a patient or encounter specific clinical action." (Grimshaw et al. 2001, pp S 44).

Reminder systems were the most frequently evaluated single intervention (Grimshaw et al. 2004). They have been used and investigated in a wide range of settings in relation to a number of different clinical practices; they appear to have a larger effect on changing clinician behaviour than any other single intervention, estimated to be 13% (Grol and Grimshaw 2003). Dijkstra et al. (2005) found reminders to be effective in changing practitioners' behaviour.

Computerised decision support systems are defined as:

"an active knowledge system in which patient data are used to generate patient –specific advice" (van der Weijden and Grol 2005, pp 159).

Systematic reviews investigating the effectiveness of computerised decision support systems generally found them to be effective for doctors for prescribing and for general patient management including preventative care but not for diagnosis (Oxman, 1995, Bero et al., 1998, Grol and Grimshaw, 2003b). A review of the literature focusing on computerised clinical decision support systems identified similar findings; improved practitioners performance in carrying out preventative care, treatment management and prescribing (Garg et al., 2005). Garg et al. identify few studies that analyse the effect of these systems on patient outcomes with inconsistent findings concluding that commonly held perceptions that computerised decision support systems may improve efficiency and reduce costs are not supported by the research.

Kawamoto et al. (2005) systematically reviewed the literature to identify what specific features of clinical decision support systems led to improved practice. They found systems that automatically support as part of the usual workflow of the clinician were successful in changing professional behaviour and improving health outcomes. Systems that were not automatic and relied on the clinician initiating them were not successful.

Wensing et al. (2006) reviewed the literature in relation to computerised services. Most trials included in the review found that such systems resulted in positive effects in relation to the process of care in specific areas including the

ordering of tests, and better prescribing. The use of electronic protocols appeared to be more effective than any other computerised intervention at the organisation level. Computerised medical records had a positive effect on the performance of doctors but when this was investigated for nurses the results were mixed (Wensing et al., 2006).

Whilst most reviews focus on primary care, Walton et al. (2001) reviewed the effectiveness of computerised advice on dosing in specialist areas of secondary care (e.g. cardiology). They found significant differences in patient outcomes. These include less time taken to reach therapeutic control of the patients' condition, less risk of toxicity, less risk of adverse drug reactions and a reduced length of hospital stay.

To summarise, computerised decision support systems have been found to be successful in changing physicians prescribing and general patient management behaviour. When used to support physicians in secondary care they have been found to improve patient outcomes.

Educational meetings, workshops and conferences involve:

> *"Participation. . . in lectures, workshops or traineeships"* (Grimshaw et al. 2001, pp S 44).

Grimshaw et al. (2004b) found few evaluations of educational meetings and those reported showed that any positive effects are likely to be small. When comparing the effect of interactive and didactic educational meetings and workshops small group discussion sessions were found to be the most useful in changing professional practice (Bauchner et al., 2001, O'Brien et al., 2007, Grol and Grimshaw, 2003b, Wensing and Grol, 2005). One review contained meta-analysis of included studies and found no significant effects of educational meetings on professional practice (Dijkstra et al., 2006).

Coomarsamy and Khan (2004) reviewed the literature comparing stand alone teaching sessions with those that integrated the relevant clinical practice. They found that both were effective in improving the knowledge base of the participant but only clinically integrated teaching brought about changes in skills, attitudes and behaviour. Furthermore, they found that changes in attitude were key to changed behaviour being sustained.

To summarise, it would appear that interactive education methods are more effective than didactic meetings for changing professional practice but the effect is likely to be small. Teaching that is integrated into practice is more effective than teaching alone in changing behaviour.

Financial incentives Economic theory suggests that a higher fee for service leads to a higher volume of that service (Wensing et al., 2005b). Equally a cost for care should decrease demand for health care from patients; this is less easy to test within health systems as often the patients pay indirectly for health care through taxes or insurances, although some countries utilise a co-payment system (Wensing et al., 2005b).

Financial incentives have been offered to doctors in order to reduce the use of health care resources, meet targets and improve compliance with guidelines (Chaix-Couturier et al., 2000). The systematic review by Chaix-Couturier et al. of the evidence on the effect of financial incentive to medical practice found they have been effective in improving guideline adherence and quality of care. In this review the population studied included physicians in both primary and secondary care. However, a need for incentives to support the goals of the physician (both improving the health of the population and maintaining their income) was identified in order to be effective.

Gosden et al. (2000) reviewed the effect of different payment schemes on the behaviour of primary care physicians. The reviewers found fees per service provided compared to fixed payments for a period of care resulted in more patient contact within primary care, fewer referrals to secondary care and fewer prescriptions. They concluded that there is evidence that different payment schemes influence primary care physicians' behaviour, fees for service providing a higher quality of primary care services compared to capitation systems (payment per registered patient) and salaries. Wensing et al. (1998) found that financial incentives and regulations to professionals and patients (in services where patients contribute to the cost of their treatment) were effective in changing professional and patient behaviour. To summarise, financial incentives appear to be effective in improving the implementation of EBP.

Techniques used at the level of the team and the organisation

Organisational techniques used to implement EBP are generally those that involve changing the structure or delivery of health care. Patient outcomes are not only influenced by the performance of individual health care professionals but also by the way the clinical team functions and by organisational structures (Grol and Wensing, 2005, Wensing et al., 2006). Reviewers have examined different aspects of the organisation of services and care that have an impact on the implementation of EBP.

Revision of professional roles A systematic review investigating the revision of professional roles found that most studies evaluated the role of nurse practitioners

substituting for GP provided care (Wensing et al., 2006). The review concluded that nurse practitioners tended to have longer consultations, ordered more tests and patient satisfaction was greater. All other aspects measured showed no difference between nurse practitioners and GPs.

Do different occupational groups benefit from different implementation strategies? There are possible differences between strategies likely to be effective in promoting EBP in different occupational groups. For example, reviews of the literature largely focusing on doctors at the end of the 1990s found written educational materials to be ineffective in changing their behaviour (Oxman, 1995, Bero et al., 1998, Worrall et al., 1997). However, during the same time period a similar review focusing on professionals allied to medicine found them to have some level of effectiveness (Thomas et al., 2000). Although many of the systematic reviews described above included all health care professionals as part of their inclusion criteria, most of the primary studies focused predominantly on doctors. Cheater and Closs (1997) carried out a selective review of the literature relating to nurses and found no readily available evaluation of the effectiveness of clinical guideline dissemination techniques. They found recommendations as to what techniques may be useful but little evaluation of these. Improvements in knowledge resulted from educational material but there was no evidence within the literature to evaluate changes in nurses' behaviour or patient outcomes.

Since that time, a cluster randomised trial involving nurses found written educational materials as effective as audit and feedback with or without outreach visits in implementing EBP (Cheater et al., 2006).

Thompson et al. (2007) undertook a systematic review of the literature on interventions aimed at increasing EBP nursing practice alone. Only four studies met their inclusion criteria, illustrating that despite the large body of implementation literature, very little of it relates to nursing practice. The review found, for nurses, that educational meetings on research utilisation resulted in no changes but educational meetings combined with opinion leader input resulted in an increase in research utilisation. The reviewers however considered the conclusions to be limited by the small number of studies included and the limitations within each study design (mainly low numbers of participants). Foxcroft and Cole (2003) conducted a systematic review of the literature in relation to organisational features on promotion of EBP for nurses and found a similar dearth of evidence that was inconclusive.

To summarise, some organisational interventions have been found to be effective in some settings but research tends to focus on efficiency rather than patient outcomes. Fewer reviews cover organisational interventions and when meta-

analysis has shown no significant differences for patient outcomes (Dijkstra et al., 2006). Authors consider organisational interventions an important area (Bauchner et al., 2001, Grol, 2005, Wensing et al., 2006) and there was general consensus that organisational interventions designed to increase implementation of EBP need to be carefully assessed with interventions tailored to the particular environment (Wensing 2006, Robertson and Jochelson 2006).

Having reviewed strategies used in the implementation of EBP and the effectiveness of these it is relevant to identify the known barriers and levers to practice. These are presented below.

The barriers and levers to EBP

Different factors are identified within the literature as constituting barriers or levers to implementing EBP. These barriers and levers are grouped around the innovation itself, the individual, the immediate social context and the organisation. However these are not distinct categories and there is a large degree of overlap and interaction between each of them.

The innovation

> *"Clinical guidelines are only one option for improving the quality of care. Too often, advocates view guidelines as a "magic bullet" for healthcare problems but ignore more effective solutions. Clinical guidelines make sense when practitioners are unclear about appropriate practice and when scientific evidence can provide an answer. They are a poor remedy in other settings. When clinicians already know the information contained in guidelines, those concerned with improving quality should redirect their efforts to the specific barriers, beyond knowledge, that stand in the way of behaviour change".* (Woolfe et al. 1999, pp 530).

There are three key areas relevant to adoption in relation to the innovation itself: the credibility of the change suggested the complexity of the change and whether the change is an entirely new innovation or if it requires modification of previous practices. These are now discussed in turn.

Credibility The credibility of the change in practice or guideline to be implemented is an important factor in predicting whether it will be accepted for implementation by practitioners (Davis and Taylor-Vaisey, 1997b, Grol et al., 1998, Haines and Donald, 1998, Cabana et al., 1999, CRD, 1999, Grol and Wensing, 2005, National Institute for Health and Clinical Excellence, 2007b). Furthermore, the features of the required change are key, in that some changes fit better within the values of the target group than others (Davis and Taylor-Vaisey, 1997b, Haines and Donald, 1998, Grol, 2005). For example, a review of the literature identifies a general consensus that health care professionals do not always believe that

guidelines or the recommendations are best for their own patients (CRD, 1999, Cabana et al., 1999, National Institute for Health and Clinical Excellence, 2007b). That is, their own experience conflicts with recommendations from research findings.

It is suggested that one reason for this view results from professionals seeing only direct outcomes from individual patients rather than population level outcomes (CRD, 1999, National Institute for Health and Clinical Excellence, 2007b). For example smoking counselling is found to increase quit rate from three to five percent, which, when viewed in the context of the prevalence of smoking is beneficial at a population level but is unlikely to be noticed at the individual practice level (Cabana et al., 1999). Cabana et al. (2000) carried out focus groups among health care professionals (mainly paediatricians) to identify barriers to asthma guideline implementation. They found outcome expectancy (the belief that performing a recommendation will have an effect) influenced whether or not guidelines were implemented.

Grol et al. (1998) studied the characteristics of guidelines and levels of implementation of these guidelines and found that recommendations were more likely to be adhered to when an explicit description of the scientific evidence informing the guideline was included. Evidence based recommendations were followed 71% of the time compared to 57% of the time where no evidence was cited.

McKenna et al. (2004) carried out a study asking GPs and primary care nurses (including practice nurses and district nurses) to rank barriers to using EBP. The credibility of the research literature was found to be important in whether these practitioners were likely to consider adopting the findings. Conflicting literature and conflicting guidelines were identified as key barriers to implementation along with the individual's ability to understand the information within the literature, which was often found to be far too technical.

In summary, the more credible a practice or the evidence for that practice the more likely it will be implemented.

Complexity of practice, research or guidance If a recommended change is complex it is less likely to be implemented by practitioners (Grol et al., 1998, Cabana et al., 1999, Berwick, 2003, Michie and Lester, 2005). Focus groups of doctors found that guidelines that are dense, repetitious and lengthy are less likely to be implemented (Cabana et al., 2000). A study of the effect of attributes of guidelines on whether their recommendations are implemented demonstrated a need for clear and precise definition of the behaviour required (Grol et al., 1998). Vague

and non-specific recommendations were followed in 35% of decisions made by GPs and clear recommendations were followed in 67% of decisions.

A systematic review found that in 34 surveys, 10% of respondents cited confusing guidelines as a barrier to their implementation (Cabana et al., 1999). Psychological research supports these findings, the clearer and more precisely behaviours are specified the more they are likely to be carried out (Grol et al., 1998, Michie and Johnston, 2004). Michie and Lester (2005) carried out an RCT where one group of mental health workers were given NICE guidelines for the management of schizophrenia and another group the same guidelines rewritten using "plain English" and behaviourally specific text, that is, text that tells the reader exactly what to do under what circumstances. The behaviourally specific text guidelines led to stronger intentions to implement the guidelines and practitioners had a more positive attitude towards them than to the original guidelines. Writing guidelines where the recommended behaviour is made specific may therefore be the easiest and most effective method of increasing the implementation (Michie and Johnston, 2004, Michie and Lester, 2005).

Established or new practice A systematic review identified changes that recommend the adaption of an established practice may be more difficult to implement than the addition of a completely new practice (Cabana et al., 1999). Grol et al. (1998) studied clinical guidelines and found that when recommendations demanded a change in existing practice they were adopted in 44% of decisions made by GPs. Where change was not required the guideline recommendations were adopted for 67% of decisions made. More recently Michie et al. (2005) carried out interviews with health care professionals and also found changing old behaviours to be more difficult. The authors identified reasons for this including, established beliefs of the benefit of the old intervention, habits and cues within the environment prompting the previous way of practising.

Having outlined barriers and levers relating to the innovation itself, barriers and levers relating to the individual practitioner will now be presented.

Barriers and levers at the individual level

The literature identifies many factors as barriers or levers to the implementation of EBP at the individual practitioner level including their level of knowledge and skill, their attitude to change, the individual's optimism or pessimism in relation to success of the suggested innovation and their motivation, self efficacy and personality. Each of these areas will be explored in turn.

Knowledge/skill Knowledge is a necessary prerequisite for change (Grimshaw et al., 2001, Wensing et al., 2005b, Robertson and Jochelson, 2006).

Change in clinical practice often requires the accumulation of new knowledge or skills; the competence of the practitioner then will influence the success or otherwise of implementation (Wensing and Grol, 2005, National Institute for Health and Clinical Excellence, 2007b). A systematic review identified a lack of awareness of best practice to be a key barrier to implementation for practitioners generally (Cabana et al., 1999). The percentage of respondents in the included studies who identified a lack of awareness as a barrier to implementation was 84%. This was attributed to the vast and expanding body of research, which makes it difficult for any practitioner to be aware of all relevant information or guidelines. Closs and Cheater (1994) identified lack of awareness of relevant research as a barrier to implementation in nurses. They cited potential reasons to be the plethora of research and opinion, poor literature retrieval skills and an insufficient time to spend locating relevant information. Interviews with GPs resulted in similar findings, due to the large quantity of information sent and available to them the resulting response was to ignore most of it (Salisbury et al., 1998). More recently reviews have shown this position has not changed with studies identifying a lack of nurses' skill in evaluating research (DiCenso, 2003) and inadequate knowledge about the change to be implemented (Windle, 2006) being key barriers to the implementation of EBP.

A lack of educational opportunities and a lack of time are identified as barriers to gaining the relevant knowledge and skills (Haines and Donald, 1998, Cranney et al., 2001, Grimshaw et al., 2004b, Pagoto et al., 2007). Cranney et al., (2001) carried out interviews with GPs and found that they experienced difficulty in prioritising education due to competing demands for their time and they also found it difficult to assess their own current educational needs. Grimshaw et al. (2004b) identified the need for protected time for learning to facilitate practitioners accessing educational opportunities. Finally, there is evidence that good levels of staffing is required if each individual is to have the time and opportunity to implement best practice (Cabana 1999, NICE 2007).

Attitude to change and to guidance Attitude to change is also well documented within the literature as a key barrier or lever to change amongst practitioners (Haines et al., 2004, Wensing and Grol, 2005, National Institute for Health and Clinical Excellence, 2007b, Pagoto et al., 2007). In particular, a positive attitude to new evidence in relation to best practice has been found to be essential in the adoption of such practice (Wensing and Grol, 2005). Most of this literature relates to doctors but Estabrooks et al. (2003) systematically reviewed the literature in relation to nurses and individual predictors of research utilisation and found beliefs and attitudes were the most significant predictors of behaviour change.

Health care practitioners are more likely to adopt guideline recommendations if they are involved in their formation (Cheater and Closs, 1997, Cranney et al., 2001, Rycroft-Malone, 2002, Elwyn et al., 2007) or if they are written by a professional organisation rather than the government (Wensing and Grol, 2005). Practitioner participation in guideline development allows an opportunity for disagreements with guidelines to be explored and resolved (Cabana et al., 2000) and establishes a commitment to decisions made (Rycroft-Malone, 2002). Most organisations do not have the adequate resources or skills to develop guidelines from scratch. However, Rycroft-Malone (2002) suggests that by adapting national guidelines for the local context, the issue of "ownership" is addressed and that attitudinal barriers to implementation may be identified and resolved.

Cabana et al. (2000) focused their systematic review on the implementation of guidelines that reflect best practice. They found that clinicians often did not agree with the very concept of guidelines believing that they conflict with the goal of individual patient care. Clinicians thought that guidelines left little leeway for individual practitioners' preferences and little consideration of patient preference and believed that guidelines were often not applicable to their particular practice population. Some practitioners identified a lack of confidence in the guideline developer and considered that rigid guidelines challenged their autonomy and clinical freedom. Lawton and Parker (2002) carried out a focus group study and found that some doctors regarded protocols as restrictive and perceived that they inhibited an individual approach to patient care.

Cranney et al. (2001) carried out a qualitative study using semi-structured interviews to ascertain the views of GPs in England on what helps and hinders implementing best practice (generally and with specific regard to hypertension). Some GPs expressed concerns about applying guidelines which were often viewed as having been developed by "enthusiasts" and having little relevance to typical patients. Doctors identified problems in balancing research evidence that a treatment may prolong a patient's life with the side effects a patient may suffer from the treatment which reduced their quality of life. Where practitioners demonstrate a negative attitude, it is suggested that adapting the innovation to meet their individual preferences may be helpful (Grol and Wensing, 2005). It is also sensible to consider that the use of a respected opinion leader may be beneficial in generating positive attitudes.

Emotion Stress has been found to reduce the ability of practitioners to change their practice (Centre for Reviews and Dissemination (CRD), 1999).

Motivation Motivation is considered relevant to the achievement of change (Cabana et al., 1999, Wensing and Grol, 2005, Elwyn et al., 2007). Grimshaw et al.

(2004b) found that the level of optimism or pessimism of General Practitioners' affected the likelihood of them pursuing funding for initiatives to implement EBP. Cabana et al. (1999) carried out focus groups and identified lack of motivation as a barrier to the implementation of asthma guidance. Incentives (e.g. financial, promotions or certificates) and disincentives (e.g. the potential for malpractice complaint) have been found to affect the motivation of practitioners (Davis and Taylor-Vaisey, 1997b, Proctor, 2004). It is also possible that audit and feedback may be useful as a motivation strategy as this offers objective information and can be used to chart progress.

Self efficacy Self efficacy is the belief that the person can perform a task (Cabana et al., 1999). A systematic review of the literature identified low self-efficacy due to a lack of confidence in ability or lack of preparation is likely to lead to poor adherence to best practice (Cabana et al., 1999).

Personality and features of the individual Salisbury et al. (1998) visited general practices in England and audited three prescribing changes, giving each practice an overall "implementation score". These scores were analysed against practice features (e.g. practice size, use of computers), characteristic of the doctors (e.g. age, sex, qualifications) and a personality measure that each doctor completed. The authors found personality variables, in particular the individuals' preferred approach to problem solving (for example a preference to adapt what exists compared with a preference to innovate) more important than the practice type or the demographic features of the doctors in relation to level of implementation carried out.

Cabana et al. (2000) found that senior doctors emphasised different barriers to younger colleagues. For example, for smoking cessation in asthma patients, younger doctors mentioned barriers associated with lack of training, whereas more senior colleagues identified barriers in relation to outcome expectancy due to patient non-compliance (they don't expect patients will stop smoking so are less likely to promote smoking cessation). This study investigated different aspects of asthma guideline implementation. Interestingly, different aspects of this guideline posed different barriers to paediatricians according to their age alone. It is therefore likely that when other factors are considered, for example different occupational group (nurses or therapists), the range of barriers is likely to be even more extensive and diverse emphasising the need identified earlier for accurate assessment of barriers for different innovations in different individuals.

Barriers and levers in relation to social context

Barriers and levers in relation to the social context of the individual include the patient, the media and the professional identity of the practitioner.

The patient and the media Patients' attitude, knowledge, compliance with treatment, coping, needs and preferences can influence the success of implementation, that is, patient characteristics can stimulate or inhibit change of professional routines (Wensing et al., 2005b). Clinicians reported that when a patient has low outcome expectations of a treatment the clinicians were less likely to adhere to suggested treatments (Cabana et al., 2000). A systematic review of the literature identifies that practitioners sometimes find it difficult to reconcile patient preferences with best practice (Cabana et al., 1999). The authors suggest that this may be because the patient is resistant to change or because the patient may perceive the recommendation as offensive (Cabana et al., 1999).

Scott et al. (2003) observed GPs for 298 patient contacts for upper respiratory tract infections in the USA to assess the reasons for over-prescribing. They found that patient pressure led to much of the inappropriate prescribing. This pressure ranged from the explicit requesting of antibiotics to more subtle strategies such as emphasising that they had waited for some time before consulting. GPs were observed to value patient satisfaction over giving best recommended care.

The media has a role to play when shaping the public's beliefs and expectations about treatments and may lead to inappropriate demands from patients potentially resulting in an impact on health depending upon the nature of the product advertised. DiCenso (2003) identified patients armed with "facts" from the internet could create pressure on clinicians to conform to the patient's expectations rather than to best practice. It is logical therefore that patient mediated interventions may be successful where patient compliance or patient pressure are identified as a barrier to the health care professional in implementing best practice.

In summary, pressure from patients may act as a barrier to the implementation of EBP.

Professional identity Professionals have been found to be influenced by the opinions of their colleagues (Haines and Donald 1998, Wensing and Grol 2005) and different occupational groups react differently to implementing EBP (Lawton and Parker 2002). Sitzia (2002) considers that EBP may be more of a challenge for non-medical practitioners due to the history of EBP starting in medicine. Lawton and Parker (2002) carried out focus groups of health care practitioners to identify barriers and levers to implementing guidelines and protocols in the NHS. Nursing and medical staff differed in their approach to adopting protocols. Non-compliance

by the medical staff was identified by participants. One reason identified for this was a difference in professional cultures. Another reason identified was the feeling of guidelines threatening the use of initiative and autonomy, particularly in the case of doctors. Participants also observed that lack of compliance was sometimes based on being more senior, including when there was no logical justification for this (e.g. hand washing).

Parker and Lawton (2000) also conducted a questionnaire survey of doctors, nurses and midwifes of all grades asking their opinions in relation to hypothetical scenarios regarding compliance with clinical protocols. Midwives were more strongly disapproving toward non-adherence than nurses or doctors irrespective of clinical outcome. Doctors were the least concerned about protocol violation. The authors consider that this may result from the different professional culture of the three groups, nurses being more willing to adhere to rules because this is an accepted part of their role, whereas medical staff may perceive this as a threat to autonomy.

The implementation of EBP may differ according to the occupational group within which the individual identifies themselves to belong.

Organisational barriers and levers

A number of organisational characteristics have been shown to influence the likelihood of EBP being adopted including the culture of the organisation, leadership, funding of innovations, communication and team working.

Organisational culture Scott et al. (2003) carried out a literature review of the nature of organisational culture and culture change in health care organisations in response to the UK government's attempts to reform the NHS aimed at instilling new structures, values and beliefs (DH, 2001). They defined culture as shared assumptions developed within a given group and include rituals, rewards, beliefs, values and assumptions. The authors found some cultural attributes may impede change. These include inadequate leadership, professional allegiances and perceived lack of ownership of the initiative. Another review of the literature identified the culture of the NHS is that of "doing" rather than "questioning" and that EBP was found to be a low priority; more value being placed on experience than research findings (Sitzia, 2002). Scott et al. (2003) investigated whether organisational cultures are capable of being changed by external strategies such as policy. The evidence was inconclusive; the authors concluded that in order to transform culture the process would be complex, multi-levelled and would require a range of strategies and implemented over a period of years.

Cultural difference between researchers and practitioners have been identified within the literature as a barrier to research utilisation (Closs and Cheater, 1994, Proctor, 2004). Differences between the two in knowledge and practice result in different use of language and each having difficulty understanding the other's perspective (Proctor, 2004). The need for clear and credible guidelines and research has been discussed in section 2.3.1. The need for researchers to make research accessible and make the applications relevant to practice is acknowledged, but practitioners also need to take responsibility for finding information that is relevant to their own practice (Closs and Cheater, 1994).

Leadership The strength and style of leadership has also been found to be crucial in implementing EBP (DiCenso, 2003, Grimshaw et al., 2004b, Grol, 2005). Elwyn (2007) found the manner in which new knowledge or guidelines was presented to practitioners to be vital to whether or not they would be accepted and implemented. The credibility of the source of the information was found to be a key factor determining whether the information was later translated into practice. Similarly, Rycroft-Malone et al. (2004) carried out focus groups and semi-structured interviews with nurses who identified the need for a credible project lead, that offers drive and enthusiasm if EBP change was to take place.

Funding Lack of funding has been found to be a barrier to the implementation of best practice (Cabana et al., 1999, Grimshaw et al., 2004a, McKenna et al. 2004, NICE, 2007b). Studies in primary care identify the opportunity costs of new innovations; if reimbursement for extra work is not secured, other areas of care may suffer (Grimshaw et al., 2004b). Cabana et al. (1999) offer an example of this, if there is insufficient funding to provide 24 hour anaesthetist cover in a hospital, it may not be possible to adhere to guidelines aimed at decreasing the rate of elective caesarean deliveries. A questionnaire sent to GPs identified funding EBP to be a major barrier by 71% of participants.

Communication Good communication is considered an essential component to the success of any implementation strategy (Cranney, 1999, CRD, 1999). However, it is recognised that whilst in groups practitioners may agree to decisions made but then individually, may act differently (CRD, 1999). Another problem is the practical issue of getting the right groups to work together as a team or to collaborate professionally due to time or resource or practical issues such as individuals dispersed over a wide geographical area (CRD, 1999).

A clear structure or processes for managing innovation is valuable (Sitzia, 2002). This author suggests that outreach workers could be valuable in bridging the physical gap between practitioners at different sites or gap between different perceptions and understanding.

Summary and critique of the evidence of the effectiveness of methods used to implement EBP and the barriers and levers to practice

Initially the literature relating to the effectiveness of interventions to change practice was reviewed. This was followed by a review of the literature relating to the barriers and levers to the implementation of EBP. Both areas of the literature are large and so the key points to emerge from the overview are now summarised.

Despite the large number of systematic reviews available in the area of implementation of EBP it is not really possible to conclude that any one implementation technique is more useful than another as little meaningful comparison between different approaches has taken place (Oxman, 1995, Bero et al., 1998, Grimshaw et al., 2001, Grimshaw et al., 2004b, Wensing and Grol, 2005, Dijkstra et al., 2006). Interventions to improve professional performance are often complex and disentangling the component parts to assess the effectiveness of each has proved difficult for researchers. Furthermore, variations in reporting between trials and the complexity in separating out different strategies in diverse fields of practice restrict external validity. Additional problems restricting the generalisability of findings include the possibility that researchers may choose interventions they consider suitable for their own environment or practice which may lead to artificially high effect sizes. Most studies contained in the systematic reviews were conduced in the USA, a smaller proportion were conducted in the UK. Differences in individual roles, health care systems, organisations and politics between the two countries could further affect generalisability of findings.

There is little mention and no real evidence available as to how sustainable any changes in professional behaviour are as a result of any one intervention. No evidence was found as to whether repeating the same intervention or a greater dose of the intervention resulted in greater change in professional behaviour or patient outcomes.

It is clear however, that different techniques may work better in different contexts and there is a general consensus that interventions should be tailored in accordance with identified barriers and levers (Oxman, 1995, Bero et al., 1998, Grimshaw et al., 2004b, Baker et al., 2010). Despite no one strategy being uniquely and consistently effective, it is estimated that individual strategies appear to achieve a median of 10% absolute change in professional performance (Grimshaw et al., 2003).

Within the limitations described, at an individual level, it may be tentatively suggested that moderately effective interventions to improve the implementation of EBP include, written materials (Grimshaw et al., 2004b, Dijkstra et al., 2006),

outreach visits and computerised decision systems (for doctors in relation to prescribing, prevention and common conditions) (Oxman, 1995, Bero et al., 1998, Grimshaw et al., 2001), audit and feedback (Oxman, 1995, Bero et al., 1998, Grimshaw et al., 2004b, Dijkstra et al., 2004) and reminders (Grol and Grimshaw, 2003b, Grimshaw et al., 2004b, Dijkstra et al., 2004). Ineffective interventions include didactic educational meetings (Grimshaw et al., 2004b). Interventions where the findings are inconclusive include, patient mediated interventions (Dijkstra et al., 2004), and opinion leaders (Bero et al., 1998, Oxman, 1995, Robertson and Jochelson, 2006, Doumit et al., 2007).

The extensive literature on the effect of multifaceted interventions on changing practitioner behaviour is inconclusive (Oxman, 1995, Grimshaw et al., 2004a, Wensing and Grol, 2005). Combining interventions is likely to be more expensive (Wensing et al., 1998). No specific combination has been found to be the key to success (Wensing et al., 2005b). There is no direct relationship between the number of interventions and the level of success (Grimshaw et al., 2004b).

Some authors consider the use of organisational strategies to be of importance (Bauchner et al., 2001, Grol, 2005, Wensing et al., 2005b) but there is much less evidence than with approaches that target individuals in assessing the effectiveness of such strategies. As with individual level strategies, some organisational strategies work in some situations and for some professionals (Wensing et al., 2005b). Financial incentives are generally found to be effective in changing doctors' professional behaviour (Chaix-Couturier et al., 2000, Gosden et al., 2000) but investigation of this is limited to primary care.

The research was examined in relation to the barriers and levers to EBP and these tend to be grouped around four key areas, the innovation, the individual, social context and organisation factors. Factors relating to the innovation include the complexity and the credibility of the innovation, the research relating to the innovation or the supporting guidelines. Research also suggests that a new practice may be easier to implement and that changing established practice is more difficult. Factors relating to the individual include the practitioners' level of knowledge regarding the practice, their attitude, motivation, self efficacy and their levels of stress. It is also possible that personal factors such as personality type and demographic features may also influence an individual's likelihood to adopt best practice. Social context features include the influence of patients and colleagues. Organisational features include culture, effective leadership and communication and the availability of funding.

Of the large number of implementation intervention studies published and systematically reviewed, there is little evidence to suggest why any of the

interventions are successful or otherwise. This may be due to the studies being carried out in a variety of settings, using different strategies on differing practitioners and as a result of this generalisation is limited.

However it is clear the success of implementation strategies is obstructed by:

A failure to tailor strategies according to identified barriers and levers to implementation of EBP (Oxman, 1995, Bero et al., 1998, Haines and Donald, 1998, Moulding et al., 1999, Cranney et al., 2001, Grimshaw et al., 2004b, Bahtsevani et al., 2004, National Institute for Health and Clinical Excellence, 2007a, Baker et al., 2010). This was the first point that formed the basis of the programme of research presented in this thesis.

The second area of deficit identified in the implementation of EBP was the lack of theoretical basis for the interventions used to support the implementation of evidence into practice (Estabrooks et al., 2003, Grimshaw et al., 2004b, Bonetti et al., 2005, Michie et al., 2005). This point is explored in more detail below.

2.3.3. Theoretical basis for the interventions used to implement EBP

As identified in Chapter 1 there is increasing interest and investigation into the use of theory in understanding the barriers and levers to the implementation of EBP and to design implementation strategies (Grimshaw et al., 2004b, Michie et al., 2005). It has been suggested that the use of theory may explain why some implementation strategies are more effective than others (Robertson et al., 1996, Moulding et al., 1999, Eccles et al., 2005). Although, as outlined above, there is a vast literature relating to implementation and considerable resources have been devoted to encouraging practitioners to implement EBP, success to date has been limited and implementation strategies often appear to be selected on the basis of intuition rather than any explicit underlying theory (Bonetti et al., 2005, Grol, 2005). Eccles et al. (2005) consider that without the application of theory improving clinical practice will always be fraught with difficulties.

The implementation of guidelines requires the adoption of particular practices/behaviours by a health professional. Thus, theories of behaviour and behaviour change may provide a sound theoretical basis for addressing issues of implementation (Eccles et al., 2005). Evidence relating to the use of psychological theories in the context of implementation of guidelines in health care is presented here.

The relevance of psychological theory

Psychological theory provides a framework to further understanding and showing relationships between psychological variables such as beliefs, attitudes and

the behaviour in question, in this case adopting best practice (Bonetti et al., 2005). There are a great number of theoretical models explaining behaviour change generally (Bonetti et al., 2005, Michie et al., 2005). Some authors have investigated these and their application to the implementation of EBP (Ashford et al., 1999, Scott et al., 2003, Grol, 2005, Michie et al., 2005). The general conclusion from this work is that relevant psychological theories fit into three broad categories; those specific to the individual (e.g. cognitions, motivation, routine and learning style), the immediate social context (e.g. the influence of others, social norms and interactions); and the organisational context (e.g. culture and resources) (Robertson et al., 1996, Ashford et al., 1999, Grol, 2005). The relevant theories are not distinct but often overlap, sometimes to a large extent (Ashford et al., 1999, Grol, 2005, Michie et al., 2005).

Applying psychological theory to EBP

Robertson et al. (1994) were one of the first research groups to suggest changing practitioners' behaviour using psychological theory. They suggested an implementation framework whereby the required innovation (or target behaviour) is identified, the barriers to implementation are assessed prospectively, the relevant theory (or theories) is then identified to inform which strategies are likely to be useful in achieving implementation.

The concept of applying psychological theory to implementation strategies is relatively new. A systematic review of the use of theory (from 1966 to 1998) in the field of implementation found only 14 out of 235 studies that explicitly used theory. The authors of the review concluded that greater use of explicit theory is required to understand barriers and to design interventions (Davies et al., 2010). More recently there have been a small number of studies testing the use of doing so. Some studies investigate the predictive utility of theoretical models and some investigate the efficacy of interventions based on such theory. These studies are discussed below.

Studies Investigating the Predictive Utility of Theoretical Models

The Theory of Planned Behaviour (TPB) is a motivation theory that focuses on the role of intention toward a behaviour, a strong intention to carry out any behaviour making the likelihood of the behaviour greater (Ajzen, 2005). Using TPB as a framework, Eccles et al. (2006) identified the value of an individual's intention to do something as the most immediate predictor of their behaviour. They carried out a systematic review (including published material up to 2004) to explore the relationship between intention and behaviour of practitioners. The authors found only ten studies that had explored this issue. The authors concluded that intention appears to be a valid precursor that can be used for predicting the behaviour of

health care professionals and may be useful in the development of implementation strategies.

Walker et al. (2001) explored TPB with GPs who continue to prescribe antibiotics for patients with sore throats in the light of evidence showing this practice is ineffective and contributes to antibiotic resistance. TPB suggests that in order to change behaviour it is necessary to change intention and intention is driven by beliefs. Walker et al. (2001) used questionnaires to measure GP's intention to prescribe antibiotics, their attitudes, beliefs, their perceived behavioural control and past prescribing patterns. The majority of GPs intended not to prescribe antibiotics for patients with an uncomplicated sore throat. Attitude and perceived control were found to be the most important predictors of intention. The more reluctant GPs were about prescribing antibiotics and the more control they felt they had over factors promoting prescription (e.g. patient expectation) the greater their intention not to prescribe. In addition the authors found that the frequency of antibiotic prescribing in the past also had an effect on intention to prescribe in the future. The authors considered this to be attributable to automatic behaviour or environmental prompts. The authors concluded that implementation interventions aimed at challenging GPs beliefs regarding antibiotics would be the most beneficial in changing practice.

TPB was used by O'Boyle et al. (2001a, 2001b) to develop a model to explain adherence to hand hygiene recommendations. The authors developed a hand washing assessment inventory designed to measure the motivation toward hand washing for practitioners. They formed questions from the underlying variables of intention; attitude, beliefs about outcomes, referent beliefs, control beliefs, subjective norm, and perceived behavioural control. One hundred and twenty registered nurses participated. Responses were then correlated with their self reported hand washing behaviour and for all variables except referent beliefs, were found to be significant. However, there was no correlation between the variables and actual hand hygiene as measured by observation.

Sax et al. (2007) found similar results. They questioned health care professionals and found normative beliefs and control beliefs were associated with good adherence with hand hygiene. However, this survey did not measure actual adherence to hand hygiene practices, rather self reported adherence.

Another questionnaire was derived from the TPB and used to investigate the relevance of intention on making appointments according to abortion care guidelines (Foy et al., 2005). Again, a lack of perceived control was found to be associated with poor compliance.

One of the limitations of the studies outlined above is their outcome measures of self reported behaviour or behavioural intentions. Some authors have found little correlation between self reported and actual behaviour (e.g. O'Boyle et al. 2001) which makes drawing conclusions based on these outcome measures difficult. Furthermore, these studies only examine the use of TPB. Two studies were found that tested the predictive utility of not only TPB but other psychological theories too. These studies also used actual behaviour as an outcome measure.

A study carried out by Eccles et al. (2007) aimed to explore the usefulness of a range of psychological theories to predict practitioner behaviour. GP's in Scotland were given a series of five clinical scenarios which described patients presenting to the GP with upper respiratory tract infections (URTI). GP's were also asked to complete questionnaires covering their views and experiences about managing patients with URTIs. This questionnaire assessed psychological constructs including TPB, social cognitive theory and learning theory. The outcome measure was antibiotic prescribing rates. The authors found that intention predicted prescribing behaviour. Other areas of importance included perceived control, risk perception, attitudes and habit. This study explored correlations not cause but the authors considered that results suggested that an intervention targeting the elements described in this study may be successful.

The second such study was a postal survey of Scottish dentists was carried out by Bonetti et al. (2006) to assess their intention to take oral X-rays. The questionnaire included items designed to assess intention, attitude, behavioural beliefs and behavioural control from TPB. It also included items designed to assess the perception of risk, outcome expectancies and self-efficacy, from social cognitive theory. From behavioural theories, the questionnaire aimed to assess anticipated consequences, previously experienced consequences and habit. The number of X-rays carried out was used as the outcome measure and was assessed from the number of claims submitted for having carried out X-rays. The authors found several variables predicted the clinical behaviour of taking X-rays. Taking X-rays was more likely the stronger the intention, the more positive the anticipated consequences and the more automatic the clinical behaviour. Fewer X-rays were taken the more control the dentist felt they had and the more confident they were that they could mange patients without an X-ray.

It is evident that early attempts have been made to establish the value of using psychological theory in the field of the implementation of EBP. However, there are very few and most of those that exist appear to be limited to the TPB. From the limited research available, it may be tentatively suggested that intention appears to

be a valid precursor for predicting the behaviour of health care professionals in implementing EBP.

Studies investigating the efficacy of interventions based on theory

Having identified a number of studies confirming the predictive utility of theoretical models the literature was reviewed to identify studies that have used such theory to investigate the efficacy of interventions based on theory and to investigate the assessment of barriers and levers to EBP and how this assessment has aided the accurate tailoring of implementation strategies.

Bonetti et al. (2003) carried out a study to explore TPB within the field of implementation of EBP by dentists. They hypothesised that as one of the best predictors of behaviour is known to be intention, an implementation strategy that successfully influences behavioural intention would be more likely to change EBP than a strategy that did not. The likelihood of performing a behaviour can be increased by the individual planning when they will carry out that particular behaviour. After dentists had been given new SIGN (Scottish Intercollegiate Guidelines Network) guidance in relation to extracting fewer molars the authors carried out an RCT, the outcome measure being the intention to extract fewer molars. The study was carried out with 99 dentists. Both groups, control and intervention, were sent questionnaires. The intervention group were asked what management alternatives (planning) they intended using instead of extraction before they were asked about their intentions relating to extraction; the control group was asked only about their intentions. The intervention group demonstrated a significantly higher intention to follow the guidance and carry out fewer extractions. This led the authors to conclude that theoretically based implementation strategies are likely to be successful. This study was based on TPB. Intention being the precursor of a behaviour, and specific planning how, where and when to carry out a behaviour increasing intention. Planning different strategies to extraction in a number of given situations successfully reduced dentists intention to extract. Unfortunately this study compared intention only and did not compare numbers of extractions in the two groups.

One study was found that designed behaviour change interventions based on psychological theory (Hrisos et al., 2008a, Hrisos et al., 2008b). The beliefs and attitudes of GPs regarding the management of upper respiratory tract infections (URTI) without antibiotics and rates of prescribing on patient scenarios were measured before and after intervention. The two interventions were, a graded task exercise (to address the construct of self-efficacy) and persuasive communication (targeting constructs of anticipated consequences and risk perception), which were incorporated into the post-intervention questionnaire. The graded task intervention

had no significant effect on the GPs intention not to prescribe antibiotics or their simulated behaviour, however, GPs reported greater confidence in their ability to manage URTIs without prescribing. The persuasive communication intervention was effective on both intention and the behavioural simulation. They also reported greater anticipation of positive consequences for themselves and their patients in prescribing fewer antibiotics. This study is one of the few to assess the barriers and levers to implementation using psychological theory. It is also one of the few to tailor interventions according to these findings. This study demonstrated the potential of using psychological theory in assessing barriers and levers to EBP and also the feasibility of developing and tailoring interventions to change practice that are underpinned by theory.

Summary and critique of the evidence of the use of theory in the implementation of EBP

Authors identify the need for an explicit theoretical basis for the assessment of barriers and levers to EBP and as the basis of interventions used to implement EBP. As described above some research has been carried out using psychological theory to understand, predict and influence practitioners' behaviour. Theories used to understand practitioners' behaviour are grouped around those that work at individual, social and organisational levels. TPB has been used the most to predict practitioners' behaviour; only two studies were identified that tested other psychological theories. Very few studies use psychological theory in the assessment of barriers and levers or as the theoretical basis for interventions. Most studies are descriptive rather than interventional and most do not measure actual behaviour.

One reason cited for this absence of recommended theory is that it is largely inaccessible to non-psychologists, being complex, vast and with many overlapping constructs (Michie et al. 2005). However, a group of Health Psychologists within the British Psychological Society (BPS) took steps to simplify theory relevant to the implementation of EBP (Michie et al., 2005). They carried out a project aiming to identify an agreed set of key theoretical constructs for the use of researchers and practitioners in the field of implementation to inform the design of implementation methods to support EBP. Initially a set of 33 relevant psychological theories were identified by a group of psychology experts. These included i) motivation theories such as TPB (Ajzen, 2002), ii) action theories such as leaning theory (also known as operant conditioning or behaviourism) (Skinner, 1987) which suggests that if a behaviour is followed by a positive consequence, the behaviour is reinforced and increases in frequency, while negative consequences have the opposite effects and iii) organisation theories such as social influence theory, which refers to the way that a person adapts their opinions, behaviours, attitudes and beliefs in response to the

opinions, behaviours, attitudes and beliefs of others (Leenders 2002). These 33 theories included 128 key theoretical constructs related to behaviour change; the psychology experts reached a consensus on categorisation of these into behavioural determinants, the aim being to integrate this vast theory into a single framework. This work resulted in a set of 12 theoretical domains with component constructs and key interview questions to prioritise the domain or domains that represent key barriers and levers to implementation of EBP.

Not only does this framework offer the opportunity to carry out a theoretically comprehensive assessment of barriers or levers, further work has been carried out that allows accurate tailoring of theoretically based implementation strategies. First of all, a taxonomy of defined, theoretically based behaviour change techniques was developed (Abraham and Michie, 2008). Following this these techniques were mapped onto the domains (determinants of behaviour change) of the BPS framework (Michie et al., 2008b).

The result of the programme of research outlined above is a framework which i) is accessible and easy to use for non-psychologists, ii) contains all identified behaviour change theories thus facilitating a comprehensive assessment of relevant barriers or levers to EBP and iii) allows the tailoring of identified behaviour change techniques according to these assessed barriers and levers. For these reasons the BPS framework was selected as the theoretical basis for the instrument developed. Examples of use of this framework are discussed in the context of this research in Chapters 3 (section 3.1.3.) and 6 (section 6.1.2.).

In section 3.3.2. it was identified that the success of implementation strategies is obstructed by a failure to tailor strategies according to identified barriers and levers to implementation of EBP (Oxman, 1995, Bero et al., 1998, Haines and Donald, 1998, Moulding et al., 1999, Cranney et al., 2001, Grimshaw et al., 2004b, Bahtsevani et al., 2004, National Institute for Health and Clinical Excellence, 2007a, Baker et al., 2010).

In this section the need for a theoretical basis to the assessment of barriers and levers and as the basis for implementation strategies was identified (Estabrooks et al., 2003, Grimshaw et al., 2004b, Bonetti et al., 2005, Michie et al., 2005). These two issues form the basis for the programme of research presented in this thesis. The example of EBP used for this research is hand hygiene. The rationale for this and some background to this area of practice are presented next.

2.3.4. Healthcare associated infections and the role of hand hygiene

Hand hygiene was the example of practice chosen for this research for a number of reasons.

1. Hand hygiene has been identified as the single most important factor in the reduction of Healthcare Associated Infections (HCAI) (World Health Organisation (WHO) 2009);

2. Despite the importance of hand hygiene, it being a seemingly simple activity and there having been a great deal of effort to improve matters, practitioners' adherence to hand hygiene guidelines is unacceptably low (Pittet and Pittet, 2001, Larson et al., 2007).

The following review of the literature begins with an outline of the size of the problem of HCAI in terms of morbidity and mortality, cost to the NHS and the reasons it has become a greater problem in recent years. Following this the literature is presented demonstrating the importance of hand hygiene in reducing HCAI, the political importance is then outlined briefly through a summary of international and national policy. Following this, the problem of practitioners' low levels of compliance with hand hygiene is presented and finally possible reasons for this are explored through presenting the literature with regard to the barriers and levers to EBP and hand hygiene practice.

Healthcare associated infections – the size of the problem

The term HCAI has been defined as:

> *"any infection by any infectious agent acquired as a consequence of a person's treatment by the NHS"* (Department of Health (DH) 2006, pp 1).

HCAI is a world wide problem in both developed and developing countries adversely affecting hundreds of millions of people (WHO, 2009). Although the term HCAI is often used to describe the problem globally, in developed countries the greatest risk of infection is associated with patients in hospital as these patients are suffering from more severe illnesses, they are cared for with other patients (who may have infections) and they are undergoing more invasive procedures than patients receiving care in other facilities (Health Protection Agency (HPA) 2007).

In developing countries the burden of HCAI is estimated to be as high as 40% of all hospital infections (60% being acquired prior to hospitalisation and often being the reason for hospitalisation) (WHO 2007). In developed counties 5-15% of patients admitted for acute hospital care acquire an infection not present or incubating at the time of admission (WHO 2009). The type of patient likely to suffer from HCAI is dependent upon their condition. For example, pneumonia contracted in hospital occurs most frequently among patients who have been ventilated and therefore have been in intensive care, 80% of urine infections are traced back to urinary catheters, 60% of blood infections are introduced by intravenous lines and post-operative infections are more likely the more complex the

surgery (Department of Health, 2002). The burden of HCAI is increased further in high-risk patients such at those admitted to Intensive Care Units where the rate of HCAI can be as high as 31.8% (WHO, 2009).

It is estimated that 5 million HCAIs occur in Europe annually (WHO 2009), in the UK it is estimated that there are 300,000 cases of HCAI per year (NAO 2000). Approximately 135,000 deaths per year in Europe (WHO 2009) and 5000 deaths per year in the UK are caused by HCAIs (WHO 2007).

Costs to the National Health Service (NHS)

There are few recent studies estimating the financial cost of HCAI. A systematic review examining the cost of HCAI to health services in developed countries (date range 1990 – 2000) found published research to be generally lacking in rigor, with many studies not including a comparison group and some studies being narrow in scope by including only a few potential costs (Stone et al., 2005). However, some of the studies included in the review, although older, were of good enough standard to estimate that the total financial burden to hospitals in the United States as a result of HCAI exceeded $6.5 billion at 2004 prices (Stone et al., 2005).

The most recent study of the cost of HCAI in England was by Plowman et al. (2001). They found that in-patient stay costs were on average 2.9 times greater for patients with HCAI than those of uninfected patients. Furthermore post discharge, patients with HCAI had greater contact with their GP, visited the hospital outpatient department more frequently and had more visits from district nurses. The annual cost to the NHS of HCAIs in England was estimated to be £986.36 million (1994/5 prices). These authors also suggest that if a 15% reduction of HCAI (considered possible) was achieved, £140 million could be saved. Further, it was estimated that a reduction of HCAI by 10% could release 364,056 bed days (Plowman et al., 2001). Pratt (2005) reports anecdotal and media opinion of further costs to the NHS through litigation and damaged reputation. This opinion is supported by a recent UK based Health Protection Agency survey of the general public's attitudes and awareness of public health issues. When given a list of public health issues to rank in order of concern HCAI was the biggest area of concern for people (HPA 2007).

HCAI as an Increasing Problem

HCAI is an increasing problem in the UK and world wide as these infections are becoming harder to treat for a number of reasons.

Increasingly vulnerable population One reason why HCAI is becoming more problematic is that the general population is becoming increasingly vulnerable due to the rising prevalence of diseases and treatments that compromise the immune system (Larson, 1999). Examples of diseases compromising the immune system

include HIV infection and malignancies and treatments that compromise the immune system including chemo therapy and drugs taken to suppress the immune system in order to prevent the rejection of transplanted organs (Larson, 1999).

The role of antibiotics Attempts to improve infection control are compromised by the evolution of bacteria that are becoming increasingly resistant to antibiotics (NAO, 2000). There is evidence that the increase in antibiotic resistant bacteria (such as Methicillin-resistant staphylococcus aureus (MRSA) may be due to the overuse of antibiotics; the use of broad spectrum antibiotics increased from 24% in 1988 to 47% in 1994 (Boyce, 2001).

More recently the increased use of antibiotics is also considered to be, in part, responsible for the increased rates of some bacterial infections such as Clostridium difficile (a severe infection of the colon) (Department of Health, 2007b). Broad spectrum antibiotics can eradicate the normal flora of the bowel which leaves it susceptible to Clostridium difficile (DH 2007).

Staffing and workload Understaffing is also an issue identified in the literature found to be associated with high rates of HCAI. Vicca (1999) found incidence of new cases of MRSA correlated with times of high nursing staff work load and times of reduced nurse to patient ratios. There is also evidence to show that staff shortages, reliance on temporary staff and increased use of unqualified staff are associated with increased HCAI (National Audit Office, 2004). Studies by Hugonnet et al. (2007) estimated that low levels of nurse staffing was associated with a 50% increase in risk of HCAI. High bed occupancy and the increased movement of patients between wards are further reasons associated with higher levels of HCAI (Pittet and Donaldson, 2005). Average daily bed occupancy in England was 80.8% in 1996/7 and 86.5% in 2002/3 (DH, 2004). The findings of the NAO (2004) report suggest that some performance targets (for example reducing waiting lists and waiting times for operations) may be making the issue of HCAI less of a priority, staff report being discouraged to close wards to control infections.

The role of hand hygiene and HCAI Hand hygiene has been identified as the primary measure to reduce HCAI (World Health Organisation, 2009). Hand hygiene is also selected as the example of practice for this study and it is now presented in detail below.

Hand Hygiene

In order to understand the role of hand hygiene in relation to HCAI it is necessary to first briefly outline normal skin flora. Skin is normally colonised with bacteria and these can be divided into two categories, transient and resident (Boyce and Pittet, 2002). Transient flora, often acquired by health care practitioners during

contact with patients or contaminated surfaces near the patient are most frequently associated with HCAI and the most amenable to removal by hand hygiene practices (Boyce and Pittet, 2002). Resident flora are less likely to be associated with HCAI and are more resistant to removal (Boyce and Pittet, 2002). The bacteria (or other pathogen such as virus fungus or protozoa) present on the patient's skin (or, for example, shed to objects close by such as furniture) can be transferred to the health care practitioner's hands. Hence, if hand hygiene is omitted or carried out inadequately the bacteria can then be passed on to the next patient the health care practitioner touches, leading to possible infection (NAO, 2000, Boyce and Pittet, 2002).

Semmelweis is recognised as being the first to demonstrate the role of hand hygiene in the prevention of infection transmission in a health care facility with his seminal paper published in 1847 (cited by Larson, 1999, Pittet and Boyce 2001, WHO, 2009). Semmelweis found that women whose babies were delivered by students and doctors in one hospital had a consistently higher mortality rate than those whose babies were delivered by midwives in a different hospital (Pittet and Boyce, 2001). Semmelweis hypothesised that the hands of the students and doctors were less clean in the first hospital and insisted they clean their hands with a chlorine solution between seeing patients and as a result the maternal mortality rate subsequently dropped dramatically (Pittet and Boyce, 2001).

More recently a large body of literature has emerged supporting the role of hand washing in health care settings in the prevention of HCAI (Aiallo and Larson, 2002, Pittet and Boyce, 2001, Pittet et al., 2000).

The Epic project guidance of 2001 (Pratt et al., 2001), updated in 2004 (Pellowe et al., 2004) was commissioned by the DH to provide national evidence based guidelines for the prevention of HCAI in England. All existing guidance on hand hygiene was reviewed and over 200 hand hygiene references were considered of sufficient quality to include in this systematic review. The authors identified four key studies that confirm an association between hand hygiene and reduced infection rates (Ryan et al., 2001, Fendler et al., 2002, Gould et al., 2000, Pittet et al., 1999a) which were also cited by the National Institute for Health and Clinical Excellence (NICE) (2003) and are described below. The guidance concluded that hands should be cleaned before and after every episode of patient care and after any activity that may result in them becoming contaminated (Pellowe et al., 2004). Furthermore, the authors concluded that hands that are visibly soiled or obviously contaminated should be washed with soap and water, alcohol based hand rub is preferable otherwise. Hands should be washed with soap and water after several consecutive applications of alcohol rub as some residue may build up from the use of rub

(Pellowe et al., 2004). The authors also describe exactly how soap and water or alcohol based hand rub should be applied.

NICE (2003) carried out a systematic review of the evidence in relation to the role of hand decontamination in the prevention of health care acquired infections in order to produce guidance. They acknowledge the difficulty in designing and conducting randomised controlled trials (RCTs) in the area due to ethical concerns. As sufficient evidence already exists regarding the positive effects of hand hygiene it would be wrong to design a study with a control group in which less than maximum attention was given to hand hygiene (NICE, 2003). This report cited the four studies also reported by Pellowe et al. (2004) that confirm the association between hand decontamination and reduced levels of infections. First an uncontrolled before and after study where a hand washing programme was introduced (Ryan et al., 2001). A programme of hand washing was introduced in a large Navy training centre in the US aiming to reduce the incidence of upper respiratory tract infections. Recruits received orders to wash their hands at least five times per day. Evaluation of the programme identified an overall reduction in rate of respiratory illness of 45% post implementation.

The second study identified was a non randomised clinical trial in a 275 bed facility caring for people with illnesses such as cerebral vascular accident, dementia and chronic diseases in the US (Fendler et al., 2002). In approximately half of the units within the facility the care givers were given alcohol hand gel, the remainder of the units served as the control group. The rate of infection in the patient group where the care givers were using the alcohol hand gel was 30% lower than in the group not using the gel over a three year period.

The third study identified was an observational study involving district nurses caring for people in their own homes (Gould et al., 2000). By observing hand hygiene practice and testing hands for bacteria throughout the day they found that poor conditions in patient's homes compromised the nurse's ability to perform hand hygiene adequately which increased the risk of cross infection.

The final study discussed in the NICE report observed episodes of care in hospitals in Switzerland over a three month period, at the end of each episode of care, hands of the health care practitioner were tested for bacteria counts (Pittet et al., 1999a). The authors found that contamination of hands increased progressively during routine patient care, contamination of hands was highest on rehabilitation wards and lowest on orthopaedic surgery wards and use of alcohol gels was more effective in removing bacteria than hand washing.

The advice resulting from the NICE systematic review of the evidence in relation to hand hygiene is:

> *"Hands must be decontaminated immediately before each and every episode of direct patient contact or care and after any activity or contact that could potentially result in hands becoming contaminated."* (NICE 2003, pp 32).

Since the systematic review by NICE (2003) other evidence has been published. Rabie and Curtis (2006) carried out a systematic review on hand washing and the risk of respiratory infections, eight studies met the review inclusion criteria and all found that hand cleansing lowered risks of respiratory infection by an average of 16%.

Although there are few randomised controlled trials in the literature that have provided evidence of the link between hand hygiene and reduced HCAI rates, it is clear that there are many quasi-experimental and epidemiological studies contributing to a large body of evidence that hand hygiene procedures result in fewer episodes of HCAI (Larson, 1999, Pittet and Boyce, 2001, Ryan et al., 2001, Fendler et al., 2002). Moreover, there is consistency of findings within the literature between improvements in hand hygiene practices and reduction of infection rates (Larson, 1999, Pittet et al., 2000, Pittet and Boyce, 2001, Rabie and Curtis, 2006). There is also consistent evidence of increased pathogens on health care practitioners' hands after patient care (Cooper et al., 1999, Pellowe et al., 2004, NICE, 2003). Hugonnet and Pittet (2000) consider the body of evidence suggesting poor hand hygiene practices as a cause for HCAI to be compelling. Larson (1999) asserts that the cumulative evidence for a causal link between hand hygiene and reduced HCAI is stronger than for many other accepted clinical practices. Indeed, the WHO (2007, 2009) now identifies hand hygiene as the primary measure to reduce infections in view of this compelling evidence.

However, despite this evidence supporting hand hygiene practice, there is still a problem with practitioners' compliance with hand hygiene policy (Aiallo and Larson, 2002, Pittet et al., 2004, National Audit Office, 2004, World Health Organisation, 2009).

A brief outline of hand hygiene policy will be presented next to illustrate the current high profile of this practice and for background information. Following this the poor compliance of health care practitioners with hand hygiene will be illustrated before explanations are sought through exploring the literature in relation to the barriers and levers to EBP and effective hand hygiene practice.

History of international and national policy on hand hygiene practice

There is considerable International and UK policy attempting to address the problem of HCAI and identifying the solution as improvement in hand hygiene practice.

In October 2004 the World Health Assembly approved the creation of an international alliance for patient safety leading to an advanced draft document of guidelines identifying hand hygiene as the primary measure required to reduce HCAI (WHO, 2004). This document identifies compliance with hand hygiene practice as a problem and offers health care professionals clear guidance on aspects of hand hygiene and information on overcoming potential barriers. The WHO evaluated the effect of this policy in pilot sites representing a wide range of health care facilities. After the evaluation a definitive set of guidelines on hand hygiene was drawn together (WHO, 2009). The WHO (2009) also aims to raise awareness and build commitment in countries to reducing HCAI. Specific recommendations include stronger leadership and greater commitment from governments (in particular health ministers). One of their key recommended actions was the formation of national campaigns to promote hand hygiene among health care practitioners, outlined in their global patient safety challenge for 2005/2006, "Clean Care is Safer Care".

The National Audit Office (NAO) (2004) carried out a review of the response to HCAI in a range of developed countries including the US, Australia, New Zealand Belgium, France, England, Denmark, Spain, Norway and the Netherlands. All countries with a strategy for addressing HCAI had developed these in response to the increasing threat of bacteria resistance to antibiotics and the consequent increase in HCAI (NAO 2004). All selected countries now have guidelines in place for preventing HCAI as well as legislation and surveillance programmes. With the exception of Spain, all countries examined also have specialist roles such as infection control directors and nurses within hospitals.

In the UK there has been a gradual increase in political attention given to the problem of HCAI (DH 2000-2008). "The Health Act" (DH, 2006) made good practice for the prevention of HCAI essential. This document identified duties of NHS hospital trusts to provide hand wash facilities and hand rubs and for all individuals to adhere to policies and protocols relevant to preventing HCAI (including hand hygiene guidelines) and identified the sanctions that would be taken if either fails to adhere. The Chief Medical Officer and Chief Nursing Officer referred to the code as:

> *"now a legal requirement for acute hospitals and other care providers"* (DH, 2006, Introductory Letter pp 1).

The government cite some success of their policies. They consider policy has led to correlation between high bed occupancy and HCAI to be weaker than previously, has led to correlation between ward cleanliness and HCAI to be weaker than previously and that policy accounts for the downward trend in MRSA numbers and incidences (Department of Health, 2007d). Hand hygiene became increasingly high on the political agenda with the formation of the National Patient Safety Agency and the "cleanyourhands" campaign (NPSA 2007). Then again in 2009 when a Care Quality Commission was set up with the power to fine hospital trusts if standards are unsatisfactory (Care Quality Commission, 2010).

However, despite the high profile of hand hygiene through policy and media and its link with the increasing problem of HCAI there is evidence of poor compliance with hand hygiene.

Health care Practitioner compliance with hand hygiene

There is consistent evidence that the frequency and the quality of hand hygiene practice are suboptimal with average compliance usually below 50%, duration of hand washing as little as 4.7 seconds and technique often being deficient (Pittet and Boyce 2001). In view of international and national efforts to address HCAI and establish good hand hygiene practice it was considered possible that this figure may have improved in recent years, however, recent estimates in the literature identify that little has changed. A systematic review of practitioners' compliance with hand hygiene practice between 1981 and 2008 indicates a range of mean baseline rates from 5 to 89% representing an overall average of 38.7% (Allegranzi and Pittet, 2009, WHO, 2009). When rates are compared across decades this gives a rate of 40.1% for the 1980's, a rate of 37.48% for the 1990's and 39.03% for the 2000's indicating that compliance has not improved. Erasmus et al. (2010) carried out a similar systematic review, including studies published before January 2009 and found a median compliance rate of 40%.

Strategies used to improve implementation of EBP were reviewed and presented in section 2.3.1. Some of these strategies have been evaluated in the case of hand hygiene. Naikoba and Hayward (2001) systematically reviewed the effectiveness of interventions aimed at increasing hand washing in health care practitioners. They found 11 studies that evaluated the effect of a single intervention on compliance with hand hygiene. Results showed that educational interventions have short term influence on hand hygiene practices. Reminders (e.g. posters or asking patients to remind staff) can have a modest but more sustained effect. Audit and feedback increased hand hygiene practice, but if it is not repeated regularly the effect is not maintained over long periods. Ten studies included investigated

multifaceted interventions. A combination of education, audit feedback, reminders were found to have an effect on hand hygiene compliance.

Gould et al. (2007) carried out a systematic review on the success of strategies to improve hand hygiene compliance. Only two studies met the inclusion criteria and both included education as their intervention. In both studies the outcome measure was number of times hand hygiene was performed before and after the intervention. One study found a post intervention increase and in the other there was no increase in hand hygiene. The authors conclude that there is little robust evidence to inform the choice of interventions to improve hand hygiene specifically.

Aboelela et al. (2007) systematically reviewed the literature for the effectiveness of interventions aimed at changing practitioners' behaviour in specific regard to infection control practices (not only hand hygiene). Strategies used included educational interventions, the formation of a multidisciplinary quality assurance team, compliance monitoring, compliance and performance feedback and staff skills development and testing. Two or more interventions were used in all studies making it difficult to determine the effectiveness of individual interventions. However the authors concluded that educational programmes and multi-disciplinary teams may be effective strategies in reducing the rates of HCAI.

The only study reported within the literature that describes sustained improvements in hand hygiene practice was carried out by Pittet et al. (2000). They observed compliance with hand hygiene before, during and after a hospital wide campaign to improve hand hygiene practice. The campaign was multifaceted comprising of colour posters emphasising the importance of hand hygiene (replaced with new designs two weekly, 70 designs in total), performance audit and feedback, individual bottles of alcohol based hand gel were given to staff and alcohol hand gel was available by all beds. Overall compliance over the three year period improved from 47.6% to 66.2% overall, with reduced levels of HCAI (16.9% to 9.9%) and reduced MRSA rates (2.6 to 0.93 episodes per 10,000 bed days).

Although this was clearly a successful campaign and unique in terms of sustained improved practice, HCAI rates before intervention were much higher that the estimated expected rate of 9% (WHO 2004). Post intervention rates were approximate to the 9% expected in developed countries. Therefore, there was more room for improvement in this hospital than is likely in others. The intervention was intended to be ongoing and the authors questioned whether the compliance would be maintained after withdrawal of the intervention. Interestingly, although overall improvements in compliance were noted, there was no significant change in the compliance of doctors in this study.

Having established low compliance with best practice for hand hygiene the possible reasons for this are now explored in terms of the barriers and levers to hand hygiene practice. Section 2.3.2. identified the barriers and levers to EBP under four key areas, the innovation, the individual, the social context and the organisation context. Barriers and levers to hand hygiene have been outlined below according to these groupings and Figure 2.2. summarises and compares the barriers and levers to EBP generally and to hand hygiene practice specifically.

Barriers and levers in relation to the innovation

Credibility The lack of scientific information on the impact of hand hygiene on HCAI is reported by practitioners as a barrier to good hand hygiene practice (Hugonnet and Pittet, 2000). Section 2.3.4. of this literature review demonstrates that scientific evidence is available supporting the use of hand hygiene in the reduction of HCAI. It is therefore possible that practitioners are unaware of this, dissemination may have been ineffective. Lack of recognition of the risk of cross infection and lack of belief in the guidelines for hand hygiene have been found to be barriers to implementation (Boyce and Pittet, 2002). Sixty one percent of practitioners report that their seldom seeing complications to poor hand hygiene practice acts as a barrier to them adopting best practice.

Complexity of research or guidance Although hand hygiene is considered simple to undertake, there are some reports in the literature that it may be difficult to integrate it into routine practices in diverse hospital environments with the competing demands that practitioners face (Grol and Grimshaw, 2003b).

Skin irritation Skin irritation, has been found to be a barrier to hand hygiene compliance. In a study of 120 doctors and nurses 81% identified irritation of the hands as a barrier to following guidelines for hand hygiene (Grol and Grimshaw, 2003a).

Barriers and levers in relation to the individual

Knowledge/skill. A lack of awareness about hand hygiene protocols or guidelines is identified as an important barrier to hand hygiene practice in surveys of staff (Hugonnet and Pittet, 2000, Pittet and Boyce, 2001). Forty nine percent of practitioners reported a lack of guidelines in hospitals (Grol and Grimshaw, 2003b). A further example of lack of knowledge has been demonstrated with glove use. Hand hygiene is necessary regardless of whether gloves are used, however, a systematic review demonstrated that staff were less likely to wash their hands after wearing them (Pittet and Boyce, 2001). A survey of practitioners identified they considered glove use meant additional hand hygiene was unnecessary, which is not the case (Hugonnet and Pittet, 2000). O'Boyle et al. (2001a) observed nurses and

found they touched numerous objects in the environment (including the common desk area) with gloves contaminated with patient secretions or excretions which where subsequently handled by other practitioners.

Attitude to change and to guidance Attitude was found to influence hand hygiene practice. Pittet et al. (2004) observed the practice of a group of doctors and asked them to complete a self report questionnaire relating to attitudes and beliefs. They found that a positive attitude toward hand hygiene was associated with greater adherence to guidelines.

Emotion Emotion is rarely acknowledged in the literature as a barrier or lever to hand hygiene practice. However there are recent studies that demonstrate that when a practitioner feels "disgust" with dirty hands this is likely to act as a motivator for hand hygiene (Whitby et al., 2007, Porzig-Drummond et al., 2009).

Motivation Two studies were found that investigated the influence of motivation on hand hygiene practice. O'Boyle et al (2001b) studied health care practitioners adherence to hand hygiene practice and the effect of motivational factors and intentions. Motivational factors and intention were related to the self reported estimation of adherence. However, motivational factors and intention were not related to observed (actual) adherence.

Pittet et al. (2004) surveyed physicians to assess beliefs and perceptions about hand hygiene and observed their hand hygiene practice. The authors found that when physicians were aware of being observed their compliance was significantly higher than when they were not being observed. This suggests that social pressure may affect hand hygiene behaviour. Adherence was associated with a positive attitude to hand hygiene, the belief of being a role model for others and the perception of hand hygiene as being a social norm.

Barriers and levers in relation to social context

The patient and the media With regard to hand hygiene there has been a recent initiative to employ patients to help promote hand hygiene practice. In the Chief Medical Officer's annual report for 2006 (Department of Health, 2007a) it was stated:

> *"although the impact of patient involvement in hand hygiene practice has yet to be assessed or researched in a significant way it is not difficult to postulate how influential this may be"* (Department of Health, 2007a).

However, no research was identified that tested this in the field of hand hygiene.

Professional identity Many studies look at differences between professions in relation to hand hygiene practice. Overall compliance may be around 50% but compliance for doctors appears to be much lower. For example Creedon (2005) found compliance of nurses to be 56%, other practitioners (including physiotherapists and health care assistants) 66% and doctors 31%. Estimations of doctors hand hygiene compliance are as low as 19% (Salemi and Canola 2002).

Pittet et al. reviewed the literature and described the consistently low compliance of doctors to hand hygiene practices to be:

"an unsolved and vexing issue" (Pittet et al., 2000 pp 1311).

Salemi and Canola (2002) recognised the problems of low hand hygiene compliance in doctors and attempted to address it. They observed the hand hygiene behaviour of doctors in an ICU and a cardiac care unit on 5 occasions over a 29 month period. Baseline compliance with hand hygiene was 19%. The intervention included an infectious disease physician meeting with participants to report results and obtain commitment to hand hygiene guidelines. Results were offered by email, and presentations. Compliance with hand hygiene practices increased significantly. When surveyed about the most effective intervention of those included, doctors reported the meeting with the infectious disease physicians. It is possible that whilst this is likely to be a costly intervention, greater costs may be saved from a reduction of HCAI. Although improvement was marked (up to 85%) there was a gradual drop in compliance (to 68%) over time.

One study found physiotherapists less likely to clean their hands than other health care practitioners (Pan et al., 2008) and male practitioners have been found to be less likely to clean their hands than females (Pittet, 2000).

Barriers in relation to the organisation

Organisational Culture With regard to organisational culture and hand hygiene, a systematic review of the literature by Pittet et al. (2001a) found the lack of role models for good hand hygiene practice and lack of priority within organisations acted as barriers to practice. The effect of role models on hand hygiene compliance was assessed by Lankford et al. (2003). They found that practitioners in a room with a higher ranking person who did not wash their hands were significantly less likely to wash their own hands. However, if the higher ranking person performed hand hygiene, the performance of the other practitioners was not significantly improved. That is, only negative role models influenced behaviour. The authors also found that practitioners washed their hands more frequently when the risk was perceived to be for themselves rather than other patients. When surveyed 45% of health care professionals considered that

management was not interested in hand hygiene practice (Grol and Grimshaw, 2003b).

Area of work There are differences in hand hygiene compliance among practitioners according to the area in which they work. Health care practitioners have been observed to be less compliant with hand hygiene if they work in intensive care units, surgical units or accident and emergency departments (Pittet et al., 2004). It is thought that this is associated with the higher frequency of hand hygiene required in these areas (Pittet et al., 2004).

Funding Lack of funding has been identified to be a barrier to the implementation hand hygiene, for example, Lawton et al., (2006) asked staff to use implementation tools to promote hand hygiene. They questioned staff about barriers to using the suggested slide set, fact sheets, posters and surveillance. Two main barriers identified were time and cost. The authors estimated the time and cost likely to be involved at 88.6 hours of individuals time and $27.30 (excluding staffing) respectively.

Practical problems: facilities A practical barrier was found to be the absence of facilities for hand hygiene (Pittet, 2001b, Grol and Grimshaw, 2003b). However, a study in Australia covertly observed nurses hand washing behaviour before and after a move from an older to a new hospital (Whitby and McLaws, 2004). In the old hospital clinical staff were often up to 30 meters away from a sink, following the move the new hospital design meant that no clinical activity could take place more than 5 meters away from a sink. Hand hygiene with alcohol based hand rub was not practised at this hospital. Hand hygiene compliance initially rose but this was not sustained over a 6 month period. This suggests that whilst provision of appropriate facilities may be an essential prerequisite to good hand hygiene practice, improving and sustaining compliance requires more intervention.

Practical problems: time Time was repeatedly reported by practitioners as a barrier to good hand hygiene practice (Brown et al., 2009, Pittet and Boyce, 2001). A study estimated the time needed for 100% hand hygiene compliance in an intensive care unit was 230 minutes per patient per day (McArdle et al., 2006). Pittet et al. (1999b) carried out a survey of hand hygiene practices. They found that professional category, type of ward, time of the week or day and the intensity of patient care needed all influenced whether or not practitioners carried out hand hygiene practice. Non compliance was higher in intensive care units compared with medical wards. This was because when there was a higher need for hand hygiene, there was lower compliance, on average compliance dropped by approximately 5% when the need for hand hygiene exceeded ten occasions per hour.

Pittet and Boyce (2001) reviewed the literature in relation to time and hand hygiene compliance and concluded that in intensive care units there may be as many as 40 occasions where hand hygiene is required per hour. They also found that the average duration of hand washing ranged from 4.7 to 24.4 seconds (guidelines suggest thorough wetting, vigorous rubbing with soap and water for a minimum of 15 seconds followed by careful drying of hands (Pittet and Boyce, 2001)). The wide implementation of alcohol gel may have addressed this somewhat as the time necessary to use such gel is around 20 seconds in total. Pittet and Boyce (2001) consider that a bedside alcohol gel could solve three barriers to hand hygiene, time, lack of facilities and skin problems. However, whilst alcohol hand gel may cut time in some instances; it is not a direct alternative to hand washing. Guidelines of the hand hygiene task force identify that none of the agents in alcohol hand rub or antiseptic soaps are effective against spore forming bacteria (e.g. Clostridium difficile) the physical action of washing and rinsing is still necessary after potential exposure to such spores (Boyce and Pittet, 2002).

Figure 2.2.

The Barriers and levers to EBP and hand hygiene practice: summary

	Evidence Based Practice		Hand Hygiene Practice	
	Barrier	**Lever**	**Barrier**	**Lever**
The Innovation	Lack of Credibility of the research/guideline Limited relevance to practice Conflicting guidance/literature Unfeasible Innovation complex Changing established practice	Research or guideline credible Relevant to practice Consistent guidance/literature Feasible Innovation easy to implement	Hand agents cause irritation Does not consider there is scientific information on impact of improved hand hygiene Disagree with guidelines	Provision of alcohol gel
Individual	Lack of competence in relation to knowledge and skill Lack of ability to understand research Negative attitude to change Lack of "ownership" of guidelines Pessimism Poor motivation Poor self efficacy Stress/negative emotions	Practitioner has the relevant knowledge and skill An ability to understand research Positive attitude to change "Ownership" of guidelines Recommendations are from a professional organisation rather than government Optimism Good motivation Good self efficacy	Lack of competence and knowledge	

Social	Patient lack of/poor expectations Patient demands for ineffective care Poor role models	Appropriate patient expectations Good role models	Doctor status Nursing assistant status Poor role models Lack of culture/tradition for HH practice	Nursing status Female
Organisational	Poor leadership Funding unavailable Poor communication Lack of time No/poor educational opportunities Practical issues such as poor equipment	Good leadership Available funding Good communication Time available Educational opportunities available Rewards/sanctions and recognition	Intensive care environment Sinks inconveniently located/shortage of sinks Lack of soap/paper towel/alcohol gel Understaffing Conflicting priorities Lack of educational opportunities Insufficient time Not an organisational priority Guidelines unavailable	Good staffing levels Sufficient time Rewards/sanctions

2.4. Conclusions

2.4.1. Summary of findings

The literature was reviewed in four sections. Initially, the evidence in relation to changing clinical practice was reviewed. There is a substantial literature relating to this and it is clear that although considerable resources are being devoted to encouraging practitioners to implement EBP success is limited and strategies appear to be selected based on pragmatism rather than any explicit underlying theory (Bonetti et al., 2005, Grol, 2005). The lack of a theoretical basis for interventions to improve the implementation of EBP has been identified as one of the reasons for the limited success of these interventions (Grimshaw et al., 2004b, NICE, 2007a).

As clinical practice is a form of human behaviour, behaviour change theory may offer the basis for use within the area of implementation (Eccles et al., 2005). Behaviour change theory and its use in the field of implementation were reviewed. There are only a small number of studies investigating the use of such theory in the implementation of EBP (including (Walker et al., 2001, Bonetti et al., 2003, Foy et al., 2005, Hrisos et al., 2008b)). Fewer still investigate the use of such theory in the implementation of hand hygiene practice (for example (O'Boyle et al., 2001a, Hanna et al., 2009)). There are a number of possible reasons why psychological theory is rarely used or tested within the field of implementation. Psychological theories have been identified as being inaccessible to many researchers in the field of health as they are numerous, complex and have many shared or overlapping constructs (Michie et al., 2005). This was addressed by a group of health psychologists in the BPS and the framework that resulted from their work was specifically designed to be used in the field of the implementation of EBP.

To investigate the implementation of EBP, in the context of this PhD thesis, hand hygiene was selected as an appropriate example. The review of the literature identified that hand hygiene is important in reducing HCAI (World Health Organisation, 2009) yet compliance with this practice has been well documented to be low (Pittet and Boyce, 2001, World Health Organisation, 2009).

The barriers and levers to the implementation of EBP and hand hygiene were presented in this chapter. It is suggested that through the assessment of barriers and levers to the implementation of EBP (Grimshaw et al., 2004b) and the tailoring of implementation strategies according to these (Grimshaw et al., 2004b, Baker et al., 2010) that success can be achieved in positively influencing clinical practice.

2.4.2. Limitations of the review of the literature

Only English language papers were included in this literature review with one exception. A questionnaire relating to the barriers and levers to evidence practice, available in English, had been extensively tested by a group of researchers (Peters et al., 2003). Unfortunately this work was not available in English. Due to the high level of relevance to this study it was translated. Other relevant studies in other languages may have been missed.

2.5. The aim of the thesis in the light of the literature

The overall aim of the research presented in this thesis (Chapter 1, section 1.3.) was to:

Develop and test a **theory-based** diagnostic instrument to accurately and prospectively **assess the barriers and levers** to hand hygiene practice to inform subsequent **tailoring of implementation strategies.**

The literature review supports this aim as follows:

1. The theoretical basis for the diagnostic instrument will be the BPS framework (Michie et al., 2005) which has been developed for the purpose of research and clinical improvement in the field of the implementation of EBP. As this framework is in the early stages of validation, this research will first test the framework in assessing barriers and levers in a qualitative study presented in Chapter 3;

2. The barriers and levers to EBP identified through review of the literature will form the basis of an interview schedule for a qualitative study to produce a comprehensive list of barriers and levers to hand hygiene practice (Chapter 3) and will subsequently form the basis of the diagnostic instrument ultimately produced (Chapter 5);

3. The instrument will be assessed for its ability to assess the barriers and levers to hand hygiene.

CHAPTER 3: BARRIERS AND LEVERS TO HAND HYGIENE

3.1. Introduction

This chapter describes a qualitative study designed to identify the barriers and levers to hand hygiene practice. The aims of this study are listed below followed by an overview of these objectives. The research methods are then described and the results are presented. This is followed by a discussion in the context of the objectives of the study.

3.1.1. Study aims

1. Identify barriers and levers to hand hygiene practice in secondary care;

2. Compare the use of a theoretically based question schedule with a non-theoretically based schedule in identifying barriers and levers to hand hygiene practice;

3. Compare and contrast the research methods used to identify barriers and levers to hand hygiene practice;

4. Assess the value of including patients in the identification of barriers and levers to hand hygiene practice.

3.1.2. Barriers and levers to hand hygiene

In order to build on the literature review presented in Chapter 2, health care practitioners and recent hospital patients were questioned about barriers and levers to hand hygiene practice.

3.1.3. Psychological theory

As discussed in Chapter 2, the British Psychological Society (BPS) framework was chosen as the theoretical framework used for this research Michie et al. (2005). The BPS framework was developed in recognition of the need to offer a theoretical basis to the assessment of barriers and levers to EBP and the need for theoretically informed implementation strategies. Health psychology theorists, health service researchers and health psychologists contributed to a study aimed to identify all theories and theoretical constructs relevant to behaviour and behaviour change, simplify these into theoretical domains and develop interview questions based on these. Ultimately, after six phases of work (1. identifying constructs, 2. simplifying into domains, 3. evaluating the importance of domains, 4. evaluating the framework, 5. validating the domain list and 6. piloting interview questions) eleven domains were identified to explain behaviour change. The 11 domains, component

constructs and examples of questions investigating the implementation of evidence based practice are summarised in Figure 3.1. No definitions for domains existed when the research for this thesis was undertaken. Recently definitions have become available and are therefore included in Figure 3.1. (Cane et al. 2010). These definitions are discussed in Chapter 4 (section 4.3.1.). A 12th domain, *"nature of behaviour"* (Michie et al., 2005) describes the behaviour itself rather than factors likely to influence it, and was therefore omitted in this study. The 11th domain, *"behaviour regulation"* was later renamed *"action planning"* (Michie et al., 2008a) which was the term adopted for the purposes of this study.

Figure 3.1. Theoretical domains, component constructs and examples of questions investigating the implementation of evidence based practice (Adapted from Michie et al. 2005)

Domain	Domain definition (Cane et al. 2010)	Examples of constructs	Examples of questions
1. Knowledge	An awareness of the existence of something	Knowledge about condition/scientific rationale	What do they think the guideline says?
2. Skills	An ability or proficiency acquired through practice	Skills, competence, ability	How easy or difficult do they find performing x?
3. Social /professional role and identity	A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting	Identity, professional identity, social/group norms, alienation, organisational commitment	What do they think about the credibility of the source?
4. Beliefs about capabilities	Acceptance of the truth, reality or validity about an ability, talent, or facility that a person can put to constructive use	Self-efficacy, control of behaviour and material and environment, perceived competence, self confidence	How easy or difficult is it for them to do x?
5. Beliefs about consequences	Acceptance of the truth, reality or validity about outcomes of a behaviour in a given situation	Outcome expectancy, attitudes, beliefs, salient events, sanctions/rewards	What do they think will happen if they do x?
6. Motivation and goals	The outcomes or end states to which one is striving and a person's willingness to exert physical or mental effort into the pursuit of those outcomes or end states	Intention, goals, intrinsic motivation, commitment	How much do they want to do x?
7. Memory, attention and decision processes	The ability to retain information, focus selectively on aspects of the environment and choose between two or	Memory, attention, decision making	Will they think to do x?

	more alternatives		
8. Environmental context and resources	Any circumstance of a persons' situation or environment that discourages or encourages the development of skills and abilities, independence, social competence and adaptive behaviour	Resources, environmental stressors	To what extent do physical or resource factors facilitate or hinder x?
9. Social influences	Those interpersonal processes that can cause individuals to change their thoughts, feelings or behaviours	Social support, social/group norms, leadership, group conformity, social pressure	To what extent do social influences facilitate or hinder x?
10. Emotion	A complex reaction pattern involving experiential, behavioural and physiological elements by which the individual attempts to deal with a personally significant matter or event	Affect, stress, anticipated regret, fear, burnout, threat, anxiety/depression	Does doing x evoke an emotional response?
11. (Behavioural regulation) Action planning	Anything aimed at managing or changing objectively observed or measured actions	Goal/target setting, implementation intention, action planning, goal priority, feedback	What preparatory steps are needed to do x?

The BPS framework is new and therefore not yet widely used. A literature review identified only the following three studies where this framework has been used to assess barriers and levers to EBP or to inform implementation strategies.

The first was a qualitative study involving general practitioners and the implementation of coronary heart disease (CHD) guidance (Michie et al., 2004). The authors investigated the difference between GPs who had been successful in achieving measures included in the guidance for CHD and those who were less successful. They interviewed GPs about these guidelines; the interview was based on the theoretical constructs of the BPS framework. Less successful implementers expressed less belief in the guidelines, they felt a lack of ownership of the guidelines, considered they challenged professional autonomy and they perceived more negative outcomes for themselves and their patients in adopting the guidelines. These fit within domains *"knowledge"* and *"social/professional"* role and identity; the authors considered that having identified these barriers and levers to implementation it was clear that in this situation the implementation strategies likely

to be the most useful included involving the professionals in developing the guidelines.

The second study involved testing the implementation of NICE guidelines for the treatment of schizophrenia (Michie et al., 2007). The guidance stated that family intervention should be offered to families of people with schizophrenia but the intervention is underused; reports suggesting that between three and 17% of patients suffering from schizophrenia actually receive family therapy. Interviews were carried out with key professional groups responsible for implementing the guidance (social workers, nurses, psychiatrists, psychologists and team managers) exploring barriers and levers to implementing these guidelines. Questions were based on the BPS framework. The numbers of participants in each professional group identifying each theory based domain as an explanation for implementation difficulties were recorded. The authors found differences in barriers between different professional groups. This led the authors to conclude that a theoretical approach was successful in identifying the underlying barriers and suggests this may therefore allow the tailoring of implementation strategies, in this case, according to professional group.

The third study involved assessing barriers and levers to blood transfusions in ICU/neonatal ICU consultants (Francis et al., 2009). Eighteen consultants were interviewed using questions based on the BPS framework. A thematic analysis took place where transcripts were coded according to the constructs within the domains of the BPS. *"Knowledge"*, *"beliefs about capabilities"*, *"beliefs about consequences"*, *"social influence"* and *"behaviour regulation"* were determined as the key domains influencing the practice of this group of clinicians. The authors concluded that using this framework resulted in the identification of a greater breadth of barriers and levers than would have been possible if a single theoretical model had been adopted.

The studies described above demonstrate some success of the BPS framework to date in assessing barriers and levers to EBP or as the basis of implementation interventions. The framework is currently being tested by a number of international research teams (Michie, 2008). For example, a study protocol describes the intention of researchers to test the effectiveness of theory based interventions for implementing lower back pain guidance in primary care (McKenzie et al., 2008). The researchers intend to carry out a cluster RCT of general practices in which the control group receive the lower back pain guidance while the intervention group will receive interventions tailored to the barriers and levers identified (Abraham and Michie, 2008).

To date no study has directly compared the findings from interviews (or any other research method) using the BPS framework to those not employing this model.

Thus, it is not possible to argue strongly that interviews utilising the framework are more effective at identifying a broad range of barriers and levers. In this study interview data will be compared according to whether participants were interviewed using the BPS or non-BPS framework.

3.1.4. Choice of method

There is no consensus within the literature as to which research method is the optimal approach to assessing barriers and levers to best practice. A recent systematic review identified 26 studies where barriers to EBP (all EBP not just hand hygiene) were assessed (Baker et al., 2010). A range of methods had been used, some studies using more than one method to assess barriers and levers. The most frequently used methods were interviews (used in 12 studies); focus groups (seven studies) and questionnaires (seven studies). Other methods of assessing barriers and levers were used in these studies less frequently, these included literature reviews of barriers (four studies) workshop discussions or meetings (three studies), observations of practice (one study) and using performance data (one study). One study identified had attempted to assess the value of different methods when assessing barriers and levers (Flottorp and Oxman, 2004). These authors used different methods to identify barriers to change in practice for two conditions: the management of urinary tract infections and sore throat. These methods included a literature review, guideline development process, brainstorming, focus groups, small groups in workshops and informal interviews. It was concluded that no method used alone identified all the barriers and levers. The authors reported that it was not possible to draw conclusions as to which methods identified different or additional barriers or levers as methods were not used independently.

Based on the lack of consensus of the best research method to assess barriers and levers and based on the findings of Flottorp and Oxman (2004) it was decided to use three data collection methods for this study. Having carried out a review of the literature already, into the barriers and levers to hand hygiene and based on a review of methods most frequently used for this purpose, the methods selected were therefore interviews, focus groups and questionnaires.

3.1.5. Patient participation

Researchers have assessed the barriers and levers to EBP in many settings using a number of techniques. Most studies involve only practitioners as participants. Only two studies were identified that involved patients in this process (Flottorp and Oxman, 2004, Peters et al., 2003). No formal evaluation of the value of patient participation took place in either study.

The first study (Flottorp and Oxman, 2004) was based in primary care in Norway and involved conducting focus groups with patients who had suffered urinary tract infections (UTIs). Patients were given the guidelines for the treatment of UTIs and discussed obstacles to implementation of these guidelines for practitioners. The authors concluded that the findings highlighted the importance of seeking multiple perspectives in the assessment of barriers and levers rather than relying solely on professional perspectives. Through personal email correspondence Professor Flottorp offered further information by way of email correspondence on the participation of patients in this study (Flottorp, 2008). She found that patients' views were sometimes different from doctors and the participation of patients allowed the doctors' preconceived perceptions of the patients' views to be challenged resulting in a varied picture of barriers and levers.

In the second study, Peters et al. (2003) constructed two questionnaires to assess barriers and levers to the implementation of EBP in different fields of health care, one for practitioners and one for patients. The main focus of the questionnaire for patients was barriers for the patient themselves (e.g. not complying with medical advice due to the cost). However, it also investigated patients' perception of barriers for the practitioner (e.g. patients considered the practitioner was not educated in the relevant field). Unfortunately the findings of the part of this research that involved patients was limited due to a low response rate and the authors concluded that more research is necessary to explore barriers to implementation with patients.

There are other factors supporting patient participation in assessing barriers and levers to hand hygiene. For example, patient mediated interventions (e.g. giving patients educational materials to enable them to influence practitioners' behaviour) are often used as implementation strategies (Oxman, 1995, Grilli et al., 2002, Grimshaw et al., 2004a) although research into their effectiveness is inconclusive (Grimshaw et al., 2004a). This illustrates the potential for patient involvement in implementing EBP.

Patients have been involved in different ways in relation to the implementation of EBP. With regard to hand hygiene specifically, recently, there has been an initiative to employ patients to help promote hand hygiene practice. In the Chief Medical Officer's annual report for 2006 (Department of Health, 2007a) it was stated:

> *"although the impact of patient involvement in hand hygiene practice has yet to be assessed or researched in a significant way it is not difficult to postulate how influential this may be"* (Department of Health, 2007a).

In response to this the National Patient Safety Agency (NPSA) carried out a feasibility study into involving patients thus (NPSA, 2008). Patients were receptive

to the idea of being given a bottle of hand gel on admission, so that they can offer it to practitioners before they care for them. However, they believed practitioners should participate in hand hygiene without being asked. Staff results demonstrated mixed views, most staff considered hand hygiene would be improved if patients were given hand gel but some staff thought such action would create tensions.

To summarise, public policy (Department of Health, 2007a) supports patient participation in both the research process and in promoting hand hygiene. However, the contribution that patients can make to assessment of barriers and levers is largely untested. It is however considered potentially useful (Flottorp and Oxman, 2004, Peters et al., 2003) and as a result of this a decision was made to add a further objective to the study, objective four, to assess the value of including patients in the identification of barriers and levers to hand hygiene practice.

3.2. Method

3.2.1. Research ethics

Ethical approval was obtained from the National Research Ethics Service (NRES), Leeds East Committee, in April 2008 (08/H1306/31). A substantial amendment was sought and achieved to include focus groups and questionnaires in the first phase of the study in June 2008 as inclusion of interviews and focus groups was added to the study protocol after initial approval had been achieved. Approval was sought and achieved from the School of Healthcare Research Ethics Committee (SHREC) to include recently admitted hospital patients in June 2008 (SHREC/RP/132) as the decision to include patients was made after the initial ethical application had been made. Research Governance approval was obtained from the three NHS hospital trusts involved before the research was carried out. (For all ethics and research governance approval see appendix 1).

3.2.2. Recruitment of study sites

Participants (health care practitioners and patients) were recruited from three different NHS hospital trusts. A diversity of NHS trusts was sought in order to identify the widest range of perspectives on barriers and levers to hand hygiene practice. For pragmatic reasons proximity was considered when selecting trusts along with two further measures:

1. MRSA rates, a publicly available (Health Protection Agency, 2007) proxy measure of hand hygiene practice as this is identified as the single most important measure to reduce hospital acquired infection (World Health Organisation, 2007);

2. Hygiene ratings based on assessed core standards (Healthcare Commission, 2007).

Figure 3.2. illustrates these measures in more detail and compares 2007 data across the three NHS hospital trusts selected.

Figure 3.2. Data used to select participating NHS hospital trusts

Measure Considered	NHS Trust		
	Trust 1	Trust 2	Trust 3
MRSA Rate compared to National Average	Lower than Average	Average	Higher than average
HCC standard C04a – infection control	Compliant	Compliant	Not Met
HCC standard C04c – decontamination	Compliant	Insufficient Assurance	Not Met
HCC standard C21 – clean, well designed environment	Compliant	Compliant	Compliant

The lead for Infection Prevention and Control (IPC) within each of the three trusts was approached, given information about the study (by email including participant information sheets) and asked if they would support the research within the trust.

3.2.3. Recruitment of participants

There is no definitive sample size when it comes to conducting qualitative research. Guest et al. (2006) carried out a literature review to establish how many interviews are enough. They found that whilst all studies suggest until data saturation is achieved there is little guidance on how to determine data saturation. The authors of this review searched 24 research methods text books and seven databases and found only seven sources where actual participant numbers are suggested. Of these seven sources only one offers guidance that is applicable to this study. Kuzel (1999) suggests that sample size should be determined according to how heterogeneous the sample is. He recommends six to eight participants for a homogeneous sample and between 12 and 20 data sources when trying to achieve maximum variation. Therefore, due to the intention to recruit a heterogeneous sample of participants, with variety in both professional role and area of work within the professional sample and area of admission for recent hospital patients, it was expected that a somewhat larger sample may be necessary in order to achieve data saturation. It was therefore decided that 25 practitioners and 25 recent (admitted in the last 12 months) hospital patients (hereafter referred to as "patients") would be interviewed in the first instance and this would be extended if data saturation had not been achieved.

To allow comparison of the three research methods similar numbers of participants were recruited to focus groups. Again, for the purpose of comparison, 25 returned questionnaires were considered sufficient. No incentives to participate were offered to participants.

Participants: Health care practitioners

The lead for Infection Prevention and Control (IPC) in each of the three participating trusts was approached and invited to participate in an interview. They also provided email contact details for managers of key groups of practitioners who were sent information about the study. Through this group of managers it was possible to gain email contact information for other practitioners who were contacted and asked to participate in an interview (interviews were carried out first). The same method was used to recruit for focus groups (which were carried out second). After discussion with departmental managers, they were sent a number of questionnaires to distribute to a range of their staff. Questionnaires were sent out last. Purposive sampling was used to recruit practitioners for interviews and focus groups. Participants were recruited from a broad range of work areas (e.g. elderly care, accident and emergency) and from a broad range of occupational groups (e.g. nurses, doctors, therapists). This was in order to ensure that a diversity of insights was captured. Questionnaires were sent out to a similarly wide range of practitioners according to work area and occupational group.

Participants: Recent hospital patients

Patients who had been admitted in the last 12 months in one of the three hospital trusts were recruited to the study to take part in an interview. This was to ensure that any information provided by patients was reasonably current. INVOLVE (public participation specialists) (2010) suggest a number of ways to recruit service users. Initially Public and Patient Involvement (PPI) groups in each of the NHS trust areas were approached. However, during this phase of the study PPI groups were being dissolved and Local Involvement Networks (LINks) were being formed. Patient representation was therefore limited within these groups and very few recent patients were identified and recruited this way (two participants only). In order to achieve a broad range of participants 10 community groups were approached. These were as follows (where stating the name of the centre compromises anonymity the trust number is substituted):

- Trust one: *"Trust One"* Trinity Methodist Church Social Group, *"Trust One"* Neighbourhood Watch Group.
- Trust Two: *"Trust two"* Neighbourhood Watch Group, *"Trust two"* Toddler and Babies Group.

- Trust three: Salvation Army Luncheon Club, *"Trust three"* Day Centre, Over 55's Club, North *"Trust Three"* Friendship Centre, *"trust three"* Day Centre, Health For All *(trust three)* Ltd.

These were carefully chosen to satisfy the objective of recruiting participants who had been admitted to a range of hospital areas as many community groups cater for a narrow group of the community. All of the 10 groups approached agreed for the researcher to attend to speak to the group leader/coordinator or those attending the group. In some cases the group leader preferred to speak to members and ask if they had been in hospital recently and if they were willing to speak to a researcher. In this case information sheets were given to the group leader. In other cases the group leader preferred the researcher to attend the group and speak to people directly. All participants who were identified to fit the recruitment criteria agreed to take part.

3.2.4. Design

In order to address the aims of this study, that was to identify the barriers and levers to hand hygiene, compare the use of theory based and non-theory based schedules and to compare and contrast the research methods for collecting the data a cross-sectional, qualitative approach was adopted using semi-structured interviews, focus groups and questionnaires. The procedure for each of these methods will be described separately below.

In order to address the second aim of the study, two schedules of questions were designed. The first schedule was based on the theoretical model, the BPS framework, the second schedule (referred to hereafter as non-BPS framework) was based on the known barriers and levers to hand hygiene practice identified from a review of the literature (see sections 2.3. and 2.7.). Questions were arranged across 5 categories, the innovation itself (hand hygiene), individual influences, social influences, organisational influences and other. Figure 3.3. provides examples of questions from both schedules.

The question schedules designed for practitioners were adapted for use with patients. These asked about participants' observations of barriers and levers to hand hygiene for practitioners and visitors and for themselves as patients (full question schedules are appended 2 to 5). For example, where practitioners were asked "How easy is it for you to carry out hand hygiene practice?" patients were asked "How easy is it for health care practitioners to carry out hand hygiene practice?"

In order to compare methods it was necessary to keep the content of questions for the questionnaires as similar to interviews and focus groups as possible.

Therefore the items used in the questionnaires were exactly the same as those shown in Figure 3.3. but space was provided for responses (appendices 6 and 7).

BPS and non-BPS schedules were used alternately for interviews and focus groups (that is every other interview or focus group carried out was BPS) and an equal number of BPS and non-BPS questionnaires were distributed.

Figure 3.3. Sample of Questions used according to schedule: BPS compared with non-BPS

BPS based questions (Adapted from Michie et al., 2005)		**Non-BPS based questions** (derived from review of the literature)	
THEORETICAL DOMAINS	**SAMPLE QUESTIONS**	**CATEGORIES LITERATURE**	**SAMPLE QUESTIONS**
Knowledge	• Can you tell me a bit about any hand hygiene policies protocols or guidance please?	**The innovation: hand hygiene**	• What do you know about infection control and hand hygiene practices and where has this information come from? • Is it easy or difficult to clean your hands in practice? • What do you think about the rules for washing /disinfecting hands?
Skills	• Do you know how to wash/disinfect your hands according to protocol?		
Social/professional role and identity	• To what extent is following guidelines for hand hygiene or infection control part of your professional role?		
Beliefs about capabilities	• How confident are you that you can achieve good hand hygiene practice?	**The Individual**	• What helps or stops you from following good hand hygiene practice? (prompts: training, time, information, constraints) • Do you sometimes fail to wash your hands when you should? (prompts: when, why)
Beliefs about consequences	• What are the advantages of hand hygiene practice?		
Motivation and goals	• Are there other things that you want or need to do or achieve that might interfere with consistently carrying out good hand hygiene practice?	**Social factors**	• Do you think different groups/teams/areas perform hand hygiene better than others? (prompts: trends, reasons) • What happens if someone does not wash their hands?
Memory attention and decision processes	• What are the times and situations you are most likely to forget to carry out hand hygiene?		
Environmental context and resources	• What environmental factors help or hinder hand hygiene? (prompts: time, gel, local sinks)	**Organisational factors**	• What measures have you seen to promote or help you/others follow good hand hygiene practices? • Is there anything that would help support good hand hygiene?
Social Influences	• Do people you work with influence your hand hygiene practices? (prompts: peers, managers, patients, relatives)		
Emotion	• How do you feel when you think about hand hygiene? (prompt: and how does that influence your hand hygiene?)	**Other**	• What helps/stops your hand hygiene practice? • What else could be done to improve hand hygiene practice?
Action Planning	• Are there any systems to monitor changes in hand hygiene in your work place?		

3.2.5. Procedure: Interviews

Pilot interviews were carried out with four practitioners and one patient. This demonstrated that the interview schedules were largely acceptable and understandable and only minor changes were made. These consisted entirely of rewording questions that the participants had not fully understood. Interviews took place over a period of 9 months from July 2008. Half were carried out using BPS format and half non-BPS.

Health care practitioners

Having received email addresses or postal addresses from departmental managers of potential participants, practitioners were sent an email or letter asking them to participate in the study (letter of invitation can be seen in appendix 8). An information sheet was attached or sent to them also (appendix 9). Practitioners were asked to consider whether or not they would like to participate and to contact the researcher (PhD student) to suggest a time, date and venue of their convenience. practitioners generally chose to be interviewed in their work place. A private office or room away from the clinical area was organised either by the participant or by the researcher. On one occasion only, a participant chose to attend a room at the researcher's place of work. The interview time was arranged to fit in with the individual participant, usually taking place during their working day.

As the researcher and participant introduced themselves, found the relevant room and completed the necessary paperwork a rapport was established prior to the interview taking place. Once settled in the interview room written and verbal information about the study was given again. The participant and researcher signed two consent forms to this effect, one of which the participant kept (appendix 10). Interviews were recorded and fully transcribed.

Patient participants

Contacts between the researcher and the patient took place in several different ways. Two patients were recruited from PPI groups. The PPI representative contacted the patients initially, requesting permission to give their contact details to the researcher. In both cases a telephone number was given. These patients were contacted by telephone and given verbal information about the study. They were asked if they would mind receiving an information sheet about the study and having agreed to this were told that they would be contacted again, once they had received the information sheet in order for an appointment to be made for interview should they be willing to take part. On both occasions, when telephoned at this time participants agreed to be interviewed in their own home.

Community group leaders were contacted by telephone. They were given verbal information about the study and asked if they would identify possible participants, give them an information sheet and request that the researcher contact them, or allow the researcher to attend the group to speak to participants directly. Where they agreed to distribute information the researcher arranged to telephone again after one to three weeks (depending on how often the group met). On this occasion the community group leader suggested a time for the researcher to attend the group to meet the potential participant or passed on the potential participant's telephone number (this happened in one case only and the procedure here was as described for those recruited through PPI groups).

On attending the community group, the leader and the potential participant were offered photographic identification of the researcher. Although most participants remembered being given an information sheet they were given a second sheet to prompt any questions they may have had about the study (patient information sheet appendix 11). A room at the community venue was provided for the interview. Plenty of time was allowed to establish a rapport and to answer any questions about the study.

Where community group leaders invited the researcher to attend the group and recruit participants, the researcher spoke to members in clusters according to where they were sitting and the activity they were engaged in. They were given verbal and written information about the study. They were told that the researcher was keen to hear the views of people who had recently been in hospital. Potential participants were given the contact details of the researcher should they be interested in participating. However, without exception, participants agreed to take part at that time. There were no subsequent telephone calls from other patient participants. When someone agreed to participate, the researcher arranged a time, date and venue convenient to the participant to meet. Patient participants were given a choice of being interviewed in their own home, the work place of the researcher or a community venue. Participants invariably chose the community group venue. Usually the researcher arranged to carry out the interview the following week, allowing the participant to consider the information and have the opportunity to withdraw should they wish.

Interviews then took place following the procedure described above for practitioner participants. Mean time taken for interviews was 19.4 minutes.

3.2.6. Procedure: Focus groups

In order to recruit approximately 25 participants it was decided to hold one focus group in each of the three NHS trusts. The intention was to gather a

multidisciplinary group of between six and 10 practitioners. It is suggested that focus group size should be small enough to allow everyone to participate but large enough to access diverse opinions to stimulate useful discussion (Freeman, 2006). This was arranged through liaison with IPC specialists. In trust one the IPC specialist suggested inviting individuals to a lunch time meeting as it was considered this would yield the best attendance. In trust two a multidisciplinary group met regularly to discuss IPC issues in their own areas of the hospital and it was suggested that this group could yield a number of participants; nine people were invited. In the third trust it was suggested that a focus group could take place after an infection control training session. The IPC specialist emailed those expecting to attend the training asking if anyone would be interested in attending a focus group immediately afterwards. Groups one and three were carried out using the BPS question schedule and group two using the non-BPS schedule. These were allocated at random.

A room was booked within the relevant hospital trust for focus groups to take place. Two of the trusts (2 and 3) had participants coming from two different hospital sites; locations were arranged to suit as many participants as possible. Focus groups were arranged for lunch time as this was convenient for most participants and refreshments were provided. The researcher arrived early to organise the furniture, paperwork and lunch and to greet participants as they arrived. Information sheets were sent to participants by email prior to the focus group and hard copies were given out before the focus group began. Verbal information and consent procedures were as described in section 3.2.5. After the digital recorder was turned on participants were asked to introduce themselves. The researcher drew a seating plan with participant names on in order to facilitate voice recognition for transcription later.

3.2.7. Procedure: Questionnaires

A systematic review by Edwards et al. (2005) investigated the effect of different strategies to improve response rates. Prior to intervention response rates of included studies ranged from approximately one in 10 (Newby et al., 2003, Ulrich et al., 2005) to approximately one in two (Gibson et al., 1999). However, most of the response rates listed were around one in four (for example Whiteman et al., 2003) to one in three (for example Beebe et al., 2005). After some interventions response rates improved greatly (Edwards et al., 2005). The author found that return increased when a stamped addressed envelope was enclosed, when participants were contacted before sending the questionnaire out and when questionnaires are designed to be of interest to participants. These strategies were all adopted in this study; however, due to hospital etiquette, rather than contacting participants

individually, departmental managers were contacted and asked to distribute the questionnaires within their department. Edwards et al., (2005) identified that response is more likely with a short questionnaire. Effort was made to keep the questionnaire brief but this had to be balanced against the need to have similar content of that of the interviews and focus group schedules to allow comparisons.

Based on the anticipated response rates estimated to be 33% (Edwards et al., 2005) 64 questionnaires in total were distributed to a range of staff through ward managers (or, where requested by managers, ward clerks) and departmental managers or, in the case of medical consultants, their secretaries.

Departmental managers (who were identified to the researcher by the IPC leads in each trust) were contacted by email and sent an information sheet and asked if they would distribute or allow the researcher to distribute questionnaires to their staff. They were requested to recruit staff with different professional roles and from different wards/departments. Where managers did not respond to email after approximately two to three weeks they were contacted by telephone. All managers who were contacted agreed to distribute questionnaires. Each manager was sent either two or three questionnaires, according to the size of the department and the diversity of the staff group within the department.

3.2.8. Data analysis

The Barriers and levers to hand hygiene

Interview and focus group transcripts and questionnaire data were imported into NVivo v.8. data management software for the purposes of qualitative analysis. A thematic analysis was conducted on the entire data set in the first instance to address the first aim of the study; the barriers and levers to hand hygiene (irrespective of method, BPS or non-BPS question schedule or whether a practitioner or patient participant). As far as possible, an inductive approach was taken using the data to generate the themes rather than trying to force the data into predetermined categories such as the BPS framework. However, the titles generated to describe some of the themes e.g. *"consequences"* were similar/identical to the BPS framework to reflect a very clear overlap within the framework definition *"beliefs about consequences"*. In other cases, however, new themes were generated. For example, although within the BPS framework, the notion of *"attitude"* is subsumed into other domains such as *"beliefs about consequences"*, here it emerged as an entirely separate theme and so was coded accordingly. This analysis took place following steps outlined by Braun and Clarke (2006) and using guidance from other sources (Miles and Huberman, 1994, Silverman, 2006, Richards, 2009).

"thematic analysis is a method for identifying, analysing and reporting patterns (themes) within data" (Braun and Clarke 2006 pp79).

The steps outlined by Braun and Clarke (2006) are outlined below with a description of how analysis of the study data took place.

1. Familiarisation with the data. Data were transcribed verbatim by the researcher. During transcription what participants had said was listened to very carefully. Once complete, transcripts were read through several times whilst listening to recordings to ensure accuracy of transcription and to become familiar with the data. Notes were made on hard copies of transcripts as they were read with early ideas of possible codes. Transcripts were imported into NVivo v.8. only when the researcher was familiar with the data.

2. Generating initial codes. By the time all data were imported into NVivo, an early list of possible codes had been created in note form on hard copies of transcripts. These were referred to as the coding of electronic transcripts took place. Transcripts were coded sentence by sentence. The researcher was mindful of the question "what are the barriers and levers to hand hygiene" throughout this process. As a barrier or lever was identified it was coded, where possible using the words of the participant. As more data were coded, codes already created were used. This process resulted in an extensive list of over 100 codes.

3. Searching for themes. From this list of over 100 codes, some themes were obvious from early on. *"Knowledge/Skills"* was one of these because of the number of strategies discussed by participants to instil or improve hand hygiene knowledge or skills. At this stage a degree of structuring and organising of codes took place, with initial codes being written on small pieces of paper and moved around, to see how codes fitted into themes. At this stage the relationship between the themes was considered, some codes forming higher level themes and others forming sub-themes. Where codes did not appear to fit into any theme they were placed in a theme entitled *"other"* for later consideration.

4. Reviewing themes. After the initial categorisation of codes into themes, each theme was examined. Firstly, data were examined by theme. Where it did not appear to fit consideration was given as to whether the data should be recoded, whether it fit else where, or whether a further theme should be created. Some data fitted within two themes. This overlapping of themes was considered at a later stage. At this stage the 12 final themes were identified along with a further theme *"other"*. Secondly, models were drawn for each theme. Figure 3.4. gives an example of the model drawn for the theme *"knowledge/skills"* at this stage of analysis. Even at this stage one sub-theme was evident, *"source of knowledge"*.

This process of modelling allowed an overview of the data. It was possible to see whether the whole data set was accurately represented. The process of modelling also allowed areas of overlap between themes to be clearly seen. Where it was possible duplicated codes were collapsed and represented within a single theme, however, at the end of the process some overlap was considered acceptable and the best representation of the data. A considerable amount of time was taken modelling (approximately 8 weeks) until themes and sub-themes were organised. The final step at this stage was considering the theme *"other"*. When the data within this theme were reconsidered, it was a very simple process to re-code it within the final coding framework; themes were developed to the point where it was clear where data within the code *"other"* belonged.

5. Defining and naming themes. Having produced a model of the data, themes were defined, refined and re-defined several times until the names represented the data within effectively. At this stage, reports were written for each theme in order to fully describe the extent of the data within each theme and sub-theme and to ensure the names and definitions of the themes were as accurate and representative as possible. The final names for themes and sub-themes are shown in Figure 3.5.

Figure 3.4. demonstrates a simplified worked example of the process described above (steps 1 to 5) for the code *"knowledge/skills"*.

6. Producing the report. The thematic analysis was written up including data extracts to provide a contemporaneous, logical and interesting account of the data. Care was taken to give the full story without repetition. This can be seen in section 3.4. of this thesis. At this stage, as a number of comparisons of data were to be reported (for example comparing method), looking at numbers of participants identifying themes also was considered to be useful. The rationale for this is reported in section 3.3.3.

3.2.9. Comparing BPS with non-BPS, comparing methods and evaluating the contribution of patient participants

To address aims two, three and four of this study, "matrix" searches were carried out within NVivo. That is, by keeping a thorough record of information such as question schedule used or method used for each participant, the data could be separated according to set parameters, in this case, i) BPS or non-BPS question schedule, ii) research method and iii) patient or practitioner participant. In each of these cases interview data were examined within each theme and sub-theme, across the comparator groups to identify differences and similarities in relation to hand hygiene.

Figure 3.4. Stages of thematic analysis: A worked example

Transcribed Data (Interview 13, Charge Nurse C=Charge Nurse, R=Researcher)	Initial Code	Refining Themes		
		Barrier/Lever	Sub-Theme	Theme
C. And you go through it, you go through the thing, you do the test at the end, you print off the certificate. The certificate gets given to me or to Carol, who is the senior sister and it gets put in the files to show that you have accessed the information that you need in order to do your job. That you know what the policies are, that you have passed the test, you have to get 80% **R.** Ok?	HH training, Training monitored Certificate of learning HH Hand hygiene policies have to pass HH training	Training E-learning Training Training monitored	Source of Knowledge	Knowledge/skills
C. So you have actually got, you can't print the certificate unless you have done it and every year, each of us has to do those things. Again. So that you prove you update yourself. **R.** Is that just qualified nurses?	Certificate of learning HH Annual Training Have to pass *HH* Training	Training monitored	Source of Knowledge	Knowledge/skills
C. That is everybody, even the ward clerks; they have to do the same thing. I don't know about the domestics actually, because we don't manage them. But everybody else has to fill in all of these things.	?Do all professionals do training/differences	Differences between profes' groups	Professional role/ group	Professional
There is a lot more you can do as well, you can go into things in greater depth as well. It is a lot broader than that, but those are the ones that we have specifically, so far been asked to do. **R.** And are they mandatory?	Information available/further training Mandatory HH training (electronic)	Policies/Protocols Up to date written information Training	Source of knowledge	Knowledge/skills
C. They are mandatory. Every year, yeah **R.** Is it just e-learning?	Mandatory HH training (electronic) Annual	Training Mandatory Training	Source of Knowledge	Knowledge/skills

C. No everything has been took out, we used to have big policy documents and that. When I first came to (name of NHS trust) there was a big file to read when I first started as a charge nurse. But now nearly all of the policies are updated regularly but left on the intranet. Rather than printing them and reprinting them

R. Yeah? The policies? So is everybody able to access the policies as well?

C. It depends how well individuals are used to using the internet. I am not particularly computer savvy; there are a lot of people here that are a lot more than I am. But what we have found is that those that are computer savvy help the others to get the access to the information.

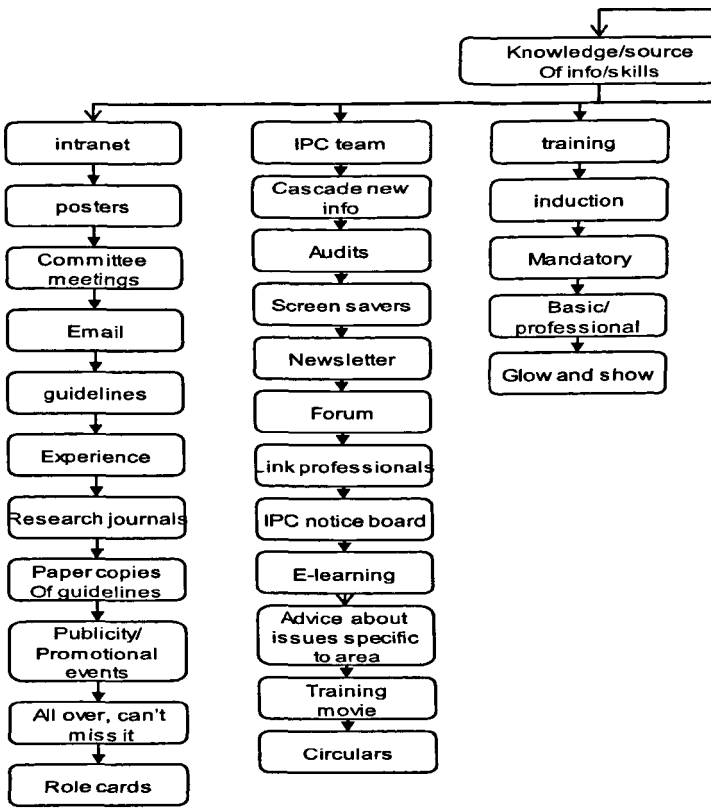
And the other thing is people that do a lot of nights, because it is quiet at nights, you can get on and do it, tend to be a lot further ahead than people who didn't or who are part time.

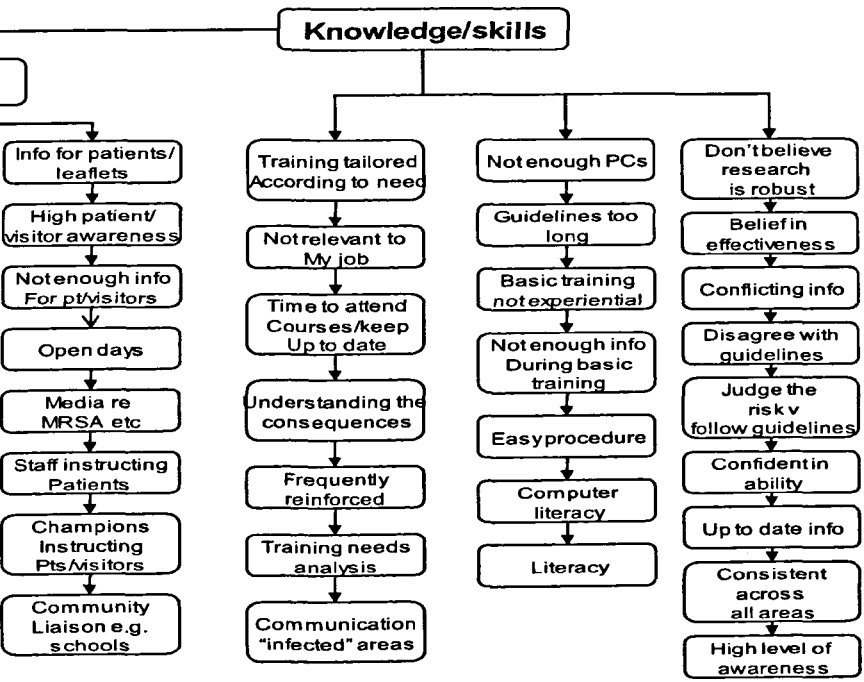
R. Yeah?

C. So you do need to be a bit computer savvy to get onto it which I think is a disadvantage, I don't know people have thought about that very much at the beginning. I think we are expected to have a lot of computer skills and a lot of us haven't.

HH policies available/information available Electronic/Paper information re HH Electronic HH information HH Information current/updated	Protocols/Policies Up to date written information Training E-learning	Source of Knowledge	Knowledge/skills
Not everyone can access internet – computer skills Staff supporting each others HH learning	Differences in access to training	Professional role	Professional
time to do training/lack of time for some staff to do training Training difficult if on busy shift or part time	Time for training	Time	Environmental
Lack of computer ability Lack of computer ability	Computer literacy	Literacy	Knowledge/skills

Figure 3.5. Model of the theme knowledge/skills




Knowledge/skills
Info for patients/ leaflets
High patient/ visitor awareness
Not enough info For pt/visitors
Open days
Media re MRSA etc
Staff instructing Patients
Champions Instructing Pts/visitors
Community Liaison e.g. schools
Training tailored According to need
Not relevant to My job
Time to attend Courses/keep Up to date
Understanding the consequences
Frequently reinforced
Training needs analysis
Communication "infected" areas
Not enough PCs
Guidelines too long
Basic training not experiential
Not enough info During basic training
Easy procedure
Computer literacy
Literacy
Don't believe research is robust
Belief in effectiveness
Conflicting info
Disagree with guidelines
Judge the risk v follow guidelines
Confident in ability
Up to date info
Consistent across all areas
High level of awareness

3.2.10. Quantifying qualitative data

Sandelowski (1986) asserts that historically there has been reluctance amongst qualitative researchers to quantify such data as some authors argue that qualitative research was developed in order to address research questions that cannot be adequately addressed through quantitative methods. More recently, quantification has been suggested as a way of improving the rigour of qualitative research (Sandelowski, 1986, Sandelowski, 2000, Tobin and Begley, 2004, Silverman, 2005).

Miles and Huberman (1994) argue that to some extent in qualitative research quantities are always used. When something is described as "significant" or "recurrent" we are, in part, making this decision based on counts. That is, when a theme is identified we are isolating something that happens a number of times and something that consistently happens. The authors identify three good reasons to report numbers. These are, to see rapidly the large amount of data contributing to a theme, to verify a hypothesis and to keep the researcher analytically honest, that is, as a measure against bias.

Sandelowski (2000) makes similar points, that meaning in qualitative research depends in part on numbers. Additionally she suggests that they are useful in testing the researcher's interpretations or conclusions.

Maxwell (2010) acknowledges that historically applying numerical values to qualitative research data has been controversial. However, the author argues that the use of simple counts makes statements such as "sometimes" or "usually" much more precise. Several advantages of incorporating quantities in qualitative research are identified. These include, establishing whether the findings are characteristic of the individuals included and identifying diversity within the data. Maxwell (2010) considers that quantifying data can help identify patterns that are not apparent simply from the unquantified data and quantifying can be helpful in presenting evidence supporting the researchers interpretations of the data, improving the rigour of analysis.

As aims two to four of this study are based on comparing different groups, it was decided that the use of frequencies would be particularly helpful during the process of analysis in order to demonstrate the extent of differences between groups in a precise manner and to improve the transparency and rigour of analysis.

3.2.11. Rigour of approach

Silverman (2005) asserts that qualitative research demands methodological rigour and a commitment to showing as much as possible to the reader in terms of transparency of process. In the context of qualitative research, rigour refers to the steps taken by the researcher to protect against bias and enhance the reliability of

findings (Pope et al., 2000). The six steps described in section 3.2.8. go some way to achieving this. A number of additional measures were also taken to ensure a rigorous approach. These are listed below.

Triangulation Triangulation refers to an attempt to find the truth of a situation by combining different ways of looking at it (Silverman, 2005). Miles and Huberman (1994) demonstrate that findings are more dependable when they can be reinforced by several independent sources. They suggest four types of triangulation, three of which were addressed in this study. Three research methods were employed here to ensure *methodological triangulation. Data source triangulation* was addressed by sampling across three NHS hospital trusts, a wide range of hospital departments and practitioner roles and by involving patient participants. *Researcher triangulation* was addressed through supervision and inter-rater reliability. *Theoretical triangulation*, the fourth type of triangulation identified by Miles and Huberman (1994) was not addressed in this study.

Inter-Rater and Intra-Rater Reliability It is necessary to demonstrate replicable analysis in order to demonstrate credibility of research results (Miles and Huberman, 1994, Richards, 2009). Data were coded by one main coder (JD); however in order to enhance the reliability of analysis, two interviews, one focus group and four questionnaires were coded by two further coders (CJ, RL, supervisors). Statistical comparison of coding was made by entering the codes assigned by each researcher onto SPSS v.16. and Cohen's Kappa agreement was calculated. Inter-rater agreement at a level of 0.73 or above was achieved which is considered satisfactory (Landis and Koch, 1977).

To ensure intra-rater reliability, data were coded then recoded three months later by JD. This was carried out on one focus group, one interview and one questionnaire and agreement was at a level of 0.74 or above. Inter-rater and intra-rater reliability test results are shown in Table 3.1.

Negative cases The case for quantifying qualitative data was presented in section 3.3.3. However, consideration was also given to the danger of introducing bias through presenting findings based on majority view points rather than a critical investigation of the data. A number of researchers suggest that this can be addressed by considering negative cases; that is presenting data that appear to contradict or do not support patterns that may have emerged in analysis (Silverman, 2005, Meyrick, 2006). Where they exist negative cases are presented in the results section of this chapter.

Supervision High quality analysis of qualitative data requires skill, vision and integrity of an experienced researcher and should not be left to the novice (Mays and

Pope, 2000). Long and Johnson (2000) consider peer debriefing and suggest that for research students, supervisors have a key role in ensuring rigour through facilitating discussion of emerging findings. This research was carried out under the supervision of three experienced qualitative researchers (FC, CJ, RL).

Table 3.1. Inter-rater and intra-rater reliability test results

Data type	Coded By	Number of Data Units (sections of transcript coded)	Number of Codes used (maximum possible 57)	Cohen's Kappa	Level of Agreement
Inter-Rater					
Interview Transcript	JD/CJ	34	21	0.75 ($p<0.001$)	Substantial
Interview Transcript	JD/CJ	101	41	0.73 ($p<0.001$)	Substantial
Questionnaire	JD/RL	24	17	0.78 ($p<0.001$)	Substantial
Questionnaire	JD/RL	24	13	0.77 ($p<0.001$)	Substantial
Questionnaire	JD/RL	26	17	0.84 ($p<0.001$)	Substantial
Questionnaire	JD/RL	27	16	0.74 ($p<0.001$)	Substantial
Focus Group	JD/CJ	150	37	0.77 ($p<0.001$)	Substantial
Intra-rater					
Focus Group	JD/JD	121	39	0.80 ($p<0.001$)	Substantial
Interview Transcript	JD/JD	22	15	0.75 ($p<0.001$)	Substantial
Questionnaire	JD/JD	23	16	0.81 ($p<0.001$)	Substantial

3.3. Results

Results relating to the first aim of the study, identifying the barriers and levers to hand hygiene are presented first. The findings from the three methods; interviews, focus groups and questionnaires are then presented in turn. Interviews provided the richest data source and therefore the barriers and levers to hand hygiene identified from interview data are described in full. As information from patients was collected by means of interviews only, these data are presented in the interview results section. Following this results from focus groups are presented. Only results that are different from those presented for interviews are included. Results from questionnaires are then presented. As with focus groups, only results that are different from those presented for interviews are included.

The next section of the results addresses the second aim of the study, whether there was any difference in the findings according to whether they were derived using BPS or non-BPS question schedules.

The third aim of the study, a comparison of results from interviews, focus groups and questionnaires is then presented.

Finally, comparison of the data from practitioners and patients is described to address the fourth aim of the study.

3.3.1. Interviews

Participants

Fifty people participated in the interview study. Table 3.2. identifies the characteristics of health care practitioners (n=25) according to their role and work area and patients (n=25) according to their area of admission across the three NHS trusts recruited for the study. Practitioners were recruited from a wide range of hospital departments and areas and included staff from all main practitioner groups, because hand hygiene is generally applicable to all hospital staff. Twenty five participants were interviewed using the BPS schedule and 25 using non-BPS schedule.

Table 3.2. Characteristics of study sample of health care practitioners (n=25) and patients (n=25) participating in interviews

Participants	Trust 1								Trust 2								Trust 3								
	Infection Prevention	More than one area	ICU	Elderly Care	A & E	Medical	Surgical	Paediatrics	Infection Prevention	More than one area	ICU	Elderly Care	A & E	Medical	Surgical	Paediatrics	Infection Prevention	More than one area	ICU	Elderly Care	A & E	Medical	Surgical	Paediatrics	Total
Manager																		1							1
Nurse	1		1	1			1		1		1	1		1			1	1		1	1				12
Doctor																1			1		1				3
Porter		1								1															2
Occupational Therapist												1						1							2
Physiotherapist	1																	1							2
Reception/Admin													1												1
Volunteer		1																							1
Other		1																							1
Patients		4				1	2			3		1		2	4			1		1		3	3		25
Total	2	7	1	1	0	1	3	0	1	4	1	3	1	3	4	1	1	5	1	2	2	3	3	0	50

3.3.2. Barriers and levers to hand hygiene: Interviews

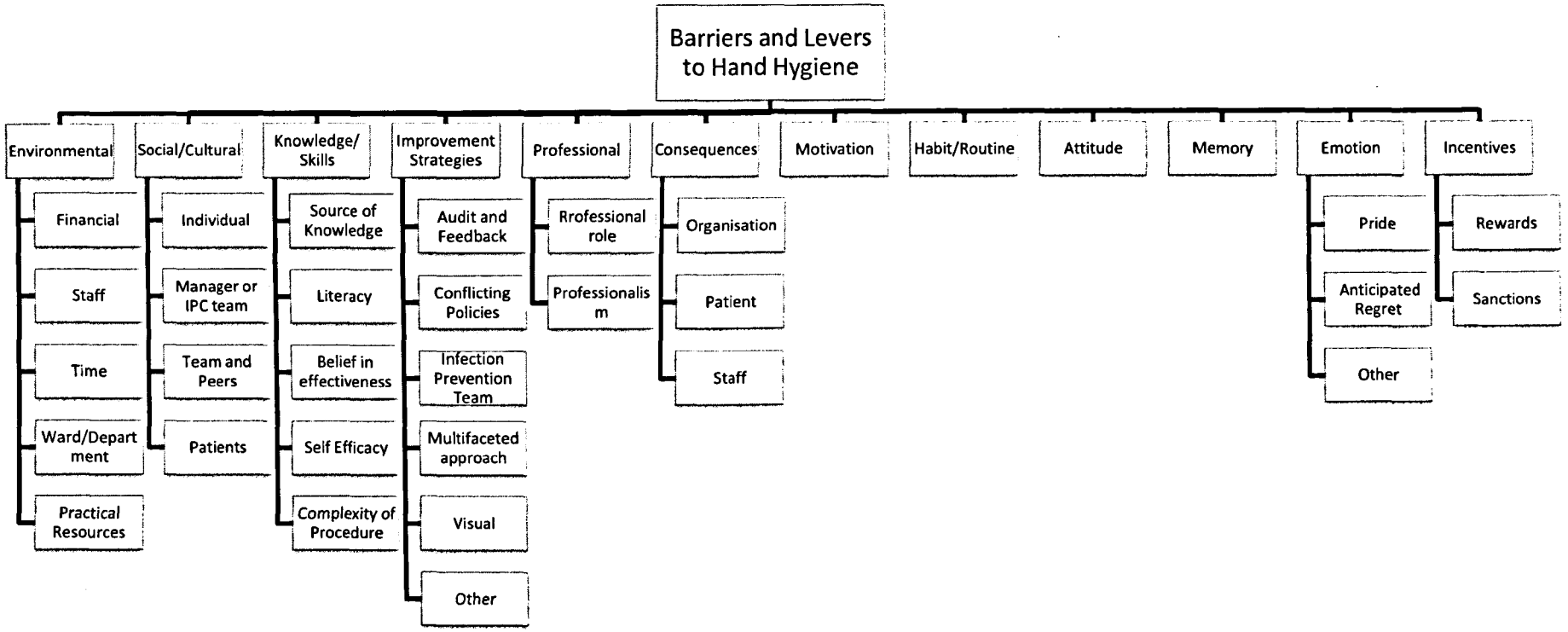
Twelve key themes and 30 sub-themes emerged to reflect barriers or levers to hand hygiene. Figure 3.6. illustrates themes and sub-themes and demonstrates the hierarchical nature of these.

Each theme will be discussed below. These are ordered according to the number of participants identifying themes as barriers or levers to hand hygiene; that is, the theme identified by the most participants first and the least participants last. For example, all participants talked about *"environmental"* issues, so this is presented first. Fewer (17 out of a total of 50 interview participants) identified *"incentives"*, which is therefore presented last. As each theme and sub-theme is presented selected quotes are provided for illustrative purpose.

Interview data includes that of health care practitioners and patient participants. Differences between the data of practitioners compared with that of patients are discussed in section 3.2.9.

There were a number of overlapping themes with some issues being relevant to more than one theme or sub-theme; these are discussed within the relevant themes.

Figure 3.6. The barriers and levers to hand hygiene: Themes and sub-themes



Environmental

The theme *"environmental"* refers to any barrier or lever to hand hygiene related to the surroundings of practitioners. This theme was identified by all interview participants (n=50). Environmental issues were cited as both barriers and levers to hand hygiene. Five clear sub-themes emerged; *"financial"*, *"staff"*, *"time"*, *"ward/department"* and *"practical resources"*. Each of these sub-themes is described separately below.

Financial This was a sub-theme identified by only four participants. Three of these participants were in senior positions within the hospital trusts. The information they gave was unlikely to be available to other staff (for example, that relating to budgets). The practitioner participants identified hand hygiene as a high government priority and said that large sums of money had been made available for trusts to use for promoting IPC and hand hygiene. Some of the improvement strategies discussed below (sub-heading *"Improvement Strategies"*) were funded in this way. However, one participant described the recent past where the NHS hospital trust in question was applying for Foundation Status. Foundation status is a recent government strategy aimed at decentralising public services and creating an NHS that is more patient led, that is, allowing the local community to tailor services (Department of Health, 2007c). Participants explained that an application could not be made if the trust was over spent. In order to prevent such an occurrence it was reported that all non-essential spending had been suspended resulting in low staffing levels which may have had an impact on hand hygiene (further discussion under sub-heading staff below) and an inability to invest in hand hygiene improvement strategies.

> *"The organisation has spent quite a few years trying to get its financial balance so that it can go for . . . foundation status. It now has but the result is that everything had been trimmed"*. (Interview 10, Consultant).

Staff Low staffing was often cited as a reason for a lack of time which acted generally as a barrier to hand hygiene. Where staffing levels were problematic, this was reported to be due to a number of factors, including staffing vacancies and difficulty recruiting staff (for example the hospital sites which are difficult to access by public transport) and demoralisation leading to high levels of sickness and a lack of cover for absence.

> *"On the wards I think it* (hand hygiene) *is around having the right, the right number of staff"* (Interview 10, Consultant).

Staffing problems were also seen as contributing to mandatory hand hygiene training being missed by some staff. When temporary "bank" or "agency" staff

were available it was felt that they were not always aware of hand hygiene guidance, particularly in the case of agency staff.

Time Lack of time was identified as a barrier to hand hygiene practice. This was often referred to as resulting in "cutting corners" and behaviours resulting from "human nature". The quote below gives a good example of this.

> *". . you erm have just finished dealing with one patient and you know you have to clean your hands but actually another patient is calling and, so there is the convenience and the pressures"* (Interview 16, Matron).

A small number of participants reported that whilst they acknowledged time as a potential problem they felt that it did not, or should not, get in the way of good hand hygiene practice.

There was some degree of overlap between the sub-themes *"staffing levels"* and *"time"*. Related to time was the frequency of hand hygiene required. Because it was required so often this was also considered to be a barrier to optimal practice. One participant explained that even when looking after a single patient it was likely that she would have to wash her hands five times in every 20 minutes of patient care. A porter estimated that he would wash his hands approximately 10 to 15 times per hour.

> *"You are doing it* (hand hygiene) *a lot of times, the frequency. I am sure it is the same for everybody"* (Interview 41, Occupational Therapist).

Ward/Department Particular wards or departments posed unique problems for some practitioners. Examples include areas of high throughput of patients such as Out-Patient Departments or Accident and Emergency (where patients often attend with a number of relatives). This was cited as a barrier for a number of reasons; the high throughput resulted in more frequent hand hygiene and the work in such areas was not considered as "routine" as on wards (for example) so a more conscious effort was required with hand hygiene. Areas where patients were considered particularly vulnerable to infections was another issue raised. For example patients in intensive care. Patients having many portals of entry for infection meant that hand hygiene had to take place between looking after different "parts" of the same patient rather than simply before and after patient contact. Another issue relating to the type of ward or department was concerning wearing a uniform for work and having to visit patients at home too. For example, some practitioners work in the community but visiting hospital to see patients. practitioners found it difficult dressing for practicality of the job (outside in the cold) along with fulfilling hospital policy (short sleeves). This is illustrated in the quote below.

"We would visit people's homes as well. And spend time with people's families. So we would skip during our working day between the hospital and the patient's house" (Interview 26, Occupational Therapist).

Data were compared across area of work and by NHS hospital trust. However, as illustrated in Table 3.2., the 25 practitioner interview participants were from eight different occupational groups and worked in seven or more areas, with no more than four participants working in the same hospital area. It was therefore not possible to make meaningful observations about the pattern of barriers and levers between area of work or NHS hospital trusts.

Practical resources The majority of participants considered having available resources such as soap, paper towels, appropriately sized gloves and a high ratio of sinks to beds to be a lever to hand hygiene practice and conversely an absence of such facilities to be a barrier.

"There is always plenty of sinks so there is always access and they are always close. Erm, sometimes there isn't any soap and sometimes there aren't any towels and if it is really busy nobody will bother to go and get any." (Interview 2, Charge Nurse).

Few participants reported the absence of such essentials. Where such resources did not exist the problem tended to be a low number of sinks. In two out of the three NHS trusts a programme of improvement leading to a ratio of 1 sink to every 4 beds was underway.

Practitioners reported the installation of shelves outside of wards and lockers to be a lever to best practice. This has some overlap with the government's "Bare Below the Elbow" policy (no clothing or jewellery below the elbow to facilitate good hand hygiene) because when staff had nowhere to take off long sleeved clothing or leave valuables before entering clinical areas, complying with this policy was more difficult. Installing shelves was considered by many practitioners to be a simple yet effective way of addressing this problem.

Availability of gel was identified by the majority of participants and was considered to be an important lever to hand hygiene practice generally. A much smaller number considered that availability of gel tempted practitioners to use it as an alternative to soap and water, even when it was not appropriate to do so. That is, some practitioners suggested that gel was being used when practitioners' hands may have been in contact with Clostridium difficile, which is removed only with soap and water and not alcohol hand gel.

Social/Cultural

This theme related to any barriers or levers to hand hygiene that are due to the background or experience of an individual practitioners or groups of practitioners. Forty eight of 50 participants identified *"social and cultural"* influences as barriers or levers to hand hygiene. Within the theme were four sub-themes: *"individual"*, *"manager or IPC team"*, *"team and peers"* and *"patients"*. These were generally seen as a lever to good hand hygiene practice. These sub-themes are discussed in turn below.

Individual A large number of participants described hand hygiene as something dependent upon the culture of the individual person, and that hand hygiene was dependent upon their childhood upbringing, their professional background and their basic training. The quote below is an example of this.

> *"Some religious reasons. Some don't allow them to bear the forearms, and they feel that it is inappropriate for their religion, Muslim ladies in particular. We have a group in the dental school at the moment, of students, that are wearing plastic sleeves. Which, they wash their hands, put the plastic sleeve on, take the plastic sleeve off and dispose of it and wash their hands again and put a new set of sleeves on for the next patient. Which they can do because they are spending perhaps an hour with a patient. On a one to one basis. We can't accommodate that, unfortunately, out on our ward areas."* (Interview 24, Manager).

Manager or IPC team Participants described organisational commitment and managers as a lever to hand hygiene practice. Positive aspects included where the organisation was perceived to view hand hygiene as a high priority, where there were clear disciplinary procedures in place if hand hygiene was consistently omitted by a practitioners, where the organisation had a good reputation for hand hygiene (and hospital acquired infection rates) and where the individual practitioner felt they were a valued part of the organisation and felt a sense of ownership. Some organisational aspects were seen as barriers. For example, some participants felt that managers were too far removed from practice to understand the challenges to hand hygiene practice. Prompting colleagues was another issue raised by practitioners. Whilst most felt this was a lever to hand hygiene, some participants did not always consider this was possible within the social structure of the organisation, as shown in the quote below.

> *"I think people should wash their hands but if they are my, well if it is seniors it is very difficult because there is quite a hierarchy in medicine. I would not want to be under pressure and I could lose my job. If I see one of my trainees not doing it though I will tell them, erm, and because I don't want it on my conscience if someone gets an infection and maybe someone dies".* (Interview 4, Doctor).

The IPC team was recognised by practitioner participants as being central to the promotion of good hand hygiene. Participants described important aspects of their role to include their presence around the hospital, their being credible, supportive and informative. Personal knowledge of members of the team seemed to be particularly influential; participants reported that they would not like to let the team down by failing audits or targets.

> *"The infection control team are visible, they are positive, they are encouraging"* (Interview 20, Charge Nurse).

> *"We work closely with control of infection and they do get involved with all areas . . .* (I) *don't know what their official title is but they have a dedicated person who comes down and checks that each individual area is following procedures, makes sure the notice board is kept up to date with any information, and if we have an issue, then certainly one of the control of infection nurses will come down and speak to a group"* (Interview 25, Porter).

Team and peers A large number of participants considered the influence of their team and peers to be a barrier or lever to good hand hygiene. Participants identified compliance with hand hygiene being necessary in order to part of the team. Practitioners participants identified a greater acceptance of being prompted to clean hands by a team member of their own team or a peer than someone else. In the examples below the Consultant talks about this team prompting as a "matter of fact" whereas the Auxiliary Nurse describes a less accepting response from a non-team member.

> *"So that the team is motivated to do it and therefore you have got an element of peer pressure. Erm and if I don't do it then someone will tell me and vice versa so hopefully there is that"* (Interview 15, Consultant).

> *"The majority are really huffy, and you know, when you tell them sort of thing"* (Interview 1, Auxiliary Nurse).

Patient There was a general consensus between patient participants that they would be reluctant to challenge staff if they did not clean their hands, largely through fear that their care would be compromised if they did. Although patients considered that they influenced practice; there was a shared view that practitioners should be responsible for their own practice and they should not need patients to prompt them.

> "(If) *they don't wash their hands, I tell 'em. I do, I do."* (Interview 11, Patient).

Practitioners' views were more mixed. Some thought that patients should challenge if they noticed a practitioner was going to care for them without cleaning

their hands however; they generally did not like this. Practitioners had a general perception that as patient awareness into hand hygiene had increased so had complaints about it. Often practitioners considered that patients had simply not seen them clean their hands. This had led to changes in practice, practitioners making a point of engaging in hand hygiene when the patient was in the room, or able to witness the procedure. This was described as a way to reassure patients rather than an improvement in actual practice.

> *"Stuff might be mentioned in the complaint, alright, there were two nurses that came in and didn't wash their hands."* (Interview 17, Nurse).

> *"And obviously when they left they didn't see them gelling their hands either, so what we did as a result of that survey, we actually changed our practice style and said to staff, label up the tube, send them off to the lab and then ask the next patient to come in and ask them to take a seat, to say, take a seat while I just clean my hands, and clean their hands in front of them. And just make it a bit more visible."* (Interview 23, Manager).

> *"I sit them down and I say I will just wash my hands. And it is not often patients; well I do it in front of patients because I want them to know. It is to give them confidence as well."* (Interview 41, OT).

Knowledge/Skills

This theme relates to what a practitioner knows or what they can do as barriers or levers to hand hygiene. This theme was identified by 46 participants and was divided into five sub-themes, *"source of knowledge"*, *"literacy"*, *"belief in effectiveness"*, *"self efficacy"* and *"complexity of procedure"*; each will be addressed in turn. Overall, most participants agreed a good level of knowledge, skills and awareness was essential if hand hygiene was to be practiced according to guidelines. Participants considered that both practitioners and patients need to be aware of when and how to clean their hands and why good hand hygiene is necessary to adhere to good practice. Participants reported some incidents of poor knowledge or skills and this was considered to be a barrier to good practice, however, these were in the minority with most participants acknowledging good resources for training. A few participants considered that hand hygiene should be covered in greater depth during basic (under-graduate level) training in order for good practices to be adopted early.

Source of knowledge Practitioner participants considered that having a wide choice of resources through which to access hand hygiene information or training to be a valuable lever. Although time to attend training was identified to be a barrier, participants thought this was compensated for by the breadth of available training and information that was accessible. Usual sources of information for practitioners

included posters, e-mail, newsletters, e-learning, training, updates, committees, forums, IPC teams and meetings. Less used sources of information included the research literature, the Department of Health website and publications and attending special interest groups, for example hand hygiene forums. Patients were aware of some of the sources of information for practitioners and utilised them also (e.g. posters and displays) however, on the whole they got their information about hand hygiene and hospital acquired infection from the television and newspapers.

> *"I don't think we had formal training but I know when I joined we had to be told and now my seniors and I, well, we do it so it is second nature to us at the moment."* (Interview 4, Doctor).

Literacy Poor Literacy was considered a barrier to hand hygiene practice. Participants discussed the challenges facing staff with poor reading and writing skills and some with dyslexia. One trust had responded to this problem by insisting that some staff groups attended face to face mandatory training.

With the advent of electronic information learning and circulars a lack of IT skills was also seen as a barrier to gaining knowledge about good hand hygiene practice. Participants identified a range of staff as having poor IT skills from top managers to staff at ward level.

> *"I think we have to acknowledge and recognise that for a lot they don't have the skills necessary to access electronically . . . and might not necessarily have the reading levels that are required."* (Interview10, Consultant).

Belief in effectiveness Participants reported that others (not themselves) often cited a lack of evidence for the link between good hand hygiene and hospital acquired infection as their "reason" for not following hand hygiene guidelines. This was identified as a barrier to hand hygiene practice. Participants almost always reported that this applied to medical staff rather than other staff groups. The quote below illustrates this.

> *"But I think for the medics . . . don't want to be involved in this theory of transmission chain."* (Interview 10, Consultant).

There were two smaller issues within this sub-theme. The first was the "Bare Below the Elbow" policy. Some participants reported that they were sceptical of the evidence supporting such a policy. However, participants reported that they generally adhered to the policy regardless. The second area was the availability of gel in patient toilets and outside of ward/department entrances. In the case of the former it was reported that guidelines had been changed and gel had been removed from toilets. (This is discussed in greater length in the section Conflicting Policies). In the case of gel outside of ward/department entrances participants said that they

used this gel in order to instil public confidence rather than because they were convinced that such practice was effective.

Self efficacy Participants generally believed they were capable of competently performing hand hygiene according to guidelines and they considered this belief to be a lever to hand hygiene practice.

"I am pretty confident yeah" (Interview 23, Manager).

"I think it is pretty easy" (Interview 20, Charge Nurse).

Complexity of procedure Hand hygiene was generally seen to be an easy procedure which was a lever to practice as demonstrated in the quote below.

> *"It's, the technique is straight forward and erm the equipment is always there"* (I42 Staff Nurse).

However, a small number of participants found the hand hygiene guidelines (and other related guidelines such as barrier nursing) too lengthy, making implementation difficult. Several participants said that short, simple guidelines for hand hygiene (and other guidelines) were more likely to be adhered to.

Improvement strategies

This theme relates to organisational strategies implemented with the intention of improving hand hygiene. Forty four participants identified improvement strategies as a barrier or lever to hand hygiene. Six sub-themes were identified, *"audit and feedback"*, *"conflicting policies"*, *"IPC team"*, *"multifaceted approaches"*, *"visual"* and *"other"*. Each of these will be discussed in turn, however, on the whole improvement strategies were considered to be a lever to hand hygiene practice with the exception of conflicting policies or campaigns which was considered to be a barrier.

There was a wide range of strategies identified within this theme including: matrons, notice boards, posters, audit and feedback, dress policies, media advertising, hand wipes, hand gel, the right to challenge, government policies, cleanyourhands campaign, board to ward campaign, targets and surveillance, certificates, media/advertising, education, champions, opinion leaders, multifaceted strategies, volunteers prompting visitors to clean hands, talking cones, open days promoting hand hygiene, DVDs, circulars and hand hygiene screen savers. These are subsumed under the following sub-themes.

Audit and feedback Audit and feedback was considered to be a lever to hand hygiene practice for a number of reasons.

Practitioners reported that audits being carried out in their work place (that is, a practitioner standing with a clip board observing and recording practice) "reminded" them to clean their hands. Practitioners invariably knew when an audit was being carried out as it was usually being carried out by one of the ward/department staff. It is possible that this created a Hawthorne effect, where the study group change their behaviour as an effect of being observed (Bowling 2005) and it was acknowledged that results may have been less accurate because of this, however, practitioners agreed that as a reminder audit and feedback was very effective.

The subsequently displayed results of audit were also considered to influence practice. There was some overlap here with the theme *"Emotion"*. Practitioners were proud of their results and many said that these results motivated them to keep up the good work. The anticipation of poor results was described as "embarrassing". There was also some level of overlap with the theme *"Incentives"*. Practitioners saw good audit results as a "reward" and often when good results were achieved certificates were given or their wards and departments were acknowledged in newsletters.

Only a small number of patients noticed these results but those who did were either reassured by them or sceptical as to the accuracy of them. Audit results were reported to increase patient awareness of hand hygiene and their expectations of how health care practitioners should carry out hand hygiene. However there was no evidence within the data to suggest that this changed the hand hygiene behaviour of patients themselves.

Audit results were broken down according to occupational group. Some practitioners liked this, for example several nurses reported that if their ward or department achieved poor results they could see that their own practice was good and it was often visitors to the ward (doctors in particular were offered as an example here) who were believed to have led to the poor outcome. Some practitioners found this reassuring and it allowed them to continue with their efforts without being demoralised about the results, others saw this as an opportunity to challenge colleagues. For example, in one trust all therapy staff were reported in audits as one group (Occupational Therapy, Physiotherapy, Dietetics etc). This was seen as less than ideal and some practitioners felt unfairly "blamed" and unable to address any identified problem as they did not know if it was relating to their department or another.

> *". . . auditing. Some areas have then chosen to do that monthly. Certainly, women's and children's, interestingly, because we now have a divisional infection prevention meeting in each five divisions as well as the trust one and I attended theirs and they made the decision to continue monthly*

because the moment they knocked it off to every quarter it (hand hygiene) *wasn't happening."* (Interview 10, Consultant).

Conflicting policies This sub-theme contained a number of different areas that were generally considered as barriers to hand hygiene practice with a small number of exceptions. The largest area was conflicting advice in relation to gel. Practitioners reported that they were encouraged to put dispensers "everywhere" including patient toilets. They reported that this advice has since been retracted by the Department of Health causing confusion for some practitioners.

Another area of conflict related to addressing patients' social needs and IPC needs. For example, open visiting times and not restricting visitor numbers were reported by some to cause problems, interrupting ward/department routine, causing physical barriers to caring for patients and increasing the necessary frequency of hand hygiene. However, it was considered important that patients had visitors but acknowledged that this made infection prevention (including hand hygiene) more difficult.

Other areas of conflict included the following:

Financial investment being suspended in order for trusts to achieve foundation status was one such area. Practitioners felt that this had contributed to vacant posts not being filled and insufficient investment in IPC measures (this overlaps with the sub-theme *"financial"* presented earlier).

Practitioners that work between the community and the hospital was a policy also reported to cause some conflict. These practitioners explained that there were different policies, needs and challenges for infection prevention and hand hygiene in different work places. For example, health care practitioners talked about visiting patients in care homes managed by social services. They reported that these had different policies to NHS run facilities. For example, in order to promote a "homely environment" in some social services run facilities, hard bars of soap and hand towels were used rather than liquid soap and paper towels. Practitioners talked about the difficulties encountered with variable standards in the patients own homes in terms of cleanliness and the availability of adequate hand hygiene facilities (for example bar soap only and towels that appeared dirty). This had led to some departments addressing the problem by providing practitioners with hand hygiene kits (containing liquid soap, paper towels and hand gel) which was considered helpful in solving the problem. However, even where this intervention had taken place, practitioners expressed concern about wearing a combination of uniform with mufti (such as cardigans and coats) and then returning to the hospital.

The "Eighteen week wait" policy states that patients should not wait longer that 18 weeks from referral to admission for treatment. This along with high "bed occupancy" rates (number of occupied beds compared to unoccupied) were reported to have increased work load for practitioners which was considered to impact on hand hygiene. Furthermore, practitioners reported that due to advances in medical science and changes to care practices (for example early discharge) the patient population had greater demands and yet staffing mix and level had not been reassessed or changed to accommodate this.

> *"Some clinical areas will have high bed occupancies; it depends on the old 18 week list initiative. So if you have some kind of initiative taking place then it is going to impact on ICU, it is gonna impact on your high risk clinical areas like your colorectal wards, your cardiothoracic wards, and obviously that is going to spill out into different areas"* (Interview 38, Consultant).

There were some policy areas that were considered to be levers to infection prevention and hand hygiene practice directly or indirectly these include:

"Agenda for Change" contracts for staff were considered to have helped recruitment problems. For example, porters hired privately (for example in hotels) were previously earning more than NHS porters. The agenda for change made NHS salaries more competitive. This was therefore reported to have had a possible knock-on effect on staffing levels and therefore hand hygiene.

> *"We used to have recruitment problems, but that seems to, with agenda for change contract, seems to have actually levelled itself out now because I think we are now probably competitive with the local hotels and places like that"* (Interview 25, Porter).

Some staff felt "empowered" due to the high political profile of hand hygiene, feeling able to challenge managers about resources and refuse admissions when appropriate beds were unavailable (for example, beds in side rooms when patients were to be admitted with MRSA).

IPC Team Participants often reported the work of IPC teams as being vital in coordinating implementation strategies, providing and cascading information and offering support. The role of the IPC team was seen as a substantial lever to hand hygiene practice.

> *". . . they* (IPC team) *do have quite a high profile around here and you know who they are"* (Interview 41, Occupational Therapist).

> *"they are a high profile group of staff* (IPC team) *because they travel around all of the wards"* (Interview 23, Manager).

Multifaceted approaches Participants reported large and small scale strategies that together they considered to be effective in improving hand hygiene practice, a lever. The general consensus was that the more strategies that were employed the more likely the practitioners would get the message. A further point that participants made was that after a while they became desensitised to the effect of strategies. Changes to strategies and the use of unusual media to get the message across were considered to be very effective. For example, one trust recorded popular songs with changed lyrics and had them played on local radio (e.g. from YMCA to MRSA), the same trust video recorded staff practising good hand hygiene to play on training days.

The main point made by participants was that the key to success was combining these individual improvement strategies and sustaining the "message" but also delivering it in fresh and new ways.

> *"The truth of it is in my experience there is no one correct way of delivering a message"* (Interview 16, Matron).

Visual Participants agreed on the effectiveness of posters and displays as a lever to improve hand hygiene. This included hand hygiene posters and screen savers, most reporting the more eye catching they were the more likely they were to notice them. Participants also talked about electronic notice boards reporting data such as MRSA rates being effective and infection prevention notice boards on every ward and in the corridors.

> *"Yeah, the IT screen saver, which I think are very useful, because the more times you see it, then it has to register. . . . . The flip side of that is that if it is on your screen all day every day you get bored with it and start to ignore it. What I think has been very clever is that they have changed the screen savers on a regular basis"* (Interview 15, Consultant).

Other This theme consisted mainly of suggested strategies that are not currently being carried out. The suggestion made most frequently was that patients and the public should be targeted in order to raise their hand hygiene awareness and practice. Participants also considered that improved patient awareness had indirectly improved practitioners' practice with practitioners being aware that complaints and criticism were more likely. Other strategies suggested included "secret" audits, spot checks and strengthening disciplinary procedures and authority within the hospital.

> *"They should bring Matrons back because I don't think there is the discipline like there used to be. They just seem to run about doing their own thing you know?"* (Interview 35, Patient).

Professional

This theme includes barriers or levers to hand hygiene that relate to the standards of behaviour of an individual or a group of practitioners. A total of 41 participants identified professional issues as relevant to hand hygiene. Two sub-themes were evident from the data, *"professional role"* and *"professionalism"*; these were considered to be both barriers and levers to hand hygiene practice.

Professional role Participants identified different challenges and different levels of hand hygiene for different occupational groups, for example, porters pushing trolleys or carrying goods around the hospital made hand hygiene difficult because their hands were full (this overlaps with the theme *"environmental"*). Medical staff were often cited as the least likely to clean their hands according to guidelines. This was reported to be for two reasons, belief about the effectiveness of hand hygiene and attitude (this area overlaps with the theme *"attitude"*). However, a number of health care practitioners discussed how this was being addressed and acknowledged some improvement over recent months.

> *"There has always been this ethos of doctors are super-human or consider themselves to be super-humans, so they don't need to do this. They don't need to write legibly, they don't need to write it down if they dispense a medicine. Because they are doctors, you know. And they're actually not super-human so erm the main, the last bastion of hand hygiene is the medical staff."* (Interview 14, Consultant).

Data were compared across occupational groups. However, as illustrated in Table 3.2. the 25 interview participants were spread across three NHS hospital trusts, seven or more working areas and, with the exception of nurses, there were no more than three participants in each occupational group. It was therefore not possible to identify barriers and levers between groups in this way.

Professionalism A number of practitioners participants considered that being part of a occupational group, having a professional identity or feeling a sense of professionalism was a lever to hand hygiene practice.

> *"a sloppy approach to clinical medicine would not make someone feel good about their professionalism . . . . . so I think professionalism. . . . and my concern is that professionalism isn't shown by some of them, not all of them, some of them are fantastic"* (Interview 14, Consultant).

Consequences

This theme includes barriers or levers to hand hygiene that relate to the outcome or expected outcome of hand hygiene or lack of hand hygiene. The majority of all participants (n=39) considered that the consequences of not washing

hands acted as a lever to hand hygiene practice. Three main sub-themes apparent from the data were *"organisation"*, *"patient"* and *"staff"*.

Organisation A relatively small number of participants identified consequences to the organisation; those who did considered this to be a lever to better hand hygiene practice. Consequences to the organisation of poor hand hygiene included cost, ward closure, loss of reputation and target failure. It was considering these factors that motivated hand hygiene.

> *"because in the past how many times has* (hospital name) *had wards closed?"* (Interview 8, Patient).

> *" . . . also in the background we also know that if we don't do it, it will affect our targets, reputation, we might lose our double excellent rating"* (Interview 23, Manager).

Patient The potential outcome of health care associated infection (HCAI) (and resulting effects of infection) was the main consequence identified of poor hand hygiene for patients.

> *"And especially when we go into the neonatal intensive care unit the policy is extremely strict and we have to, erm, either wash out hands with soap or use the alcohol solution before and after each patient . . . because the risk of spreading infection is very high from neonatal intensive care unit and if you get an infection in 20 week babies they could die."* (Interview 4, Doctor).

However, participants considered the strength of being motivated to hand hygiene (in order to prevent this) to be tempered by the time gap between the practitioners not engaging in hand hygiene and the patient acquiring an infection. Participants also considered that because the individual practitioner who had failed to clean their hands (resulting in an infection) could not be identified this also weakened the effect of this consequence as a lever to hand hygiene. A number of practitioner participants felt that where they had witnessed HCAIs and the effect of these first hand (illness, greater length of hospital stay and death) they were more likely to clean their hands according to guidelines than where such consequences had not been witnessed.

Staff The main consequence of not adhering to hand hygiene identified by participants was staff contracting an infection as illustrated by the following quote.

> *"It is not just about protecting patients with me it is about looking after me, you know? I don't want to catch summat what I don't want. You know what I mean?"* (Interview 3, Porter).

This was a consequence that acted as a lever. The other consequence to staff identified was getting sore hands as a result of frequent hand hygiene, which acted as a barrier.

> *"We did have a problem with people with dry hands. We have had a few people that have been down to occupational health but we were told it is not dermatitis it is dry skin problems and they need to use the hand cream."* (Interview 24, Manager).

> *"I know some people say they break out in skin irritation with the gel. I can understand how that would effect their compliance."* (Interview 26, Occupational Therapist).

Motivation

This theme relates to a person's drive or lack of motivation to practice hand hygiene and factors that may influence this. *"Motivation"* was a theme identified by a total of 32 participants. Within this theme participants referred to intent and drive as levers to hand hygiene, an example of this is given below.

> *"What helps me, the first thing is that I am motivated to do it. I believe that it is the right thing to do. I believe it is good for patients and as, if you like it is good for me as a doctor, professionally, as a doctor to be seen to wash my hands, to keep my hands clean. So I am motivated to do it. I think the next thing that helps is, well, two fold, not only am I motivated to do it but I hope that I have motivated my team and those around me."* (Interview 15, Consultant).

Complacency and competing priorities were reported as barriers to hand hygiene as barriers. The quotations below give examples of this.

> *"And therefore in that wonderful high tech world something as basic as hand hygiene is actually not perceived. To be as important, you know?"* (Interview 16, Matron).

> *"I don't think it is deliberate it is just what you are doing at the time overtakes the importance of washing your hands".* (Interview 1, Auxiliary nurse).

Within this theme there were some overlaps with other themes. For example it was considered that information or knowledge was considered to be something that would improve intrinsic motivation to hand hygiene. Lack of regard from others, for example peers or managers, or feeling demoralised at work generally was also reported to reduce motivation.

Complacency was often used to describe ward "culture" as well as individual practitioners' characteristics.

Participants described being less likely to clean their hands if they were busy or in emergency situations (such as situations of falls or cardiac arrest), they described having to prioritise, their actions being motivated by what they considered the greatest need at the time.

Habit/Routine

This theme related to hand hygiene as an automatic pattern of behaviour. Twenty eight participants talked about habit and routine in relation to hand hygiene practice. Participants considered that developing good hand hygiene habits was a lever to best practice. There was little variation within this theme and therefore no sub-themes. Participants talked about "good habits", "automatic" behaviour, and "embedding" hand hygiene into their practice, routinely cleaning hands before patient contact and hand hygiene becoming "second nature".

> *"I think hand washing amongst nurses almost becomes habitual".* (Interview 2, Charge Nurse).

> *"I have been on the wards and maybe the sister has said to me, you are the first porter I have seen to that, it is just habit. . . . with me, once you get into the habit. . . . . I have just got into the habit; it is getting into the habit . . ."* (Interview 3, Porter).

> *"I don't think we had formal training but I know when I joined we had to be told and now my seniors and I, well, we do it so it is second nature to us at the moment".* (Interview 4, Doctor).

Attitude

This theme related to the predisposition of a practitioner to be positive or negative about hand hygiene. Attitude was cited as a barrier to hand hygiene by 26 participants. It was nearly always identified in negative terms, that is a bad attitude. Participants nearly always described the attitudes in others; only one participant talked about their own attitude. A poor attitude was often identified to explain a lack of hand hygiene compliance.

> *"Well I would say, if you were to change that question around and ask what is one of the main barriers to hand hygiene I would have said that it is not a lack of understanding but it is the attitude."* (Interview 16 Matron).

> *". . .it is more attitudinal barriers than anything else. . . . and it seems to affect some staff more than others I would say."* (Interview 9, Patient).

Memory

This theme includes factors influencing whether hand hygiene is remembered or forgotten. Twenty three participants identified lapses of memory as a barrier to hand hygiene. Often this was due to distractions, for example, patients requesting

help or a heavy work load. Gel availability, posters and notices were identified as strategies employed to jog the memory.

> *". . .it is not that we don't want to do it, consciously we do want to do hand washing before and after every patient but sometime the list is too long or sometimes there is emergency or you know we forget?"* (Interview 4, Doctor).

> *"I am sure there are times when I fail to wash my hands and it is purely because it is busy, and also because I might just forget".* (Interview 17, Charge Nurse).

Emotion

This theme related to any feeling that influences the likelihood of hand hygiene. Emotion was identified by 20 participants and most of the time as a lever to good hand hygiene. Occasionally emotion was seen as a barrier for example, emotions such as stress burn-out or feeling demoralised were considered to inhibit best practice. Although the theme was very broad, containing references to many different emotions, two sub-themes were clear, *"pride"* and *"anticipated regret"*. However, a wider range of emotions were identified as barriers and levers and a third sub-theme, *"other"*, was formed to capture these.

Pride This was identified by many participants as a key lever to hand hygiene. Participants talked about having pride in their work, in the job, in their ward or department or the work place generally and in the team. They also talked about professional pride and being proud of their practice or when audit results are good or targets are met (there was some overlap here with the sub-theme *"audit and feedback"*).

> *"We hope that people take pride in their work."* (Interview 14, Consultant).

Anticipated regret This was invariably discussed in relation to the patient having contracted an infection or the thought of potential infection.

> *"I don't want it on my conscience if someone gets an infection and maybe someone dies."* (Interview 1, Auxiliary Nurse).

Other Within this sub-theme emotion was identified as both a barrier or a lever to hand hygiene. For example, anger and frustration toward those who did not clean their hands and fear of infection motivated participants to prompt practitioners, patients and visitors when hand hygiene was omitted and ensure their own practice was optimal. There were small numbers of occasions where the reverse was the case and emotion was a barrier. For example, participants considered that when they felt stressed, demoralised or lazy, they were less likely to engage in hand hygiene practice. Other emotions identified as levers to hand hygiene practice

included fear of contracting an infection, guilt when hand hygiene is not carried out and empathy or consideration toward the patient.

> *"I think most people feel guilty if they don't do it now."* (Interview 5, Patient).

> *"I don't know what the word is really. It is almost like letting people down. Letting the side down, it is that feeling that you have not performed in a way that you should have, it is pride in a way but it is very personal to that individual patient"* (Interview 24, Manager).

Incentives

This theme included any rewards or sanctions influencing the likelihood of hand hygiene. Incentives were identified as barriers or levers to hand hygiene by 17 participants. Within the theme two sub-themes were clear, *"rewards"* and *"sanctions"*.

Rewards. Rewards were considered to be a lever to hand hygiene and reported to be more effective than sanctions. On some occasions practitioners said that rewards would be effective in improving hand hygiene but were not aware of any within their area of work.

> *"There are little rewards that you can give to people that have done good work or have been very thorough workers but basically there is not much that really that any manager can do."* (Interview 13, Charge Nurse).

Rewards included good audit results being made public, praise certificates and awards, praise, acknowledgement and recognition from managers and the IPC team (this overlaps with the sub-themes manager or IPC team (social/cultural) and IPC team improvement strategies). Patients who identified rewards talked about audit results and thought that staff received a bonus or cash incentive to clean their hands.

Sanctions Often sanctions were said to lead to "demoralisation". However, participants considered they would be unable to insist on good hand hygiene practice without defined action that could be taken should a simple request be insufficient. Sanctions included getting negative feedback, an incident report being completed and sent to managers and being identified to peers (named and shamed).

> *"Eventually we could take disciplinary action. We have never dismissed anybody for not washing their hands. And I would like to think we would never get there but potentially, we could take disciplinary action."* (Interview 24, Manager).

3.3.3. Focus groups

Participants

There were a total of 21 focus group practitioners participants in three groups (six, seven and eight participants respectively). Table 3.3. identifies the

characteristics of practitioners according to role and work area. Although practitioners came from a wide range of work areas, there was less variety of practitioners according to role than with interviews. Specifically, there were no doctors, porters or therapists. However, one phlebotomist and one pharmacist attended that were not represented in interviews. These variations in the number and type of participants are likely to be reflected in the findings.

Table 3.3. Characteristics of study sample of health care practitioners (n=21) participating in focus groups

	Trust 1								Trust 2								Trust 3								
Participants	Infection Prevention	More than one area	ICU	Elderly Care	A & E	Medical	Surgical	Paediatrics	Infection Prevention	More than one area	ICU	Elderly Care	A & E	Medical	Surgical	Paediatrics	Infection Prevention	More than one area	ICU	Elderly Care	A & E	Medical	Surgical	Paediatrics	Total
Manager									1	3															4
Nurse	1			1		1	1		1		1			1						2		2	2	1	14
Phlebotomist	1																								1
Pharmacist	1																								1
Other										1															1
Total	3			1		1	1		2	4	1			1						2		2	2	1	21

3.3.4. Barriers and levers to hand hygiene: focus groups

Data generated from focus groups were similar to interviews. In terms of barriers and levers to hand hygiene, a number of themes that were identified by interview participants were not identified in focus groups. These will be presented here. There were no additional themes identified by focus group participants not identified in interviews. However, there were a number of other differences between interview and focus group data which are presented in section 3.3.8.

Barriers and levers identified

Generally the focus group data were very similar to interview data. All first level themes identified by interview participants were also identified by focus group participants. Five sub-themes identified by interview participants were not identified by focus group participants. These were *"pride"* and *"anticipated regret"* (within the theme *"emotion"*), *"organisation"* (within the theme *"consequences"*), *"professionalism"* (within the theme *"professional"*), *"individual"* (within the theme *"social/cultural"*). There were a number of other differences between questionnaire, interview and focus group data; these are presented in section 3.3.8.

3.3.5. Results: Questionnaires

Participants

Table 3.4. identifies the characteristics of HCPs who completed a questionnaire (n=24) according to their role and work area within each NHS hospital trust. A total of 64 questionnaires were distributed and 24 returned, a response rate of 37.5%. Forty one percent of those returned were based on BPS and 59% were based on non-BPS schedule based questionnaires. There was diversity in terms of the range of practitioner roles and areas of work included in the sample of respondents. More admin/reception workers and doctors completed questionnaires than had participated in interviews or focus groups. However, no managers or occupational therapists completed and returned the questionnaire.

Differences in terms of barriers and levers to hand hygiene identified in questionnaires compared with interviews will be presented here. There were a number of other differences between questionnaire, interview and focus group data; these are presented in section 3.3.8.

Table 3.4. Characteristics of study sample of health care practitioners (n=21) completing questionnaires

	Trust 1								Trust 2								Trust 3								
Participants	Infection Prevention	More than one area	ICU	Elderly Care	A & E	Medical	Surgical	Paediatrics	Infection Prevention	More than one area	ICU	Elderly Care	A & E	Medical	Surgical	Paediatrics	Infection Prevention	More than one area	ICU	Elderly Care	A & E	Medical	Surgical	Paediatrics	Total
Nurse		1	1	1					1		1	2		1				1						1	10
Doctor	1												1									1			3
Porter										1															1
Physiotherapist																				3					3
Admin/reception													2	1	1								1		5
Phlebotomy		2																							2
Total	1	3	1	1	0	0	0	0	1	1	1	2	3	2	1	0	0	1	0	3	0	1	1	1	24

3.3.6. Barriers and levers to hand hygiene: questionnaires

Generally, the questionnaire data were very similar to interview data in terms of the barriers and levers to hand hygiene identified. There were no themes identified in returned questionnaires that were not identified by interview participants. All themes identified by interview participants were also identified in questionnaires. Three sub-themes identified by interview participants were not identified by questionnaire participants. These were *"pride"* (within the theme *"emotion"*), *"literacy"* (within the theme *"knowledge"*) and *"financial"* (within *"environment"*).

3.3.7. Results: Comparing BPS with non-BPS

The second aim of the study was to compare the use of a theoretically based question schedule with a non-theoretically based schedule for the purposes of identifying barriers and levers to hand hygiene practice.

Twenty five participants were interviewed using the BPS schedule and 25 using the non-BPS schedule. Although the same number of BPS and non-BPS questionnaires were distributed, of those returned 10 were BPS and 14 non-BPS. Two focus groups (n=6 and n=8) were carried out using the BPS and one (n=7) using the non-BPS question schedules.

Differences in responses between BPS and non-BPS groups are compared below.

Numbers of participants identifying themes: BPS compared with non-BPS

The numbers of participants identifying themes was compared according to whether they had been questioned using BPS or non-BPS question schedule. It was not possible to quantify the numbers of focus group participants identifying a theme (the reasons for this are discussed in section 3.3.8., Comparing Methods). The numbers of interview and questionnaire participants identifying themes are presented in Table 3.5. Numbers have been converted to percentages for ease of comparison. When comparing the results from participants questioned using BPS compared to non-BPS formats there were three themes within which there were differences between the two groups. These were *"emotion"* (χ^2 (1, n=74) = 13.66, $p<0.001$), *"habit/routine"* (χ^2 (1, n=74) = 6.9, $p<0.01$) and *"incentives"* (χ^2 (1, n=74) = 18.01, $p<0.001$). These themes were mentioned significantly more frequently in the BPS questioned group than in the non-BPS group. Based on the odds ratio, participants questioned using the BPS schedule were 6.25, 3.49 and 10.24 times more likely to mention *"emotion"*, *"habit/routine"* and *"incentives"* respectively than participants questioned using the non-BPS schedule.

Table 3.5. Number of participants identifying themes: BPS compared with non-BPS Schedules (interview and questionnaire data only)

BPS schedule	Participants mentioning item (ranked)		Non-BPS schedule	Participants mentioning item (ranked)	
Theme	**%**	**n = 35 (Interviews, Questionnaires)**	**Theme**	**%**	**n = 39 (Interviews, Questionnaires)**
Environmental	100	35 (25, 10)	Environmental	100	39 (25, 14)
Knowledge/Skills	94	33 (23, 10)	Knowledge/Skills	92	36 (23, 14)
Social/Cultural	94	33 (24, 9)	Social/Cultural	94	37 (24, 13)
Consequences	88	31 (21, 10)	Improvement Strategies	87	34 (21, 13)
Improvement Strategies	88	31 (23, 8)	Consequences	76	30 (18, 12)
Professional	82	29 (23, 6)	Professional	74	29 (18, 11)
Habit/Routine*	**71**	**25 (16, 9)**	Motivation	76	30 (18, 12)
Motivation	69	24 (14, 10)	Attitude	51	20 (12, 8)
Emotion*	**66**	**23 (16, 7)**	Memory	44	17 (10, 7)
Incentives*	**63**	**22 (13, 9)**	**Habit/Routine***	**41**	**16 (12, 4)**
Attitude	51	18 (14, 4)	**Emotion***	**23**	**9 (4, 5)**
Memory	51	18 (13, 5)	**Incentives***	**7**	**3 (3, 0)**

Where differences existed, these will be presented by theme.

The barriers and levers to hand hygiene: BPS compared with non-BPS

Emotion was a theme identified by more participants questioned using the BPS format (66%) compared with those questioned using the non-BPS (23%) format. Each of the sub-themes *"pride"* and *"anticipated regret"* were identified by both groups (although by fewer non-BPS participants). The largest difference was in the sub-theme *"other"*. Here there was much less variability in what the non-BPS participants talked about compared with BPS participants. Both groups of participants spoke about stress, burn out and feeling tired as barriers to hand hygiene. Only BPS participants spoke about embarrassment, frustration, demoralisation and empathy, all of which were cited as emotions likely to be levers to hand hygiene practice.

Habit/Routine was also identified by more BPS (71%) than non-BPS participants (41%). However, there was no difference in the content of what was said across the two groups, both groups considering good habits a lever to hand hygiene. There were no sub-themes within this theme.

Incentives were identified by more BPS participants (63%) than non-BPS participants (7%). This was the case for both sub-themes within the theme incentives (rewards and sanctions). However, whilst all of the rewards mentioned

by BPS participants were also identified by non-BPS participants, this was not the case for sanctions. BPS participants identified incident reports, being named and shamed, being cited in patient complaints and failing assessments or audits, whereas non-BPS participants did not.

3.3.8. Results: Comparing methods

The third aim of the study was to compare and contrast the research methods used to assess barriers and levers to hand hygiene practice.

In total there were 50 interview participants, 3 focus groups (21 participants) and 24 returned questionnaires. Methods were compared in two ways. Firstly by looking at the themes and sub-themes that were identified by participants in each group and secondly by reflecting on the merits of each method used in the assessment of barriers and levers to hand hygiene.

Barriers and levers to hand hygiene: Comparing method

The differences in the themes and sub-themes identified by interview, focus group and questionnaire participants are reported in sections 3.3.2. and 3.3.3. under the title Barriers and Levers Identified.

Other differences: Comparing method

Apart from differences in barriers and levers identified, there were a number of other differences between using the three different research methods in assessing barriers and levers. The investigator considered the process of each of the three research methods carried out from recruitment through to analysis of data and results. When there were differences between methods these were considered and have been listed, in the order they were encountered in the study process, in Figure 3.7. Boxes are ticked where a method fulfilled the attributes listed. Each will be discussed in turn.

Figure 3.7. Comparing the attributes of research methods in assessing barriers and levers to hand hygiene

Attribute	Interviews	Focus groups	Questionnaires
Recruitment			
Purposive sampling possible	√	√	
Range of practitioners achieved (work area)	√	√	√
Range of practitioners achieved (role)	√		√
Good recruitment/ response rates	√	√	
Organisation simple	√		√
Not time consuming (researcher)			√
Not time consuming (participant)			√
Participant convenience	√		√
Participant preference of method	√	√	
Participants communicate openly	√		√
Able to quantify participant responses	√		√
Data saturation achieved	√		
Data Rich	√	√	

Recruitment Purposive sampling was possible with interviews and it was easily possible to get a range of practitioners in terms of role and area of work. All participants approached to participate agreed. Recruitment to focus groups was harder. Although purposive sampling was possible, and all participants approached agreed to take part, however, finding a time (and location in two site NHS trusts) that was convenient to all was very difficult. It is notable that no doctors took part in the focus groups. One doctor had agreed to attend focus group 3 but had to send apologies. Had this occurred with an interview it could have been rescheduled, this was not possible with a focus group. Questionnaires were distributed to a range of participants with regard to area of work and role and a good range were returned. Questionnaire return rate was 37%.

Organisation simple It was very simple to organise interviews and send out questionnaires. Trying to get a diverse group of practitioners (in terms of role and area of work) together in a focus group (time and place) was difficult. This was due to practitioners working a variety of days and hours and also due to them having to cover wards and departments and therefore being unable to predict or organise time in their work day to attend a group meeting. Focus groups had to be organised at least six weeks in advance to allow for participants to respond to invitations and suggest convenient times.

Not time consuming (researcher) Four hours was allocated for each interview and each focus group (one hour per interview or focus group, two hours travelling, depending on NHS trust location and one hour for setting up, and contingency time). As only three focus groups were held compared to 50 interviews, focus groups were less time consuming to arrange from the researchers perspective. Questionnaires were not time consuming to circulate.

Not time consuming (participant) Focus groups were the most time consuming for participants. Interviews took a mean of 19.4 minutes, focus groups 36 minutes and questionnaires 16.6 minutes. Furthermore, focus groups required participants to travel a small distance to a central location, whereas the other methods could be carried out at the participant's place of preference.

Participant convenience Interviews could be held at a time and place of convenience to the participant. Questionnaires could be completed at a time of convenience to the participant. Focus groups were organised according to what was the most convenient for the majority.

Participant preference of method All participants were asked what method they would have preferred should they have been given a choice. Some participants had no preference; some chose more than one method they would have been happy with. Excluding focus group participants, 15 participants had no preference, interviews were considered a preferred option by 27 participants, focus groups were chosen by 14 participants and 11 participants chose questionnaires. All three focus groups said they were happy with focus group format but there was a general consensus that they would have been equally happy with interview participation.

Participants communicate openly When data were examined; focus group participants appeared at times reluctant to talk about issues that may have been considered sensitive.

This is illustrated below where practitioners consider doctors less likely to clean their hands than other practitioners. The first example is from a focus group the second and third examples are interviews.

> *"We all know who is worst at it don't we?"* (Matron). All laugh and make agreement noises, including yeah and yes. *"They feel they have got more important things to be doing."* (Matron). *"Yeah, like the consultants, the doctors. We can tell because of doing the hand hygiene audits."* (Nursing Assistant). (Focus Group 1).

> *"Doctors are the worst. They are the worst. They will go like from patient to patient without washing their hands."* (Interview 1, Auxiliary Nurse).

> *"A lot of doctors, don't bother like, just go in."* (Interview 3, Porter).

These excerpts illustrate the reluctance of practitioners to speak in a group situation about an issue that, in retrospect, is clearly sensitive but could probably not have been predicted to be so. As a result of this much greater facilitation was required in focus groups to explore some areas.

Able to quantify participant responses It was useful for this study to quantify the number or participants identifying themes and sub-themes. The reasons for this were to enable the comparison between BPS with non-BPS formats, methods and comparing patient data with that of practitioners. Reasons and justification for this approach are explained in full in section 3.3.3. Whilst it was possible to identify how many participants identified themes in interviews and questionnaires, this was not possible with focus groups. The excerpt from a focus group below illustrates this.

> *"It does become a habit doesn't it?"* (Pharmacist). *"Well yeah. . . ."* (IPC nurse). *"Yeah I think it has become a habit now. We do it automatically."* (Nurse specialist). *"I think for some people it is still an ongoing procedure, isn't it, to learn. But on the whole for nurses it is constant. The amount of times you wash your hands . . . "* (Matron). *"You wouldn't like to count would you really?"* (Phlebotomist). *"This is why we all have old ladies hands."* (Matron).

From this passage it can be seen that the Pharmacist identifies hand hygiene as a habit, the Nurse Specialist agrees and adds that hand hygiene is done automatically. The Matron then appears to agree, but does not do so explicitly, the phlebotomist then changes the subject to how often hands are cleaned. It is not possible to say from this passage which practitioners consider that habit or automatic behaviour may influence hand hygiene.

Data saturation achieved After 15 (out of 50) interviews had been carried out no further themes were identified by interview participants. Focus groups and questionnaires data failed to identify all of the themes and sub-themes identified by interview participants (these omissions are presented in sections 3.3.4. and 3.3.6.)

Data rich Data for interviews were rich, full of examples, explanation and discussion of why barriers or levers were considered to be so. Focus group data were similar to interview data other than an occasional reluctance to discuss issues considered to be sensitive. Questionnaire data were brief; answers were clear but lacked elaboration or explanation.

Very often questionnaire data consisted of single words or very short phrases. Only rarely were explanations or elaborations offered. The excerpts below, each relating to attitude, give typical example of the differences between interviews,

questionnaires and focus groups in terms of information and examples offered by participants to illustrate their point.

> *"I think some people become sneaky, like the smoking policy. Find a new way of doing something. But I think there are people who just won't change. . . . I think it is about attitude with staff and therefore there are some staff that will sneak on their engagement rings and bracelets."* (Interview 26, OT).

> *"When I have said things to staff that I thought were really off, it's never been accepted nicely. It is never "you've got a right to say this". It is more like "who the hell do you think you are opening your mouth?" You do as you are told. You can't do anything 'cause they have you in a bed. And it is that attitude. I think, well, I don't know how you get away from that really".* (Interview 5, Patient).

> *"When we have challenged about non-compliance we have to put an incident report in. Then our director sends a letter to their . . . erm. . . clinical lead. And that does have an effect you know".* (Matron). *"Right?"* (Researcher). *But I don't know that other business units would do that. I don't know".* (Matron). *"Does that have an effect on their performance?"* (Nurse Specialist). *"Performance, yes."* (Matron). *"So when it's reported it does result in changes?"* (Researcher). *"So while it actually affects the performance, what about their attitude with the individual who has reported them?"* (Nurse Specialist). *"Obviously they don't name names of who has reported them but they are a bit . . . . (pause). . . . their attitude."* (Matron). *"Laughs. That deteriorates!"* (Manager). *"Well yes, it has a negative effect from that, but their actual hand washing is improved."* (Matron) (Focus Group 3).

> *"Bad Attitude"* (Questionnaire 10, Phlebotomist).

The excerpts below demonstrate how explanations were more likely to be offered by interview and focus group but not questionnaire participants.

> *"We had, well, not the team of doctors that we have at the minute, the previous team, we had had two doctors that were quite recalcitrant. One of them wasn't convinced that the thing. . . . . we produce all of this research saying, its hands, its hands, its hands, but he had read about it and wasn't convinced that it was right. The other was just lazy and couldn't be bothered."* (Interview 13, Charge Nurse).

> *"I think generally it's the medics."* (Nurse Specialist). *"Yeah, medics."* (Matron). *"Still the medics I think yeah."* (Nursing Assistant). *"The only thing I would say is they are yet to be convinced that wearing a wrist watch has a detrimental effect."* (Phlebotomist). *"The thing I would say is that they tell you there is no evidence for it."* (Nurse Specialist). *"Exactly."* (Phlebotomist). *"It is a stupid political thing."* (Nurse Specialist). *"I am not sure about Porters."* (Matron). *"No."* (Nurse Specialist). *"I don't often see them. When they are pushing a patient in a wheelchair."* (Matron). *"I don't think porters tend to."* (Nursing Assistant).

Do you think different groups/teams/areas perform hand hygiene better than others? If so are there any trends? And why is this case? *"Yes, consultants are the worst."* (Questionnaire 4, Porter).

3.3.9. Results: Patient participation

The fourth aim of the study was to assess the value of including patients in the identification of barriers and levers to hand hygiene practice.

Patients were involved in interviews only and are therefore compared with practitioner interviews only. Twenty five patients and the same number of health care practitioners were interviewed. Other research methods are not considered in this section. Patient involvement was evaluated in two ways. Patient interviews were compared with practitioner interviews to establish which themes were identified by each group and secondly by examining the data in relation to themes and sub-themes across these two participant groups.

Number of participants identifying themes: Patients compared with health care practitioners

All themes identified by practitioners were identified by patients (Table 3.6.). However there were some themes reported by significantly more practitioners than patients. These were *"habit/routine"* (χ^2 (1, n=50) = 8.12, $p<0.01$), *"improvement strategies"* (χ^2 (1, n=50) = 6.82, $p<0.01$), *"incentives"* (χ^2 (1, n=50) = 7.22, $p<0.01$), *"knowledge/skills"* (χ^2 (1, n=50) = 4.35, $p<0.05$), *"memory"* (χ^2 (1, n=25) = 3.95, $p<0.05$) and *"motivation"* (χ^2 (1, n=50) = 8.68, $p<0.01$). Three sub-themes were identified by practitioners but not patients. These were *"anticipated regret"* (in the theme *"emotion"*), *"multifaceted"* (in the theme *"improvement strategies"*) and *"sanctions"* (in the theme *"incentives"*). There were a number of other differences noted in the data. When differences exist these are presented by theme below.

Table 3.6. Number of participants identifying themes: Practitioners compared with patient participants (interviews only)

Health Care Practitioners	Participants mentioning item (ranked)		Patients	Participants mentioning item (ranked)	
Theme	**%**	**n = 25**		**%**	**n = 25**
Environment	100	25	Environment	100	25
Social/Cultural	100	25	Social/Cultural	92	23
Knowledge/Skills	100	25	Knowledge/Skills	84	21
Improvement Strategies	100	25	Improvement Strategies	76	19
Professional	88	22	Professional	76	19
Consequences	84	21	Consequences	72	18
Motivation	84	21	Attitude	52	13
Habit/Routine	76	19	Motivation	44	11
Memory	60	15	Habit/Routine	36	9
Incentives	52	13	Emotion	36	9
Attitude	52	13	Memory	32	8
Emotion	44	11	Incentives	16	4

Social/Cultural Data were similar between patients and practitioners within this theme with the exception of two sub-themes. Practitioners (n=10) were more likely to cite the influence of managers and the IPC team than patients (n=1). More patients (n=18) than practitioners (n=7) spoke about the influence of patients on hand hygiene. With regard to the influence of patients, practitioners talked about patients complaining about their hand hygiene, patients spoke about their reluctance to challenge practitioners practice.

> *"I don't think they do! In my experience I have never felt so powerless in my life when I go in somewhere like that. It completely turns it on its head for me. I wouldn't dream of saying to someone can you wash your hands please."* (Interview 5, Patient).

> *"Stuff might be mentioned in a complaint, alright, there were two nurses that came in and didn't wash their hands."* (Interview 17, Nurse)

Knowledge/Skills Practitioners were more likely to identify three of the sub-themes than patients, *"belief in effectiveness"* (n=8 compared with n=1), *"literacy"* (n=6 compared with n=1) and *"self efficacy"* (n=12 compared with n=2). Practitioners tended to talk more about the specifics of where they gained their knowledge and how useful or otherwise this had been. Patients talked about where they got their own information and about information available to the general public

as well as an awareness that practitioners received information and training in hand hygiene.

> *"The infection control team have regular meetings for infection control link nurses. All wards and departments are expected to send someone along to the link nurse meetings. And then the link nurses feed back that information to ward areas. There is also a senior nurse, matron group that meets with infection control on a monthly basis to discuss infection control issues."* (Interview 22 Matron).

> *"I know because of what I see stuck on the walls around the hospital telling you to wash your hands whenever you go into, well, put alcohol on you hands when you go into hospital and you are in and out of any particular ward. And before and after touching any patient."* (Interview 9, Patient).

Improvement strategies A similar number of patients and practitioners identified improvement strategies as a theme. Patients did not identify the sub-themes the *"IPC team"* and *"multifaceted strategies"*. All other sub-themes were identified by both patients and practitioners; however, practitioner information was much more detailed. Practitioners identified 28 separate and specific improvement strategies used, compared with patients identifying nine.

> *"Infection control link nurse updates. I work with one of the nurses* (in the department) *who goes to regular meetings and updates us through a communication book or verbally updates us . . . . the infection control update is mandatory and you have a hand hygiene update as part of that, annually, . . . gel . . . . . it is the little things, like pin badges with hands on, it is ok to as . . . . . and maybe stickers, sometimes there are stickers around, little things that promote, the advertising. . . . posters that are around as well, you know the ones that have been designed by children? The other thing was the training video . . . . . "* (Interview 20, Nurse).

> *"That is what they want back is a good matron, cracking the whip as they say."* (Interview 37, Patient).

Consequences Fewer patients (n=5) than practitioners (n=14) interviewed identified consequences to *"staff"* as a sub-theme. Patients were more likely to talk about sore hands as a consequence of hand hygiene for staff rather than the risk of infection as a consequence of lack of hand hygiene. Examples of this are given below.

> *"It is not just about protecting patients with me, it is about looking after me you know?"* (Interview 3, Porter)

> *"It effects their hands you know, they don't like washing them so much because you know the hands go funny, so I think that is another thing. I think it stops them doing it, a lot of them don't do it for that reason."* (Interview 6, Patient).

Incentives Fewer patients (n=4) than practitioners (n=13) identified *"incentives"* as a theme. This was largely due to patients being unaware of any *"sanctions"* that could be imposed for failing to engage in hand hygiene (no patients identifying this sub-theme). The quantity of patient data within this theme was very small; patients mentioned audit results and thought that staff received a bonus or cash incentive to clean their hands, whereas practitioners spoke about incentives at length and in detail.

> *"But also as an employer of the organisation we have a policy and if somebody is not following the policy they are potentially open to disciplinary action."* (Interview 24, Manager).

> *"Give them a payment to do it. As an incentive, they should do, they give them incentives to do other things".* (Interview 12, Patient).

Attitude. Although there was no difference between the numbers of patients and practitioners interviewed who identified *"attitude"* as a theme patient participants spoke at much greater length about attitude. There was a difference also in the frequency with which attitude was mentioned, patients talking about it on more occasions (31) than practitioners (22). Patient participants identified attitude as a barrier to hand hygiene but they were more likely to speak about attitude much more generally, in relation to all aspects of care. They considered that poor hand hygiene was often associated with a general lack of care and this was as a result of practitioner attitude. Examples of quotes are given below.

> *"Some people what ever you say to them will probably not bother. They say, you are nagging again but they still don't do it. Because that certain person is not going to do it whatever you say. I tell them or prompt them, remind them. It most probably doesn't go down awfully well sometimes. Some people take notice, other people just think, gosh. . . . . sometimes I just think here I go again."* (Interview 24, Staff Nurse).

> *"It is more attitudinal barriers than anything else. Where they don't provide a good patient experience then quite often they will be less likely to do hand hygiene as well."* (Interview 9, Patient).

Emotion Practitioners talked about many emotions they considered helped or hindered hand hygiene practice. Patients did not identify the sub-theme *"anticipated regret"*. Patients talked about emotion as much as practitioners but there were less variation in the range of emotions they reported. Most of the time patients talked about being afraid of catching an infection if hands were not cleaned. Examples of quotes are presented below.

> *"When you are in hospital you have to be very careful. You don't want to go upsetting people but there was times that I felt upset over the fact that other people were catching infection because of them people that don't bother."* (Interview 21, Patient).

"If I see one of my trainees not doing it though I will tell them, erm, and because I don't want it on my conscious if someone gets an infection and maybe someone dies." (Interview 4, Doctor).

3.4. Discussion

This study sought to address four aims. Each of these will be discussed in turn. Following this the strengths and limitations to the study will be presented.

3.4.1. The barriers and levers to hand hygiene

The first aim of this study was to identify barriers and levers to hand hygiene practice in secondary care. Twelve themes and 30 sub-themes were identified (see Figure 3.6.). Individual barriers and levers to hand hygiene are discussed in the sections above and listed in appendix 13.

Many of the barriers and levers to hand hygiene identified in this study have been previously identified in the literature (Pittet and Boyce, 2001, Grol and Grimshaw, 2003b, Gould et al., 2007). There were three areas where this study adds to what is reported in the literature. These are *"emotion"*, *"incentives"* and *"habit/routine"*. Each of these areas will be discussed in turn.

Emotion is rarely acknowledged in the literature as a barrier to hand hygiene practice. Where it is mentioned it is in relation to feelings of "disgust" with dirty hands as a motivator for hand hygiene (Whitby et al., 2007, Porzig-Drummond et al., 2009). In this study a wider range of emotions were cited as barriers or levers to hand hygiene.

Incentives and sanctions have been found to affect the application of EBP generally among health care practitioners (Davis and Taylor-Vaisey, 1997a, Proctor, 2004). There are no such studies applying this to hand hygiene. In this study participants talked about incentives such as certificates and sanctions such as disciplinary action as being levers to hand hygiene practice.

Habit/Routine; although there are some reports in the literature that it may be difficult to integrate hand hygiene into routine practice in diverse hospital environments (Grol and Grimshaw, 2003b) there is little mention of habit or routine as a lever to hand hygiene practice. In this study participants often identified habit or routine as a lever to good hand hygiene.

The identification of these additional barriers and levers has implications for practice. Designing interventions to improve hand hygiene addressing these three, as well as previously identified barriers to hand hygiene may lead to improved practice. *"Habit/routine"*, *"emotion"* and *"incentives"* will be discussed in more

depth in section 3.4.2. as these were identified more by BPS participants than non-BPS participants.

The barriers and levers to hand hygiene identified here can be seen in appendix 13. These were used as the basis of the Delphi study detailed in Chapter 4.

3.4.2. Comparing BPS with non-BPS

The second aim of the study was to compare the use of a theoretically based question schedule with a non-theoretically based schedule in identifying barriers and levers to hand hygiene practice.

"Habit/routine", *"emotion"* and *"incentives"* were identified with greater frequency by participants when they were questioned using the BPS schedule where these areas were covered explicitly.

An additional potential explanation for this difference may relate to the way we explain our own behaviour. Nisbett and Wilson (1977) assert that we are sometimes unaware of what stimuli influence our behaviour. We are likely to suggest the stimulus is based on what we judge to be plausible. We often refer to external factors in explaining our behaviour when behaviour leads to unsuccessful outcomes; this is referred to in psychology as Fundamental Attribution Error (Ross, 1977). We also tend to neglect those factors that have an impact on our behaviour that we may not be consciously aware of, e.g. automatic responses to cues such as emotion (Bargh and Chartrand, 1999).

A person's behaviour is determined not just by their deliberate and conscious intentions but by environmental cues, emotions and desires of which an individual is largely not conscious (Bargh et al., 2001). Non-conscious goals do not necessarily operate in harmony with conscious goals, these often conflict (Bargh et al., 2001). If this is applied to hand hygiene practice, the intention to clean hands may be either reinforced or undermined by non-conscious influences e.g. emotions, habits and reward systems. It is possible that the process of asking participants about habit/routine, emotion and incentives (BPS schedule) increased the conscious awareness of these influences on hand hygiene behaviour.

The use of psychological theory in the assessment of barriers and levers to EBP has been seldom used. A number of studies have investigated the predictive utility of theoretical models in the field of the implementation of EBP. Many explore just one theory (usually The Theory of Planned Behaviour (Ajzen, 2005)) (O'Boyle et al., 2001b, Walker et al., 2001, Bonetti et al., 2003, Foy et al., 2005) although, less frequently, some studies have explored more than one theory (Bonetti et al., 2006, Eccles et al., 2007). This study has demonstrated the potential use of

the BPS framework (Michie et al., 2005) in assessing barriers and levers to hand hygiene practice.

This has implications for practice. Assessing barriers and levers using a theoretical framework may identify barriers and levers not otherwise identified. Furthermore, recent work has been carried out to link behaviour change techniques to the psychological domains of the BPS framework (Michie et al., 2008b). These behaviour change techniques may provide some guidance as to how to address the factors inhibiting optimal hand hygiene. This feasibility study is reported in Chapter 6.

3.4.3. Comparing methods

The third aim of the study was to compare research methods used to identify barriers and levers to hand hygiene practice as there is no consensus within the literature as to which method is best for this purpose. Interviews, focus groups and questionnaires were undertaken and compared.

Interviews are reported to allow the uncovering of new areas or ideas that were not anticipated at the outset of the research allowing the researcher to check the meaning of what participants say (Britten, 1995). They can however, be expensive and time consuming, (Bowling, 2002). In this study, interviews yielded the most detailed and rich data of all methods used. Indeed, interviews were the only method whereby data saturation was reached.

Questionnaires are best used as a survey technique to gather straightforward factual data in response to closed questions (Gillham, 2008) and can be structured or semi-structured (Bowling, 2002). Questionnaires may be relatively quick and inexpensive to administer and they eliminate the problem of interviewer bias and are useful for sensitive topics as there is more anonymity (Bowling, 2002). In this study questionnaires were found to be easy to organise and relatively (compared with interviews and focus groups) quick for the researcher to administer and for the participant to complete. There was no evidence of a reluctance on the part of participants to offer their views freely. The main disadvantages of using questionnaires at this stage of the study were the lack of explanation and elaboration. Given that the main aim of this study was exploratory in nature, to build on the literature to compile a comprehensive list of barriers and levers to hand hygiene, questionnaires were considered less effective than other methods.

Questionnaire participants failed to identify three sub-themes that were identified by interview participants. This could be as a result of the brevity of response offered by questionnaire participants. As with focus groups there was less

of a range of participants than with interviews which could also account for this to some extent.

Focus groups are recommended as a quick and convenient way to collect data from several people simultaneously (Kitzinger, 2006). They allow the researcher to tap into different forms of communication such as jokes and anecdotes, teasing and arguing, which offer a different perspective to the researcher than the more reasoned response expected from interviews or questionnaires (Kitzinger, 2006). Barbour (2005) identifies focus groups as being good for stimulating discussion and allowing comparisons. However, it is suggested that participants need to be comfortable with one another if they are to fully engage in discussion with one another (Rabiee, 2004). In this study focus groups were found to be time consuming to organise but quick to execute. Less than three hours were required to carry out groups containing 21 participants who identified all themes and nearly all sub-themes identified in interviews. More importantly there was evidence of interaction between participants stimulating ideas and discussion between participants, allowing them to discuss, compare and share different perspectives.

There were five sub-themes not identified by focus group participants. This could have been for a number of reasons. For example, as identified in section 3.3.8. it was evident that practitioners were less likely to talk about sensitive issue in focus groups. Two of the sub-themes not identified, *"pride"* and *"anticipated regret"* in the theme *"emotion"* could be considered sensitive. There was less of a range of practitioners in the focus groups than there were in interviews. It is possible that this could also account for some sub-themes not being identified. For example, the sub-theme *"organisation"* in the theme *"consequences"* was identified by managers in interviews more than other practitioners. There were no managers as participants in focus groups.

Carrying out three different methods for this study allowed triangulation, several methods allowed different aspects to be considered. Questionnaire data tended to identify the barriers and levers to hand hygiene, focus group and interview data tended to not only identify these but also explain why they posed barriers or levers.

3.4.4. Patient participation

The fourth aim of the study was to assess the value of including patients in the identification of barriers and levers to hand hygiene practice.

Only two studies were identified where patients were involved in identifying barriers and levers to hand hygiene (Flottorp and Oxman, 2004, Peters et al., 2003). Although neither formally evaluated patient contribution, Flottorp and Oxman

(2004) found patients offered a different perception and challenged practitioners' preconceived ideas.

In this study, identifying barriers and levers to hand hygiene, it is notable that patients identified all of the themes reported by practitioners. There were only four sub-themes not identified by patients.

The emphasis placed on themes was similar throughout the data with the exception of the theme *"attitude"*, which ranked higher for patients than for practitioners in terms of numbers of participants identifying themes and it was mentioned more frequently by patients.

In summary, involving patients in assessing barriers and levers to hand hygiene was valuable in terms of the particular insight and perspective they offered.

3.4.5. Strengths and limitations of the study

This study has identified barrier and levers to hand hygiene, tested the use of the BPS framework as a theoretical basis for assessing these barriers and levers in interviews, and found that this framework compared methods for assessing barriers and levers and has evaluated patient involvement in this process. These are all areas of that are currently under-researched.

However, there are some shortcomings associated with this study which should be identified.

This study was carried out in only three NHS hospital trusts in the north of England. Although the trusts were chosen based on two separate indicators (MRSA rate and hygiene scores) the findings may not be generalisable to hospitals elsewhere.

It is possible that there was an element of social desirability bias, with participants wishing to present their own practice and that of their employing NHS trust as optimal. This may have resulted in a possible under-reporting of barriers to practice or the honest reporting of some barriers. For example practitioners may prefer to cite environmental barriers as their reason for not complying fully with hand hygiene rather than a feeling of complacency as the former may seem more acceptable than the latter; that is the environment rather than individual shortcomings.

In relation to the use of a theoretical approach, numbers of participants for BPS (n=49) and non-BPS (n=46) groups were similar in terms of practitioner role and area of work, however there were small differences between the two groups in relation to the research method they participated in. More participants in the BPS group had been part of a focus group, more participants in the non-BPS group

returned questionnaires. This may have had a small confounding impact on the differences between themes identified by participants questioned using BPS compared with non-BPS schedule.

Although practitioner participants interviewed or completing questionnaires were similar in terms of role and area of work, focus groups did not contain the same range of participants. In particular there were no doctor or manager participants in focus groups this may have had some impact on the differences between themes identified by participants when comparing across methods.

3.5. Conclusions

Four main outcomes emerge from this study.

A comprehensive list of barriers and levers to hand hygiene has been produced to be used in the main aim of this research, to develop and test a theory-based diagnostic instrument to accurately and prospectively assess the barriers and levers to hand hygiene practice to inform subsequent tailoring of implementation strategies.

In addition to barriers and levers previously identified and documented within the literature, this study has found that *"habit/routine"*, *"emotion"* and *"incentives"* influence hand hygiene practice.

The use of a theory based question schedule is likely to give a fuller and more accurate picture of the barriers and levers to hand hygiene practice.

When comparing research methods for assessing barriers and levers to hand hygiene, each method had its own merits and associated limitations. Together the result was a large and rich data set that appeared to offer a comprehensive account of barriers and levers to hand hygiene practice.

When evaluating patient participation in assessing barriers and levers to hand hygiene, patients identified all themes and all but four sub-themes identified by practitioners.

The overall aim of the research conducted for the PhD, presented in this thesis, was to develop and test a theory-based diagnostic instrument to accurately and prospectively assess the barriers and levers to hand hygiene practice to inform subsequent tailoring of implementation strategies. The comprehensive list of barriers and levers to hand hygiene identified in this study has been used as the basis for this instrument as presented in Chapters 4 and 5.

CHAPTER 4: A DELPHI SURVEY

4.1. Introduction

This chapter describes a modified Delphi survey conducted with a panel of experts in behavioural psychology and infection prevention and control (IPC). The purpose was to assess the fit of barriers and levers to hand hygiene (presented in section 3.4. Chapter 3) with the domains and constructs of the British Psychological Society (BPS) framework (Michie et al., 2005).

The chapter begins by providing a rationale for using the Delphi survey method followed by an account of the methods, process of conducting the survey and the presentation of the results. The chapter concludes with a discussion of the findings and conclusion.

4.1.1. Study Aim

To assess the fit of barriers and levers to hand hygiene to the domains of the BPS framework.

4.1.2. Rationale

The overall aim of the research conducted for the PhD, presented in this thesis, was to develop and test a theory-based diagnostic instrument to accurately and prospectively assess the barriers and levers to hand hygiene practice to inform subsequent tailoring of implementation strategies.

As discussed in Chapter 2, the BPS framework was the theoretical framework chosen for this research. Psychological theory has been identified as being inaccessible to many researchers in the field of health as theories are numerous, complex and have many shared or overlapping constructs (Michie et al., 2005). This issue was addressed by a group of health psychologists within the BPS who carried out a project aiming to identify an agreed set of key theoretical constructs for use by researchers in the field of implementation (Michie et al., 2005). After initially identifying a set of 33 relevant psychological theories which included 128 explanatory constructs, a group of psychology experts reached consensus on which domains were most useful for use in implementation research. This work resulted in a list of 11 domains with component constructs which, with slight modification, have been used as the theoretical basis for this study (Michie et al. 2005).

A comprehensive set of 100 barriers and levers to hand hygiene were identified systematically through a literature review, reported in Chapter 2, and

supplemented by eliciting the views of health care practitioners and patients as reported in Chapter 3.

Through a modified Delphi survey participants were asked to categorise the barriers and levers to hand hygiene within each of the theoretical domains of the BPS framework. This formed the basis of the first version of the diagnostic instrument (questionnaire) to be tested (presented in Chapter 5).

4.1.3. Choice of consensus method

The three best known consensus methods are Delphi surveys, the nominal group technique and consensus development conferences (Jones and Hunter 1995). Both the nominal group technique and consensus development conferences rely upon expert participants meeting together. The Delphi method enables communication amongst a panel of geographically dispersed experts (Ziglio 1996) avoiding the need for experts to have contact with one another (Dalkey and Helmer 1962). For this reason, a Delphi survey was chosen as the consensus method of choice for this study.

4.1.4. Background to the Delphi method

The Delphi survey approach is a method used to achieve consensus on a particular topic of interest and has been used by researchers in a wide range of fields including healthcare (Beech, 1997, Bond and Bond, 1982, Hearnshaw et al., 2001). The method was first developed for use in the area of health at the RAND corporation in the 1950s (Dalkey and Helmer, 1963). The method was originally developed to improve methods of forecasting, hence the name "Delphi" which Dalkey, one of the founders of the method, considers unfortunate. Delphi was the site of the Greek oracle and as such the name suggests baseless prediction rather than making the most of available information (Dalkey, 1969). The Delphi survey approach was developed to obtain the most reliable consensus of opinion of a group of experts through a series of rounds of questionnaires.

There are a great many opinions as to many of the components of the Delphi method; for example, the number of expert participants and the acceptable level of consensus. Relevant issues relating to Delphi are outlined below in support of the decisions made relating to the methods of this study.

Modification

Many researchers refer to the use of a "modified" Delphi method (Fink et al., 1984, Keeney et al., 2001, Keeney et al., 2006). Review of healthcare research where the Delphi method has been used illustrates that "modification" usually refers to the number of rounds used, the format of the questionnaires distributed, the level

of consensus required and the number of expert contributors necessary. Each of these are considered separately in section 4.2., methods. There appears to be no one fixed approach for use of this method. Keeney et al. (2001) have used Delphi in several studies and acknowledge the lack of any universally agreed guidelines on the use of the Delphi method. They consider this allows flexibility for the researcher and suggest that the Delphi method varies according to the aims of the individual study. However, these authors emphasise that modifications to the method should be conducted in a systematic and rigorous manner.

4.2. Methods

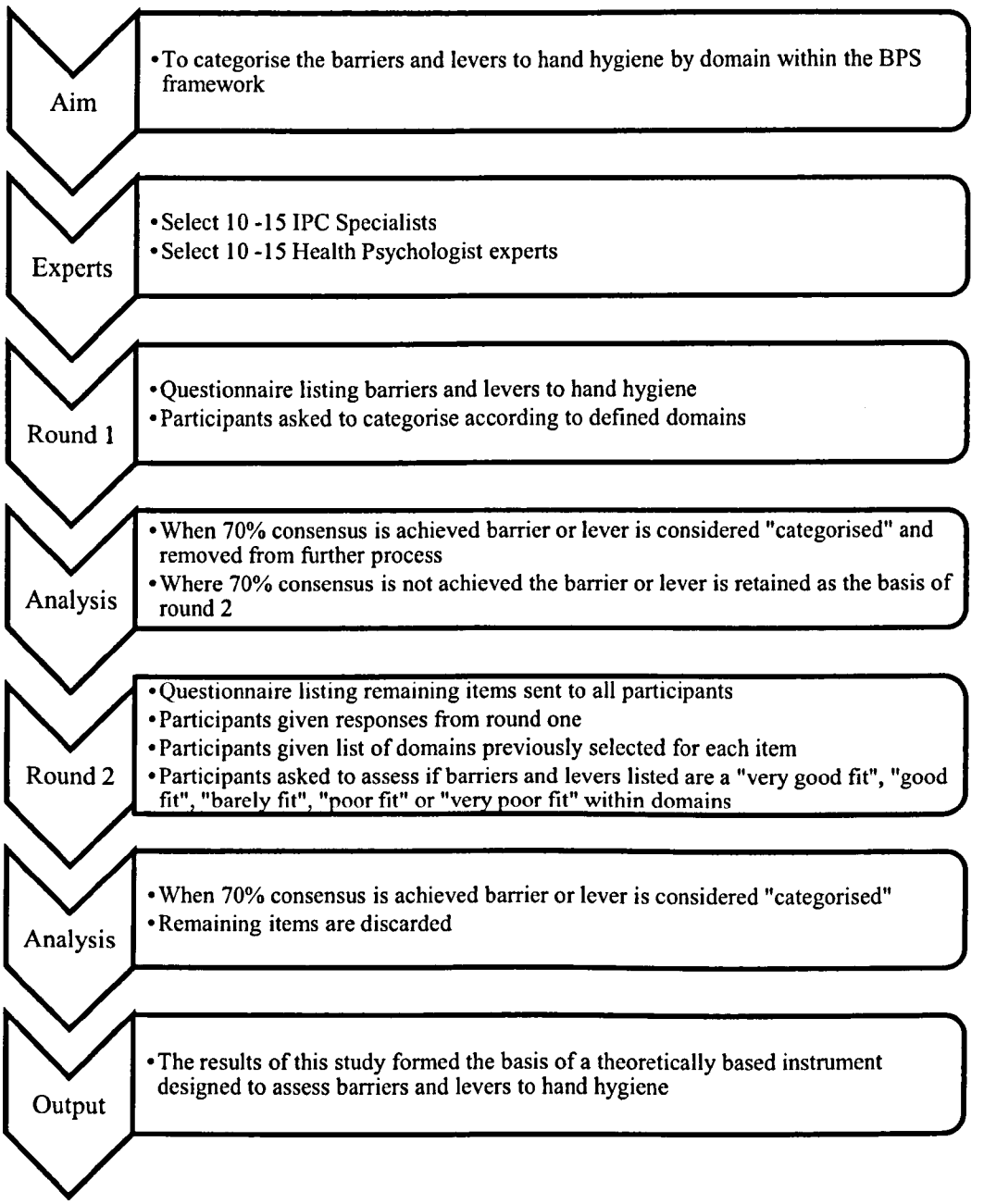
A modified two round Delphi survey was used to generate consensus amongst a panel of experts. Figure 4.1. demonstrates the process of this Delphi survey. There appears to be little consensus on the number of rounds necessary to achieve an acceptable level of consensus. Fink et al (1984) reviewed the literature relating to Delphi studies and they suggested that the reliability of the data increases with the size of group and the number of rounds. However, they also acknowledged the need to consider that panellists become tired after two or three rounds, hence increasing the risk of a low response rate. They suggested the number of rounds should be considered sufficient when there is a convergence of opinion or when a point of diminishing returns is reached. Hasson et al. (2000) suggest the number of rounds is decided based on the amount of time available and the number of questions asked (as an indication of possible sample fatigue). They report classic Delphi surveys involving four rounds, but found more recently that two or three are preferred and tend to be sufficient for achieving an adequate level of consensus.

Based on this, and given that the initial questionnaire was developed from a thorough review of the literature (Chapter 2) and the results of a qualitative study (Chapter 3) it was anticipated that two rounds would not over burden the panel of experts and would be sufficient to reach consensus.

4.2.1. Research ethics

Ethics approval was obtained to conduct the Delphi survey as discussed previously in section 3.2.1.

Figure 4.1. Flowchart demonstrating the Delphi survey process



4.2.2. Recruitment of participants

Choice of experts

Selection of appropriate experts should be based on explicit criteria depending on the aims and context of the Delphi (Ziglio, 1996). Experts need to be representative of their profession or discipline and have credibility amongst their peers in the appropriate field (Goodman, 1987, Fink et al., 1984).

In the context of a health related study requiring academic and clinical expertise in achieving consensus, Hearnshaw et al. (2001) suggested an expert panel should include "advocates" (professionals involved in the area of study e.g. clinicians) and "referees" with expertise derived from the study of the topic e.g. academic researchers. For this reason it was decided to purposively recruit two groups to comprise the expert panel for this Delphi survey. A group of "advocates" would comprise of infection prevention and control experts and a group of "referees", academic experts in the field of health (behavioural) psychology, particularly those with expertise in the implementation of EBP. In this second group it was considered important to try and recruit at least one of the original contributors to the BPS framework (Michie et al., 2005).

Numbers of experts

Hasson et al. (2000) reviewed the literature in relation to Delphi surveys and reported expert panels ranging from between 15 to 60 participants. Overall, for a group of experts within a similar field or expertise Ziglio (1996) considers good results can be obtained with a panel of 10 to 15 individuals. McColl et al. (2001) considered that due to participant attrition no less than 20 participants should be recruited. It was therefore decided to recruit 15 IPC specialists and 15 health psychologists. Taking into consideration some level of attrition, it was anticipated that this would allow for a minimum of 10 participants in each of the two groups and for each round.

Participants: Infection prevention and control specialists

Three NHS hospital trusts had been recruited to the research (see section 3.2.2. Chapter 3). The investigator had established good links with the IPC teams in each of the three hospitals in conducting the first phase of the study. It was therefore decided to recruit an IPC specialist from each of these trusts to support the conduct of the Delphi survey. These practitioners were asked to pilot the questionnaire for each of the two rounds providing the investigator with feedback before they were sent out to other participants. They were informed that their data would be retained and used within the main Delphi study if no major alterations were made to the questionnaires following piloting.

Additionally, the investigator is a member of the Infection Prevention and Control Society (IPS). This group meet four times annually and membership includes senior and experienced IPC practitioners. It was decided to recruit to the expert panel from this group. The investigator had been asked to speak to this group on two occasions prior to the start of this Delphi survey. On the second occasion the purpose and intention of the Delphi survey was outlined at the meeting and members of the IPS were asked to consider participation. Members were asked to provide their name, job role and email address if they wished to be involved. Following piloting, interested members of the IPS (n=25) were sent information about the study by email including a participant information sheet (appendix 12).

Participants: Health and behavioural psychology experts

The PhD supervisors had excellent links with health psychologists in the fields of implementation (FC, CJ, and RL). As a contributor to the original BPS framework RL also had good links with the other researchers involved in this work. Through these links, potential participants (n=18) were approached by email and asked if they would consider participation in the Delphi survey. A participant information sheet was attached. One of the psychologists approached was asked to pilot each of the questionnaires in the two rounds before they were sent out to other participants. He was informed that his data would be retained and used within the main Delphi survey if no major alterations were made to the questionnaires following piloting.

4.3. Round One

4.3.1. Design

In order to address the aim of the Delphi survey, the barriers and levers derived from the literature and from the qualitative study reported in Chapters 2 and 3 were listed according to the themes reported in Chapter 3. These were adapted slightly to account for overlapping and repeated barriers and levers and to clarify or define these where necessary. (Appendix 13 demonstrates the process of adaptation). By the end of this process there were 100 barriers and levers to hand hygiene which were then listed in random order. Participants on the expert panel were asked to categorise each barrier and lever within one or more of the 11 domains of the BPS framework. If participants were unable to assign a barrier or lever to a particular domain they were asked to suggest an alternative.

The first section of the questionnaire consisted of information about the study (a summarised version of the participant information sheet) followed by a set of instructions on how to complete the exercise.

Participants were given a list of the BPS domains, labelled "categories". A decision was made to call the domains "categories" for the purpose of the Delphi survey in order to ensure understanding by non-psychologist participants. For the sake of this Delphi survey the terms "domains" and "categories" may be considered interchangeable. For the same reason some of the domains were re-named slightly. For example, the domain *"Beliefs about Consequences"* became *"Consequences"*. Any words omitted (in this case "beliefs about") were then used in defining domains. Although it was important to keep categories simple and understandable to all participants it was also crucial not to lose the meaning of domains within this process.

Defining the domains was a difficult process because at the time of conducting the survey (June 2009) no published definitions existed. This was confirmed by email correspondence with Susan Michie, the lead researcher on the work developing the BPS framework (Michie, 2009). Although, there were plans for a study to create such definitions no such work had started at the time this Delphi survey was conducted. Definitions of the themes were therefore constructed by referring to the component constructs of each domain and discussing with the PhD supervisors. Great care was taken to ensure that definitions were easy to understand for both health psychologists and IPC specialists alike. Furthermore, care was taken to refer specifically to the target behaviour, hand hygiene and the constructs linked to each domain in all definitions.

The resulting list of domains and definitions was revised several times and the participants in the pilot study were asked to comment on the clarity of definitions prior to being asked to complete the questionnaire, and again after completion of the questionnaire.

Figure 4.2. shows the domains, how they were simplified for the purpose of the questionnaire, the relevant constructs within the domain and the resulting definition used for this Delphi survey. Since the completion of the Delphi survey, in October 2010, research had been carried out which produced a set of (yet to be published) definitions for domains (email correspondence, Cane 2010). Cane (2010) described the process for producing such definitions as follows. Definitions for the domains were selected using dictionaries (e.g. the American Psychological Association Dictionary of Psychology) and internet sources (e.g. www.oed.com). Each definition was passed to the original theorists for comments on the appropriateness of definition. When there was consensus that a definition needed to be changed, these were changed in line with the comments given.

Although these definitions were not available to use at the time of the study these are included in Figure 4.2. to allow comparison between these and the ones

developed for the Delphi survey. The content of the definitions used in this survey and the subsequently produced definitions were very similar with the exception of four key differences.

First, the definitions used for the Delphi survey include the behaviour hand hygiene; the official definitions refer to "a behaviour". For example "expected outcome of hand hygiene" compared with "outcomes of a behaviour in a given situation".

Second, the definitions used for the Delphi are written in lay language where the official definitions often use professional language that may not be accessible to non-psychologists. For example, Delphi definition for *"emotion"* included examples such as "mood, stress, fear, burn out, anxiety, regret in regard to hand hygiene" the official definition was "a complex reaction pattern involving experiential behavioural and physiological element by which the individual attempts to deal with a personally significant matter or event".

Thirdly, the definitions used for the Delphi did not go far beyond the domain title and the constructs of the domains and definitions of these constructs. The definitions subsequently produced by Cane (email correspondence, 2010) add more in terms of explaining the ideas within the domains.

Finally, the definition for the domains *"Motivation and Goals"* were slightly different in focus. Both definitions touched on goal setting and intentions but the Delphi definitions also mentioned goal conflict, whereas definitions by Cane (2010) did not.

The implication of these differences is that participants may have categorised barriers and levers slightly differently than if they had been given the official definitions. Further implications are discussed in section 4.5. strengths and limitations of the study.

Figure 4.2. Psychological domain, component constructs, definitions used for the Delphi survey and definitions subsequently developed by the BPS contributors

Category Number	Psychological Domain (Michie et al. 2005)	Category (Psychological Domain)	Component Constructs (Michie et al. 2005)	Definition used in Delphi Survey	Definitions Subsequently agreed by the original BPS contributors (Cane, 2010)
0		None		There is no suitable category	
1	Knowledge	Knowledge	Knowledge, Knowledge about condition/scientific rationale, schemas and mindsets and illness representations	Knowledge about hand hygiene as a procedure or the scientific rationale for it.	An awareness of the existence of something
2	Skills	Skills	Skills, competence/ability/skill assessment, practice/ skills development, interpersonal skills, coping strategies	Ability to clean hands according to guidelines.	An ability or proficiency acquired through practice
3	Social/ professional role and identity	Professional Role	Identity, professional identity/boundaries/role, group/social identity, social/group norms, alienation/organisational commitment	Identity, role or professional standards in relation to hand hygiene.	A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting
4	Beliefs about Capabilities	Capabilities	Self-efficacy, control of behaviour and material an social environment, perceived competence, self-confidence/professional confidence, empowerment, self-esteem, perceived behavioural control, optimism/pessimism	Self confidence, empowerment or self esteem about hand hygiene. How easy or difficult hand hygiene is.	Acceptance of the truth, reality or validity about an ability, talent, or facility that a person can put to constructive use
5	Beliefs about Consequences	Consequences	Outcome expectancies, anticipated regret, appraisal/evaluation/review, consequents, attitudes, contingencies, reinforcement/punishment/consequences, incentives/rewards, beliefs, unrealistic	Expected outcome of hand hygiene or neglecting hand hygiene. Incentives/rewards/punishment /sanctions. Attitudes.	Acceptance of the truth, reality or validity about outcomes of a behaviour in a given situation

			optimism, salient events/sensation/critical incidents, characteristics of outcome expectancies, sanctions/rewards, proximal/distal, valued/not valued, probable/improbable, perceived risk/threat	Perceived risk threat.	
6	Motivation and goals	Motivation and Goals	Intention, stability of intention/certainty of intention, goals, goals target/setting, goal priority, intrinsic motivation, commitment, distal and proximal goals, transtheortical model and stages of change	Intention to clean hands, goal setting, priority, commitment to hand hygiene. Other goals conflicting with hand hygiene.	The outcomes or end states to which one is striving and a person's willingness to exert physical or mental effort into the pursuit of those outcomes or end states
7	Memory and Attention and Decision processes	Memory and Attention	Memory, attention, attention control, decision making	Memory, attention and decision making that may affect hand hygiene.	The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives
8	Environmental context and resources	Environ-mental Resources	Resources/material resources, environmental stressors, person x environment interaction, knowledge of task environment	Physical resources for hand hygiene. Available time and other resources.	Any circumstance of a persons' situation or environment that discourages or encourages the development of skills and abilities, independence, social competence and adaptive behaviour
9	Social Influences	Social Influences	Social Support, social/group norms, organisational development, leadership, team working , group conformity, organisational climate/culture, social pressure, power/hierarchy, professional boundaries/roles, management commitment, supervision, inter-group	The influence of leadership or team work on hand hygiene. Power/hierarchy. Social Support.	Those interpersonal processes that can cause individuals to change their thoughts, feelings or behaviours

			conflict, champions, social comparisons, identity, group/social identity, organisational commitment/alienation, feedback, conflict, change management, crew resource management, negotiation, social support, interpersonal, social group norms, learning and modelling		
10	Emotion	Emotion	Affect, stress, anticipated regret, fear, burnout, cognitive overload/tiredness, threat, positive/negative affect, anxiety/depression	Mood, stress, fear, burn-out, anxiety, regret in regard to hand hygiene. Anticipated regret.	A complex reaction pattern involving experiential, behavioural and physiological elements by which the individual attempts to deal with a personally significant matter or event
11	Action Plans (term adopted from Abraham and Michie 2008).	Action Plans	Goal/target setting, implementation intention, action planning, self monitoring, goal priority, generating alternatives, feedback, moderators of intention-behaviour, project management, barriers and facilitators	Making specific plans for hand hygiene, target setting, creating routine.	Anything aimed at managing or changing objectively observed or measured actions

Figure 4.3. demonstrates a sample of the task given to participants in round one of the Delphi survey. On the left participants were given a list of categories (defined elsewhere in the survey) and on the right a list of barriers or levers to fit within these categories. "None" was an offered as an option when participants considered none of the other categories were suitable. (Full questionnaire appendix 13).

4.3.2. Participants

Fifteen health psychologists were approached and asked to participate. Three declined and two did not respond leaving 10 in total who participated in both rounds of the Delphi survey. All of these participants worked in a university in either England or Scotland, all had a history of working in the field of implementation research and one was a contributor to the BPS framework.

Twelve infection prevention and control (IPC) specialists had offered to participate in total (three from the hospital trusts in the study and nine recruited from the Infection Prevention Society meeting (described in section 4.2.2.). These ICP specialists were approached by email, one declined to participate and the remaining 11 completed both rounds of the survey. One participant was a doctor (microbiologist) 10 were nurses (consultant n=1, nurse specialists n=6, matrons n=3). All IPC specialists worked in hospitals in England and all were members of the Infection Prevention Society, one holding a position of office within the organisation.

4.3.3. Procedure

A small pilot study was conducted with four participants, three IPC specialists and one health psychologist before commencing the main survey. Pilot results demonstrated that the questionnaire was largely acceptable and understandable. Following feedback from the pilot study three changes were made to the survey. If a barrier or lever was perceived by participants as not fitting any category, participants in the pilot found it difficult to suggest an alternative category as they had been requested to do. The questionnaire was therefore adapted. Instead, participants were offered the additional option of *"none"* to select in circumstances where they perceived a barrier or lever did not fit any of the domains. They were then asked at the end of the questionnaire to suggest any additional or alternative categories for the items they had assigned to the option *"none"*.

The second change to be made was the addition of a box reminding the participants of names of "categories" (domains). This allowed participants to see the options for categorising the barriers and levers on every page to make the process of survey completion easier.

Finally, in the light of the pilot, the approximate time the participants were likely to take to complete the questionnaire (approximately 15 minutes) was added to the front of the form as a guide to the expected time commitment for completion.

As so few changes were made, pilot participant data were used as part of the main study. Following the amendments made after piloting, all panel participants in the main survey were subsequently sent the questionnaire and an information sheet; both were attached as documents to an email. Participants were asked to complete the questionnaire, either electronically or by printing the questionnaire and returning to a freepost address, which was provided.

Figure 4.3. Sample of task: Delphi survey round one

Next to each barrier or lever please write/type the number of the category within which you consider the barrier or lever best fits.

Number	Category
0	None
1	Knowledge
2	Skills
3	Professional Role
4	Capabilities
5	Consequences
6	Motivation and goals
7	Memory and attention
8	Environmental Resources
9	Social Influences
10	Emotion
11	Action Plans

Barrier or Lever	Category
Example Positive ward Culture	*9*
Criticised when hand hygiene missed	
Type of ward environment (e.g. elderly v ICU) makes HH difficult	
Good role Models for HH	
Necessary equipment for HH is too expensive	

*HH = Hand Hygiene

4.3.4. Analysis

Determining the threshold for an acceptable level of consensus depends on the focus of the study and there is no one accepted definition for this (Hasson et al., 2000). Although not always the case, many Delphi surveys predefine the level of acceptable consensus they seek within the context of the individual study (Fink et

al., 1984, Hasson et al., 2000). Fink et al. (1984) suggested that a reasonable level of consensus is a position where approximately two thirds of the panel of participants agree. Review of the literature by Hasson et al. (2000) found consensus levels ranging from 51% to 80%. For the purpose of the Delphi study reported here a consensus level of 70% (or higher) was agreed as the threshold cut-off for both rounds. This threshold was considered an adequate level of consensus in the context of the aim of this study and likely to be achievable within the timeframe.

For each barrier and lever, participants' individual responses were aggregated. Where consensus was achieved at 70% or higher, the individual barrier or lever was considered to have achieved consensus from the panel of experts in terms of being assigned to a particular domain and this item was therefore removed from the list of barriers and levers for the second round of testing.

4.3.5. Results

During the first round, consensus was achieved at 70% or above for 40 barriers and levers, leaving 60 remaining. Table 4.1. lists the barriers and levers where consensus was agreed at the minimum of 70% level and to which domain these were assigned.

Table 4.1. Barriers and levers categorised in round one

Psychological Domain		Barrier or lever	Level of consensus (%)
1	Knowledge	E learning about Hand Hygiene (HH)	70
2	Skills		
3	Professional Role	HH is embedded into professional practice	76
		HH is a non negotiable part of the job	75
		Some professional groups are more likely to clean hands than others	81
4	Capabilities	A confidence in HH ability aids good practice	76
5	Consequences	Sore hands reduces HH	75
		Patient may catch an infection and die if HH omitted	81
		HH is carried out to prevent an infection to self	71
		Fear of disciplinary action if HH not carried out	76
		HH carried out to prevent complaint from patients	86
		The thought of cost of infections in hospital improved HH	90
		HH creates patient confidence	71
6	Motivation and Goals	More important things to do than HH	71
		Enthusiastic about HH	71
		Good intentions to HH result in better HH	71
7	Memory and Attention	Forgets HH	90
8	Environmental Resources	Type of ward environment	90
		Necessary equipment is too expensive	86
		There are not enough sinks for good HH	100
		There is no money for the improvements that would help HH	90
		Facilities are inadequate for HH	100
		Some Government Policies make HH difficult (e.g. bed occupancy)	71
		Hand cream encourages HH	71
		Gel is always available	86
		A cluttered environment prohibits HH	95

9 Social Influences	Strong leadership makes HH more likely	86
	Reluctant to let the team down by omitting HH	71
	Positive ward culture increases the likelihood of HH	90
	The influence of peer pressure on HH	95
	HH champions help HH compliance	81
	Patients expect good HH from Staff	71
	Supervision from seniors improves HH	71
	Opinion leaders promote HH	76
10 Emotion	Fear of ward closure due to infection if HH omitted	71
	Anticipated guilt or regret in hands are not cleaned	81
		71
	HH is forgotten when feeling stressed	71
	Feel guilty when HH omitted	71
	Ashamed if HH omitted	71
11 Action Plans	Several improvement strategies at the same time make HH more likely	71

Items where consensus had not been reached at 70% or above were examined prior to round two. There were a number of issues arising which will be addressed below under the following headings; no suitable category, knowledge and skills, difference in responses (IPC specialists compared to Health Psychologists).

No suitable category

Resulting from the first round there were 29 occasions where participants chose *"none"*, i.e. no suitable domain. On six occasions when this occurred, alternatives were suggested by the participants. Each suggestion was considered, but none were adopted for reasons identified in Figure 4.4. One slight change to definitions was made as a result of this feedback.

Figure 4.4. Participant's suggestions for additional categories

Participant Suggestion	Barrier or Lever	Action taken and Rationale
Cues to action/reminders	Adverts relating to HH prompt practice	No action because: Adding "reminders" may create bias to the domain "memory"
Physical barriers	Full hands (e.g. carrying equipment) makes HH Difficult	A large number of participants had categorised this to domain "environment" which at face value seemed appropriate. However, on examination of definition, only positive environmental factors were offered, i.e. "physical *resources* for HH". It was therefore decided to adapt this

		definition to "physical *resources or barriers* to HH".
Physical prompts	Adverts relating to HH prompt practice	No action because: Adverts may act as information OR as a visual prompt.
Peer pressure and external social influences e.g. patients and relatives perceptions	General suggestion – not in relation to a particular barrier or lever	No action because: This suggestion was not linked to a particular barrier on the Delphi survey, and once items categorised in round one were removed it did not seem relevant to items left.
Beliefs convictions	Hand cream encourages HH	No action because: Consensus had been achieved at above 70% therefore this addition was considered unnecessary
Individual health Issues	Sore hands reduce HH	No action because: Consensus had been achieved at above 70% therefore this addition was considered unnecessary

Knowledge and Skills

The items for which no consensus had been reached were examined. It was noted that where participants had categorised barriers or levers into the domains *"knowledge"* or *"skills"*, often, for the same barrier or lever half of the participants had assigned the item to knowledge and half had selected skills. An example of this is the lever listed "Good HH training helps". Seven participants had categorised this into the domain *"skills"* and nine participants had categorised this into the domain *"knowledge"*. The remaining participants chose a range of other domains. Similarly, the barrier "Basic training does not cover HH sufficiently", seven participants categorised into the domain skills and 10 categorised the item into the domain *"knowledge"*. At this first round stage it was decided to take no action. However, due to the evident overlap between *"knowledge"* and *"skills"* (within the context of hand hygiene practice) the possibility of combining *"knowledge"* and *"skills"* into a single domain would be considered after round two of the Delphi survey if the overlap remained evident at this stage.

Difference in responses: IPC specialists compared with health psychologists

Due to the difference in the background of the expert groups, advocates being psychologists and referees IPC specialists, it was considered worthwhile to examine the barriers or levers where consensus had yet to be reached for differences in responses between the groups.

There were only four barriers or levers where there were stark differences in the responses of IPC specialists compared with health psychologists. These were as follows. (IPC participants n=11, health psychologist participants n=10).

- "Afraid to ask others". The majority of IPC specialists categorised this to the domain *"capabilities"* (n=7). Only two health psychologists chose this domain, five chose *"emotion"* and the remaining participants chose a range of other domains;
- "HH is a priority". The majority of psychologist participants categorised this to the domain *"motivation and goals"* (n=8). Three IPC specialists selected *"motivation and goals"*. Remaining participants selected range of different domains;
- "IPC teams influence HH". The majority of health psychologists categorised this to the domain *"social influences"* (n=9). Only 3 IPC specialists chose *"social influences"* the remainder chose a range of domains including *"action plans"* (n=3), and *"professional role"* (n=3);
- "Professional culture influences HH". The majority of psychologist experts selected the domain *"social influences"* (n=6), three psychologists selected *"professional role"*. The majority of IPC specialists selected the domain *"professional role"* (n=6), three chose *"social influences"*.

4.4. Round two

4.4.1. Design

Having removed items where consensus had been achieved at 70% or more 60 items remained.

There is agreement within the literature that feedback summarising findings between Delphi rounds is important (Campbell et al., 2002, Dalkey, 1969, Dalkey and Helmer, 1963, Fink et al., 1984, Green et al., 1999, Hasson et al., 2000, Hearnshaw et al., 2001, Keeney et al., 2006, Powell, 2002). However there is less agreement on how this should be done. Some authors suggest reporting of previous results after aggregation only (Fink et al., 1984, Elwyn et al., 2006, Powell, 2002) whereas others suggest both aggregated and individual participant feedback should be given for each question/item after each Delphi round (Dalkey and Helmer, 1963, Hearnshaw et al., 2001).

Turoff and Hiltz (1996) suggest that as panel participants are usually unaware of who the other expert members are, it is easier for participants to change their mind about previous choices without any loss of face. Powell (2002) suggests that greater feedback promotes consensus. For these reasons it was decided to offer participants maximum feedback. The aggregated responses for all panel participants

provided in round one was provided for round two of the Delphi. The response of the individual participant in round one was also provided in round two.

To form the survey for round two, the 60 remaining barriers and levers to hand hygiene were stated. Below each barrier or lever, the domains chosen in round one were listed. Outliers were removed, that is, where only one participant chose a domain, this was not offered as a choice for round two. Aggregated results from round one were listed next to each domain. The domain selected by the individual participant in the first round was also highlighted. Figure 4.5. illustrates this (full questionnaire appendix 14).

Researchers have used different formats for second and subsequent rounds of a Delphi survey. Some authors ask participants to rate items according to fit (e.g. (Hearnshaw et al., 2001, Campbell et al., 2002); others ask participants to rank items according to fit (Bond and Bond, 1982, Hauck et al., 2007). Due to the overlap of psychological domains it was decided that participants should be afforded the opportunity to choose more than one domain for barriers or levers. For this reason, in order to discriminate between level of fit, participants were asked to rate the fit of barriers into domains (again, the term "category" was used). This was done with a Likert style questionnaire with participants being asked to judge the fit of barriers or levers into domains as "very good fit", "good fit", "barely fits", "poor fit" or "very poor fit".

Figure 4.5. Sample of task: Delphi survey round two

Example: Praise Makes HH more likely

Category	Your resp-onse	All responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Social Influences	✓	35%	X				
C nsequences		30%			X		
Motivation and Goals		25%			X		

1.Criticised when HH missed

Category	Your resp-once	All responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Consequences	✓	52%					
Social Influences		26%					
Emotion		16%					

2.Inefficient systems of care inhibit HH

Category	Your resp-onse	All responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Environmental resources		37%					
Action plans	✓	25%					

4.4.2. Procedure

A pilot study was conducted with the same four participants, three IPC specialists and one Health Psychologist as previously discussed in section 4.2.2. Following the round 2 pilot no changes were made other than the estimated time of completion (10 minutes) being added to the information section.

In the main survey, as before (section 4.3.3.), all panel participants in round two were sent the questionnaire and participant information sheet as a document attached to an email and asked to complete it, either electronically or by printing the questionnaire and returning it to a free post address, which was provided. Participants were advised to print off the list of definitions for the domains and to refer to this as they completed the questionnaire.

All panel members in the first round completed the second round.

4.4.3. Analysis: Round two

As justified in section 4.3.3. consensus at a level of 70% or higher was the threshold selected for round two, as in round one. The following procedure was followed.

1. Aggregate results;

2. Calculate percentage of participants agreeing "very good" or "good" fit;

3. Where more than one domain is chosen at 70% or above for "very good" or "good" fit, the barrier or lever as considered "categorised" to this or these domains.

Worked examples are provided in Table 4.2.

Table 4.2. Worked examples of analysis: Delphi round two

Barrier or Lever	Potential Domains	Very Good Fit (%)	Good fit (%)	Total Agreement (%)	Decision
Criticised when HH missed	Consequences	57	38	95	This barrier/lever will be categorised into both consequences AND social influences
	Social Influences	28.5	52.5	81	
	Emotion		43	43	
Inefficient systems of care inhibit HH	Environmental Resources	57	38	95	This barrier/lever will be categorised into Environmental Resources
	Action Plans	5	27	33	
Respect for patient improves HH Emotion	Professional Role	57	33	90	This barrier/lever will be categorised into Professional Role.
	Consequences	9	29	38	
	Motivation and Goals	5	33	38	
	Emotion	5	28	33	

4.4.4. Results: Round two

Consensus was achieved at 70% or more for 59 of the 60 barriers and levers to hand hygiene categorised in round two. One question barrier/lever failed to be categorised at this level. This was "HH guidelines are too long". Sixty six percent of participants categorised this in the domain *"knowledge"* and 66% in *"memory and attention"*. This means that out of 100 barriers and levers, 99 were assigned to one or more categories from the BPS framework by the Delphi experts at a level of 70% or greater by the end of round two.

There were five barriers or levers where participants agreed they fitted within two domains. Table 4.3. lists the barriers and levers from round two and how they

were categorised by domain. The five barriers or levers that fall into two domains are highlighted in bold and indication of the other domain within which it fits. It was decided that these items would remain in two domains for further analysis during questionnaire testing (Chapter 5).

Table 4.3. Barriers and levers categorised in round two

Psychological Domain	Barrier or lever	Level of Consensus (%)
1 Knowledge	Don't believe that HH reduces infections in hospitals	86
	Information for patients improves their HH	86
	Adverts relating to HH inform practice	86
	A HH newsletter helps improve practice	86
	Advice from occupational health regarding sore hands improves HH	86
	Basic training does not cover HH sufficiently	95
	Training lag – staff are insufficiently trained for specialist posts	95
	Available HH guidelines	90
2 Skills	Not computer literate	90
	HH training is tailored to professional group and need appears also in professional role	**90**
	Good HH training helps	100
3 Professional Role	Respect for patient improves HH	90
	Board to ward responsibility improves practice	95
	HH training is tailored to professional group and need appears also in skills	**90**
	HH is better when the practitioner takes pride in their work	86
	Professional culture influences HH appears also in professional role	**86**
4 Capabilities	Full hands e.g. carrying equipment makes HH difficult	86
	It is impossible to do HH as frequently as needed	81
	Afraid to ask others to carry out HH	86
5 Consequences	**Criticised when HH missed** appears also in social influences	**100**
	Good attitude promotes HH appears also in motivation and goals	**70** 81
	HH avoids getting a bad reputation	100
	Name and shame – being made an example of if HH is omitted	100
	Challenged when HH not carried out	100
	There is zero tolerance to poor HH	95
	A certificate for good HH	90
	Using the "glow and show" light box identifies unclean hands and influences HH	95

		The organisation would lose status if HH not carried out	100
		Don't want to feel responsible for infecting patient so carry out HH	100
		Blame from others if HH not carried out	100
		Self-blame if HH omitted	
6	Motivation and goals	**Good attitude promotes HH** appears also in consequences	**85**
			95
		Belief that HH is not important	86
		Complacent about HH	90
		Emergencies and other priorities prevent HH	95
		HH is a priority	
		Disagree with HH guidelines	90
		Can't be bothered to carry out HH	
7	Memory and attention	It is automatic to clean hands	86
		Infection promotion notice boards prompt HH appears also in environmental resources	**70**
		HH is a good habit	86
		Forget HH when tired	100
		Infection promotion notice boards inform HH	86
		Adverts relating to HH prompt practice	95
8	Environmental resources	Inefficient systems of care inhibit HH	100
		Infection promotion notice boards prompt HH appears also in memory and attention	**70**
		Staff/skill mix is important if HH is to be carried out	76
		No time to attend HH courses	85
		Working in more than one area makes HH difficult (e.g. hospital and community based)	100
		Poor staffing levels make HH difficult	95
9	Social influences	**Criticised when HH missed** appears also in consequences	**95**
			95
		Praise makes HH more likely	95
		The reintroduction of Matrons improves HH	
		Infection prevention and control teams influence HH	95
		A practitioner (link) is responsible for communicating with the infection prevention team	95
			100
		Good role models improve HH	100
		Encouragement helps HH compliance	100
		Nobody else bothers with HH	**100**
		Professional culture influences HH appears also in professional role	100
		Reluctant to prompt senior staff with HH	100
		Managers and the IPC team are very motivating with HH	
10	Emotion	Frustrated when others omit HH	100
		Embarrassed to fail HH audit	95
		Angry if HH not carried out	100
11	Action Plans	Government and organisational targets mean	

	HH is more likely	76
	Audit and feedback improves HH	76

To summarise, the two round Delphi survey allowed 99 out of a total of 100 barriers and levers to hand hygiene to be categorised according to one or more of the domains of the BPS framework at a level of consensus of 70% or above.

For one item, "HH guidelines are too long" the consensus threshold was not reached. Sixty six percent of experts considered it fitted the domain *"memory and attention"* while 66% decided it fit the domain *"knowledge"*. This item was therefore removed from the item list at this stage.

4.5. Discussion

In this study the barriers and levers to hand hygiene were categorised according the domains of the BPS framework. This was successful in 99 out of 100 barriers and levers to hand hygiene. However, as demonstrated in Figures 4.1. and 4.3. this process resulted in some domains containing as few as three (*"skills"*) or four (*"beliefs about capabilities"* and *"action planning"*) barriers and levers and some with as many as 19 (*"beliefs about consequences"* and *"social influences"*). This was addressed in study 3, Chapter 5. However, this was expected to be the case. It is to be expected that some domains are more relevant to some practices than to others. For example, hand hygiene was demonstrated to be a procedure considered to be relatively simple to practitioners (see Chapter 3) and it is therefore to be expected that there may be fewer items in the domain skills.

In the first round of the Delphi survey there were two areas where there were dichotomous views. The first concerned the domains *"knowledge and skills"*. This was also the case in round two. For example, "HH is tailored to professional group and need" reached above 70% consensus in the domains of *"professional role"* and *"skills"*. However, it also reached 57% consensus in the domain *"knowledge"*, which was below the 70% cut off point for consensus. Another example is, "Basic training does not cover HH sufficiently", although consensus was achieved at over 70% for the domain *"knowledge"*, 66% of participants considered *"skills"* to be an appropriate domain. *"Knowledge"* and *"skills"* are very closely related in hand hygiene training and practice which could account for this overlap. It was decided that these barriers or levers would remain in the domains to which they were categorised by Delphi survey experts, however this overlap would undergo further analysis during questionnaire testing (Chapter 5).

A similar overlap was evident between the two domains *"consequences"* and *"emotion"*. For example, "name and shame – being made an example of if HH is omitted", was allocated to the domain *"consequences"*, however, 66% of

participants considered it fitted in the domain *"emotion"*. The situation was similar with "Ashamed if HH omitted", consensus was achieved for the domain *"emotion"*, however, 66% of participants considered it fitted the domain consequences. Shame (an emotion) could be considered a consequence of not cleaning hands. Again, due to the overlap of the domains of the BPS framework it was decided that these barriers or levers would remain in the domains to which they were categorised by Delphi survey experts, however this overlap would undergo further analysis during questionnaire testing (Chapter 5).

There were four barriers or levers in round one of the Delphi study where there were stark differences between the domains selected by IPC specialists compared with health psychologists. These are discussed in turn below.

In round one, IPC specialists categorised "Afraid to ask others" to *"capabilities"* and psychologists chose a range of domains, but in particular *"emotion"*. In round two consensus was reached on the domain capabilities. In round one, "HH is a priority" was categorised to the domain *"motivation and goals"* by psychologists and IPC specialists chose a range of domains. In round two consensus was reached on the domain *"motivation and goals"*. In round one, "IPC teams influence HH" was categorised to the domain *"social influences"* by most psychologists, however only three IPC specialists chose this domain. In round two consensus was achieved for the domain *"social influences"*. In round one, "Professional culture influences HH" was categorised to *"social influence"* by the majority of psychologist experts and to *"professional role"* by the majority of IPC specialists. In round two of the Delphi survey 100% of participants agreed that this was a very good or a good fit in the domain *"social influences"* and 86% of participants considered it was a very good or good fit in the domain *"professional role"*. "Professional culture influences HH" was therefore categorised to both domains. The initial disparity is understandable as the IPC practitioners are likely to view the task from a practical point of view and the psychologists from a more theoretical perspective. Despite the different backgrounds of IPC specialists compared with health psychology experts by the second round of the Delphi study a strong consensus amongst participants in fitting barriers and levers to hand hygiene to the BPS framework was achieved. This goes some way to validating this framework in terms of participants being able to agree on the assignment of the barriers and levers to hand hygiene with the psychological domains identified in this framework.

This study has implication for designing interventions to improve hand hygiene. Recent work has been carried out to link behaviour change techniques to the psychological domains of the BPS framework (Michie et al. 2008). Having

successfully categorised barriers and levers to hand hygiene to the BPS framework it is possible that linked behaviour change techniques may be successful in addressing the factors inhibiting optimal hand hygiene. This was tested subsequently and is reported in Chapter 6.

Strengths and limitations of the study

The strength of this study was the high level of consensus achieved on categorisation of barriers and levers to the domains of the BPS framework. This provided a good basis for instrument development and further adds to the validation of the BPS framework. However there were a number of limitations.

Goodman (1987) considers the validity of Delphi studies depends on the strength of expertise of the panel participants. For the purpose of the Delphi survey reported here great care was taken to recruit both advocates (academic health psychologists) and referees (IPC specialists). There was a bias toward nurses rather than other health care practitioners in the referee group. This was largely unavoidable as the IPC specialists in most hospitals are nurses. Furthermore, IPC nurses have an appropriate level of expertise, so this limitation is unlikely to have had a detrimental effect on the findings of the study.

Definitions for domains were not available at the time the survey was constructed. Definitions were therefore derived from the constructs within the BPS framework domains and from the literature of the original theories underlying the framework, for example Theory of Planned Behaviour (Ajzen, 2005). Subsequently definitions derived from research have been produced (personal email correspondence, Cane 2010). These published definitions were compared to those used in this Delphi survey in section 4.3.1. and key differences were outlined. Although overall, they were considered to be similar, there were some differences that may have influenced participants' choices regarding categorisation of some of the barriers and levers. Of particular note, the official definitions helped in explaining each of the domains and the constructs within, the Delphi definitions were less explanatory. However, categorisation by use of the Delphi survey was considered to be a starting point for further testing (Chapter 5) and as such it was anticipated that the influence of the small number of differences in definition would be minimal. Although the influence on the instrument may be estimated to be minimal these differences in definition must be considered when comparing this programme of research with other research using the framework.

Although the pilot results had provided an estimate of the amount of time for completing the Delphi exercise, feedback from a small number of panel participants in the main survey reported that the time required to complete the survey had been

underestimated, the survey requiring up to 30 minutes to complete. This did not affect response rates however as all participants agreeing to take part completed both surveys.

4.6. Conclusions

This study resulted in barriers and levers to hand hygiene being categorised according to the original domains of the BPS framework. The results of this study formed the basis of a theoretically based instrument designed to measure barriers and levers to hand hygiene and allow the tailoring of implementation strategies. This is reported in Chapter 5.

CHAPTER 5. DEVELOPING AND TESTING AN INSTRUMENT TO ASSESS BARRIERS AND LEVERS TO HAND HYGIENE

5.1. Introduction

The overall aim of the research conducted for the PhD, presented in this thesis, was to develop and test a theory-based diagnostic instrument to accurately and prospectively assess the barriers and levers to hand hygiene practice to inform subsequent tailoring of implementation strategies.

In Chapters 2 and 3 barriers and levers to hand hygiene were established in order to inform the development of this instrument. In Chapter 4, through a modified Delphi survey, participants categorised the barriers and levers to hand hygiene within each of the theoretical domains of the BPS framework, which formed the theoretical framework of the instrument.

This Chapter describes the process by which the "Barriers and Levers to Hand Hygiene Instrument" (BALHHI), designed to assess barriers and levers to hand hygiene, was developed in three rounds. This chapter also compares barriers and levers assessed using the instrument according to NHS hospital trust, occupational group and area of work. The chapter begins by stating the study aims. A background relating to the development of this instrument is then presented. This is followed by an account of each of the three rounds of instrument development, the methods and the results. The barriers and levers to hand hygiene practice are then presented. The chapter concludes with a discussion of the findings and conclusion.

5.1.1. Study aims

To develop and test the reliability and validity of a diagnostic instrument designed to assess barriers and levers to hand hygiene.

To identify and compare barriers and levers to hand hygiene according to NHS trust, occupational group and area of work.

5.1.2. Background: Using questionnaire based instruments to assess barriers and levers to evidence based practice

A review of the literature was carried out to identify any previous attempts at constructing questionnaires to assess barriers and levers to Evidence Based Practice (EBP).

One questionnaire that has been used a great number of times is the BARRIERS questionnaire (Funk et al., 1991). A recent systematic review found 63

reports of its use (Kajermo et al., 2010). The BARRIERS questionnaire was developed in the USA to assess barriers to research utilisation amongst nurses (Funk et al., 1991). It consists of 29 statements that can be rated from 1 to 4 to demonstrate the extent of the barrier. This questionnaire identifies barriers and levers to practice along with quantifiable indication of the magnitude of each barrier. However, there are a number of restrictions to its use. This questionnaire is a non-specific tool for identifying general barriers to the utilisation of research in nurses. Kajermo et al. (2010) question the value of a general research uitlization quesitonnaire and suggest it may be better to assess the specific barriers in order to capture the context and characteristics of the innovation. Because the questionnaire is specific only to nurses this restricts its use in terms of assessing barriers in other health care practitioners; hand hygiene for example is applicable to all practitioners. Not a single study was identified that attempted to use this scale for the tailoring of implementation strategies according to identified barriers (Carlson and Plonczynski, 2008, Kajermo et al., 2010). Kajermo et al. (2010) suggest that this could be due to the general nature of the questionnaire, the identified barriers could be too vague to allow the tailoring of appropriate strategies. Another reason could be that there is no theoretical basis to the scale. The use of a theoretical basis to the assessment of barriers and levers not only helps develop the science of the implementation of EBP and allows us to theoretically test a model of implementation but it also allows barriers and levers to be linked directly to behaviour change strategies (Grimshaw et al., 2004a, Michie et al., 2005). One final potential problem with this questionnaire has been identified by Kajermo et al. (2010). Since its development in 1991 this questionnaire has not been significantly developed or updated according to changes in the healthcare environment, healthcare systems or indeed changes to information technology and its use within healthcare. This makes the scale potentially dated (Kajermo et al., 2010).

McKenna et al. (2004) sought permission from the original contributors to use the BARRIERS questionnaire with GPs but the authors were resolute that it could not be used with a multidisciplinary primary care sample. McKenna et al. (2004) therefore designed a questionnaire for use in primary care, the "Attitudes to Evidence-Based Practice Questionnaire" that is similar to the BARRIERS questionnaire, having 26 statements most of which are included in the BARRIERS questionnaire. The Evidence-Based Practice Questionnaire poses similar problems as the BARRIERS questionnaire; in particular, it is not theoretically based.

Whilst questionnaires have been used to identify barriers and levers, only two studies were identified that evaluated the value of such questionnaires. The first study involved the authors creating a questionnaire to identify perceived barriers to

change (Peters et al., 2003). This questionnaire was tested by the authors in 10 different projects. The authors considered that use of the questionnaire made the planning of implementation strategies much easier as barriers were made explicit, thus making it useful in clinical practice. However, the authors suggest its main strength lies in research rather than the practical application of changing professional behaviour. This is because the use of a standard instrument, such as the one in the study described here, in assessing barriers and levers to practice allows comparison across practices, practitioners and areas of work. Although the questionnaire made tailoring of strategies easier, this process and tailored strategies were based on pragmatism as the questionnaire had no theoretical basis

The second study investigated barriers to doctors' adherence to sub-fertility guidelines (Haagen et al., 2005). The authors carried out two focus group discussions including fertility physicians and gynaecologists to identify potential barriers to the use of guidelines. These were combined with the questionnaire designed by Peters et al. (2003) (discussed above). The focus groups identified a list of potential barriers which was useful in itself. The questionnaire, allowed the quantification of the extent of a problem each barrier constituted, however, again, this questionnaire has not been tested in terms of tailoring interventions according to assessed barriers and it has no theoretical basis.

To summarise, the questionnaires that currently exist have been used to describe barriers and levers to the implementation of EBP. No questionnaire was found that assesses the barriers and levers to hand hygiene practice. Furthermore, there is no example of these questionnaires being used to tailor implementation strategies. It is suggested that the theoretical underpinning of a questionnaire means that as participants identify their "barriers and levers" to practice they are also identifying behavioural determinants to change. This allows for theoretically based, tried and tested behaviour change techniques to be directed at these determinants maximising the likely effectiveness of such interventions (Michie et al., 2005). The instrument developed here aims to do this. However, for clarity and consistency throughout, the term "barriers and levers" rather than "behavioural determinants to change" will continue to be used in this thesis.

5.2. Method

The questionnaire style instrument was developed and tested in three rounds. For simplicity, the instrument was referred to as a questionnaire with participants. The two terms, instrument and questionnaire, may therefore be used interchangeably from this point onward. Methods for each round of development and testing will be described separately in the order in which they were conducted for this study.

Figure 5.1. illustrates the three rounds. Initially, however, methodological issues that are relevant to all three rounds of the instrument development are discussed.

5.2.1. Instrument development: some general considerations

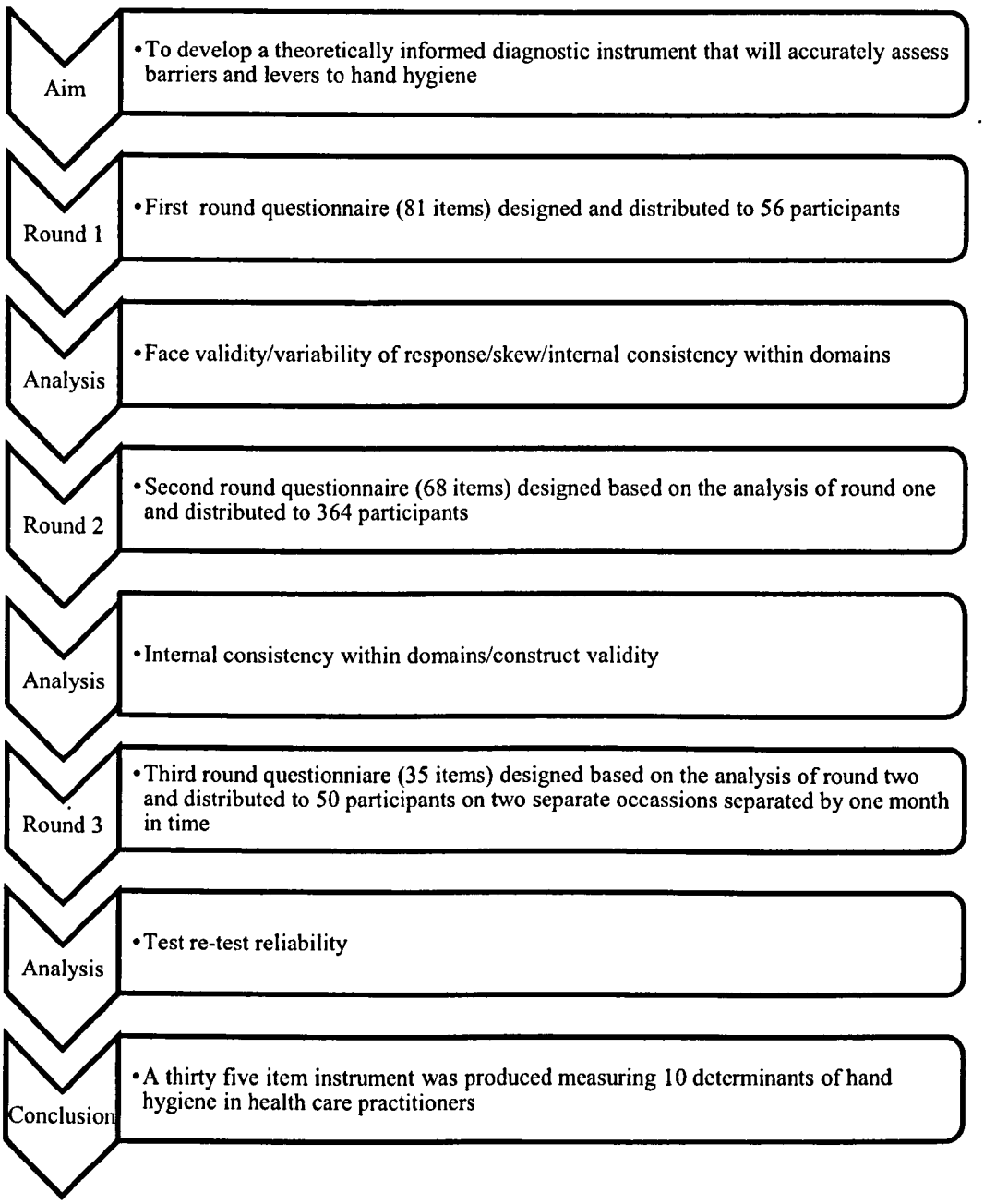
The Items The first step in writing an instrument is devising the items, which are often derived from what people consider to be important within the field of investigation (Oppenheim, 1992, Streiner and Norman, 2008). A comprehensive list of 100 barriers and levers were compiled based on the literature review reported in Chapter 2 and the qualitative study reported in Chapter 3. Ninety nine of these were successfully categorised according to the BPS framework (Chapter 4) and subsequently formed the basis for the items in the instrument.

Other questions It was reported in Chapter 2, that barriers may vary according to health care setting, groups of health care practitioners and individual factors. It was therefore decided that it would be necessary to know the practitioner's role and their area of work. In order to ensure anonymity and avoid social desirability bias, with regard to individual factors it was decided to ask only length of experience. Finally, practitioners were asked to rate their compliance with hand hygiene (expressed as a percentage) in order to investigate the relationship between compliance with hand hygiene and barriers and levers to practice.

Likert scale The purpose of the instrument was to ask practitioners to identify barriers or levers to their own individual hand hygiene and suggest the extent of these. A Likert scale was therefore chosen to be the most appropriate format for the instrument, fulfilling both of these criteria and being quick and simple to complete. Streiner and Norman (2008) report a review of literature carried out to test the reliability of scales according to the number of choices given. Generally, it was found that reliability increased with the number of choices up to seven. No improvement in reliability was found if more than seven choices were offered. There was relatively little difference in reliability found between five and seven choices in a Likert scale (approximately 12%); however, the same authors identify the potential problem of end aversion bias, where participants have a tendency to avoid the extremes on a scale. In order to achieve a range of responses and to accommodate any end aversion bias a seven point scale was selected. It was decided to label only the end points on the Likert scale rather than every point to keep the instrument free of unnecessary wording as research evidence suggests that a questionnaire of pleasing appearance is likely to result in greater response rates (McColl et al., 2001). Research demonstrates that there is no significant difference in participant response according to whether only end points or all points are labelled (Dixon et al., 1984).

Bias Consideration was given to possible bias and decisions were made in respect of these. The instrument was aimed at a wide range of practitioners, including qualified and unqualified groups of staff. Care was taken to ensure the instrument was written in plain English, jargon was avoided and they were piloted with a range of health care practitioners. Some consideration was also given to social desirability bias; participation was anonymous, that is no names or identifying information was requested. In addition to this, anonymity was explicitly stated on the front page of the instrument. Acquiescence bias (ticking the yes box) was avoided by mixing questions so that ticking the "agree" box sometimes identified a barrier and sometimes a lever.

Figure 5.1. Flowchart illustrating the process of instrument development



5.2.2. Research ethics

Ethics approval was obtained to construct and distribute the instrument as discussed previously in section 3.2.1. When ethics approval was initially given from NRES in April 2008, the instrument for this study had yet to be produced. Although it was not a condition of ethical approval, in November 2009, the first draft of the instrument was sent to NRES and receipt was acknowledged.

5.3. Round One

5.3.1. Design

The purpose of the first round of testing was to identify items most likely to provide good measures of the 11 domains of the BPS framework. All 99 barriers and levers were considered for inclusion as items for the instrument. This was because it is suggested that, in the first stages of instrument testing, the researcher should aim to be as inclusive as possible, even to the point of being "over inclusive" as poor items can be detected and removed during the process of statistical testing of the instrument (Oppenheim, 1992, Streiner and Norman, 2008). Decisions were made to include and discard questions according to the process outlined below. These decisions were made by the PhD student and supervisors in a series of three meetings which were held over a period of three months.

Barriers and levers were considered according to the domain to which they had been categorised in the Delphi study (reported in Chapter 4). It was expected that the final instrument would have approximately three to four unambiguous items per domain. However, the distribution of barriers and levers by domain at this stage was very uneven with the domains *"beliefs about consequences"* and *"social influences"* containing 19 items and *"skills"* and *"action plans"* containing only three.

As barriers and levers were considered by domain a number of points were noted and actions taken before they were either adopted or rejected as items on the instrument. These are now listed below.

Knowledge and Skills In the first round of the Delphi survey there were a number of instances where half of participants had assigned a barrier or lever to the domain *"knowledge"* and half assigned it to *"skills"* (reported in Chapter 4 section 4.5.). Although consensus was reached on these items in the second round of the Delphi survey a number of these items were still very borderline, narrowly missing being categorised to both domains.

It was acknowledged that hand hygiene training often combines knowledge and skills as a package which could account for the overlap of these items between the two domains. For this reason, due to there being only three items in the domain *"skills"* and in the interests of parsimony, it was decided to combine *"knowledge and skills"* as one domain for the purpose of this instrument.

Removing redundant questions There were a number of reasons why items were considered to be redundant. Some items overlapped to a large degree with others. For example in the domain of *"environmental context"* and resources the

barrier "there are not enough sinks for hand hygiene (HH)" was considered to overlap with "facilities are inadequate for HH" and was therefore removed. Other items applied to a very small group of practitioners, and as the instrument was designed to be distributed to a wide range of health care practitioners, these were removed. For example, "the thought of the cost of infections improves HH" was a lever identified predominantly by managers in the qualitative study reported in Chapter 3; it was therefore removed.

Complex barriers or levers Some barriers or levers appeared too complex to turn into items on a questionnaire as they stood and required some adjustment. For example, "audit and feedback improves HH". From the information participants had given in the qualitative study (Chapter 3) it was clear that this acted as a lever in two different ways. Firstly, the practitioner being aware that their practice was being monitored or was likely to be monitored was considered to improve their practice. Secondly, the results of the audit, when received or displayed, inspired the practitioner to improve or to continue to perform well. This was therefore divided into two parts for inclusion on the instrument "HH audits are regularly carried out in my work place" and "Feedback from audits encourages me to do good HH".

All barriers and levers along with the actions taken to turn them into items on the instrument are listed in detail in Figure 5.2. The initial 99 items became 81 after refinement. Initially five items fitted within two domains, following this process three items were left within two domains. There were between four and fourteen items in each domain.

At this point each barrier or lever was taken and turned into an item for inclusion on the instrument following the steps below.

1. Barrier/lever turned into first person statement in order to fit in with the Likert style of the instrument and in order to encourage participants to consider their own practice rather than what may be barriers or levers hypothetically or for people in general. For example "praise about HH" became "I am sometimes praised about my HH";

2. Jargon was removed or defined to ensure understanding by all. (For example, "a link practitioner" becomes "our area has a practitioner "link" who communicates with the infection prevention team";

3. All statements were written to include the target behaviour (hand hygiene). From the example above, "who communicates with the infection prevention team about *hand hygiene*";

4. A mix of "direction" of statement was ensured to minimise acquiescence bias. For example "there is no evidence that HH reduces infection in hospital", a

response of "agree" would identify a barrier compared with "HH guidelines are easily accessible", a response of "agree" would identify a lever;

Steps 1 to 4 are presented in Figure 5.2. Where items were categorised to more than one domain in the Delphi study these are highlighted in bold with an asterix. Grey cells highlight item that were omitted and the rationale for this is presented.

The items that remained after the process described above were then listed in random order. Participants were asked to circle the number that best reflected their opinion, ranging from one, strongly agree with the statement to seven, strongly disagree.

Figure 5.2. Process of converting barriers and levers identified to items for the instrument

Domain	Barrier or Lever identified in Qualitative study	Resulting Item or Rationale for Omitting a Barrier or Lever (item number on round one instrument)
1/2 Knowledge and skills	Don't believe that HH reduces infections	There is no evidence that HH reduces infections in hospitals (12)
	Information for patients improves their HH	The link between this lever and HH was considered too tenuous
	A HH newsletter helps improve practice	Considered similar and therefore combined to: There are adverts or newsletters in my work place (25)
	Adverts relating to HH inform Practice	
	Advice from occupational health regarding sore hands improves HH	The link between this lever and HH was considered too tenuous
	Basic training does not cover HH sufficiently	Basic training doesn't cover enough about hand hygiene (48)
	Training lag – staff are insufficiently trained for specialist posts	The link between this barrier and HH was considered too tenuous
	Available HH guidelines	HH guidelines are easily accessible (60)
	Not computer literate	Literacy was related to the accessibility of computerised HH training to all types of staff. E-learning is also related to training. As the questionnaire will ask participant what their professional group is, it was not felt necessary to ask about tailoring to group. All four barriers/lever combined to: **Hand Hygiene Training is available to me*** (76)
	Good HH training helps	
	E-learning about HH	
	HH training is tailored to professional group and need	
		The fundamental principle of this domain is sufficient knowledge and sufficient skills. Two further items were therefore added: I have sufficient knowledge about hand hygiene (21) I have sufficient skills about hand hygiene (28)
3 Profes-sional role and Identity	HH is embedded into professional practice	HH is embedded into my professional practice (7)
	HH is a non-negotiable part of the job	HH is a non-negotiable part of my role (19)
	Professional groups are more likely to clean hands than others	My professional group is less likely to engage in HH than others (26)
	Respect for patients improves HH	I engage in HH out of respect for my patients (29)
	HH is better when the practitioner takes a pride in their work	I take a pride in my HH (27)

	Board to ward responsibility improves practice	Board to ward responsibility for HH influences my practice (62)
	HH training is tailored to professional group and need	**Hand Hygiene training is available to me *** (rationale for changes described above – item 76)
	Professional culture influences HH	**HH is a part of my professional culture*** (41)
4 Beliefs about Capa-bilities	A confidence in HH ability aids good practice	I am confident in my ability to carry out HH (15)
	Full hands e.g. carrying equipment makes HH difficult	This was considered too specific and was therefore generalised slightly to: There are some practical barriers because of my job/role. (39)
	It is impossible to do HH as frequently as needed	The frequency of HH required makes it difficult for me to carry it out as often as necessary (34)
	Afraid to ask others to do HH	I am reluctant to ask others to engage in HH (54)
5 Beliefs about Conse-quences	Sore hands reduces HH	Doing HH gives me sore hands (20)
	Patient may catch an infection and die if HH omitted	I engage in HH in order to prevent patients catching infections (42)
	HH is carried out to prevent an infection to self	I engage in HH to prevent myself from catching an infection (61)
	Fear of disciplinary action if HH not carried out	I engage in HH to avoid disciplinary action (58)
	HH carried out to prevent complaint from patients	If I do not engage in HH patients will complain (63)
	The thought of cost of infections in hospital improves HH	This lever was identified mostly by managers and was therefore considered inappropriate for a questionnaire designed for a multidisciplinary group and was therefore omitted.
	HH creates patient confidence	I engage in HH to improve patient confidence (68)
	Criticised when HH missed	This was considered to be very similar to item 77 "challenged" when HH missed and was therefore omitted
	Good attitude promotes HH	Participants identified a "bad" attitude only in others, therefore this item was omitted.
	HH avoids getting a bad reputation	This item overlapped with "name and shame" and "criticised when HH omitted" and was therefore omitted.
	Name and shame – being made an example of if HH is omitted	If I do not engage in HH I may be named and shamed (75)
	Challenged when HH not carried out	I am challenged when HH not carried out (77)
	There is zero tolerance to poor HH	HH is easier because there is zero tolerance to lack of hand hygiene in my work place (8)
	A certificate for good HH	Compared with the other items in this domain this one appears weak. As there are a high number of items in this domain, this was omitted.

	Using the "glow and show" light box identifies unclean hands and influences HH	This is not something used in all hospitals and was therefore omitted.
	The organisation would lose status if HH not carried out	This was identified by managers and was therefore considered inappropriate for a questionnaire designed for a multidisciplinary group.
	Don't want to feel responsible for infecting patients so carry out HH	Similar to item 42 therefore omitted
	Blame from others if HH not carried out	Is similar to challenged by others – item 77 therefore omitted
	Self blame if HH omitted	I would blame myself for infections if I omitted HH (9)
6 Motivation and Goals	More important things to do than HH	Sometimes I have more important things to do than HH (10)
	Enthusiastic about HH	I am enthusiastic about HH (30)
	Good intentions to HH result in better HH	I have good intentions regarding HH (56)
	Good attitude promotes HH*	Participants identified a "bad" attitude only in others, therefore this item was omitted.
	Belief that HH is not important	I do not consider HH to be important (64)
	Complacent about HH	I feel complacent about HH (78)
	Emergencies and other priorities prevent HH	Emergencies and other priorities make HH more difficult (36)
	HH is a priority	Participants described HH as a priority to i) themselves and ii) to the organisation. This therefore formed two items: HH is a priority to the organisation (38) HH is a priority to me (69)
	Disagree with HH guidelines	I disagree with some parts of the HH guidelines (72)
	Can't be bothered to carry out HH	I cannot be bothered with HH (57)
Memory Attention and decision process	Forgets HH	Sometimes I miss out HH simply because I forget it (11)
	It is automatic to clean hands	This was considered to overlap or repeat with other items in this domain and was therefore omitted.
	Infection promotion notice boards prompt HH	**There are infection prevention notice boards in my work place*** (55)
	Infection prevention notice boards inform HH	
	HH is a good habit	HH is a habit for me (35)
	Forget HH when tired	I am more likely to forget HH when I am tired (14)
	Adverts relating to HH prompt practice	This was considered similar to item 4 in domain Knowledge/Skills. There are adverts or newsletters in my workplace (25)

Environmental context and Resources	Infection promotion notice boards prompt HH	**There are infection prevention notice boards in my work place*** (55)
	Type of ward environment	HH is more difficult for me due to the type of ward I work on (53)
	Necessary equipment too expensive There is no money for the improvements that would help	These items were combined into: I engage in hand hygiene because infections are expensive to the hospital (67)
	HH There are not enough sinks for HH	This was considered to overlap with item 44 and was therefore omitted
	Facilities are inadequate for HH	Facilities are inadequate for hand hygiene in my area of work (44)
	Some Government Policies make HH difficult (e.g. bed occupancy)	Some government targets make hand hygiene more difficult (such as high bed occupancy) (79)
	Hand cream encourages HH	Hand Cream is available to me (66)
	Gel is always available	Alcohol gel is readily available for me for hand hygiene (16)
	A cluttered environment prohibits HH	My environment is cluttered which makes HH more difficult (73)
	Inefficient systems of care inhibit HH	This item related to systems rather than the individual and was therefore omitted.
	Staff/skill mix is important if HH is to be carried out	The staff skill mix is just right in my work place (74)
	No time to attend HH courses	It is difficult for me to attend HH courses due to time pressure (50)
	Working in more than one area makes HH difficult (e.g. community and hospital based	HH is more difficult for me because I work in several areas of the hospital (59)
	Poor staffing levels makes HH difficult	My area of work has poor staffing levels making HH more difficult (82)
Social Influences	Strong leadership makes HH more likely	There is strong clinical leadership in my area (31)
	Reluctant to let the team down by omitting HH	I engage in HH because I do not want to let the team down (47)
	Positive ward culture increases the likelihood of HH	There is a positive culture toward HH in my work place (52)
	The influence of peer pressure on HH	Peer pressure influences my HH (24)
	HH champions help HH compliance	Not every hospital has champions, so this item was
	Patients expect good HH from staff	My patients expect good HH from me (80)
	Supervision from seniors improves HH	Supervision from senior staff means that carrying out HH is easier for me (18)
	Opinion leaders promote HH	Not every hospital has champions, so this item was omitted
	Criticised when HH missed	This was considered to be very similar to item 77 "challenged" when HH missed and was therefore omitted.

	Praise makes HH more likely	I am sometimes praised about my HH (51)
	The reintroduction of matrons improves HH	This was considered to overlap with items 49, 31 and 18 and was therefore not included in the questionnaire.
	IPC teams influence HH	IPC teams have a positive influence on my hand hygiene (49)
	A practitioner/link is responsible for communicating with the IPC team	Our area of work has a practitioner "link" who communicates with the infection prevention team about hand hygiene (81)
	Good role models improve HH	There are good role models for HH in my work place (22)
	Encouragement helps HH compliance	My HH is encouraged by others (45)
	Nobody else bothers with HH	Nobody else bothers with HH where I work (83)
	Professional culture influences HH	**HH is part of my professional culture*** (41)
	Reluctant to prompt senior staff with HH	It is difficult to prompt senior staff when they miss out HH (33)
	Managers and IPC team are motivating with HH	This was considered to overlap with items 49, 31 and 18 and was therefore not included in the questionnaire.
Emotion	Fear of ward closure due to infection if HH omitted	The link between this lever and HH was considered too tenuous
	Anticipated guilt or regret if hands are not cleaned	This was considered to overlap with item 32 and 23.
	HH is forgotten when feeling stressed	This was considered similar to items 55 and 14 and therefore not included in the questionnaire.
	Feel guilty when HH omitted	I feel guilty if I omit HH (32)
	Ashamed if HH omitted	I feel ashamed if I omit HH (23)
	Frustrated when others omit HH	I feel frustrated when others omit HH (46)
	Embarrassed to fail HH audit	I engage in HH because I am embarrassed if we do poorly in HH audits (43)
	Angry if HH not carried out	I feel angry if HH not carried out by others (17)
Action Plans	Several improvement strategies at the same time make HH more likely	It was considered that practitioners would be unable to differentiate between whether several or only one strategy had influenced their practice. Therefore this item was split into the two items below: Some strategies designed to improve HH influence my practice (70) Improvement strategies that are unusual have a greater impact on my hand hygiene than those I am used to (40)
	Government and organisational targets mean HH	This was divided into two more specific questions:

	is more likely	Government targets have led to improvements in my HH (65) Hospital targets relating to infection or hand hygiene has led to improvements in my HH (71)
	Audit and feedback improves HH	Hand hygiene audits are regularly carried out in my work place (13)
		Feedback from audits encourages me to do good HH (37)

NB:

1. Bold text is used to demonstrate where barriers or levers fit within two domains
2. Shaded areas indicate barriers or levers that were not used as items on the instrument and rationale for this.

5.3.2. Participants: round one

The purpose of the first round was to perform preliminary tests to identify items most likely to provide good measures of the 11 domains of the BPS framework.

The recruitment of study sites was reported in Chapter 3, section 3.2.2. In brief, these were three NHS Hospital trusts in the North of England, diverse in terms of MRSA rates and hygiene ratings.

Postal questionnaire response rate from health care practitioners is well documented to be low. Some strategies have been found to be effective in improving response rates (Edwards et al., 2002) (reported in Chapter 3, section 3.2.7.). These were adopted for this study and included keeping the instrument as brief as possible, sending a stamped addressed envelope and contacting participants prior to sending out the instrument. Based on the return rates listed in this systematic review by Edwards et al. (2002) a return of approximately one in three was expected. A target of a minimum of 50 returned questionnaires was sufficient for the analysis required (detailed in section 5.3.4.). Therefore 150 questionnaires in total were distributed to a range of staff through ward managers (or, where requested by managers, ward clerks) and departmental managers or, in the case of medical consultants, their secretaries.

Departmental managers or secretaries (who were identified to the investigator by the infection prevention leads in each trust) were contacted by email and sent an information sheet and asked if they would distribute or allow the investigator to distribute questionnaires to their staff. They were requested to recruit staff with different professional roles and from their ward or department. When managers or secretaries agreed, they were sent either two or three questionnaires, according to the size of the department and the diversity of the staff group within the department. Where managers or secretaries did not respond they were contacted again by email or by telephone on two further occasions to remind them about the study and to encourage them to take part.

5.3.3. Procedure: round one

A small pilot study was conducted with a sample of ten participants (five nurses (of a range of grades including unqualified nurses such as students and nursing assistants), two radiographers, one pharmacist, one doctor and one ward housekeeper) before commencing the main survey. As well as being asked to complete the questionnaire, pilot participants were asked to comment on the items and suggest improvements that could be made. Pilot results demonstrated that the questionnaire was acceptable and comprehensible. Following feedback from the

pilot study no changes were made to the survey. As no changes were made, pilot participant data were used as part of the main study. Following the pilot study, the questionnaire was subsequently sent out to a range of staff as described above. This was accompanied by a covering letter (appendix 16) for each participant which identified the purpose of the study, the value of the participants contribution and asked them to complete the questionnaire within 7 days and then return it in the freepost envelope provided. No prompts or reminders were sent.

Information and instruction for completion were given on the front page of the questionnaire. As with the pilot study, participants were asked to identify any statements that were difficult to understand and to offer any ideas on what would improve the instrument. Figure 5.3. presents examples of items and the full questionnaire distributed in round one can be seen in appendix 17.

Figure 5.3. Sample of questions

	Strongly agree						Strongly disagree
1. Doing hand hygiene gives me sore hands	1	2	3	4	5	6	7
2. I have sufficient knowledge about hand hygiene	1	2	3	4	5	6	7
3. There are good role models for hand hygiene in my work place	1	2	3	4	5	6	7
4. I feel ashamed if I omit hand hygiene	1	2	3	4	5	6	7
5. Peer pressure influences my hand hygiene	1	2	3	4	5	6	7
6. There are adverts or newsletters about hand hygiene in my workplace	1	2	3	4	5	6	7
7. My professional group is less likely to engage in hand hygiene than others	1	2	3	4	5	6	7
8. I take pride in my hand hygiene	1	2	3	4	5	6	7

5.3.4. Analysis

Data were entered into SPSS v. 17. The area of work and role of practitioners were examined to ensure that the sample of participants reflected the population from which they were drawn. Data were considered for face validity, variability of response, skewness and internal consistency.

As well as using these measures to identify and remove redundant items at this stage, this process was also used to consider areas where further items might be required.

5.3.5. Results

Fifty six participants (37.4%) returned questionnaires of which 92.2% were female (n=52) and 7.1% were male (n=4). The range of years experience in the job ranged from less than a year to 49 years (mean = 16.2, SD = 11.36). A good range of participants returned questionnaires in terms of role and area of work; this is presented in Table 5.1.

The reliability of whole questionnaire, calculated using Cronbach's alpha was 0.91.

Table 5.1. Role and area of work: participants round one

	Trust 1									Trust 2								Trust 3										
Participants	Specialist area	More than one area	ICU	Elderly Care	A & E	Medical	Surgical	Out patient s	Paediatrics	Specialist area	More than one area	ICU	Elderly Care	A & E	Medical	Surgical	Outpatients	Paediatrics	Specialist area	More than one area	ICU	Elderly Care	A & E	Medical	Surgical	Outpatients	Paediatrics	unknown	Total
Nurse	1	2		1					3				1		5	1			4		3	1		5	3	2	7	1	40
Doctor													1								1						1		3
Porter											2																		2
OT																													
Physiotherapist																			1										1
Admin														1															1
Pharmacist																								1					1
Dietician																				2									2
Radiographer																								2					2
Other															1							1					2		4
Total	1	2	0	1	0	0	0	0	3	0	2	0	2	1	6	1	0	0	5	2	4	2	0	8	3	2	10		56

Removal of items

Items were removed according to the following principles:

- Face validity based on analysis of feedback from participants.

After this the following three measures were considered:

- A skew of greater than 3 in either direction (Kline, 1986);
- A lack of variability, defined as a standard deviation of less than 1.5 (this cut off point was set quite low as there were only 7 options on the Likert scale);
- Poor construct validity. The aim being to achieve a Cronbach's alpha of 0.6 or more per domain which was considered to demonstrate good correlation between items within the domain (Ping, 2004).

However, a pragmatic approach was taken, and items were retained where at all feasible in accordance with the advice of experts in questionnaire design (including Streiner and Norman, 2008, Oppenheim, 1992), to be as inclusive in the early stages of instrument testing as possible, particularly where there were fewer items per domain. The items that were removed and the reasons for this are listed below according to domain. Figure 5.4. identifies items removed and the rationale for removing items. Cronbach's alpha is presented for each domain.

Figure 5.4. Removal of items from instrument and rationale for removal

Domain	Item	Rationale for removal
1 Knowledge / and Skills 2	12. There is no evidence that HH reduced infections in hospital	High skew (-3.1) Poor variability of response (SD=0.84)
5 Beliefs about consequences	8. HH is easier because there is zero tolerance to lack of HH in my work place	On face validity this was considered to overlap with "HH to avoid disciplinary action", "named and shamed" and "challenged when HH missed"
	42. I engage in HH in order to prevent patients from catching infections	Poor variability of response (SD=1.48) Large number of items in this domain
	63. If I do not engage in HH patients will complain	Poorly correlated within domain. (α=0.37 for the domain with item included α=0.43 with item removed)
6 Motivation and goals	38. HH is a priority for the organisation	High skew (4.37) Poor variability of response (SD=0.99)
	56. I have good intentions regarding HH	High skew (3.99) Poor variability of response (SD=0.86)

	64. I do not consider HH to be important	High skew (-7.4) Poor variability of response (SD=0.13)
	69. HH is a priority for me	High skew (4.9) Poor variability of response (SD=0.9)
8 Environmental context and resources	16. Alcohol gel is readily available to me for hand hygiene	High skew (3.9) Poor variability of response (SD=1.26) Face validity, Only two participants disagreed with this statement and they worked on a specialist ward for Clostridium difficile where hand gel is contraindicated.
	67. I engage in HH because infections are expensive to the hospital	Poorly correlated within domain (α=0.57 for the domain with item included. α=0.62 when item is removed)
9 Social influences	22. There are good role models for hand hygiene in my work place	Poor variability of response (SD=1.06) Large number of items in this domain
	31. There is a strong clinical leadership in my area	Poor variability of response (SD=1.34) Large number of items in this domain
	52. There is a positive culture toward HH in my workplace	Poor variability of response (SD=1.33) Large number of items in this domain

Strengthening and adding items

There were a number of items that did not perform well but on review, appeared slightly ambiguous. Where this was the case items were made clearer and retained for round two. These are identified in Figure 5.5.

Figure 5.5. Items improved and retained for round two of instrument development

Domain	Item Round 1	Item Round 2	Rationale for changes
1 / 2 Knowledge and Skills	There are adverts or newsletters in my workplace	There are adverts or newsletters about HH in my workplace	Added reference to hand hygiene to link to target behaviour
	Basic training doesn't cover enough about hand hygiene	Newly qualified staff have not been properly instructed in hand hygiene in their training	Participant feedback suggested differences in understanding regarding the term "basic training"

3 Professional role and identity	Board to ward responsibility for HH influences my practice	Hand Hygiene is a priority for every single member of staff in this organisation irrespective of their role	Participant feedback suggested some practitioners may not understand the political term "board to ward"
4 Beliefs about capabilities	There are some practical barriers because of my job/role.	There are some practical barriers to hand hygiene because of my particular job/role	To make reference to the target behaviour hand hygiene
5 Beliefs about consequences	I would blame myself for infections if I omitted hand hygiene	If I omitted hand hygiene I would blame myself for infections	To put the behaviour before the consequence to better reflect the meaning of the domain
	I engage in HH in order to prevent myself from catching an infection	If I do not engage in hand hygiene I may catch an infection	To put the behaviour before the consequence to better reflect the meaning of the domain
	I engage in hand hygiene to avoid disciplinary action	If I miss out hand hygiene I will be subject to disciplinary action	To word the item so that disciplinary action is a consequence of lack of hand hygiene rather than a motivating factor for hand hygiene
	I am challenged I miss out HH	If I were to miss out hand hygiene I would be challenged	To make "challenged" a potential outcome rather than an actual outcome. The practitioner may clean hands at all opportunities and never be challenged but the possibility of such an outcome may influence their behaviour
6 Motivation and goals	Emergencies and other priorities make hand hygiene more difficult	Emergencies and other priorities make hand hygiene more difficult at times	The initial wording was too strong and all encompassing.

7 Memory attention and decision process	There are infection prevention notice boards in my work place	Infection prevention notice boards remind me to do hand hygiene	This item was reworded to better fit the domain
8 Environmental resources	Hand hygiene is more difficult for me because I work in several areas of the hospital	I work in several areas of the hospital	Although it was considered important to include the target behaviour, in this case doing so made two question in one
9 Social Influences	I am sometimes praised about my hand hygiene	When staff engage in hygiene they are praised	Social influences may work whether the participant is ***subject*** to praise, ***gives*** praise or ***observes*** praise
	Nobody else bothers with hand hygiene where I work	Other staff don't bother with hand hygiene where I work	Nobody was felt to be all encompassing and was adapted to "other staff"

In addition to the items adapted listed in Table 5.5. consideration was given to whether any further items should be added. Items were examined within each domain. Those within *"beliefs about capabilities"* did not appear to fully reflect the meaning of the domain. The component constructs for the domain *"beliefs about capabilities"* are; self efficacy, control of behaviour/material/social environment, perceived competence, self confidence, self esteem, perceived behavioural control, optimism/pessimism (Michie et al., 2005). The items remaining in this domain at this stage and the limitations were as follows.

"I am confident in my ability to carry out hand hygiene"; this item seems to fit well in terms of self efficacy, self confidence and perceived confidence.

"The frequency of hand hygiene makes it difficult for me to carry it out as often as necessary"; although this item appears to fit well in terms of self efficacy, the difficulty cited is actually to do with frequency rather than hand hygiene as a practice and is therefore potentially limited in identifying a barrier within this domain.

"There are some practical barriers because of my job/role": although it is possible that this item could reflect perceived control of the material/social environment, equally this item may simply be a reflection of environmental resources.

"I am reluctant to ask others to engage in hand hygiene"; although this item appears to fit well in terms of self efficacy the difficulty cited is to do with asking others to engage in hand hygiene rather than hand hygiene itself.

These items remained in the instrument at this stage. However, there were construct areas within the domain that were not reflected, control of behaviour/material/social environment, perceived behavioural control and optimism/pessimism. It was decided to add two further items that encompass these areas for testing in round two. These were:

1. I feel positive about hand hygiene;

2. I have no control over whether I do hand hygiene.

5.4. Round Two

5.4.1. Design

The purpose of the second round of instrument testing was construct validation, to see if the specific items of the instrument fit within the domains of the BPS framework. Some items were slightly reworded in order to reflect more accurately the domain to which they were allocated. For example, "I engage in hand hygiene in order to prevent myself from catching an infection" was changed to "If I do not engage in hand hygiene I may catch an infection". This was considered to better reflect the meaning of the domain *"beliefs about consequences"*. (All changes made are presented in Figure 5.5.)

In addition to this, it was considered that the items in the domain *"beliefs about capabilities"* did not properly reflect this domain. This is presented in full detail in section 5.3.5. Two further items were therefore added, "I have control over whether or not I do hand hygiene" and "I feel positive about hand hygiene".

Although most of the questions in the domain *"knowledge and skills"* were retained for round two of the instrument, the questions within this domain tended to have a poor variability of response with most practitioners judging their knowledge and skills to be sufficient. Consideration was given to whether this was likely to be the case, or whether participants were unaware of their knowledge requirements. It was decided to add some questions to the instrument that specifically tested knowledge. The Institute of Healthcare Improvement, in association with the Centres for Disease Control and Prevention (CDC), the Association for Professionals in Infection Control and Epidemiology (APIC), and the Society of Healthcare Epidemiology of America (SHEA) and with input from WHO published a guide for improving hand hygiene among healthcare practitioners (www.IHI.org

accessed 2010). They suggest testing knowledge before implementing strategies to improve hand hygiene. Seven questions are listed for use. The authors give permission for any part of the guide to be used or reprinted without permission provided appropriate reference is made to the Institute for Healthcare Improvement. It was decided to include and test these questions on the instrument. They were modified slightly to fit in with the format of the instrument.

After the changes described in section 5.3.5. and those listed above, barriers and levers listed as items were reduced from 81 to 68; there were a minimum of 5 items per domain. In addition to this seven knowledge questions were also added as described above. The full questionnaire is presented in appendix 18.

A fourth NHS hospital trust

Due to the large number of questionnaires to be distributed in round three (and due to the needs of study four, reported in Chapter 6) it was decided to recruit participants from a fourth trust. Ethical and research and development approval was sought and obtained for this trust to be included as presented in Chapter 6, section 6.2.1.).

5.4.2. Participants

The main form of analysis for round two was Confirmatory Factor Analysis (CFA) and it was therefore necessary to ensure the sample size was sufficient for this test. Two methods for calculating sample size for confirmatory factor analysis were identified within the literature. The "rule of thumb" gives rough guidelines for sample sizes, suggest that less than 100 is considered small and appropriate for only simple models, 100 to 200 is considered medium, and may be accepted for most models, however, a sample of 200 or more is considered to be large and acceptable for most models (Kline, 2005). Tabachnick and Fidell (1989) suggest five participants per item to be tested. As there were sixty eight items this suggests a minimum sample of 340. It was decided to err on the side of caution and recruit the larger of these estimates.

Nine hundred questionnaires were distributed in order to achieve this (based on the 37% response rate achieved in round one).

By this stage of the research, the investigator had good links within each of the three NHS hospital trusts within which the research had taken place so far. This had been achieved through meeting people in the trusts throughout the research process, through presenting at local conferences and meeting delegates and through attending the Infection Prevention Society meetings. Participants were recruited in these three trusts as follows. Recruitment in the fourth NHS hospital trust will be presented separately.

Participant recruitment NHS hospital trusts one, two and three

Firstly a list of all of the wards and departments in each of the trusts was obtained from the each of the trust's websites. The investigator systematically worked down the list. Where the investigator had a link with a member of staff in any department, they were contacted by email (or where that was not possible by telephone). The contact person was briefly updated about the purpose and the stage of the study and asked if they would distribute questionnaires amongst their staff, a participant information sheet was attached to the email. If they were not the manager or head of the department they were briefly updated on the study and asked for the name and email address of their manager so that permission could be sought to distribute, or to ask the manager to distribute questionnaires.

Secondly, the investigator telephoned the areas where they had no known contact. The investigator asked for the name of the charge nurse or department manager, and asked to speak to them. They were briefly informed of the study and asked if they would consider allowing the distribution of questionnaires in their department. They were asked to provide their email address so that further information could be sent to them and so they could consider the request further. Information was then sent by email.

Through this process links were made with a great range of many departments within the three NHS hospital trusts (full range of departments can be seen in Table 5.2.). Some of these were selected and questionnaires were distributed. Others were thanked for their interest and help with the study and informed that they would be sent questionnaires later in the year, the third round of questionnaire testing. In most instances questionnaires were sent to the charge nurse or departmental manager for distribution. In some cases, they were sent to individuals. For example, medical secretaries often suggested the questionnaire be sent directly to doctors and provided names and contact details.

All questionnaires were sent out with covering letters which identified the purpose of the study, the value of the participants contribution and asking them to complete and return the questionnaire within 7 days in the freepost envelope provided (appendix 16). No prompts or reminders were sent.

Participant recruitment NHS hospital trust four

In trust four questionnaires were distributed through the secretary of the Executive Medical Director (MD). Due to the needs of study four (presented in Chapter 6) questionnaires were sent to all junior doctors in the trust. In addition to this the investigator explained to the secretary the need for a range of practitioners in terms of role and area of work. It was also explained that the sample should be

approximately proportionate to the population (that is, the biggest workforce in the hospital are nurses, so the sample should contain proportionately more nurses).

All questionnaires were sent out with covering letters which identified the purpose of the study, the value of the participants' contribution and asking them to complete and return the questionnaire within 7 days in the freepost envelope provided. The MD added a further covering letter emphasising the importance of the study and his support of the research (appendix 19).

5.4.3. Procedure: round two

The questionnaire was subsequently sent out to a range of staff according to the procedure reported in section 5.4.2.

5.4.4. Analysis

Data were entered onto SPSS v. 17. Analysis followed the steps listed below.

Internal Consistency This refers to the degree to which the items that make up a scale fit together (Field, 2005, Pallant, 2001). That is, whether they are all measuring the same underlying domain. Cronbach's alpha was used for this. Ping (2004) suggests a Cronbach's alpha of 0.6 or greater indicates a reasonable level of fit. Items were therefore removed as necessary to achieve as close to 0.6 as possible. Negatively worded items were reversed before checking reliability.

Construct validity Confirmatory Factor Analysis (CFA) was performed using AMOS v. 17. to test whether the data from the individual items on the instrument fit within the domains to which they had been allocated during in the Delphi survey. This involved the following steps.

1. Data preparation: missing data. The amount of missing data was calculated using SPSS to be less than 5%. Tabachnick and Fidell (2007) suggest that for large data sets with 5% or less of the data missing this is unlikely to effect results of analysis and any method of handling missing data will be sufficient. It was therefore decided to impute the mean score for missing values (Byrne, 2001). This was carried out in SPSS and with the help of a qualified statistician (Munyombwe, 2010).

2. Normality. It is suggested that only variables with a skew greater than 3 and kurtosis index greater than 10 are of concern (Kline, 1986). Therefore skew and kurtosis were calculated in SPSS v. 17. No items exceeded these values and therefore all items were retained at this stage.

3. A model was then specified in AMOS.

4. The model was tested for goodness of fit. This was done using three criteria. Each type of fit index provides different information about model fit. Brown (2006) recommends using three indices: 1. absolute fit, 2. parsimony and 3. comparative fit.

- Absolute fit assesses the how reasonable the hypothesis presented in the model is given the data. The measure chosen was Chi square to degrees of freedom ratio (χ^2/df). A good fit is indicated if χ^2/df is less than 2 (Byrne, 2001).
- Parsimony of fit takes into account the number of estimated parameters of the hypothesized model in the assessment of model fit. The recommended index from this category is the Root Mean Square Error of Approximation (RMSEA) (Brown, 2006). A RMSEA of close to or less than 0.06 is recommended (Brown, 2006) and was aimed for in this study.
- Comparative fit evaluates the model specified compared with a null hypothesis, that is, comparing the model specified with a baseline model. The Comparative Fit Index is recommended for this and a value of "close to" 0.95 indicates good fit (Brown, 2006). Brown (2006) emphasises that the use of the term "close to" is not accidental, but based on research by Hu and Bentler (1999) where recommended cut off values were found to fluctuate.

5. Model Revision. The model was revised and the fit was retested. This was repeated until the model was judged to fit well according to the three measures of fit described above. Two values were examined in the factor loading matrix to identify areas of poor fit. 1. Modification Indices (MI) and 2. Standardised Residuals (SR).

- An MI of greater than 3.84 indicates that a change will probably result in a significant improvement in model fit (Brown, 2006).
- An SR of greater than 2.58 indicates an area of strain (Brown, 2006).

However, Brown (2006) cautions that model re-specification should not be based only on this statistical data but should only be undertaken when there is a compelling basis to do so based on empirical or theoretical considerations. Therefore, where examination of MI and SR suggested that removing an item would improve goodness of fit, the item in question was only removed if there was good justification for doing so, that is a theoretical reason that the item may not fit well. In addition to this face validity was considered throughout and effort was taken to keep the number of items per domain similar. When an item was removed fit was

recalculated (according to the measures identified in point 3. above). If this improved the fit the item was discarded. If the fit did not improve the item was replaced.

6. Steps 4 and 5 were repeated until there was good overall model fit.

Knowledge questions In addition to the barriers and levers forming the items of the questionnaire, questions testing knowledge had been added too. These were treated separately from the rest of the data. They were examined for face validity and correlated with the items asking participants to rate knowledge.

5.4.5. Results

Three hundred and fifty four participants (35.4%) returned questionnaires of which 85% were female (n=301) and 13.3% were male (n=47) (6 participants omitted this information). The range of years experience in the job ranged from less than one year to 56 years (mean = 14.63, SD = 11.14). A good range of participants returned questionnaires in terms of role and area of work; this is presented in Table 5.2.

Internal consistency Reliability for whole questionnaire was calculated using Cronbach's alpha at 0.84. The internal consistency statistics for each domain, measured by Cronbach's alpha is presented in Table 5.3. Ten items were removed because they reduced the alpha within their respective domains. However, three of the items removed were tested in two domains (as they were categorised this way by Delphi survey participants reported in Chapter 4). After removing items in order to improve internal consistency, this was no longer the case; all three items remained only one domain (these are presented in bold with an asterix in Table 5.3.).

An alpha of close 0.6 was achieved for all domains except *"beliefs about capabilities"* (α=0.49).

The items remaining after this process and the domains within which they fit formed the model for the confirmatory factor analysis carried out.

Table 5.2. Role and area of work: participants round two

Participants	Trust 1								Trust 2								Trust 3								Trust 4								
	Several	ICU	Elderly Care	A & E	Medical	Surgical/theatre	Out patients	Paed/mat	Several	ICU	Elderly Care	A & E	Medical	Surgical/theatre	Outpatients	Paed/mat	Several	ICU	Elderly Care	A&E	Medical	Surgical/theatre	Out patients	Paed/mat	Several	ICU	Elderly Care	A & E	Medical	Surgical/theatre	Outpatients	Paed/mat	Total
Nurse	3			3	8	9	5	8	4		7		8	19	10	8	13	8	6	4	20	17	4	7	1	2	3	2	6	8	3	5	201
Doctor					1	1		1						1				1	1	1	1	4		2			6	3	6	4			33
Porter									2																7								9
OT	1				2	1	1	3	1					1		1						1											12
Physiotherapist														1			1				3												5
Admin	1					1		1						2				2			3												10
Radiographer	1						9										3																13
Medical Student																									2		1	1	2	1			7
Domestic	1								3				1	1											2								8
Midwives								1								3								14									18
Other	8						4	1	4					1	6	2	1	1	1		1			2	1						5		38
Total	15	0	0	3	11	12	19	15	14	0	7	0	9	26	16	14	18	12	8	5	28	22	4	25	13	2	10	6	14	13	3	10	354

Paed/mat= paediatrics or maternity

Table 5.3. Cronbach's alpha for each domain and items removed as a result (prior to model specification)

Domain	Items (Numbers from Instrument Round Two)	Cronbach's Alpha with all items	Item(s) removed	Cronbach's Alpha after Removing Item(s)
Knowledge and Skills	18, 21, 24, 41, 51, **67***	0.42	41	**0.65**
Professional role and identity	7, 16, 22, 23, 25, **35***, 53, **67***	0.42	22 23 **67***	0.50 0.56 **0.60**
Beliefs about capabilities	13, 29, 33, 46, 60, 64	0.35	64	**0.49**
Beliefs about Consequences	8, 17, 49, 52, 56, 66, 68	0.59		**0.59**
Motivation and goals	9, 26, 31, 48, 61, 69, 72	0.61	72	**0.61**
Memory attention and decision process	10, 12, 30, **47***, 58, 62	0.63		**0.63**
Environmental context and resources	37, 43, **47***, 50, 55, 63, 65, 70, 73	0.30	**47*** 55 65 50	0.35 0.48 0.56 **0.61**
Social Influences	15, 20, 28, **35***, 38, 40, 42, 44, 71, 74	0.53	**35*** 74	0.56 **0.60**
Emotion	14, 19, 27, 36, 39	0.63		**0.63**
Action Planning	11, 32, 34, 54, 57, 59,	0.68		**0.68**

Item numbers relate to items on instrument version draft 2, appendix 18

Construct validity. Overall model fit was calculated and the model did not fit well according to the parameters described in section 5.4.4. but it was not far out with these parameters; CMIN/DF = 3.67 ($p<0.01$), RMSEA = 0.07 and CFI = 0.55. The process described in section 5.4.4. and the outcomes of the process are illustrated step by step in Table 5.4. By the end of the process the final model consisted of 35 items within the 11 domains and the fit was good; CMIN/DF = 1.9 ($p<0.01$), RMSEA = 0.05 and CFA = 0.84. The items that remained in the instrument are listed in Figure 5.5.

Although Table 5.4. demonstrates the values that resulted in all other items being removed it does not demonstrate the empirical or theoretical justifications for doing so (illustrated to be important in section 5.4.4. (Brown, 2006)). Therefore a worked example of the first two items removed is presented below.

The Factor loading matrix presented in the AMOS output was considered. On examination of MIs item 9 "Sometimes I have more important things to do", fit poorly (MI>3.84) with 4 other domains, *"environmental context and resources"*, *"memory attention and decision process"*, *"motivation and goals"* and *"beliefs about capabilities"*. Examination of SRs indicated poor fit (SR>2.58) with 18 questions. It was therefore decided to remove question 9 and re-test model fit. It was theoretically understandable that this question overlapped with other domains as "more important things to do" could cover a range of activities that fit within the *"environment"*, that influenced or was influenced by *"memory attention and decision process"* and affected or was affected by *"motivation"*. After removing the item the fit of the model was improved (CMIN/DF = 3.06 (p<0.01), RMSEA = 0.07, CFI = 0.54).

MIs and SRs were examined again to identify other areas of strain. Item 47 "Infection prevention and control notice boards remind me to do hand hygiene" was identified as MIs were above 3.84 for three domains, *"environmental context and resources"*, *"beliefs about consequences"* and *"action planning"* and six other items. SRs were above 2.58 for two questions. It was logical theoretically that there should be some overlap with the domains listed; notice boards are within the environment, the content of such boards could display notices relating to hospital acquired infection (for example, as a consequence of lack of hand hygiene) and other displayed material could prompt plans to clean hands according to guidelines. This item was therefore removed and the fit of the model was improved (CMIN/DF = 3.02 (p<0.01), RMSEA = 0.07, CFI = 0.55).

In addition to these two changes, 18 further changes were made which are detailed in Table 5.4. below. Items remaining after this process are listed in Figure 5.6.

Table 5.4. Process of establishing construct validity using Confirmatory Factor Analysis

Domain	Item selected for removal (based on MIs>4 and SI>2.58)	MI>4 with how many domains and other items		SI > 2.58 Number of items	Resulting CMIN/DF after removing item	Resulting RMSEA after removing item	Resulting CFI after removing item
		Number of Domains	Number of Items				
7. Memory attention and decision process	9. Sometimes I have more important things to do than HH	4	0	18	3.57	0.07	0.45
7. Memory attention and decision process	47. IPC notice boards remind me to do HH	2	6	2	3.02	0.07	0.55
6. Motivation and goals	26. I am enthusiastic about HH	5	10	2	2.9	0.07	0.57
7. Memory attention and decision process	30. HH is a habit for me	6	8	1	2.75	0.07	0.6
11. Action Planning	11. HH audits are regularly carried out in my work place	6	0	0	2.75	0.07	0.6
4. Beliefs about Capabilities	60. I feel positive about HH	6	0	12	2.5	0.07	0.65
8. Environmental context and resources	37. Facilities are inadequate for HH in my area of work	3	1	7	2.49	0.07	0.66
11. Action Planning	34. Improvement strategies that are unusual have a greater impact on my HH than those I am used to	4	2	2	2.5	0.07	0.66
9. Social Influences	71. My patients expect good HH from me	4	1	3	2.4	0.06	0.67
10. Emotion	36. I engage in HH because I am embarrassed if we do poorly in HH audits	2	1	4	2.4	0.06	0.68

9. Social Influences	28. It is difficult to prompt senior staff when they miss out HH	4	1	0	2.36	0.06	0.68
3. Professional role and identity	7. HH is embedded into my professional practice	5	0	18	2.3	0.06	0.73
11. Action Planning	32. Feedback from audits encourages me to do good HH	5	0	1	2.3	0.06	0.73
9. Social influences	42. IPC teams have a positive influence on my HH	4	0	1	2.3	0.06	0.74
1/2. Knowledge and skills	18. I have sufficient knowledge about HH	3	0	11	2.23	0.58	0.78
1/2. Knowledge and skills	24. I have sufficient skills for HH	1	0	2	2.16	0.58	0.78
7. Memory attention and decision process	58. I am sometimes distracted from HH by other things patients need	1	0	4	2.05	0.05	0.8
6. Motivation and goals	31. Emergencies and other priorities make HH more difficult at times	1	0	3	1.94	0.05	0.83
5. Beliefs about Consequences	56. If I engage in HH it improves patient confidence	1	0	1	1.93	0.05	0.83
5. Beliefs about Consequences	68. If I were to miss out HH I would be challenged	1	0	1	1.9	0.05	0.84

Figure 5.6. Remaining items by domain

Domain		Item
1/2	Knowledge and skills	There are adverts or newsletters about hand hygiene in my workplace Hand hygiene guidelines are easily accessible Hand hygiene training is available to me
3	Professional role and identity	I engage in hand hygiene out of respect for my patients Hand hygiene is a non-negotiable part of my role Hand hygiene is part of my professional culture
4	Beliefs about capabilities	There are some practical barriers to hand hygiene because of my particular job/role I am reluctant to ask others to engage in hand hygiene The frequency of hand hygiene required makes it difficult for me to carry it out as often as necessary I am confident in my ability to carry out hand hygiene
5	Beliefs about consequences	If I do not engage in hand hygiene I may catch an infection If I omitted hand hygiene I would blame myself for infections If I engage in hand hygiene it improves patient confidence If I miss out hand hygiene I will be subject to disciplinary action
6	Motivation and goals	I feel complacent about hand hygiene I cannot be bothered with hand hygiene I disagree with some parts of the hand hygiene guidelines
7	Memory attention and decision process	Sometimes I miss out hand hygiene simply because I forget it Hand hygiene is not second nature for me I am more likely to forget hand hygiene if I am tired
8	Environmental context and resources	It is difficult for me to attend hand hygiene courses due to time pressure Some government targets make hand hygiene more difficult (such as high bed occupancy) My environment is cluttered My area of work has poor staffing levels
9	Social Influences	When staff engage in hand hygiene they are praised I engage in hand hygiene because I do not want to let the team down Supervision from senior staff means that carrying out hand hygiene is easier for me My hand hygiene is encouraged by others
10	Emotion	I feel angry if hand hygiene is not carried out by others I feel frustrated when others omit hand hygiene I feel guilty if I omit hand hygiene I feel ashamed if I omit hand hygiene
11	Action planning	Government targets have led to improvements in my hand hygiene Hospital targets relating to infection or hand hygiene has led to improvements in my hand hygiene Some strategies designed to improve hand hygiene influence my practice

Knowledge questions Questions added to test knowledge were examined for face validity. Questions 80. "which of the flowing bacteria readily survive in the environment of the patient for days to weeks?" and 81. "which of the following statements about alcohol-based hand hygiene products is accurate?" were incorrectly answered by the majority of participants (only 23 and 82 out of 364 participants answering correctly). These were therefore removed. This left 3 items asking participants to rate their *"knowledge/skills"* and five questions testing knowledge. The mean score for *"knowledge/skills"* items was correlated with the number of knowledge test questions participants answered correctly using Pearson's coefficient. There was no correlation ($r=0.027$, $n=364$, $p=0.201$).

5.5. Round Three

5.5.1. Design

The purpose of the third and final round of instrument development was to assess the test-retest reliability. Test-retest reliability is assessed by administering the questionnaire to the same people on two different occasions and calculating the correlation between the two responses obtained (Field, 2005). If the phenomenon being measured is unchanged between time periods correlation should be high if the instrument is reliable (Streiner and Norman, 2008, Field, 2005). The time between administering the two questionnaires is generally between two and fourteen days as this is not so long that things may have changed but not so short that participants remember what they answered on the first occasion and put that down rather than answering the question objectively (Streiner and Norman, 2008). However, due to the shift patterns of hospital workers and the postal time delay (internal university post, the external post service, internal hospital post, questionnaire completion, and then three postal systems to return the questionnaire) it was decided to separate the two occasions by one calendar month.

"Test" questionnaire

The questionnaire remained the same as for the third round of testing as for round two other than some items being removed according to the rationale given in section 5.4.5. After omissions the items included were reduced from 68 in round two to 35 in round three. The number of knowledge questions was reduced from seven in round two to five in round three.

"Re-test" questionnaire

It was expected that the barriers and levers to hand hygiene would be consistent for an individual unless measures had been taken to address these. Communication with the infection prevention teams within each trust established

that no changes in hand hygiene promotion were planned for the test-retest period. Another factor that could confound test-retest reliability testing could be the individual's work circumstances changing. Two questions were added to the end of the retest instrument asking participants if this was the case

1. Has your job changed at all in the month since you completed this questionnaire? a. Yes b. No

2. If you answered yes to question 1 please say how in the space below.

"Test" and "re-test" questionnaires can be seen in appendix 20.

5.5.2. Participants

For the final round of questionnaire testing participants were required to complete the questionnaire on two occasions. On this occasion, the investigator contacted potential participants directly by email or telephone to ask them if they would be prepared to participate. Potential participants were identified by ward or departmental managers and secretaries during recruiting for round two. One hundred and fifty participants were identified in this way.

5.5.3. Procedure

Other than the removal of a number of items the questionnaire was largely unchanged from round two. It was therefore decided it was unnecessary to carry out a third pilot study of the questionnaire. Questionnaires were sent out with a covering letter (appendices 21 and 2) which identified the purpose of the study, the value of the participants contribution and asking them to complete the questionnaire within 7 days and to return it in the freepost envelope provided. No prompts or reminders were sent for the test questionnaire. The re-test questionnaire was sent out exactly one calendar month later the procedure was as for the test questionnaire. However, after three weeks participants were sent an email reminding them to complete the re-test questionnaire and the re-iterating the reasons for completing the questionnaire on two occasions.

5.5.4. Analysis

Data were entered onto SPSS v. 17. The area of work and role of practitioners were examined to ensure that the sample of participants reflected the population from which they were drawn. Pearson coefficient is designed for interval level variables but can also be used for continuous or dichotomous variables (Field, 2005, Pallant, 2001) and was therefore selected as the test of choice for these data. A perfect correlation would be identified by a result of 1.

Cohen (1988) suggest the following meanings to results: 0.10 to 0.29 small correlation, 0.30 to 0.49 medium correlation, 0.5 to 1 large correlation. It was decided that a medium or large correlation was desirable and that items scoring less than 0.3 would be removed.

5.5.5. Results

Sixty nine participants (34.5%) returned the questionnaire on the first occasion. Fifty (25%) of those participants returned the questionnaire on the second occasion after reminders. A further eight participants returned the questionnaire late, these were not included in analysis. Ninety percent were female (n=45) and 10 percent were male (n=5). The range of years experience in the job ranged from 2 to 35 (mean = 21.25, SD = 8.66). A good range of participants returned questionnaires in terms of role and are of work; this is presented in Table 5.5.

Pearson's coefficient was calculated for the agreement between each item for the two time periods. All results were based on n=50 and $p<0.01$. and are presented in Table 5.6. Pearson's coefficient was greater than 0.3 for all items. Two items fell in the "medium correlation" range of 0.30 to 0.49 and the remaining 33 items fell in the "good correlation" range of 0.5 or above.

Following this the Pearson's correlation was calculated for the agreement between domains, all results were based on n=50 and $p<0.01$. Results are presented in Table 5.7. All items fell within the range of 0.5 or above "good correlation".

Table 5.5. Role and area of work: participants round three

	Trust 1							Trust 2								Trust 3										
Participants	Specialist area	More than one area	ICU	Elderly Care	Medical	Surgical	Out patient s	Specialist area	More than one area	ICU	A & E	Medical	Surgical	Outpatients	Paediatrics	Specialist area	More than one area	ICU	Elderly Care	A & E	Medical	Surgical	Outpatients	Paediatrics	unknown	Total
Nurse	1	1	3	1	2	1	1	1	1	1	1	1	1		1	1	2	2	2	1	4	2	2	1	1	35
Doctor															1				1							2
OT		1																				1				2
Admin											2															2
Radiographer																	2									3
Other							1		1					1			3									6
Total	1	2	3	1	2	1	2	1	2	1	3	1	1	1	2	1	7	2	3	1	4	3	2	1	1	50

Table 5.6. Test-retest reliability: Pearson's coefficients for instrument items

Item number	Pearson's coefficient	Item number	Pearson's coefficient
7	0.91	24	0.78
8	0.99	25	0.74
9	0.42	26	0.77
10	0.92	27	0.92
11	0.81	28	0.39
12	0.71	29	0.81
13	0.66	30	0.78
14	0.94	31	0.70
15	0.97	32	0.60
16	0.87	33	0.78
17	0.62	34	0.76
18	0.63	35	0.58
19	0.78	36	0.76
20	0.71	37	0.77
21	0.67	38	0.59
22	0.77	39	0.81
23	0.60	40	0.61
		41	0.79

Item numbers relate to items on instrument version draft 3, appendix 20

Table 5.7. Test-retest reliability: Pearson's coefficients for instrument domains

Domain		Items included	Pearson's coefficient
1/2	Knowledge and Skills	11, 18, 26	0.76
3	Professional role and identity	1, 3, 27	0.71
4	Beliefs about capabilities	12, 19, 20, 22	0.72
5	Beliefs about consequences	13, 16, 25, 35	0.86
6	Motivation and goals	5, 14, 21	0.90
7	Memory, attention and decision process	6, 7, 10	0.84
8	Environmental context and resources	4, 15, 28, 31	0.84
9	Social influences	9, 17, 32, 34	0.67
10	Emotion	8, 24, 29, 30	0.80
11	Action planning	2, 23, 33	0.94

5.6. The Barriers and levers to hand hygiene

The data used to assess the barriers and levers to hand hygiene were those collected during round two of questionnaire testing (n=354). Only items that remained in the final questionnaire however were included in analysis.

The questions of interest were:

1. What are the top barriers and levers for practitioners?

And, in order to consider how best strategies should be tailored, whether according to area of work or occupational group:

2. Is there a difference in barriers and levers according to the hospital trusts within which professionals work?

3. Is there a difference in barriers and levers according to occupational group?

4. Is there a difference in barriers and levers according to area of work (by speciality)?

5.6.1. Analysis

Data had been entered into SPSS v. 17. Means were calculated according to domain. Sometimes the data were reverse scored so that in all cases 1 represented a lever or the absence of a barrier and 7 represented a barrier or the absence of a lever. For example, if a participant "strongly agreed" that facilities were adequate in their work place for hand hygiene, this would be seen as a lever to hand hygiene. If a participant "strongly disagreed" this would be interpreted as a barrier. Any mean above four was therefore beyond the mid-point and was considered to be a barrier. Items between three and four were considered to be "borderline". Means were also calculated for the knowledge test questions (number of questions correct out of a possible maximum of 5). In order to assess differences between NHS hospital trusts, occupational groups and areas of work a one-way between analysis of variance (ANOVA) was conducted. In order to assess the effect size eta squared (η^2) was calculated using the formula below.

$$\text{Eta squared } (\eta^2) = \frac{\text{Sum of squares between groups}}{\text{Total sum of squares}}$$

Cohen (1988) suggests that 0.01 is a small effect, 0.06 a moderate effect and over 0.14 is a large effect. These guidelines were used to judge the effect size for the tests carried out here.

Differences between self-rated compliance with hand hygiene between occupational groups were also calculated using the procedure described above.

5.6.2. Results: Barriers and levers to hand hygiene: NHS hospital trusts, occupational groups and areas of work

Results are presented here according to the question of interest. The implication of results are discussed in section 5.7.

1. What are the top barriers and levers for practitioners?

Descriptive statistics

Means were calculated for domains for all practitioners and are presented ranked in Table 5.8. The domains *"social influences"* (M=3.89, SD=1.39), *"environment"* (M=3.44, SD=1.27) and *"memory"* (M=3.43, SD=2.10) posed the greatest barriers to hand hygiene for practitioners; *"knowledge and skills"* (M=1.62, SD=1.05) and *"professional identity"* (M=1.57, SD=1.09) the least.

Table 5.8. Means for all practitioners by domain

Domain		Mean	(SD)
9	Social influences	3.89	(1.39)
8	Environmental context and resources	3.44	(1.27)
7	Memory, attention and decision process	3.43	(2.10)
11	Action planning	2.89	(1.57)
5	Beliefs about consequences	2.68	(1.04)
4	Beliefs about capabilities	2.60	(1.12)
10	Emotion	2.40	(1.22)
6	Motivation and goals	2.07	(1.06)
1/2	Knowledge and Skills	1.62	(1.05)
3	Professional identity	1.57	(1.09)

2. Is there a difference in barriers and levers according to the NHS hospital trusts within which professionals work?

Descriptive Statistics

Table 5.9. presents means according to NHS hospital trust by domains. For ease of comparison where the mean was above 4 the cell in the table is shaded dark grey and where the mean was between 3 and 4 the cell is shaded a lighter grey.

Trust four scored highest for the domains *"memory"* (M=5.30, SD=1.56) and *"social influences"* (M=4.05, SD=1.27), trust one scored highest for the domains *"social influences"* (M=3.94, SD=1.40) and *"environment"* (M=3.60, SD=1.21), trust two scored highest for the domains *"social influences"* (M=4.06, SD=1.39) and *"action plans"* (M=3.16, SD=1.82) and trust three didn't score very high in any domain, but scored highest in the domains *"memory"* (M=2.66, SD=1.44) and *"social influences"* (M=2.66, SD=1.44). The column entitled "all" in Table 5.9. represents the mean score for all items, trusts scoring similarly overall.

Overall practitioners from trust three answered the most questions correctly (M=3.93, SD=0.96) though there was very little difference between the trusts with trust one answering 3.69 correctly (SD=1.06), two answering 3.15 correctly (SD=1.21) and trust four answering a mean of 3.48 correctly (SD=0.99).

Table 5.9. Mean score for domains according to NHS hospital trust

NHS Trust	1/2 M SD	3 M SD	4 M SD	5 M SD	6 M SD	7 M SD	8 M SD	9 M SD	10 M SD	11 M SD	All M SD	Test M SD
Trust 1 (n=75)	1.60 0.73	1.51 0.68	2.60 1.16	2.67 0.98	2.18 1.17	3.54 2.03	3.60 1.21	3.94 1.40	2.32 1.17	2.95 1.44	2.69 0.54	3.69 1.06
Trust 2 (n=86)	1.64 0.99	1.76 1.16	2.45 1.21	2.75 1.15	1.97 0.94	2.83 2.04	3.25 1.34	4.06 1.39	2.26 1.31	3.16 1.82	2.61 0.71	3.15 1.21
Trust 3 (n=122)	1.45 1.45	1.42 0.77	2.60 1.02	2.60 1.04	2.06 1.09	2.74 1.78	2.29 1.23	2.66 1.44	2.47 1.29	2.61 1.43	2.50 0.57	3.93 0.96
Trust 4 (n=70)	1.90 1.00	1.64 0.84	2.78 1.11	2.77 0.96	2.12 1.03	5.30 1.56	3.61 1.30	4.05 1.27	2.52 1.01	2.97 1.54	2.97 0.53	3.48 0.99

1/2=knowledge and skills, 3=professional identity, 4=beliefs about capabilities, 5=beliefs about consequences, 6=motivation and goals, 7=memory, attention and decision process, 8=environmental context and resources, 9=social influences, 10=emotion, 11=Action Plans, All=all items, Test=knowledge test questions, M=mean, SD=Standard Deviation

Comparing Means

Where there was a statistically significant difference between the NHS hospital trusts these are listed below according to domain.

Within the domain of ***"knowledge and skills"*** there was a statistically significant difference for the NHS trusts, $F(3, 349)=4.285$, $p=0.05$. The effect size was calculated to be small ($\eta^2 = 0.03$). Post-hoc comparison using the Tukey HSD test indicated that the mean scores for NHS trust four (M=1.90, SD=1.00) was significantly higher than NHS trust three (M=1.45, SD=0.66).

Within the domain ***"professional identity"*** there was a statistically significant difference for the NHS trusts, $F(3, 349)=2.67$, $p=0.05$). The effect size was small ($\eta^2 = 0.02$). Post-hoc comparison using the Tukey HSD test indicated that the mean score for NHS trust two (M=1.73, SD1.17) was significantly higher than NHS trust three (M=1.42, SD=0.77).

Within the domain ***"memory and decision process"*** there was a statistically significant difference for the NHS trusts $F(3, 349)=32.40$, $p<0.001$. The effect size was small ($\eta^2 = 0.02$). Post hoc comparison using the Tukey HSD test indicated that the mean scores for NHS trust four (M=5.40, SD=1.55) was significantly higher than those of NHS trusts one (M=3.54, SD=2.03), two (M=2.83, SD=2.04) and three (M=2.74, SD=1.78). This also has practical significance as a mean score of 5.40 for trust one indicates that memory and decision process is a barrier.

When means were compared for ***all items*** there was a statistically significant difference for the NHS trusts $F(3, 349)=9.64$, $p<0.001$, which represents a moderate effect ($\eta^2 = 0.08$). Post-hoc comparison using the Tukey HSD test indicated that the mean scores for NHS trust four (M=2.97, SD=0.53) was significantly higher than those of NHS trusts one (M=2.69, SD=0.54), two (M=2.61, SD=0.71) and three (M=2.50, SD=0.57).

3. Is there a difference in barriers and levers according to occupational group?

Descriptive statistics

Table 5.10. presents means according to occupational group by domain. For ease of comparison, where the mean was above 4 the cell on the table is shaded dark grey and where the mean was between 3 and four the cell is shaded a lighter grey.

Doctors (M=3.06, SD=0.51) and porters (M=3.22, SD=0.75) were the two occupational groups demonstrated to have greatest barriers according to mean scores overall.

"Social influences" posed the greatest barrier to staff nurses (M=3.73, SD=1.55), unqualified nurses (M=4.06, SD=1.51), midwives (M=4.24, SD=1.33), doctors (M=4.14, SD=1.05), occupational therapists (OT)/physiotherapists (M=4.35, SD=1.19), admin staff (M=3.83, SD=0.79) and the group "others" (M=3.94, SD=1.40). Radiographers' mean scores were highest in the domains *"social influences"* (M=3.79, SD=1.59) and *"memory"* (M=3.79, SD=1.77). Senior nurses' mean scores were higher in the domain *"memory"* (M=4.04, SD=2.41) as were porters' (M=5.00, SD=1.96) and domestic staff (M=4.71, SD=2.65).

When examining the means for the knowledge test questions midwifes (M=3.95, SD=0.97) got the most questions correct. However, all occupational group achieved mean scores of over 3.25 with the exception of porters (M=2.11, SD=0.60) and domestic staff (M=2.50, SD=1.31).

Table 5.10. Mean score for domains by occupational group

Staff group	1/2 M SD	3 M SD	4 M SD	5 M SD	6 M SD	7 M SD	8 M SD	9 M SD	10 M SD	11 M SD	All M SD	Test M SD
Staff Nurses (n=79)	1.57 0.83	1.36 0.73	2.33 1.09	2.51 0.99	1.97 1.21	3.06 2.07	3.53 1.45	3.73 1.55	1.97 1.17	2.78 1.71	2.48 0.62	3.80 0.97
Senior Nurses (Charge Nurse/Nurse Specialist/Matron) (n=70)	1.39 0.59	1.34 0.69	2.14 0.96	2.56 1.07	1.67 0.81	4.04 2.41	3.41 1.34	3.51 1.33	2.25 1.18	2.54 1.54	2.49 0.45	3.77 1.09
Unqualified Nurses (Student nurse and Nursing Assistant) (n=49)	1.55 0.96	1.74 1.13	2.68 1.16	2.60 1.01	2.25 0.98	2.77 2.02	3.12 1.17	4.06 1.51	2.61 1.41	2.75 1.45	2.62 0.63	3.25 1.19
Midwives (n=21)	1.55 0.75	1.22 0.30	2.15 0.94	2.98 1.24	1.95 1.27	3.25 2.42	3.25 1.14	4.24 1.33	2.32 1.01	3.16 1.60	2.61 0.63	3.95 0.97
Doctors (n=39)	2.29 1.07	1.85 0.81	3.20 1.00	2.92 0.90	2.61 0.88	3.76 1.19	3.98 0.83	4.14 1.05	2.87 0.96	3.07 1.25	3.06 0.51	3.67 0.93
Occupational Therapist/Physiotherapist (n=17)	1.61 0.69	1.55 0.74	3.01 0.86	2.59 0.70	1.76 0.75	2.75 1.61	3.44 0.86	4.35 1.19	3.22 1.01	3.29 0.96	2.67 0.55	3.65 0.86
Radiographers (n=18)	1.66 0.76	1.59 0.72	2.65 1.21	2.60 1.28	2.06 1.02	3.79 1.77	3.52 1.44	3.79 1.59	2.94 1.28	3.14 1.55	2.77 0.66	3.72 1.18
Porters (n=9)	1.52 0.53	2.63 1.29	3.00 1.19	3.22 0.96	2.13 1.24	5.00 1.96	3.86 1.20	4.58 1.36	2.64 1.36	3.67 1.86	3.22 0.75	2.11 0.60
Domestic staff (n=8)	1.25 0.58	1.46 0.85	2.13 1.05	2.59 1.07	2.21 1.42	4.71 2.65	3.16 1.41	3.97 1.14	1.53 0.95	5.17 2.34	2.82 0.59	2.50 1.31
Administrative staff (n=10)	1.43 0.75	1.47 0.76	2.72 1.15	2.78 0.89	2.25 1.21	3.00 2.20	2.23 0.98	3.83 0.79	2.40 1.60	2.03 0.97	2.41 0.55	3.80 1.03
Others (Pharmacists/Managers/Speech Therapists/Dieticians/Nursery Nurses/Social Workers/Lab workers/Phlebotomists/Podiatrists (n=29)	1.67 0.79	1.97 1.14	3.39 1.00	3.10 1.13	2.37 0.95	3.32 1.75	3.69 1.03	3.94 1.40	2.80 1.02	2.74 1.40	2.90 0.68	3.43 1.07

1/2=knowledge and skills, 3=professional identity, 4=beliefs about capabilities, 5=beliefs about consequences, 6=motivation and goals, 7=memory, attention and decision process, 8=environmental context and resources, 9=social influences, 10=emotion, 11=Action Plans, All=all items, Test=knowledge test questions, M=mean, SD=Standard Deviation

Comparing means

There was a statistically significant difference between the following occupational groups listed by domain.

Within the domain of ***"knowledge and skills"*** there was a statistically significant difference for the occupational groups F(10, 340)=3.72, $p<0.001$, a moderate effect ($\eta^2 = 0.09$). Post-hoc comparisons using the Tukey HSD test indicated that the mean score for doctors (M=2.29, SD=1.07) was significantly higher than staff nurses (M=1.57, SD 0.83), senior nurses (M=1.38, SD=0.59), unqualified nurses (M=1.56, SD=0.96), domestic workers (M=1.25, SD=0.58) and midwives (M=1.56, SD=0.76).

Within the domain of ***"professional identity"*** there was a statistically significant difference for the occupational groups F(10, 340)=4.13, $p<0.001$, a moderate effect ($\eta^2 = 0.10$). Post-hoc comparisons using the Tukey HSD test indicated that the mean score for porters (M=2.63, SD=1.29) was significantly higher than staff nurses (M=1.36, SD=0.73), senior nurses (M=1.34, SD=0.69) and midwives (M=1.22, SD=0.30). The mean score for the group "other" (M=1.97, SD=1.14) was significantly higher than staff nurses (M=1.36, SD=0.73) and senior nurses (M=1.34, SD=0.69).

Within the domain ***"motivation and goals"*** there was a statistically significant difference for the occupational groups F(10, 338)=2.85, $p=0.02$ which represents a small effect size ($\eta^2 = 0.07$). Post-hoc comparisons using the Tukey HSD test indicated that the mean score for doctors (M=2.62, SD=0.88) was significantly higher than senior nurses (M=1.67, SD=0.81).

Within the domain ***"memory and decision process"*** there was a statistically significant difference for the occupational groups F(10, 340)=2.68, $p<0.01$, representing a moderate effect size ($\eta^2 = 0.08$). Post-hoc comparisons using the Tukey HSD test indicated that the mean score for senior nurses (M=4.04, SD=2.41) was significantly higher than unqualified nurses (M=2.77, SD=2.02). This also represents a potential difference practically as a mean of 4.04 in senior nurses represents a barrier to practice.

Within the domain ***"environmental context and resources"*** there was a statistically significant difference for the occupational groups F(10, 338)=2.41, $p<0.01$, effect size moderator ($\eta^2 = 0.07$). Post-hoc comparisons using the Tukey HSD test

indicated that the mean score for doctors (M=3.99, SD=0.84) was significantly higher than unqualified nurses (M= 3.12, SD=1.17) and administrative staff (M=2.23, SD=0.98). There were no significant differences between other occupational groups.

Within the domain of ***"emotion"*** there was a statistically significant difference for the occupational groups F(10, 340)=3.19, p=0.001, effect size moderator (η^2 = 0.09). Post-hoc comparisons using the Tukey HSD test indicated that the mean score for the group "other" (M=2.80, SD=1.02) and doctors (M=2.87, SD=0.96) was significantly higher than staff nurses (M=1.97, SD=1.17).

Within the domain ***"action plans"*** there was a statistically significant difference for the occupational groups F(10, 336)=2.99, p=0.001, a moderate effect size (η^2 = 0.08). Post-hoc comparisons using the Tukey HSD test indicated that the mean score for domestic workers (M=5.17, SD=2.34) was significantly higher the staff nurses (M=2.78, SD=1.71), senior nurses (M=2.58, SD=1.53), unqualified nurses (M=2.74, SD=1.45), doctors (M=3.07, SD=1.25), administrative workers (M=2.03, SD=0.97) and the group "other" (M=2.74, SD=1.40).

When the means are compared for ***all items*** there was a statistically significant difference for the occupational groups F(10, 340)=4.95, p<0.001, the effect size was moderate (η^2 = 0.13). Post-hoc comparisons using the Tukey HSD test indicated that the mean score for doctors (M=3.06, SD=0.51) was significantly higher than staff nurses (M=2.48, SD=0.62), senior nurses (M=2.49, SD=0.45) and unqualified nurses (M=2.62, SD=0.63). The mean score for the porters (M=3.23, SD=0.75) was significantly higher than for staff nurses (M=2.48, SD=0.62) and senior nurses (M=2.49, SD=0.45). The mean score for the group "other" (M=2.9, SD=0.68) was significantly higher than for staff nurses (M=2.48, SD=0.62).

When means were compared for ***knowledge test question*** results (number of questions answered correctly) there was a statistically significant difference for occupational groups F(10, 333)=4.14, p<0.001, effect size moderate (η^2 = 0.11). Post-hoc comparisons using the Tukey HSD test indicated that the mean score staff nurses (M=3.80, SD=0.97), senior nurses (M=3.77, SD=1.09), doctors (M=3.67, SD=0.93), OT/physiotherapist (M=3.65, SD=0.862), midwives (M=3.95, SD=0.97), radiographers (M=3.72, SD=1.18), administrative workers (M=3.80, SD=1.03) and the group "other"

(M=3.43, SD=1.07) was significantly higher than for porters (M=2.11, SD=0.60) and for domestic staff (M=2.50, SD=1.31).

4. Is there a difference in barriers and levers according to area of work (ward or department)?

Descriptive statistics

Table 5.11. presents means for domains according to area within which practitioners worked. For ease of comparison where the mean was above 4 the cell in the table is shaded dark grey and where the mean was between 3 and 4 the cell is shaded a lighter grey. Staff working in the operating theatre (M=3.13, SD=0.62) had the greatest barriers according to the means for all items. Staff working in medical wards and departments had the least barriers (M=2.51, SD=0.55). *"Social influences"* posed the greatest barrier to staff working in surgery (M=3.82, SD=1.45), medicine (M=3.91, SD=1.38), several areas of the hospital (M=4.01, SD=1.33), Elderly care (M=3.64, SD=1.41), ICU, (M=4.09, SD=1.47), Paediatrics (M=4.15, SD=1.47), maternity (M=4.10, SD=1.29), out patient departments (M=3.77, SD=1.58) and "other" areas (which consisted of laboratories and pharmacy). *"Environmental context and resources"* the greatest barrier to accident and emergency staff (M=4.09, SD=1.23) and *"memory"* posed the greatest barrier to theatre staff (M=5.42, SD=1.82).

With regard to knowledge test questions, scores were over 3 (out of 5) in all areas. The range being between "other" areas (M=4.29, SD=0.95) and theatre (M=3.00, SD=0.82).

Table 5.11. Mean scores for domains by area of work

Area of Work	1/2 M SD	3 M SD	4 M SD	5 M SD	6 M SD	7 M SD	8 M SD	9 M SD	10 M SD	11 M SD	All M SD	Test M SD
Surgery (n=65)	1.70 0.91	1.61 0.94	2.53 1.08	2.41 0.90	2.00 1.06	3.41 2.09	3.60 1.36	3.82 1.45	2.10 1.03	2.80 1.64	2.59 0.55	3.58 1.12
Medicine (n=62)	1.62 1.00	1.32 0.67	2.31 1.06	2.62 1.02	2.00 0.98	3.21 2.08	3.23 1.31	3.91 1.38	2.13 1.21	2.79 1.73	2.51 0.66	3.80 0.89
Several areas (n=44)	1.69 0.67	2.10 1.20	3.12 1.14	2.95 1.01	2.42 1.00	3.67 1.95	3.55 1.21	4.01 1.33	2.83 1.23	3.20 1.52	2.95 0.68	3.34 1.24
Elderly care (n=25)	1.37 0.64	1.52 0.85	2.55 1.21	2.62 1.02	1.92 1.01	3.36 2.32	2.90 1.00	3.64 1.41	2.40 1.61	2.15 1.29	2.54 0.57	3.72 1.14
Accident and Emergency (n=14)	1.92 1.13	1.71 0.80	3.14 1.15	2.42 0.72	2.23 1.71	3.80 1.77	4.09 1.23.	2.96 1.14	2.17 0.91	2.28 1.31	2.68 0.40	3.62 0.96
ICU (n=14)	1.50 0.52	1.31 0.44	2.96 0.94	2.61 0.78	2.00 1.15	3.14 1.62	3.69 1.33	4.09 1.47	3.19 1.40	3.00 1.42	2.75 0.50	4.14 0.86
Paediatrics (n=37)	1.47 0.62	1.37 0.53	2.18 0.96	3.00 1.11	2.00 0.83	3.30 2.27	3.31 1.09	4.15 1.26	2.46 1.05	3.14 1.64	2.61 0.59	3.31 1.01
Maternity (n=27)	1.58 0.72	1.32 0.52	2.26 0.91	2.87 1.15	1.99 1.20	3.26 2.36	3.15 1.12	4.10 1.29	2.31 0.98	3.64 1.46	2.59 0.58	3.84 1.03
Out Patient Department (n=44)	1.58 0.96	1.64 0.95	2.77 1.21	2.44 1.14	2.02 1.11	3.70 1.97	3.41 1.41	3.77 1.58	2.60 1.32	3.03 1.54	2.68 0.65	3.57 1.17
Theatre (n=7)	1.95 0.71	1.62 1.03	2.68 1.44	3.14 1.01	2.19 1.00	5.42 1.82	3.71 1.17	4.64 0.92	3.18 1.13	2.76 0.83	3.13 0.62	3.00 0.82
Other (n=7)	1.47 1.00	2.02 1.44	2.96 0.91	3.07 1.44	2.04 0.80	2.95 1.88	3.32 1.03	4.28 1.14	2.89 0.97	2.90 0.83	2.79 0.65	4.29 0.95

1/2=knowledge and skills, 3=professional identity, 4=beliefs about capabilities, 5=beliefs about consequences, 6=motivation and goals, 7=memory, attention and decision process, 8=environment context and resources, 9=social influences, 10=emotion, 11=Action Plans, Test=knowledge test questions, M=mean, SD=Standard Deviation

Comparing means

Where there was a statistically significant difference between the areas of work these are listed below according to domain.

Within the domain of ***"professional identity"*** there was a statistically significant difference for the areas of work $F(10, 335)=2.91$, $p<0.01$, a moderate effect ($\eta^2 = 0.08$). Post-hoc comparisons using the Tukey HSD test indicated that the mean score for staff working in several areas of the hospital (M=2.10, SD=1.20) was significantly higher than those working in medicine (M=1.33, SD=0.94), paediatrics (M=1.37, SD=0.52) and maternity (M=1.37, SD=0.52).

Within the domain of ***"beliefs about capabilities"*** there was a statistically significant difference for the areas of work $F(10, 335)=2.90$, $p<0.01$, a moderate effect size ($\eta^2 = 0.08$). Post-hoc comparisons using the Tukey HSD test indicated that the mean score for staff working in several areas of the hospital (M=3.12, SD=1.14) was significantly higher than those working in medicine (M=2.31, SD=1.06) and paediatrics (M=2.18, SD=0.96).

When the means are compared for ***all domains*** there was a statistically significant difference for the areas of work $F(10, 335)=2.14$, $p<0.05$, effect size moderate ($\eta^2 = 0.06$). Post-hoc comparisons using the Tukey HSD test indicated that the mean score for working in several area (M=2.96, SD=0.68) was significantly higher than medicine (M=2.51, SD=0.66).

When means were compared for ***knowledge test question*** results (number of questions answered correctly) there was no statistically significant difference according to area of work.

5.7. Discussion

The aim of this programme of research was to develop and test a theory-based diagnostic instrument to accurately and prospectively assess the barriers and levers to hand hygiene practice to inform subsequent tailoring of implementation strategies. The first aim of this study was to develop and test the reliability and validity of a diagnostic instrument designed to assess barriers and levers to hand hygiene. The second aim of this study was to identify and compare barriers and levers to hand hygiene according to NHS trust, occupational group and area of work.

5.7.1. Instrument development

An initial list of 99 barriers and levers to hand hygiene, that had been previously categorised to the 11 domains of the BPS framework (Michie et al., 2005) (Chapter 4) were considered for inclusion. After initial refinement these formed the basis of an 81 item instrument which was tested for validity and reliability in three rounds.

The first round considered face validity (through participant feedback) and performed preliminary tests to assess skew, variability of response and the construct validity of domains. As a result of this 81 items were reduced to 68.

In round two confirmatory factor analysis was carried out to test construct validity. Through a process of assessing modification indices and standardised residual scores and considering theoretical reasons for why items may or may not fit within domains, the initial instrument was modified until a good model fit was achieved. This resulted in a 35 item instrument measuring a modified 10 domains (the domains *"knowledge"* and *"skills"* were combined) of the BPS framework (Michie et al., 2005).

Finally, in the third round of testing, test-retest reliability was carried out using Pearson's correlation coefficient, with two items achieving "moderate" correlation (within the range of 0.3 and 0.49) and the remaining items "good" correlation (0.5 or above) according guidelines set by Cohen (1988). Correlation for all domains was "good" with items achieving above 0.50.

The result was a 35 item instrument with all domains containing a minimum of three items. This study was conducted due to two reasons identified for the limited success of strategies implemented to improve the uptake of EBP:

1. There is a need for accurate assessment of barriers and levers to implementation (Grimshaw et al., 2004b) and tailoring of implementation strategies according to these (Grimshaw et al., 2004b, Baker et al., 2010).

2. There is an absence of a theoretical basis informing implementation interventions used (Grimshaw et al., 2004b, Michie et al., 2005).

There are a limited number of instruments that pertain to the assessment of barriers and levers to EBP and no instrument was identified to assess barriers and levers to hand hygiene. While these instruments have been useful in identifying the barriers and levers to EBP, their main limitation is that they have no underlying theoretical basis and have not been tested in tailoring implementation strategies.

The questionnaire developed here is based on a theoretical framework which thus allowing the tailoring of effective implementation strategies. In order to move

from assessment of barriers and levers to tailoring implementation strategies two psychologists recently carried out a review of the relevant literature and identified a set of distinct, theory-linked definitions of behaviour change techniques (Abraham and Michie, 2008). This was developed further and behaviour change techniques were linked to the theoretical constructs forming the 11 domains of the BPS framework (Michie et al., 2008b). That is, each technique was considered as to whether or not it would be effective as part of an intervention to assess behaviour with respect to each of the domains. Having assessed barriers and levers to hand hygiene using the instrument developed and reported here it should be a straightforward process to select the appropriate behaviour change strategy or strategies (according to the work of Michie et al. (2008b)) to these barriers and levers according to the domain within which they fit. However, questions do still remain. Is this approach feasible? Can interventions be tailored according to barriers and levers assessed using this instrument? How many domains should be focused on when selecting interventions? Can theoretical behaviour change strategies be adapted pragmatically for use within hospitals with health care practitioners? Some of these issues are addressed in study 4 (Chapter 6).

5.7.2. The barriers and levers to hand hygiene

*1. **What are the top barriers and levers for practitioners?*** The domains with the highest mean scores for practitioners were *"social influence"* (M=3.89, SD=1.29), *"environmental context and resources"* (M=3.44, SD=1.27) and *"memory"* (M=3.43, SD=2.10). These are all areas previously reported in the literature as barriers (Pittet and Boyce, 2001, McArdle et al., 2006). The domains *"professional identity"* (M=1.57, SD=1.09) and *"knowledge and skills"* (M=1.62, SD=1.05) had the lowest means. This is interesting as historically the focus of the implementation strategies for decades has been aimed at increasing knowledge (Grimshaw et al., 2004b). However, these results are specific to hand hygiene which may be seen as a relatively simple and uncomplicated form of professional practice.

*2. **Is there a difference in barriers and levers according to the NHS hospital trusts within which professionals work?*** There were a number of statistically significant differences between trusts for the domains *"knowledge and skills"*, *"professional identity"* and *"memory, attention and decision processes"*. However the effect size of these according to eta squared calculations was small. There was a moderate effect size between the means for all items for trust four compared with trusts one, two and three. The difference appears to be largely explained by the higher mean for the domain *"memory attention and decision processes"* in trust four. Whilst this suggests that an intervention to address this domain may improve

practice within this trust, this data is of very little additional practical help in terms of improving hand hygiene.

3. Is there a difference in barriers and levers according to occupational group? The group "other" (n=29) consisted of a wide and disparate range of staff from all four trusts and a wide range of areas. This group included pharmacists, managers (of a range of disciplines and areas), speech therapists, dieticians, nursery nurses, social workers, lab workers, phlebotomists and podiatrists. In view of the range included it is not possible to generalise about this group and therefore no further reference will be made to them, other than to say, in order to identify potential barriers to these groups of practitioners further research needs to be undertaken with greater numbers of participants from these groups.

The most noticeable finding was in relation to doctors. When the means of all items were compared doctors identified significantly more barriers than all groups of nurses (moderate effect size). Doctors also had significantly higher means than a range of other staff groups within the domains *"knowledge and skills"* (moderate effect), *"motivation and goals"* (small effect), *"environmental context and resources"* (moderate effect) and *"emotion"* (moderate effect). In Chapter 2 it was identified that doctors were less likely to be compliant with hand hygiene than other groups of practitioners (Creedon, 2005, Salemi et al., 2002, Pittet et al., 2000). The work here suggests that doctors have more barriers to hand hygiene than other staff and may require greater support in order for this to be addressed.

There were two other groups of staff where there were noteworthy differences. Both porters and domestic staff had significantly lower mean scores on the knowledge test questions than all other staff groups except unqualified nurses (moderate effect). This would be expected as these groups have no professional qualification. When means were compared for all items porters had significantly more barriers than staff nurses and senior nurses.

4. Is there a difference in barriers and levers according to area of work (ward or department)? There were few significant differences in means according to area. Those that existed were all in relation to staff working in several areas of the hospital. Staff working in several areas had higher means for all questionnaire capabilities (moderate effect). This is in concordance with the findings of the qualitative study presented in Chapter 3 where staff reported difficulties where they worked in several areas of the hospital. These findings may also link with doctors having scored significantly higher means than other practitioners. Doctors often work on several different wards as well as the out patient department and in some cases the operating theatre.

The literature does not identify greater barriers to staff working in any particular area but does identify that practitioners have been observed to be less compliant with hand hygiene if they work in intensive care units, surgical units or accident and emergency departments (Pittet et al., 2004). It is thought that this may be associated with the higher frequency of hand hygiene required in these areas (Pittet et al., 2004). Staff working in these areas did not score significantly higher means than other areas, despite the instrument item "the frequency of hand hygiene required makes it difficult for me to carry it out as often as necessary" in the domain *"beliefs about capabilities"*. However, staff working in several areas and staff working in accident and emergency departments scored highest within this domain.

Barriers to hand hygiene differ to a greater extent according to occupational group than to NHS trust or area of the hospital within which a practitioner works. It could therefore be tentatively suggested that when tailoring strategies, this may be best done according to occupational group rather than the ward or department within which the practitioner work.

5.7.3. Strengths and limitations of the study

This study has produced a theory based instrument designed to identify barrier and levers to hand hygiene, and allow the tailoring of implementation strategies. This is an area of implementation that is prioritised and yet currently under-researched. This study has also added to what is known about the barriers and levers to hand hygiene according to occupational group and area of work.

However, there are some shortcomings associated with this study which should be identified. Although the instrument developed and reported here was tested for validity and reliability it has not been tested in terms of its ability to allow the tailoring of theoretically based implementation strategies according to assessed barriers and levers. A further study was designed and is reported in Chapter 6 to start to address this deficit.

The domain *"skills"* had only three barriers or levers assigned to it during the Delphi survey (reported in Chapter 4). It was considered that *"knowledge"* and *"skills"* and related training are likely to overlap with regard to hand hygiene (presented in section 5.3.1.). As a result the two domains were combined. The resulting domain contained three items, "there are adverts or newsletters about hand hygiene in my workplace", "hand hygiene training is available to me" and "hand hygiene guidelines are easily accessible". It is questionable whether these items actually reflect the absence or presence of skills as all three refer predominantly to information and knowledge (although it is expected that any training programme relating to hand hygiene would include a skills component).

Items rating knowledge did not correlate with questions testing knowledge. This could be due to hand hygiene being perceived as being "easy" by health care practitioners. The qualitative study (Chapter 3) demonstrated that participants generally believed they were capable of competently performing hand hygiene according to guidance (section 3.3.2.). Hand hygiene may be seen as a practice that does not require extensive knowledge as it is not a practice carried out only by health care practitioners but also by non-practitioners such as members of the public. When tested practitioners do not score as highly as perhaps they would expect. However, this could also be due to the knowledge test questions and the knowledge items measuring different aspects of knowledge, the former testing knowledge and the latter asked practitioners to express an opinion on availability of sources of knowledge rather than actual knowledge. For this reason both sets of questions were considered worth keeping. This is discussed further in section 7.4.

Although, overall, there were a good range of participants included in all three rounds of instrument testing (in terms of role and area of work), rounds one and three involved only small numbers of participants (n=56 and n=50 respectively) so it is likely that there are some practitioner groups and areas that were not represented in these rounds. Furthermore, only 7.1%of participants in round one were male which is unlikely to be representative of the population from which the sample were drawn.

When discussing differences between the occupational groups there were two limitations. Firstly, it is important to state that where there is a large sample size, quite small differences can become statistically significant (Field, 2005, Pallant, 2001). For this reason, eta squared calculations were carried out to estimate effect size. Secondly, in this sample there were small numbers of porters (n=9), domestic staff (n=8) and administrative staff (n=10). Further research with greater numbers of participants from these groups and other groups is recommended as these practitioners make up a large proportion of the hospital workforce.

This study identified greater barriers to practitioners working in several areas of the hospital than those working in other areas. For the purposes of this study it was not possible to investigate according to specific ward or department as the study was spread over four NHS trusts, and it is unlikely that more than one or two participants responded from any one particular ward or area. Differences in barriers and levers according to specific ward or department is an area that requires further research investigation, when considering on what basis to tailor interventions.

5.8. Conclusions

The instrument developed here is designed to allow the tailoring of theoretically based implementation strategies according to the assessed barriers and levers to hand hygiene. The potential implications of this are improved hand hygiene practice and the resulting effects on the human and financial costs of HCAI.

However, although tested for validity and reliability, this instrument has not been tested with regards to tailoring and implementing strategies and further research needs to be carried out in order to assess this, ideally in a randomised controlled trial (RCT). Such a trial is outside the scope of this research, being costly, time consuming and labour intensive. However, in line with the guidelines for complex interventions (Medical Research Council, 2008) a study was designed to assess the feasibility of such a trial. A small study assessing barriers and levers to hand hygiene practice and tailoring implementation strategies accordingly is presented in Chapter 6.

CHAPTER 6 TAILORING INTERVENTIONS ACCORDING TO ASSESSED BARRIERS AND LEVERS TO HAND HYGIENE: A FEASIBILITY STUDY

6.1. Introduction

Chapter 5 described the process by which The Barriers and Levers to Hand Hygiene Instrument (BALHHI) was developed in three rounds. Although tested for validity and reliability, this instrument had not been tested with regards to tailoring theoretically based implementation strategies according to assessed barriers and levers. This chapter describes a feasibility study conducted with a group of junior doctors in an NHS hospital trust in the north of England. The purpose of the study was to assess whether interventions could be tailored according to the barriers and levers assessed using the BALHHI and to establish the potential effectiveness of such an approach. Such a study is considered a necessary first step, prior to conducting a randomised controlled trial (RCT) when developing and evaluating gating complex interventions (Medical Research Council, 2008).

The chapter begins by stating the aim of the study and background information supporting this aim is presented. Research methods and results are reported in two phases. Firstly the methods for, and the results relating to, assessing barriers and levers to hand hygiene for junior doctors are presented. Following this, the methods used to tailor and design theoretically based interventions are presented, followed by the results for the effect this had on doctors hand hygiene as measured by audit. This chapter ends with a discussion of the findings and conclusions.

6.1.1. Study aim

To carry out a feasibility study using the instrument to assess whether theoretically based interventions can be tailored according to assessed barriers and levers to hand hygiene and to establish the potential effectiveness of such an approach.

6.1.2. Background

Chapters 3, 4 and 5 outlined the process by which the BALHHI was achieved. However, although tested for validity and reliability (presented in Chapter 5), the BALHHI had not been tested with regards to tailoring theoretically based implementation strategies according to assessed barriers and levers or the potential effectiveness of such an approach.

In line with the guidelines for complex interventions (Medical Research Council, 2008) a smaller scale study was designed to assess the feasibility of a trial. Complex interventions are defined as those with several interacting components (Medical Research Council, 2008). Medical Research Council (MRC) produced a framework for the development and evaluation of RCTs for such interventions (MRC, 2008, Craig et al., 2008). These guidelines suggest that having explored relevant theory and the components of the intervention a feasibility study should be carried out. This step is described as being "the crucial" stage prior to an RCT, providing vital opportunity to explore the feasibility of components of a larger main trial, in particular, defining the intervention (MRC, 2008).

In October 2009, after presenting to an Annual Research and Clinical Governance Conference in an NHS hospital trust in the North of England, the investigator was approached by the Executive Medical Director (MD) of the trust and asked to consider using the BALHHI (which was still in development at the time) within the trust. Hand hygiene audits within the trust had demonstrated that junior doctors were less compliant with hand hygiene than other health care practitioners. After discussion within the research team, it was decided that this would provide an ideal opportunity for a feasibility study.

Designing theoretically based interventions based on assessed barriers and levers to hand hygiene

In Chapter 2 (section 2.3.3.) the history and effectiveness of the use of theory in changing behaviour, the problems associated with a theoretical approach and the potential solutions brought to these by the BPS framework were discussed. However, there is still a dearth of research testing the use of this framework.

Chapter 3 presented the only three studies identified that had used the BPS framework to assess the barriers and levers to evidence based practice (EBP) (Michie et al., 2004, Michie et al., 2007, Francis et al., 2009). All three studies found this framework to be effective and suggested that tailoring implementation strategies based on this theoretical assessment of barriers and levers should be possible. However, no study was identified that had taken the next step, that is, to design strategies based on theoretically assessed barriers and levers to EBP, although, there is some work underway. For example, one study protocol describes the intention of researchers to test the effectiveness of theory based interventions for implementing lower back pain guidance in primary care (McKenzie et al., 2008). These researchers intend to carry out a cluster RCT of general practices in which the control group receive the lower back pain guidance while the intervention group will receive interventions tailored to the barriers and levers identified following assessment of these using the BPS framework.

Although, not related to the implementation of evidence based practice, rather a population health intervention, one study was found where behaviour change interventions were designed according to the BPS framework to improve hand hygiene practice. Judah et al. (2009) designed interventions to improve hand hygiene among the general public according to the BPS framework (and according to the formative studies that contributed to the framework). They monitored hand hygiene compliance within public toilets at motorway service stations in the UK based on numbers entering the toilets (counted by motion sensors) and soap usage. A group of 13 health psychologists and marketing specialists designed two text sentences per domain designed to change hand hygiene behaviour (seven of the original 11 domains were used for this study). These were displayed on electronic display boards at the entrance of the public toilets. The two sentences for each domain were displayed for one hour in turn. Soap usage per person significantly increased irrespective of which message the public were exposed to (although the extent of improvement differed slightly between domains). Although interventions were not tailored, rather they were implemented on a population basis, this study demonstrates the potential for designing effective interventions according to the BPS framework.

In order to move from assessment of barriers and levers to tailoring implementation strategies two psychologists recently carried out a review of the relevant literature and identified a set of distinct, theory-linked definitions of behaviour change techniques (Abraham and Michie, 2008). Examples of these techniques include graded tasks, rehearsal of relevant skills, social processes of encouragement, pressure and support and information regarding the behaviour and the outcome of behaviour. This was developed further and behaviour change techniques were linked to the theoretical constructs forming the 11 domains (behavioural determinants) of the BPS framework (Michie et al., 2008b). That is, each technique was considered as to whether or not it would be effective as part of an intervention to change according to each domain. A group of four behavioural psychologists rated 35 techniques according to the 11 psychological domains. They were asked to answer the question "Which techniques would you use as part of an intervention to change each domain?" The possible answers were: 0 = No, 1 = Possibly, 2 = Probably, 3 = Definitely. Responses were collated and techniques were mapped against domains where there was "agreed use", "uncertain" use, "agreed non use" or "disagreement" amongst the expert panel. As a result there was at least one technique per domain that was agreed by the panel to be effective in changing behaviour. This taxonomy of behaviour change techniques (Abraham and Michie, 2008) and their agreed use within domains (Michie et al., 2008b) formed the basis for pragmatic interventions designed for the feasibility study reported here.

6.2. Methods

This was a two phase study. In this section, 6.2., the methods that were used in both phases will be presented. Following this the study will be presented in chronological order, in section 6.3. the methods relating to the assessment of barriers and levers to hand hygiene are presented, followed, in section 6.4 results from that part of the study. In section 6.5. the methods relating to the tailoring and implementation of interventions are presented followed by the results of this in section 6.6. Finally the entire study will be discussed in section 6.7.

6.2.1. Research Ethics

Ethical approval was achieved as detailed in section 3.2.1. A substantial amendment was sought and achieved from the National Research Ethics Service (NRES), Leeds East Committee, to include this feasibility study in December 2009. Research Governance approval was obtained from the NHS trust involved in this study prior to commencement. For paperwork see appendix 1.

6.2.2. Participants

All junior doctors (foundation level one (FY1), n=21) at an NHS hospital trust in the North of England were approached to take part in the study. Consideration was also given to including doctors from foundation level two however, after discussion with the Deputy Medical Director (Post Graduate Tutor) it became clear that this group of doctors was not expected to attend training in the months running up to them leaving the NHS trust and that therefore, recruitment of this group would be difficult given the time scale of the study. A decision was therefore made to focus on FY1 doctors.

6.2.3. Design

A feasibility study was designed based on audit. In the field of the implementation of EBP; such studies are often used to measure the effectiveness of interventions (Grimshaw et al., 2000). The benefit of this type of study is that they are simple to conduct and are superior to observational studies. Their weakness is in evaluating changes to practice and due to confounding by the Hawthorne effect (defined in Chapter 3, section 3.3.2.). However, the primary purpose of this study was to assess whether theoretically based interventions can be designed, tailored and implemented according to assessed barriers and levers to hand hygiene, and the design was therefore considered appropriate.

Figure 6.1. shows a flowchart of the entire study process. This process is based around the stages identified in McEachan et al. (2008) a study where

interventions were mapped to develop a worksite physical activity intervention. The study design involved the following key components which are presented in turn.

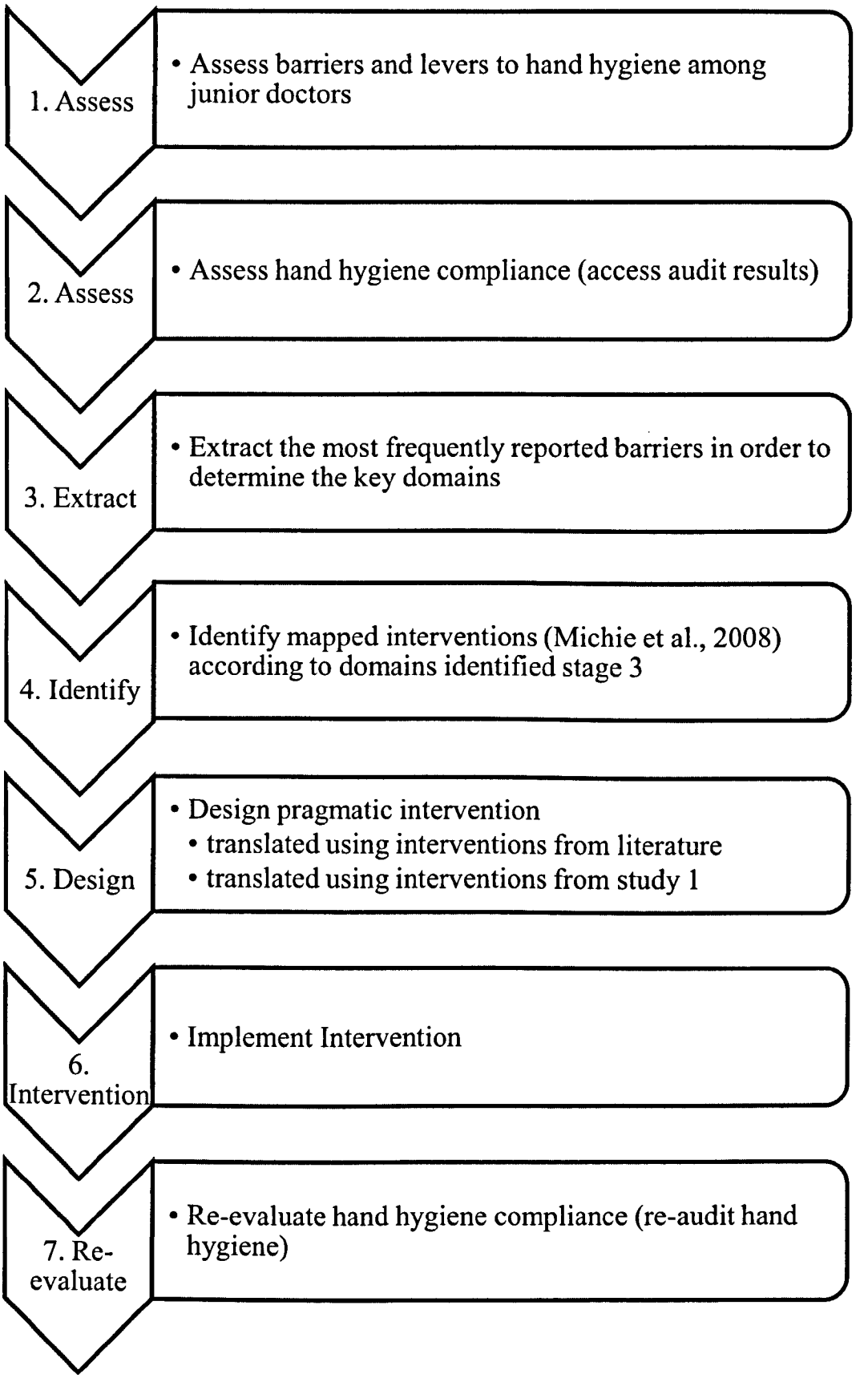
Phase one:

1. Assessing barriers and levers to hand hygiene;
2. Assessing baseline hand hygiene compliance;
3. Extract the most frequently reported barriers and determine key domains;

Phase two:

4. Identify mapped interventions;
5. Design pragmatic interventions (with input from users);
6. Implement interventions;
7. Re-evaluate hand hygiene compliance.

Figure 6.1. Flowchart Demonstrating the Study Process



1. Assessing barriers and levers to hand hygiene In Chapter 5 the design and testing of the BALHHI was reported. In using the instrument practitioners are asked to rate "strongly agree" to "strongly disagree" for a set of items. Each item represents a barrier and lever to hand hygiene. For example if a participant "strongly agreed" that "I have sufficient knowledge about hand hygiene" this was considered a lever. If they "strongly disagreed" this was considered a barrier. Items have been validated within the 11 domains of the BPS (British Psychological Society) framework (Michie et al., 2005). Each domain of the BPS framework represents a determinant of behaviour change. The questionnaire distributed to junior doctors in this feasibility study was at the beginning of second stage of testing (see section 5.4.2. and instrument draft 2 appendix 18). In the second stage of testing construct validity was established. Confirmatory factor analysis was performed to test whether items fit within the domains to which they were allocated during the Delphi survey. The initial model was tested, items were removed and the model was retested until a good level of fit resulted. Although it would have been preferable to distribute the final instrument, after this process, time would not allow for this. Junior doctors came to the end of their period of employment within the trust in July 2010 and the BALHHI would not have completed all three rounds of validity testing until after this time. This was taken into account during analysis of completed questionnaires and is discussed in greater detail in section 6.3.2.

2. Assessing hand hygiene compliance This feasibility study was not designed to evaluate the effectiveness of tailoring theoretically based interventions according to assessed barriers and levers, however, it was considered useful to have some measure of the potential effectiveness of such an approach. Direct observation of health care practitioners during patient care activity by a trained and validated observer is recognised as the gold standard for hand hygiene monitoring (World Health Organisation, 2009, Boyce and Pittet, 2002). However, direct observation is demanding and requires observers that have the relevant training skill and experience (Sax et al., 2009).

> *"An ideal indicator of hand hygiene performance would produce an unbiased and exact measure of how appropriately HCWs"* (Health Care Workers) *"practice hand hygiene. Ideally, this would require a technology that does not interfere with the behaviour of those being observed, assesses the microbiological outcome of each hand hygiene action in real time, and reliably captures each moment requiring hand hygiene even during complex care activities. . . . . today, such an ideal method does not exist".* (Sax et al., 2009)

For pragmatic reasons, a compromise was made. Hand hygiene audits were routinely carried out within the NHS hospital trust and were available according to occupational group. Audits were carried out by a practitioner (usually a nurse)

observing other practitioners working in or visiting their ward or department. It was decided to use these audits as a baseline from which to measure changes or otherwise to hand hygiene. Eighty observations were expected from each ward and department per month. The number relating to doctors depended entirely on how often a doctor visited a ward and whether that visit happened to be during a period of auditing. However, historical hand hygiene data indicated that between approximately 300 and 500 hand hygiene opportunities in doctors would be observed per month. It is well documented that hand hygiene audits are subject to the Hawthorne effect (Eckmanns et al., 2006), however, as these were taking place both before and after the intervention it was expected that any bias would be non-differential (would apply to before and after the intervention and the effect size would be unaffected).

Figure 6.2. shows the audit tool used in the NHS trust within which this study took place. A member of hospital staff (usually but not always a nurse) on each ward and in each clinical department stood with a clipboard and observed hand hygiene practice of the health care practitioners around them. For each patient care episode observed a record is made of whether or not the practitioner cleaned their hand before and after contact and the designation of the staff being observed.

Figure 6.2. Hand Hygiene Audit Tool[1]

Hand - Hygiene Observation Sheet: target of 80 per month

Ward/Unit: _____ **Month:** ☐☐ / ☐☐ / ☐☐
dd/mm/yy

Patient care episode number	Did the health care provider cleanse hands with soap or alcohol gel **before** contact?	Did the health care provider cleanse hands with soap or alcohol gel **after** contact?	Designation of staff being observed?
1	☐ Yes ☐ No	☐ Yes ☐ No	☐ DR ☐ RN/RM ☐ HCSW ☐ Other
2	☐ Yes ☐ No	☐ Yes ☐ No	☐ DR ☐ RN/RM ☐ HCSW ☐ Other
3	☐ Yes ☐ No	☐ Yes ☐ No	☐ DR ☐ RN/RM ☐ HCSW ☐ Other
4	☐ Yes ☐ No	☐ Yes ☐ No	☐ DR ☐ RN/RM ☐ HCSW ☐ Other
5	☐ Yes ☐ No	☐ Yes ☐ No	☐ DR ☐ RN/RM ☐ HCSW ☐ Other
6	☐ Yes ☐ No	☐ Yes ☐ No	☐ DR ☐ RN/RM ☐ HCSW ☐ Other

[1] RN/RM refers to registered nurse or midwife, HCSW refers to healthcare support workers and other refers to any other health care practitioner attending the ward

3. Extract the most frequently reported barriers and determine key domains As reported above, the instrument was only in the second phase of testing at the time of this study. Therefore, first of all, where necessary, items were reversed so that 1 always represented a lever (or the absence of a barrier) and 7 always represented a barrier (or the absence of a lever). Then, to ensure internal consistency of items per domain, Cronbach's alpha was calculated and items demonstrating a poor fit (alpha less than 0.6) were removed. This is reported in full in sections 6.3.2. analysis and 6.4. results.

Following this, the means for instrument items were calculated according to each of the domains of the framework. Domains with the highest means equated to barriers to hand hygiene and interventions were tailored to these key domains.

4. Identify mapped interventions The taxonomy of behaviour change techniques (Abraham and Michie, 2008) was examined in order to understand the definitions and principles of the techniques listed. These have been mapped to the domains of the BPS framework (Michie et al., 2008b). Only behaviour change techniques where there was "agreed use" were selected as the basis for the interventions in this study. For example a technique with "agreed use" for addressing *"knowledge"* barriers is "Information regarding behaviour and outcome" and one for addressing *"skills"* barriers is "Goal target specified: behaviour or outcome". Figure 6.3. includes all identified techniques with "agreed use" for the domains *"Knowledge and Skills"*.

Figure 6.3. Worked example of designing interventions for the domain knowledge and skills (including interventions with "agreed use" from the taxonomy of behaviour change techniques)

Items	Interventions suggested from the taxonomy (Michie et al. 2008)	Pragmatically translated for educational meeting format using: 1. strategies from the literature 2. the qualitative study presented in Chapter 3 3. the individual items of the instrument
18. I have sufficient knowledge about hand hygiene 21. There are adverts or newsletters about hand hygiene in my workplace 24. I have sufficient skills for hand hygiene 41. Newly qualified staff have not been properly instructed in hand hygiene 51. Hand hygiene guidelines are easily accessible 67. Hand hygiene training is available to me	1. Information regarding behaviour and outcome	Presentation of relevant knowledge/information
	2. Goal target specified: behaviour or outcome	Interactive activity. Letters written to be sent to all junior doctors in the country with what is expected of them in relation to hand hygiene
	3. Monitoring self-monitoring	"Offenders" doing the hand hygiene audits, glow and show box.
	4. Rewards/incentives	Certificates for groups/departments Awareness of good audit results Awareness of HCAI rates
	5. Graded task, starting with easy tasks	Glow and show box
	6. Increasing skills: problem solving, decision making, goal setting	Workshop discussions, identify times of difficulty and suggesting solutions
	7. Rehearsal of relevant skills	Glow and show box
	8. Modelling/demonstration of the behaviour by others	Demonstration of Ayliffe technique Posters demonstrating the steps of good hand hygiene
	9. Homework	To apply hand hygiene in practice
	10. Perform behaviour in different settings	Practice in the workshop with glow and show discuss different settings

5. Design pragmatic interventions Having identified effective behaviour change techniques, these needed translating into pragmatic implementation strategies. A list of hand hygiene improvement strategies was compiled from the review of the literature (Chapter 2) and from the qualitative study (Chapter 3). Figure 6.4. summarises these. Where possible these were matched to the behaviour change techniques listed in the taxonomy. The result was, for each domain, a list (or at least one) behaviour change technique with "agreed use" (Michie et al., 2008b) linked to a list of pragmatic strategies that could be implemented within the hospital environment with the target group of practitioners, the junior doctors. This was discussed and agreed amongst the research team (including RL a contributor of the BPS framework). In addition to these currently used or reported implementation strategies, the items within the domain were examined and potential strategies were considered that may address the particular barrier identified in the item. For example, should participants disagree that "hand hygiene guidelines are easily accessible" a potential solution would be to make them more accessible. A worked example of this process for the domain *"knowledge and skills"* is presented as an example in Figure 6.3. The domains *"knowledge"* and *"skills"* were combined during questionnaire testing due to the overlap of these two elements within the field of hand hygiene. The rationale is presented in full in Chapter 5, section 5.3.1.

Figure 6.4. Summary of interventions identified from the literature and from study 1 (Chapter 3)

Intervention used in Implementation of Evidence Based Practice Overall (literature)	Interventions used to improve Hand Hygiene (literature)	Interventions used to improve Hand Hygiene (study one)
Leaflets, guidelines, audiovisual, electronic, reminders	Guidelines, posters,	Guidelines, posters, audiovisual, adverts, newsletter, infection prevention notice boards
Educational meetings/workshops, training in the practice setting	Educational meetings	Educational meetings/workshops, training, e-learning, "glow and show" light box
Outreach visits		Support/advice from IPC team
Opinion leaders		Opinion leaders, support/advice from the IPC team, name and shame, good role models, HH champions, "link" practitioners
Patient mediated	Prompts from patients	Prompts from patients
Audit and feedback	Audit and feedback	Audit and feedback, certificate for good practice,
Multifaceted strategies	Multifaceted strategies	Multifaceted strategies, unusual strategies
	Widely available gel, individuals carry gel, hand cream	Widely available gel, individuals carry gel, hand cream
	Sustaining interventions	
	Availability of facilities, sinks and HH equipment	Availability of facilities, sinks and HH equipment

6. Implement interventions The first consideration toward creating strategies to improve hand hygiene was that they would be acceptable to the group in question and to the NHS hospital trust generally. The researcher was fully informed as to the strategies usually carried out to improve hand hygiene as a result of the review of the literature (reported in Chapter 2) and the qualitative study (reported in Chapter 3). The doctors included in the study were required to attend monthly educational meetings and it was therefore decided to use these meetings to deliver the interventions. Interventions therefore needed to fit this educational meeting format. There are few evaluations of the effectiveness of educational meetings, but evidence suggests they are more effective if they are interactive (Grimshaw et al., 2004b), carried out with small groups (Grimshaw et al., 2004b), integrated with the relevant clinical practice (Coomarasamy and Khan, 2004) and involve an opinion leader (Thompson et al., 2007). Additionally, strategies are more likely to be successful if the relevant practitioners feel a sense of "ownership" with the guidelines or practice

(Cheater and Closs, 1997, Cranney et al., 2001, Rycroft-Malone, 2002, Elwyn et al., 2007). These strategies were adopted for the purpose of this study as follows.

Interactive: Participants were asked to engage in an activity that required them to interact with one another and feed back to the whole group.

Carried out with small groups: Those attending the educational meeting were be split into three of four smaller groups.

Integrated with the relevant clinical practice: The doctors engaged in the practical activity of hand hygiene during the educational meeting.

Involve an opinion leader: The deputy MD (also the post-graduate tutor for this group of doctors), a qualified and eminent health psychologist and a specialist from the IPC team contributed to the educational meeting. It was decided that the interventions would take place within two, booked educational meetings, to be held in June 2010.

Ownership: Doctors were asked to design interventions that they considered would be effective within the trust and the trust subsequently adopted these.

The resulting interventions are presented in section 6.5. Two educational meetings were booked in June 2010. The meetings were presented by the investigator (JD, who is also a nurse), a Health Psychologist and contributor to the BPS framework (RL), an Infection Prevention and Control (IPC) specialist working within the trust and the Deputy MD within the trust.

These sessions involved interventions designed for four domains. The domain *"knowledge and skills"* (as knowledge is a necessary prerequisite to any implementation strategy (Grimshaw et al., 2001, Wensing et al., 2005b, Robertson and Jochelson, 2006)), and the three domains, which upon assessment, were identified as being the greatest barriers to hand hygiene (see section 6.3.2.).

In addition to these meetings, the MD and IPC team within the NHS trust agreed to implement any further suggestions made by the research team. This was in order to continue influencing doctors hand hygiene after the educational meetings and, potentially influencing junior doctors who were unable to attend the educational meeting. It was decided that as part of the intervention, the doctors would be given a brief summary of each of the three domains within which their particular barriers to hand hygiene fell. They would also be given a summary of the behaviour change theory relevant to those particular domains. They would then be asked to put together a list of strategies that the NHS hospital trust could implement that would support the hand hygiene of doctors. Although this was a valuable part of the

intervention overall, the interventions would not be implemented until the doctors involved ended their period of employment and a new group of doctors would be employed at the trust.

Finally, an educational meeting based intervention for each of the relevant domains of the BPS framework was designed. Figure 6.3. demonstrates a worked example of this process. The specific interventions related to assessed barriers and levers are presented in section 6.5.

7. Re-evaluate hand hygiene compliance For the group of doctors involved in the study, hand hygiene audits were to continue throughout this period and for one month after completion of the intervention (after which the doctors were to leave the NHS trust). Hand hygiene audits were monitored after this time to assess any influence the strategies suggested by doctors and subsequently implemented by the trust may have had.

6.3. Methods: Assessing barriers and levers

6.3.1. Participants

All junior doctors (FY1, n=21) at an NHS hospital trust in the north of England were approached to take part in the study.

6.3.1. Procedure

Assessing barriers and levers to hand hygiene

The medical secretary (of the MD) distributed questionnaires (draft instrument 2, appendix 18) on behalf of the investigator. A postal questionnaire was sent to each junior doctor (n=21) along with a covering letter (appendix 16) which identified the purpose of the study, the value of the participants contribution and asking them to complete and return the questionnaire within 7 days in the freepost envelope provided. The MD added a further covering letter to all junior doctors emphasising the importance of the study and his support of the research (appendix 19). Only five questionnaires were returned. Email reminders were sent out by the MD to all junior doctors in order to improve recruitment which resulted in no further questionnaires being returned. The researcher therefore attended one of the routine educational meetings held for the doctors and asked them to complete the questionnaire. In total 19 questionnaires were completed.

Assessing hand hygiene compliance

Good links had been made with the IPC team at this NHS trust and after collating data from all wards and departments in the hospital hand hygiene compliance figures were made available to the research team to include data for the

years before, during and after the study. These were broken down by staff group, in particular, identifying the hand hygiene of doctors.

6.3.2. Analysis

Data were entered onto SPSS v. 17.

1. Data for items in the BALHHI were turned to ensure that 1 always represented a lever and 7 a barrier.

The instrument was at round two stage of development when it was sent out to junior doctors (Chapter 5, section 5.4.). No testing had been carried out for internal consistency or construct validity. At this stage of testing only 317 questionnaires had been returned. It was therefore not possible to carry out construct validity tests as this required a minimum sample size of 340 (see Chapter 5, section 5.4.2.). However, it was possible to test the instrument for internal consistency.

2. Internal consistency was carried out using Cronbach's alpha. Internal consistency refers to the degree to which the items that make up a scale fit together (Field, 2005, Pallant, 2001). Ping (2004) suggests a Cronbach's alpha of 0.6 or greater indicates a reasonable level of fit.

3. Means and standard deviations for questionnaire items were calculated for each domain in order to establish which domains presented the greatest barriers to hand hygiene for junior doctors.

4. The knowledge test questions were examined for the percentage and number of items marked correct by doctors.

5. The domain *"knowledge/skills"* and the top three domains proving barriers, as identified by domain means were selected as the basis for interventions to improve the hand hygiene of this group of junior doctors. The decision to select three domains was made for two reasons. Had the intervention been delivered to individuals, less domains may have been chosen, however as this was a group intervention, it was decided to err on the side of caution, and select more than one domain. The second reason was for purely pragmatic purposes; three (plus a knowledge component to the intervention) was as many as could be carried out in two, hour long educational meetings.

6.4. Results: Assessing barriers and levers

Cronbach's alpha was calculated for each domain and 17 items were removed as they reduced the alpha within their respective domains. Items were removed as necessary to achieve as close to 0.6 as possible. Table 6.1. demonstrates the Cronbach's alpha for each domain, items that were removed and subsequent alpha

calculations. Items in bold with an asterix represent those that fit within two domains at this stage of testing and correspond with items in Figure 5.2., Chapter 5.

Table 6.1. Cronbach's alpha for each Domain and Items Removed as a Result

Domain	Item Number (From Instrument Round Two)	Cronbach's Alpha with all items	Item(s) removed	Cronbach's Alpha after Removing Item(s)
Knowledge and Skills	18, 21, 24, 41, 51, **67***	0.42	41	**0.67**
Professional role and identity	7, 16, 22, 23, 25, **35***, 53, **67***	0.40	22 23 **67***	0.45 0.48 **0.57**
Beliefs about capabilities	13, 29, 33, 46, 60, 64	0.48	64	**0.53**
Beliefs about Consequences	8, 17, 49, 52, 56, 66, 68	0.54	17 52	0.59 **0.64**
Motivation and goals	9, 26, 31, 48, 61, 69, 72	0.44	72 26 48	0.49 0.56 **0.63**
Memory attention and decision process	10, 12, 30, **47***, 58, 62	0.58	**47***	**0.67**
Environmental context and resources	37, 43, **47***, 50, 55, 63, 65, 70, 73	0.30	**47*** 55 65 50 73	0.35 0.43 0.52 0.57 **0.62**
Social Influences	15, 20, 28, **35***, 38, 40, 42, 44, 71, 74	0.53	**35*** 74	0.56 **0.60**
Emotion	14, 19, 27, 36, 39	0.63		**0.63**
Action Planning	11, 32, 34, 54, 57, 59,	0.68		**0.68**

Figure 6.5. demonstrates the items that remained after this process. The items presented in bold were included in the final questionnaire after all psychometric tests were carried out (reported in Chapter 5, Figure 5.6 and as seen in appendix 20). Items that are not presented in bold represent items that were removed during later stages of testing, but were included for the purposes of the study reported here.

Figure 6.5. Remaining items by domain

Domain		Item
1/2	Knowledge and skills	**There are adverts or newsletters about hand hygiene in my workplace** **Hand hygiene guidelines are easily accessible** **Hand hygiene training is available to me** I have sufficient knowledge about Hand Hygiene I have sufficient skills for Hand Hygiene
3	Professional role and identity	**I engage in hand hygiene out of respect for my patients** **Hand hygiene is a non-negotiable part of my role** **Hand hygiene is part of my professional culture** Hand Hygiene is embedded into my professional Practice Hand Hygiene is a priority for every single member of staff in this organisation irrespective of their role
4	Beliefs about capabilities	**There are some practical barriers to hand hygiene because of my particular job/role** **I am reluctant to ask others to engage in hand hygiene** **The frequency of hand hygiene required makes it difficult for me to carry it out as often as necessary** **I am confident in my ability to carry out hand hygiene** I feel positive about hand hygiene
5	Beliefs about conse-quences	**If I do not engage in hand hygiene I may catch an infection** **If I omitted hand hygiene I would blame myself for infections** **If I engage in hand hygiene it improves patient confidence** **If I miss out hand hygiene I will be subject to disciplinary action** If I do not engage in hand hygiene I may be named and shamed
6	Motivation and goals	**I feel complacent about hand hygiene** **I disagree with some parts of the hand hygiene guidelines** Sometimes I have more important things to do than hand hygiene Emergencies and other priorities make hand hygiene more difficult at times
7	Memory attention and decision process	**Sometimes I miss out hand hygiene simply because I forget it** **Hand hygiene is not second nature for me** **I am more likely to forget hand hygiene if I am tired** Hand hygiene is a habit for me Sometimes I am distracted from hand hygiene by the other things patients need
8	Environ-mental context and resources	**It is difficult for me to attend hand hygiene courses due to time pressure** **Some government targets make hand hygiene more difficult (such as high bed occupancy)** **My environment is cluttered** Facilities are inadequate for hand hygiene in my area of work
9	Social Influences	**When staff engage in hand hygiene they are praised** **I engage in hand hygiene because I do not want to let the team down**

		Supervision from senior staff means that carrying out hand hygiene is easier for me **My hand hygiene is encouraged by others** Peer pressure influences my hand hygiene It is difficult to prompt senior staff when they miss out hand hygiene Infection Prevention teams have a positive influence on hand hygiene My patients expect good hand hygiene from me
10	Emotion	**I feel angry if hand hygiene is not carried out by others** **I feel frustrated when others omit hand hygiene** **I feel guilty if I omit hand hygiene** **I feel ashamed if I omit hand hygiene** I engage in hand hygiene because I am embarrassed if we do poorly in hand hygiene audits
11	Action planning	**Government targets have led to improvements in my hand hygiene** **Hospital targets relating to infection or hand hygiene has led to improvements in my hand hygiene** **Some strategies designed to improve hand hygiene influence my practice** Hand hygiene audits are regularly carried out in my work place Feedback from audits encourages me to do good hand hygiene Improvement strategies that are unusual have a greater impact on my hand hygiene than those I am used to

Means and standard deviations were computed for each item and combined across domains to identify the domains representing barriers (listed in Table 6.2.). The higher the mean value, the more of a barrier the domain represented (1 being a lever or the absence of a barrier, 7 being a barrier or the absence of a lever). These were ranked according to the domain that represented the greatest barrier to junior doctors. The top three (as justified in section 6.3.2.) were selected as the basis for interventions for junior doctors. These were *"memory, attention and decision processes"*, *"social influences"* and *"motivation and goals"*.

Whilst the domain *"knowledge and skills"* was reported to pose the least barrier to doctors it was decided that this domain would also be selected for intervention. This was because, as discussed above, knowledge has been cited as a necessary pre-requisite to the implementation of EBP (Grimshaw et al., 2001, Wensing et al., 2005b, Robertson and Jochelson, 2006). Furthermore, only one doctor answered all of the knowledge test questions correctly (questions 76 to 82 on the instrument, appendix 18) indicating that self reports of knowledge may not be reliable. Two doctors got six questions correct, seven doctors got five questions correct, seven doctors got four questions correct and two doctors got only two

questions correct. Table 6.3. demonstrates how many doctors correctly answered each of the questions.

Table 6.2. Means (ranked by greatest barrier) of juniors doctors responses by domain (1 = lever, 7 = barrier)

Domain	Mean Score (SD)	Rank
7. Memory attention and decision processes	4.35 (1.23)	1
9. Social Influences	4.28 (1.08)	2
6. Motivation and Goals	4.27 (0.89)	3
4. Beliefs about Capabilities	4.07 (1.07)	4
8. Environment	4.05 (1.14)	5
5. Beliefs about Consequences	3.85 (0.93)	6
11. Action Planning	3.20 (1.30)	7
10. Emotion	3.05 (1.17)	8
3. Professional Identity	1.74 (1.12)	9
1. and 2. Knowledge Skills	1.73 (0.84)	10

Table 6.3. Numbers of doctors answering knowledge test questions correctly

Question Number	**Number of Questions Correct n=19**
76	17 (86%)
77	12 (63%)
78	18 (95%)
79	6 (32%)
80	18 (95%)
81	3 (16%)
82	12 (63%)

6.5. Methods: Tailoring and implementing interventions

6.5.1. Procedure

Interventions were designed according to the procedure outlined in section 6.2.3. for the domains *"knowledge and skills"*, *"memory"*, *"social influences"* and *"motivation and goals"* and took place within two educational meetings within the month of June 2010. Meetings, telephone conversations and email correspondence took place between the four people presenting within the sessions (the investigator, a Health Psychologist and contributor to the BPS framework, the Deputy MD and Postgraduate Medical Tutor and an IPC specialist) to ensure that all involved had a good understanding of the purpose of the sessions and their role within the session.

The first session consisted of giving the doctors information about the research overall, the development of the BALHHI and the aims of the feasibility study. The knowledge component of the intervention was also presented (see Figure 6.6. for intervention 1).

The second session consisted of delivering the interventions for the domains *"memory"*, *"social influences"*, *"motivation and goals"*. Figures 6.6. and 6.7. demonstrate the structure of the two sessions. The slides for the two sessions are in appendices 24 and 25 (on disc).

In addition to these two interventions, in the second session, doctors were informed of their top three barriers to hand hygiene identified by the BALHHI. The behaviour change techniques that mapped onto these barriers were also presented. Doctors were then asked to consider these when designing pragmatic interventions to help with hand hygiene practice. For example, for the domain motivation and goals, a definition was presented along with the mapped behaviour change techniques, one of which was information about the behaviour outcome. In response to this doctors suggested that hand hygiene audit information and HCAI rates would motivate them to better hand hygiene. All of their suggestions were subsequently implemented by the trust. All junior doctors were sent a letter by the MD to inform them that their suggestions were being implemented and thanking them for their contribution to the sessions (appendix 25).

Hand hygiene audits continued according to the NHS trust policy as described in section 6.2.3.

Figure 6.6. Intervention 1: Background to the study and the domain knowledge and skills

Intervention	**Rationale Interventions Agreed to be Effective (Michie et al., 2008b)**
Welcome and introduction of self and the rest of the research team	
Introduction to the session. Aims: • To tell them about the research • To talk about Hand Hygiene	
Why Hand Hygiene is important (HCAI, morbidity and mortality)	1. Information regarding the behaviour and outcome
The implementation of Hand Hygiene Practice and compliance (from the literature) • Show their own audit results and those of other practitioners within the trust • Show the Hand Hygiene Audit tool and talk about what is being observed and recorded by auditors	2. Goal/target specified 3. Monitoring
The aims of the research	
The objective of the feasibility study	
How can they help	
Knowledge as a pre-requisite to hand hygiene and knowledge and skills as one of the theoretical domains	
Present evidence with regard to the link between hand hygiene and HCAIs	1. Information regarding the behaviour and outcome
Summarise the session. Tell them what will happen in the next session. Thank them and ask them to complete feedback forms.	

Figure 6.7. Intervention 2: The domains knowledge and skills, memory attention and decision processes, social influences and motivation and goals

Intervention	Rationale Interventions Agreed to be Effective (Michie et al., 2008b) (relevant domain in brackets)
Welcome and introduction of self and the rest of the research team	
Introduction to the session. Aims: • Feedback the results from the questionnaires junior doctors completed within the trust • How theory can be used to change practice • How they can help change trust policy	Information regarding behaviour and outcome (knowledge, motivation)
Remind them what the questionnaire looked like – examples of questions	
Show them the 11 domains of the BPS framework within which items are categorised	
What their barriers were: "memory attention and decision processes", "social influences" and "motivation and goals".	Persuasive communication (social influences). Allow suggestions that fit into all relevant domains (knowledge and skills, motivation, memory, social influences)
Health Psychologist presents definitions each of these domains and presents strategies that are agreed to be effective at addressing these barriers	
Task: they are split into three groups and asked to suggest pragmatic strategies that they could adopt or the trust could implement that would help them with hand hygiene. Each group are given one of the three domains to work within.	
They feedback their suggestions to the rest of the group in a convincing manner. The investigator takes these suggestions to write up and present to the MD for implementation. (The MD subsequently writes to doctors informing them of this action).	To allow interventions to be hospital wide, influencing doctors that do not attend the educational meeting. Persuasive communication (motivation)
IPC specialist demonstrates the Ayliffe technique (Ayliffe et al., 1988)[2]	Increasing skills (skills) Modelling (social influences)
They split into two groups and each group nominate a volunteer. Both volunteers have their hands covered in ultra violet opaque "hand cream". One group asked to support their volunteer in washing their hands	Graded task starting with easy task (skills, motivation) Increasing skills (skills) Rehearsal of relevant skills (skills)

[2] The Ayliffe technique is a systematic process of hand hygiene practiced in many NHS trusts including the study trust

according the Ayliffe technique, one group asked to support their volunteer washing their hands in their own way. Hands will then be examined in the "glow and show" box to look at the effectiveness of each technique.	Perform behaviour in different settings (skills) Role play (motivation and goals) Goal target specified (knowledge, motivation)
Deputy MD operates the glow and show box and judges the best washed hands. Prize for the winner.	Rewards and incentives (knowledge, motivation and goals) Social processes of encouragement, pressure support (motivation, social influences)
Summarise the session. Tell doctors that their suggestions will be implemented by the trust. Thank attendees and ask them to complete feedback forms.	

6.5.2. Analysis: Measuring the potential effectiveness of interventions, hand hygiene audit results

The doctors involved in the study had been employed within the trust from 1st August 2009 to 31 July 2010. Hand hygiene audit results were available for all doctors (not just those involved in the interventions) for each of these months. No individual level data were available. Between 371 and 529 hand hygiene opportunities among doctors had been observed in each of the months from August 2009 to July 2010. However, it is not possible to know which doctors these were. Some doctors may not have been audited at all, some may have been audited several times. For this reason, inferential statistical analysis (e.g. repeated measures analysis of variance) was not appropriate and therefore frequency data are presented here.

6.6. Results: Tailoring and implementing interventions and the potential effectiveness of interventions

6.6.1. Tailoring and implementing theoretically informed interventions

Twenty one junior (foundation year 1) doctors employed at the NHS trust at the time of the study. Nineteen of these completed questionnaires. Eighteen junior doctors attended the first educational meeting/intervention and 15 attended the second educational meeting/intervention.

Figure 6.8. lists the interventions suggested by the doctors in session two. Interventions highlighted in bold were subsequently implemented by the NHS trust. The doctors were informed of this by letter from the executive MD. However, these additional strategies were not fully implemented until August 2010.

The two interventions that doctors particularly advocated were receiving information relating to hand hygiene audits and HCAI data according to wards and departments.

Figure 6.8. Strategies suggested by doctors and subsequently implemented by the NHS hospital trust

Domain	Suggestions for the NHS trust to adopt	Suggestions for junior doctors to adopt
Memory attention and decision processes	Pens to have "wash your hands" adverts on them **Hand gel on all trolleys including notes trolleys** **Change the HH signs that are displayed regularly and move signs around**	Poster competition
Social Influences	**More posters** **Doctors to be made aware of results of monitoring and bacteraemia rates** Prizes for most successful ward/department **Disapproval (particularly from ward sisters)**	Less apathy Modelling the appropriate behaviour for other doctors
Motivation and Goals	**Publish bacteraemia rates and infection rates broken down to ward level** **Targets to reduce these by an specified amount each month** **Routine use of the "glow and show" box** **Feedback from hand hygiene audits with comparisons of improvements made**	Free pens and gels Prizes for doctors with the best hand hygiene record Somewhere to put the notes and the gel when seeing patients on the wards

6.6.2. Potential effectiveness of interventions

Hand hygiene audits reported here potentially include all doctors employed within the NHS hospital at the time of the audit. Data from the recruitment officer at the NHS trust was able to report that approximately 249 doctors are usually employed by the trust. According to grade these as follows: foundation year one, 21; foundation year two, 21; senior trust levels one and two, 36; senior trust level three, 25; associate specialists, 34; consultant specialists, 112.

Table 6.4. shows the hand hygiene audit results for doctors employed the years before during and after the study. The times of questionnaire distribution and interventions are also indicated. The time at which the NHS trust subsequently

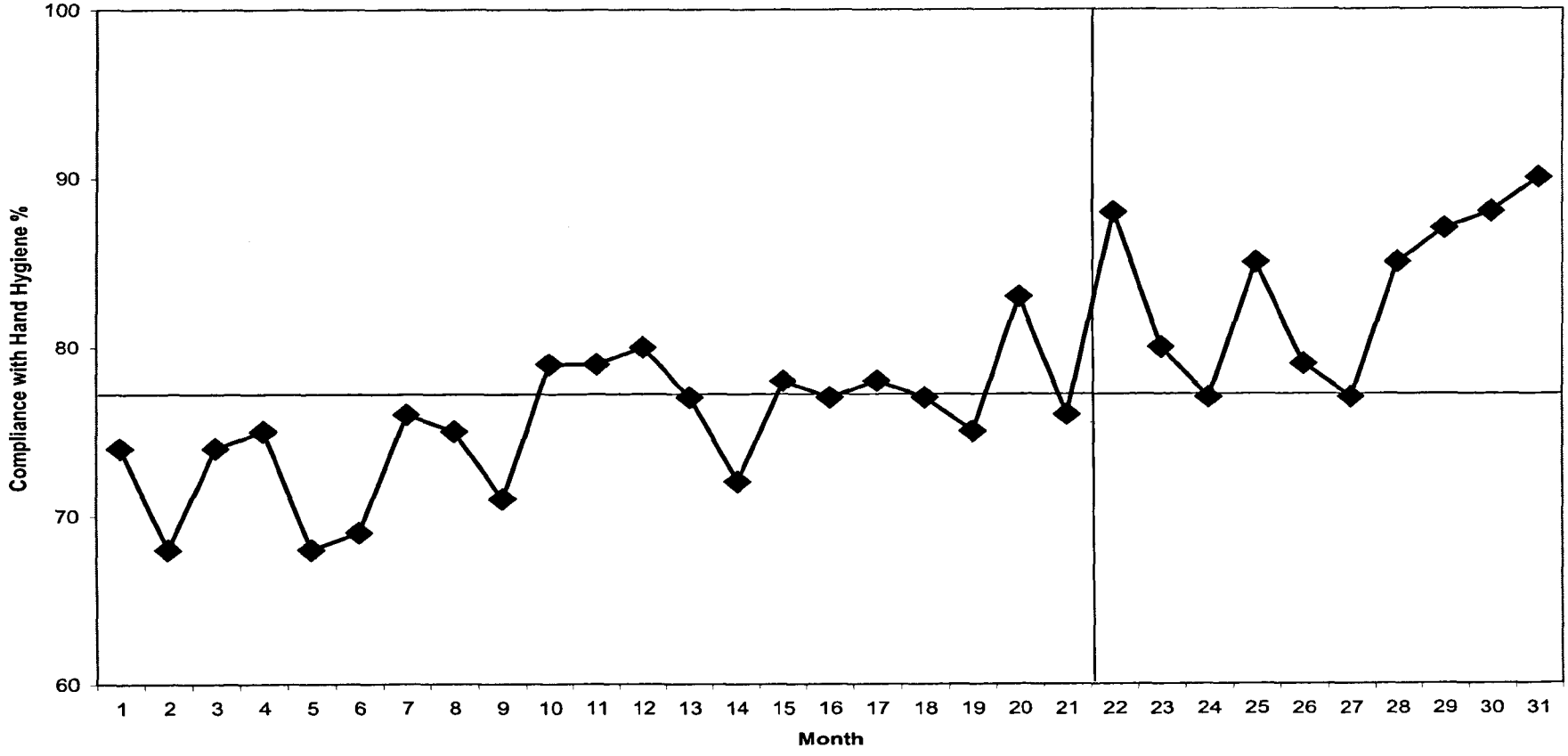
implemented further interventions suggested by the junior doctors (listed in Figure 6.8.) is also indicated. Hand hygiene compliance improved after the interventions were delivered. Cells shaded in grey indicate the time that the doctors involved in the educational meeting interventions were employed at the trust.

Figure 6.9 shows this information as a run chart. The horizontal line represents the mean value of all data points. The vertical line indicates the time that questionnaires were distributed. Hand hygiene compliance does appear to have improved since the study, however it is not possible to be confident that this is as a direct result of the intervention. This will be discussed in more depth in section 6.7.

Table 6.4. Hand hygiene audit results for doctors before, during and after the study

Month of Audit		Number of Hand Hygiene Opportunities	Number of times Hand Hygiene carried out	Compliance (%)	Notes
1	Aug 08	357	239	74	An average of 75% compliance in the months before questionnaire distribution
2	Sept 08	Unavailable	Unavailable	68	
3	Oct 08	Unavailable	Unavailable	74	
4	Nov 08	424	319	75	
5	Dec 08	311	211	68	
6	Jan 09	411	286	70	
7	Feb 09	305	231	76	
8	March 09	337	253	75	
9	April 09	447	319	71	
10	May 09	500	397	79	
11	June 09	500	397	79	
12	July 09	454	362	80	
13	Aug 09	413	319	77	
14	Sept 09	376	274	72	
15	Oct 09	425	331	78	
16	Nov 09	403	309	77	
17	Dec 09	371	291	78	
18	Jan 10	357	275	77	
19	Feb 10	460	343	75	
20	March 10	419	347	83	
21	April 10	455	349	76	
22	May 10	524	464	88	Questionnaires distributed
23	June 10	529	425	80	Educational meeting interventions implemented
24	July 10	424	327	77	At the end of July doctors moved on
25	Aug 10	521	447	85	Implementation of interventions suggested by doctors was complete
26	Sept 10	488	386	79	
27	Oct 10	517	398	77	
28	Nov 10	389	332	85	
29	Dec 10	527	457	87	
30	Jan 10	427	377	88	
31	Feb 10	495	446	90	

Figure 6.9. Run chart demonstrating hand hygiene compliance for junior doctors



6.7. Discussion

In this feasibility study the BALHHI was used with a group of junior doctors in an NHS trust in the North of England. Means for instrument items and domains were calculated. The top three domains proving to be barriers to hand hygiene for this group of practitioners were *"memory attention and decision processes"*, *"social influences"* and *"motivation and goals"*.

Interventions were designed to target to these three domains and the domain *"knowledge and skills"*. *"Knowledge and skills"* was added as an additional domain as it is considered a necessary prerequisite to the implementation of EBP (Grimshaw et al., 2001, Wensing et al., 2005b, Robertson and Jochelson, 2006) and because the doctors who completed the instrument scored poorly on the knowledge test questions included in the instrument. Interventions were designed according to the taxonomy of behaviour change techniques compiled by Abraham and Michie (2008) and to where these techniques had been mapped to the 11 domains of the BPS framework by Michie et al. (2008b). These mapped behaviour change techniques were converted into pragmatic strategies that were considered to be acceptable to the NHS trust and to the junior doctors included in this study. In order to do this strategies currently being used in the implementation of EBP and the implementation of hand hygiene practice were considered (according to the literature review carried out and reported in Chapter 2 and according to the qualitative study reported in Chapter 3). This appears to have been a successful strategy as the doctors engaged in the educational meeting based interventions with enthusiasm. During the interventions doctors were asked to suggest additional strategies that they could adopt themselves or that the trust could adopt to help them with their hand hygiene. A range of strategies were suggested, and the majority of these were subsequently implemented by the NHS trust (Figure 6.8. presents these).

Hand hygiene audit results were available for doctors for the entire period of the junior doctors being employed at the trust. These were used as a measure of hand hygiene compliance before, throughout and after the interventions were delivered. For the nine months prior to administering questionnaires hand hygiene compliance was an average of 77% amongst doctors. During the month the questionnaires were circulated for completion this rose to 88%. During the month the interventions were implemented compliance remained higher at 80%. For the seven months after the intervention hand hygiene practice hand hygiene compliance was an average of 83.5%. A number of discussion points arise from these findings.

In order to suggest a trend a run chart needs to have at least 25 data points (Bamford and Greatbanks, 2005). A trend is defined when there are eight

consecutive point above or below the mean; points that equal the mean should not be counted (Bamford and Greatbanks, 2005). There were eight points above the mean line after questionnaire distribution (discounting the points equal to the mean). However, interventions took place one month later, leaving only seven points above the mean line. So whilst the results look promising, a further elevated data point is required before firm conclusions can be drawn. From these early results however, it can be tentatively suggested that interventions, that is, the educational meetings and strategies implemented by the NHS hospital trust at the suggestion of junior doctors, appear have contributed to improvements in hand hygiene compliance. These results suggest that the BALHHI is feasible to use in practice as is the approach of tailoring to theoretically based interventions according to prospectively identified barriers and levers.

There was only one outlying result demonstrated on the run chart (Figure 6.9). In March 2010, before the study took place, hand hygiene compliance rose to 83%. There were no new initiatives going on within the NHS trust at that time. No other explanation was found for this result and it is therefore expected to be a product of chance.

The effectiveness of the interventions in improving hand hygiene cannot be concluded based on the small feasibility study reported here. However, this study demonstrates the potential effectiveness of such an approach as audit results for the doctors in the NHS trust improved during and after the intervention. It is of interest that the audit result for the month after the educational meeting interventions (but before the trust implemented interventions) demonstrated that compliance with hand hygiene amongst doctors went back down to 77%. This finding is consistent with other hand hygiene intervention studies. There was only one study found in review of the literature that described sustained improvements in hand hygiene practice (Pittet et al., 2000). The intervention was ongoing and the authors questioned whether this could be an indicator that hand hygiene implementation strategies do need to be ongoing if improvements in hand hygiene are to be sustained.

Another point of interest was, at the time of questionnaire distribution, no interventions had begun. Any improvement in hand hygiene at this time was likely to be due to the mere measurement effect; simply considering their hand hygiene is likely to have influenced doctors to comply more fully with hand hygiene guidelines (Godin et al., 2008).

Although firm conclusions cannot be drawn with regard to the effectiveness of interventions, due to the study design and insufficient data, what is of significance is that after only a short introduction (delivered by RL) to the three relevant domains of the BPS framework (those that were assessed to pose barriers to this group of

doctors) and an outline of theoretically based behaviour change strategies that have been mapped to these domains (Michie et al., 2005, Abraham and Michie, 2008, Michie et al., 2008) junior doctors were able to tailor theoretically informed pragmatic implementation strategies accordingly. This further validates the BPS framework.

Although this study was a small feasibility study it goes one step further than those reported in the current literature in not only assessing barriers and levers to hand hygiene but also in the subsequent development and implementation of tailored strategies according to the BPS framework. The study reported here found that the BPS framework along with the taxonomy of behaviour change techniques (Abraham and Michie, 2008) mapped to this framework (Michie et al., 2008b) made the process of tailoring theoretically based interventions according to assessed barriers and levers to hand hygiene a straightforward process for the research team and the junior doctors involved.

6.7.1 Strengths and limitations of the Study

The strength of this study is that it takes knowledge a step forward in considering a theoretical approach in not only the assessment of barriers and levers to hand hygiene but also in the tailoring of implementation strategies. It also contributes to the validation of the BPS framework.

However, the results of this study must be interpreted in the context that this was only a feasibility study. The results from this study are valuable in informing a larger study or an RCT in the future but findings relating to the effectiveness of the interventions cannot be generalised further due to the limited design and size of the study. Relevant issues are presented here.

One problem with design of the study is that there was no control for other influences on behaviour other than the intervention. However, sometime, evaluation takes place in settings that constrain the researchers; choice of intervention or evaluations (MRC 2008). MRC 2008 suggest that researchers need to consider carefully the trade-off between the importance of the intervention evaluation should still be considered "best available " methods even in if not theoretically optimal may yield useful results (Medical Research Council, 2008). Furthermore, it is also considered a sensible approach to carry out a convenient low cost study such as a feasibility study (Grimshaw et al., 2000). Any potential confounding was minimised by careful communication with the IPC team to ensure they had no new hand hygiene initiatives at the time of the study.

Another issue with the study design was the "varying" group of participants. Nineteen junior doctors completed the BALHHI, from which barriers and levers

were assessed and interventions tailored. Nineteen and fifteen respectively attended the two educational meeting interventions. Interventions designed by this group of doctors were subsequently adopted by the trust and delivered all doctors employed by the trust. Approximately 2000 patient episodes requiring hand hygiene were observed by auditors per month. Between 350 and 500 of these episodes observed the practice of doctors. Audits results were not available by individual doctor or by grade of doctor. Some of the doctors subject to audit may have been observed on several occasions and some not at all. Some doctors may have attended the educational workshops (before they left the trust at the end of July) the majority did not. Ideally, a study design where the same group are involved in interventions and audits would have been desirable.

This study tailored interventions according to occupational group rather than individually or according to area of work. There is some evidence that suggests that this may be effective, for example, Michie et al. (2007) questioned different groups regarding the implementation of NICE guidelines for schizophrenia. They used questions based on the BPS framework to ask key occupational groups responsible for implementing the guidance (social workers, nurses, psychiatrists, psychologists and team managers) about their barriers and levers to adhering to these. The authors found differences in barriers between different occupational groups and suggested that it may be effective to tailor strategies according to occupational group. In Chapter 5 differences in barriers and levers to hand hygiene were examined according to NHS trust, the area the practitioner worked and occupational group. The most significant differences were according to occupational group. This suggests that tailoring according to occupational group may be worthwhile.

The BALHHI was still in the second stage of development when it was completed by the junior doctors for this feasibility study. Internal consistency tests were carried out on 317 returned questionnaires (final participant number was 364). As a result of this, two items were removed that were later retained in the final instrument. Furthermore 19 questions were included at this stage that were later removed. Chapter 5 (section 5.4.5.) demonstrates that the instrument at this stage was not far out with expected parameters with regard to model fit, however further work was required to modify the instrument to achieve good fit. It is therefore possible that some barriers identified by doctors did not properly measure the domains that interventions were tailored to.

Finally, it was decided to select the three domains representing the greatest barriers for doctors. This was for pragmatic reasons in particular the limitations of resources. However, a mean score of 4 on the BAHHLI represented the middle point on a potential range of 1 to 7. Table 6.2. demonstrated that five domains had

a mean score of over 4. It may have been more effective to implement interventions for all 5 areas than to tailor according to what is assessed to be the greatest barriers. Furthermore, no mean score was higher than 5 for this group of practitioners. This raises the question as to the degree to which the domains represented barriers to these doctors. These are areas requiring further investigation.

6.8. Conclusions

This study assessed barriers and levers to hand hygiene in junior doctors using the BALHHI and tailored theoretically based interventions accordingly. This study established the feasibility the approach in practice and the results my inform a future RCT in line with the MRC guidelines (2008) for complex interventions. An RCT would appear to be the next logical step to test the effectiveness of this instrument in promoting EBP in secondary care, comparing the effect of interventions tailored on the basis of barriers and levers assessed using this instrument with standard implementation techniques. This would be the next step for this programme of research.

CHAPTER 7: FINAL DISCUSSION AND CONCLUSIONS

7.1. Introduction

The findings from each of the four studies included in this thesis were discussed in Chapters 3, 4, 5 and 6. Therefore, in this final chapter, a brief overview of the thesis is summarised followed by a synopsis of the key findings of the four studies. The contribution of the work presented in the thesis to advancing knowledge in the field of implementation research is then discussed, where there are limitations to the research that have not been previously discussed these will be addressed here together with the implications for practice and future research.

7.1.1. Thesis overview

In order to improve the translation of evidence into practice the literature identifies the need for accurate prospective assessment of the barriers and levers to implementation (Grimshaw et al., 2004b) and the subsequent tailoring of implementation strategies (Grimshaw et al., 2004b, Baker et al., 2010). A need for a theoretical approach in this process and the implementation strategies employed is also identified (Michie et al., 2005). The theoretical framework selected for this study was the British Psychological Society (BPS) framework (Michie et al., 2005) because this framework has simplified the large number of overlapping constructs of behaviour change theory. The programme of research presented within this thesis was centred on these areas. The aim of the research was to:

Develop and test a theory-based diagnostic instrument to accurately and prospectively assess the barriers and levers to hand hygiene practice to inform subsequent tailoring of implementation strategies.

Hand hygiene was chosen as the example of practice used due to:

- It being relevant to all health care practitioners;
- Its importance in terms of preventing health care associated infections (World Health Organisation, 2009);
- Practitioner compliance with hand hygiene being historically low (Aiallo and Larson, 2002, Pittet et al., 2004, National Audit Office, 2004, World Health Organisation, 2009).

The objectives of the research were to:

1. Identify barriers and levers to hand hygiene practice in secondary care;

2. Compare the use of a theoretically based question schedule with a non-theoretically based schedule in identifying barriers and levers to hand hygiene practice;

3. Compare research methods used to identify barriers and levers to hand hygiene practice;

4. Assess the value of including patients in the identification of barriers and levers to hand hygiene practice;

5. Assess the fit of barriers and levers to hand hygiene to the domains of the British Psychological Society theoretical framework (Michie et al., 2005);

6. Develop and test the reliability and validity of a diagnostic instrument designed to assess barriers and levers to hand hygiene;

7. Compare barriers and levers to hand hygiene according to NHS hospital trust, occupational group and area of work;

8. Assess whether theoretically based interventions can be tailored according to barriers and levers to hand hygiene identified using the instrument developed as part of this programme of research.

In order to address the aim and objectives listed above, four studies were conducted. Having carried out a scoping review of the literature (Chapter 2), study one (Chapter 3) focused on identifying barriers and levers to hand hygiene (objective one) through interviews with health care practitioners and patients and through focus groups and distributing questionnaires amongst health care practitioners. Objectives two three and four, listed above, were also addressed in this study and data were compared to compare evaluate the use of a theoretically based question schedule, which was based on the BPS framework (Michie et al., 2005), the different research methods used and patient with health care practitioner participation. In study two (Chapter 4), barriers and levers to hand hygiene were categorised according to the domains of the BPS framework though a Delphi survey (objective five). Study three (Chapter 5) used these barriers and levers to hand hygiene, categorised to the BPS framework, as the basis of the BALHHI (research aim and objective six). This instrument was tested for reliability and validity in three stages. Data collected during this process were analysed to identify the barriers and levers to hand hygiene and compare these across different NHS trusts, areas of work and by occupational group (objective seven). Finally, study four

(Chapter 6), examined the feasibility of tailoring implementation interventions according to barriers and levers to hand hygiene assessed using the BALHHI.

7.2. Summary of studies

7.2.1. A qualitative study (presented in Chapter 3)

Objective one: To identify barriers and levers to hand hygiene in secondary care.

In order to ensure a full, comprehensive up to date list of barriers and levers to hand hygiene, a range of hospital staff (in terms of occupational group and area of work) (n=70) and patients (n=25) who had been admitted to hospital in the previous 12 months were asked to identify the barriers and levers to hand hygiene. This resulted in a list of 12 distinct themes and within these, 30 sub-themes (see Figure 3.6, Chapter 3) in which 100 barriers and levers to hand hygiene were identified.

When considering the main findings of this study with regard to this objective, most of the barriers and levers identified had been previously reported in the literature (Pittet and Boyce, 2001, Grol and Grimshaw, 2003b, Gould et al., 2007). This study contributed to the current literature with regard to three key themes, *"emotion"*, *"incentives"* and *"habit/routine"* which are rarely considered as barriers or levers to the implementation of EBP. The 100 barriers and levers to hand hygiene were used as the basis for the second study, the Delphi survey.

Objective two: To compare the use of a theoretically based question schedule with a non-theoretically based schedule in identifying barriers and levers to hand hygiene practice

Two schedules of questions were designed, one based on the BPS framework and the second organised on what is currently known about the barriers and levers to hand hygiene (from the literature). Half of the participants were questioned with the BPS schedule, half with the non-BPS schedule and the resulting data were compared.

The key findings were; three themes were mentioned significantly more frequently in the BPS questioned group than the non BPS group. These were *"emotion"* (χ^2 (1, n=74) = 13.66, $p<0.001$), *"habit/routine"* (χ^2 (1, n=74) = 6.9, $p<0.01$) and *"incentives"* (χ^2 (1, n=74) = 18.01, $p<0.001$).

The evidence from this study not only added to the knowledge base with regard to the barriers and levers to hand hygiene (and thus the range of items to be later included in The Barriers and Levers to Hand Hygiene Instrument (BALHHI)),

but it also supported the decision to use the BPS theoretical framework as the basis for instrument development.

Objective three: To compare research methods used to identify barriers and levers to hand hygiene practice

When designing study one, it became clear that there is no consensus as to the best method to use to assess barriers and levers to EBP or to hand hygiene practice. It was therefore decided to use the three methods most frequently used previously, as identified in a key systematic review relating to the tailoring of interventions; interviews, focus groups and questionnaires (Shaw et al., 2005, later updated Baker et al., 2010). The data resulting from each of these three methods were compared.

As data saturation was achieved for the interviews these data were used as the basis for comparison for the other methods. The key findings were as follows. Focus group participants identified all themes identified by interview participants but failed to identify five sub-themes, *"pride"* and *"anticipated regret"* (within the theme *"emotion"*), *"organisation"* (within the theme *"consequences"*), *"professionalism"* (within the theme *"professional"*), and *"individual"* (within the code *"social/cultural"*. Questionnaire participants identified all themes identified by interview participants but failed to identify three sub-themes, *"pride"* (within the theme *"emotion"*), *"literacy"* (within the theme *"knowledge"*) and *"financial"* (within *"environment"*).

Upon comparison there were a number of other differences between using these three research methods for the purpose of assessing barriers and levers to hand hygiene, these included strengths and weaknesses with recruitment and convenience to the participant and the researcher. A list of these is presented by method in Figure 3.7. (Chapter 3).

Despite these differences, the three methods together allowed methodological triangulation; a high level of consistency in data in terms of the barriers and levers identified across these methods resulted in confidence that all barriers and levers to hand hygiene had been identified. This was important as these barriers and levers were to form the basis of the instrument development.

Objective four: To assess the value of including patients in the identification of barriers and levers to hand hygiene

Two studies were identified in the scoping review that had included patients in the identification of barriers and levers to EBP (Flottorp and Oxman, 2004, Peters et al., 2003). In both cases the researchers emphasised the importance of such an approach but neither formally evaluated patient participation. Flottorp and Oxman (2004) considered that patients offered a different perception on practitioner

practice. Due to the importance of identifying a comprehensive list of barriers and levers for this study, a decision was made to include patients in view of the additional insights that could be gained. It was also decided to formally evaluate patient participation in identifying barriers and levers to hand hygiene.

There was a statistically significantly greater number of practitioners compared to patients identifying six of the 12 themes, *"habit/routine"* (χ^2 (1, n=50) = 8.12, $p<0.01$), *"improvement strategies"* (χ^2 (1, n=50) = 6.82, $p<0.01$), *"incentives"* (χ^2 (1, n=50) = 7.22, $p<0.01$), *"knowledge/skills"* (χ^2 (1, n=50) = 4.35, $p<0.05$), *"memory"* (χ^2 (1, n=25) = 3.95, $p<0.05$) and *"motivation"* (χ^2 (1, n=50) = 8.68, $p<0.01$). However it was notable that there were only three sub-themes identified by practitioners that were not identified by patients. This suggests patients have a good awareness of the barriers and levers to hand hygiene for health care practitioners.

7.2.2. A Delphi study (presented in Chapter 4)

Objective five: To assess the fit of barriers and levers to hand hygiene to domains of the British Psychological Society theoretical framework

In order to be able to tailor theoretically informed strategies based on the assessed barriers and levers to hand hygiene it was first necessary to link the barriers and levers identified in the first study to the psychological domains/constructs identified in the BPS framework (Michie et al., 2005). Thus, a two round modified Delphi survey was designed in which experts (n=21) in the fields of health psychology and infection control and prevention were asked to categorise the barriers and levers to hand hygiene within each of the 11 psychological domains of this framework.

The key results of this study were the categorisation of 99 out of the initial 100 barriers and levers to these 11 domains to a level of 70% consensus or above. The barrier/lever where consensus was not achieved was discarded. Five barriers/levers resulted were categorised to two domains. A good level of consensus was achieved between the two groups (health psychologists and infection prevention specialists). This further adds to the validation of the BPS framework in terms of its use within this health context with participants being able to agree on the assignment of barriers and levers with the psychological domains.

The results of this study, the 99 barriers and levers to hand hygiene categorised to the 11 domains of the BPS framework were used as the basis for study three, developing and testing an instrument to assess barriers and levers to hand hygiene.

7.2.3. Instrument Development (presented in Chapter 5)

The overall aim of the research was to develop and test a theory-based diagnostic instrument to accurately and prospectively assess the barriers and levers to hand hygiene practice to inform subsequent tailoring of implementation strategies. This was largely addressed through meeting objective six.

Objective six: To develop and test the reliability and validity of a diagnostic instrument designed to assess barriers and levers to hand hygiene

A comprehensive process of questionnaire development and design was undertaken. This starting point involved considering the 99 barriers and levers to hand hygiene, categorised in the Delphi survey to the domains of the BPS framework. Eighty one of these were used as the initial items on the Likert style instrument. The instrument was tested with a sample of health care practitioners from four NHS trusts in the North of England through three phases, involving 1. Face validity, variability of response, skew, internal consistency within domains, (n=56) 2. Construct validity (n=364) and 3. Test re-test reliability (n=50).

The key result was a final instrument consisting of 35 items. The 11 domains of the BPS framework were modified slightly throughout this process with the two domains *"knowledge"* and *"skills"* being combined to one domain. A minimum of three items remained within these final 10 domains. The model fit was good; CMIN/DF = 1.9 ($p<0.01$), RMSEA = 0.05 and CFA = 0.84.

Objective seven: To compare barriers and levers to hand hygiene according to NHS hospital trust, occupational group and area of work

Data collected during this study were used to answer a number of questions relating to barriers and levers to hand hygiene amongst healthcare practitioners. Data were analysed according to the domains of the BPS framework. These questions with key results are listed here.

What are the top barriers and levers for practitioners? The domains *"social influences"*, *"environment"* and *"memory"* posed the greatest barriers to hand hygiene for practitioners; *"knowledge and skills"* and *"professional identity"* the least.

Is there a difference in barriers and levers according to the hospital trusts within which professionals work? There were few statistically significant differences between trusts. The main difference was the high mean score within the domain memory and decision process in NHS trust 4.

Is there a difference in barriers and levers according to occupational group? Doctors, as an occupational group, had significantly higher mean scores (which

equate with greater barriers) in the domains *"knowledge and skills"*, *"motivation and goals"*, *"environmental context and resources"* and *"emotion"* than a range of other staff groups. Porters and domestic staff had significantly lower means scores on the knowledge test questions than all other staff groups except unqualified nurses (nursing assistants, auxiliaries and student nurses).

Is there a difference in barriers and levers according to area of work (ward or department)? There were few differences in barriers and levers according to the area in which health care practitioners worked. Those that existed were all in relation to staff working in more than one area of the hospital. Staff working in several areas (moving between different wards or departments) experienced more hand hygiene barriers than staff working in single areas (where movement was not required).

The key conclusion from this analysis of barriers and levers to hand hygiene was that when tailoring interventions this may be best done according to occupational group rather than ward or department as this is where most differences in barriers and levers to hand hygiene were noted.

7.2.4. A Feasibility Study (presented in Chapter 6)

Objective eight: To carry out a feasibility study using the instrument to assess whether theoretically based interventions can be tailored according to assessed barriers and levers to hand hygiene and to establish the potential effectiveness of such an approach

Studies one, two and three contributed to the development of an instrument to assess barriers and levers to hand hygiene. To this point however, although tested for validity and reliability the instrument had not been tested with regards to tailoring implementation strategies. Therefore, a feasibility study was carried out to investigate the use of the use of the BALHHI in practice, including whether it was possible to develop tailored interventions in response to a prospective assessment of the identified barriers and levers to hand hygiene in the hospital context. This in line with recommendations of the Medical Research Council (2008) for the evaluation of complex interventions. The BALHHI developed and reported here was used to assess the barriers and levers to hand hygiene in a group of junior doctors in an NHS hospital trust in the north of England. A taxonomy of behaviour change techniques (Michie and Abraham, 2004) had been developed and later mapped onto the domains of the BPS framework (Michie et al., 2008b). This taxonomy of behaviour change techniques formed the theoretical basis for pragmatic (educational meeting based) strategies that were designed and implemented with this group of practitioners.

The study reported here demonstrated the feasibility of the process of assessing barriers and levers according to a theoretical framework, tailoring theoretically based implementation strategies accordingly and measuring outcomes with regard to the uptake of EBP.

This study demonstrated the potential effectiveness using the BALHHI in practice as a means of accurately identifying barriers and levers to hand hygiene and to the subsequent tailoring of theory based implementation strategies to these barriers. The findings were also encouraging with regard to the potential effectiveness of this approach in improving practice. Early results suggest that the tailored strategies may have contributed to improvements in hand hygiene compliance among doctors.

7.3. Implications for practice and future research

The implications for practice and future research will be addressed in four sections, those relating to i) tailoring interventions, ii) the barriers and levers to hand hygiene, iii) the use of behaviour change theory and iv) instruments to assess barriers and levers to evidence based practice.

Tailoring Interventions

Baker et al. (2010) included 26 studies in their recent systematic review of the effects of tailoring interventions on professional practice and health care outcomes. They were able to conclude that tailored interventions can change professional practice. However, they also acknowledge the lack of evidence relating to the most effective approaches to tailoring interventions, including with regard to identifying barriers and levers and selecting interventions. The research presented in this thesis offered insight into these issues in the following ways.

Which research method should we use to assess barriers and levers to hand hygiene? In study one (Chapter 3) methods were compared and each had different strengths and weaknesses when used for the purpose of assessing barriers and levers to hand hygiene. This may suggest therefore that the method of choice will depend on the particular features of the clinical area, the practice to be implemented and the needs of those assessing barriers and levers; whether to improve clinical practice or for research purposes. An instrument such as the one constructed here (Chapter 5) is a potentially low cost method of identifying barriers and levers in large numbers of practitioners.

If we tailor strategies according to group – which group should we select? In study 3 (Chapter 5) barriers and levers to hand hygiene were analysed according to NHS hospital trust, area of work and occupational group. The greatest variations in

barriers and levers were identified according to occupational group which suggests that tailoring to occupational group may be more effective than tailoring according to area.

However, "areas" were assessed in this research according to specialism (for example ICU, medicine, care of the elderly). Previous research has identified that hand hygiene compliance differs according to the area in which the health care practitioner works; practitioners being observed to be less compliant if they work in intensive care units, surgical units or accident and emergency departments (Pittet et al., 2004). This research presented in this thesis identified greater barriers experienced by practitioners working in several areas of the hospital than those working in single areas. For the purposes of this study it was not possible to investigate according to specific ward or department as the study was spread over four NHS hospital trusts, and it is unlikely that more than one or two participants responded from any one particular ward or area. But this level of precision in terms of area of work may be necessary when considering tailoring implementation strategies. In the qualitative study (Chapter 3), the social influence of colleagues was reported to act as either a barrier or lever to hand hygiene which supports the possibility that there may be differences in barriers and levers according to specific ward or department. This is therefore a limitation of the research conducted and an area that requires further investigation.

This study found greater differences according to occupational group. Previous research has identified doctors as being less compliant with hand hygiene than other occupational groups (Pittet et al., 2000, Salemi et al., 2002, Creedon, 2005). However, no explanation is offered for this and it has been referred to as:

"an unsolved and vexing issue" (Pittet et al., 2000 pp 1311).

This study demonstrated that doctors may experience greater barriers to hand hygiene than other occupational groups. Whilst it is not possible to generalise that this is the case for all doctors, this research included a sample of only 33 doctor participants, it does suggest a potential difference for this group that may go some way to explaining their lower levels of compliance with hand hygiene than that of other occupational groups. Doctors may need different support to other groups, certainly this finding emphasises the need to tailor strategies according to assessed barriers and levers. Doctors as a professional group, therefore, offers an example of where differences between different profession groups was apparent but this study also demonstrated differences in barriers and levers according to other occupational groups, some of these were statistically significant and have been reported earlier in this thesis. These findings suggest that tailoring according to professional group may be an effective way forward in terms of practice improvement.

However, in this study some occupational groups (for example porters and domestic staff) had limited representation. Further research is required with sufficient numbers to properly power a study investigating differences between groups.

In conclusion, within the context of hand hygiene and from the results of this study, tailoring according to professional group is likely to be more effective than tailoring according to area of the hospital.

How should we select interventions? In feasibility study described in Chapter 6 describes one way that theoretically based interventions may be selected. This is discussed further below in the section titled "the use of behaviour change theory".

Barriers and levers to hand hygiene

As discussed above this study adds to the knowledge base relating to differences in barriers and levers according to occupational group and area of the hospital. Additionally, in study 1 (Chapter 3) health care practitioners reported barriers and levers to hand hygiene that are rarely mentioned in the literature. Emotion is infrequently acknowledged in the literature as a barrier to hand hygiene practice and where it is mentioned it tends to be in relation to feelings of "disgust" with dirty hands as a motivator for hand hygiene (Whitby et al., 2007, Porzig-Drummond et al., 2009). In this study a wider range of emotions were cited as barriers or levers to hand hygiene. Incentives have been previously found to affect the application of EBP generally among health care practitioners (Davis and Taylor-Vaisey, 1997a, Proctor, 2004). There are no such studies applying this to hand hygiene. In this study participants talked about incentives such as certificates and sanctions such as disciplinary action as being levers to hand hygiene practice. Habit/Routine; although there are some reports in the literature that it may be difficult to integrate hand hygiene into routine practice in diverse hospital environments (Grol and Grimshaw, 2003b) there is little mention of habit or routine as a lever to hand hygiene practice. In this study participants often identified habit or routine as a lever to good hand hygiene.

The identification of these additional barriers and levers has implications for practice in two ways. Firstly, designing interventions to improve hand hygiene addressing these three, as well as previously identified barriers to hand hygiene may lead to improved practice. Secondly, each of these three barriers or levers were reported by more participants that had been questioned using the BPS schedule than the non-BPS schedule, which supports previous research suggesting the need for a theoretical basis in the field of the implementation of EBP.

However, generalisability is limited as these findings were based on a sample of only 70 health care practitioners working in three NHS trusts and limited to the practice of hand hygiene. Further research is needed to investigate this further and with regard to different examples of professional practice (other than hand hygiene).

The use of behaviour change theory

Only three studies were found that assessed the barriers and levers to EBP using the BPS framework used in this study (Michie et al., 2004, Michie et al., 2007, Francis et al., 2009). The feasibility study reported here found similarly. The framework could be used to produce an evidence-based theoretically informed instrument that was shown to be feasible to use in practice in the context of hand hygiene. Additionally, the taxonomy of behaviour change techniques (Abraham and Michie, 2008) mapped to the domains of the BPS framework (Michie et al., 2008b) made designing theoretically informed tailored interventions within this context a straightforward process. Further research testing this process and using other examples of evidence based practice is required as the research presented here suggests that the framework has the potential to be valuable to use in clinical practice in the implementation of EBP.

A number of issues arose when using the framework. These were in relation to i) the domain *"knowledge and skills"*, ii) the domain *"beliefs about capabilities"* and iii) the potential interaction of domains.

Firstly in relation to the domain ***"knowledge and skills"***. The domain skills had only three barriers or levers assigned to it during the Delphi survey (reported in Chapter 4). It was considered that *"knowledge"* and *"skills"* and related training are likely to overlap with regard to hand hygiene (presented in section 5.3.1.). As a result the two domains were combined. The resulting domain contained three items, "there are adverts or newsletters about hand hygiene in my workplace", "hand hygiene training is available to me" and "hand hygiene guidelines are easily accessible". It is questionable whether these items actually reflect the absence or presence of skills as all three refer predominantly to information and knowledge. Conversely, when considering the behaviour change techniques mapped to this framework (Michie et al., 2008b), there are 10 strategies with agreed effectiveness for the domain of *"skills"* and only one for the domain of *"knowledge"*. *"Knowledge/skills"* as a combined domain was not assessed to be a barrier in the feasibility study presented in Chapter 6, however, due to evidence identifying knowledge as a necessary prerequisite to behaviour change (Grimshaw et al., 2001, Wensing et al., 2005b, Robertson and Jochelson, 2006) interventions were designed to address this domain nevertheless. It was clear from the qualitative study carried out (presented in Chapter 3) that there was an overlap with regard to *"skills and*

knowledge" with regard to hand hygiene. This was confirmed in the first round of the Delphi survey (Chapter 4), where for the same barrier or lever half of the participants assigned the item to *"knowledge"* and half selected *"skills"*. This was further emphasised in the second round of the Delphi study where some knowledge or skills items were only just below the 70% consensus cut off point.

When completing the instrument, practitioners generally did not identify knowledge or skills barriers. However, the knowledge test questions demonstrated that there were knowledge deficits. Similar findings were reported in a study investigating the barriers and levers to the implementation of the Human Papillomavirus Vaccination (Brotherton et al., 2010). Whilst the self-rated knowledge of the GPs delivering the vaccination was "high", actual knowledge was only "moderate". This questions the value of including items in an instrument that ask the practitioner about their knowledge rather than just simply testing knowledge. Through the process of confirmatory factor analysis, the items that best fit within the domain knowledge were those that asked practitioners to express an opinion on availability of *sources* of knowledge rather than *actual* knowledge per se (for example the availability of guidelines). In the case of the BALHHI both sets of questions were considered worth keeping as they were addressing different aspects of knowledge. However, further research into this aspect of the instrument is required. The question is; is there any link between the availability of information and the knowledge of practitioners?

The domain ***"beliefs about capabilities"*** presented a number of challenges throughout the process of instrument development. In the first round of instrument testing the items within this domain did not appear to fully reflect the meaning of the domain (according to the component constructs of the domain). Two further items were therefore added at this stage to address this problem. In the second round of testing, internal consistency was tested for each domain using Cronbach's alpha. All domains achieved a Cronbach's alpha of close to 0.6 with the exception of *"beliefs about capabilities"* which achieved only 0.42. Removal of further items did not improve the alpha. The remaining items in this domain did however achieve good model fit with regard to construct validity.

On examination of the items within the domain, one of the items "I am reluctant to ask others to engage in hand hygiene" is more about the practitioners' belief in their capabilities to prompt others rather than their capabilities regarding hand hygiene per se. Whilst, prompting others is a big part of campaigns to improve hand hygiene (National Patient Safety Agency, 2004) and was cited in the qualitative study (Chapter 3) as a lever to hand hygiene, and therefore important, its fit within the meaning of domain is questionable.

It may be that *"beliefs about capabilities"* is less of an issue for the practice hand hygiene than it would be for other practices, and is perhaps perceived to be "easy" by health care practitioners. The qualitative study (Chapter 3) demonstrated that participants generally believed they were capable of competently performing hand hygiene according to guidance (section 3.3.2.). *"Beliefs about capabilities"* is an area that requires further investigation with regard to its relevance to assessing barriers and levers to hand hygiene.

A third issue that arose when using the BPS framework was in relation to how the ***domains may interact.*** In study four it was acknowledged that knowledge had been found to be a necessary prerequisite to the implementation of EBP (Grimshaw et al., 2001, Wensing et al., 2005b, Robertson and Jochelson, 2006). For this reason a knowledge intervention was carried out, even though practitioners did not identify knowledge as a barrier to practice. If knowledge is a necessary prerequisite, it would be helpful to have this connection built into the framework to inform those planning implementation strategies. The authors of the framework identify a likely degree of overlap between the domains of the BPS framework (Michie et al., 2005). However, consideration has not been given as to whether domains interact at any other level. One of the values of this framework is its simplicity and therefore unnecessary complications are undesirable, however, the example offered here with regard to the domain knowledge suggests that research investigating interactions between domains may be of value to those aiming to change professional practice using the framework.

Instruments to assess barriers and levers to evidence based practice

Development of the BALHHI was a significant undertaking. It involved four studies, over three years and a high level of participant involvement. Hand hygiene is only one of many practices carried out by health care practitioners. Consideration must therefore be given to whether context specific instruments have a place in the assessment of barriers and levers to evidence based practice and the cost effectiveness of such an approach.

A particular benefit of an instrument such as the BALHHI is its ability to sample large numbers of practitioners and thus allow trends between groups and areas to be observed informing the tailoring of implementation strategies. For practices such as hand hygiene, where universal adoption of all practitioners across entire hospital trusts is necessary, development of such an instrument would appear to be a sensible and pragmatic approach. However, when the practice in question is relevant to fewer practitioners or affects a limited number of hospital areas (for example removing an endotracheal tube from a ventilated patient is only likely to be relevant to those working in the operating theatre or ICU, applying plaster of Paris

only relevant to Accident and Emergency and the fracture clinic), an approach involving interviews or focus groups, as presented in study one, may be effective in enhancing evidence based practice and be more cost effective.

So how generalisable is the BALHHI to other practices? The BALHHI contains barriers and levers that are very specific to hand hygiene, for example items such as using the "glow and show" light box and the availability of gel and hand cream. However, many questions could be equally applicable to any practice in hospitals such as peer pressure, available guidelines, and pride in doing a good job. This suggests that a more "generic" instrument could be developed whereby the only adaptation required would be to make the items context specific. This is supported by the literature reviewed and presented in Chapter 2. Figure 2.2. lists barriers and levers for evidence based practice generally next to those for hand hygiene practice specifically. The main difference between the two lists is the level of detail in terms of being specific to practice. For example, in the case of evidence based practice generally, one barrier listed is that the practice or the research informing the practice lacks credibility in the eyes of the practitioner. In the case of hand hygiene practice, this is translated as practitioners do not believe the link between hand hygiene and hospital acquired infection. The generic interview questions listed along the domains the BPS framework (Michie et al., 2005) were easily adapted for the questions for study one, a qualitative study investigating the barriers and levers to hand hygiene practice. It would seem reasonable to assume that a similar list of generic instrument questions could be developed that are easy to adapt for any form of evidence based practice. This approach could be much more cost effective and eliminate the need for preliminary work in developing a questionnaire to be repeated by research or practitioner groups. Furthermore this could enhance the accessibility of the BPS framework in practice with the implementation of EBP.

7.4. The next steps

In terms of hand hygiene and the BALHHI, the next step is to test the effectiveness of this instrument in promoting hand hygiene practice through an RCT to compare the effectiveness of interventions tailored on the basis of the results from the diagnostic instrument compared with standard implementation techniques.

Another way forward would be for data collection on several smaller studies, similar to the one reported in Chapter 6. This is a strategy suggested to be useful in the field of implementation of EBP, as so little is known about the effectiveness of interventions, the cost of a trial needs to be weighed against the likelihood of the intervention being successful (Grimshaw et al., 2000).

Throughout the process of this research it was clear that IPC specialists and managers within NHS hospital trusts are keen for a way forward to improve the implementation of hand hygiene among staff. A booklet, guiding them on how to use the instrument developed here to assess barriers and levers and tailor interventions could i) be valuable to practice and ii) allow the collection of data from a wide range of NHS trusts allowing growth of an evidence base. Such an approach would allow further comparisons of differences between, not only occupational group and specialist area but also differences according to ward and department locally.

7.6. Conclusions

In response to recognition of the need for:

- accurate assessment of barriers and levers to implementation (Grimshaw et al., 2004b);
- tailoring of implementation strategies accordingly (Grimshaw et al., 2004b, Baker et al., 2010);
- the absence of a theoretical basis informing implementation interventions used (Michie et al., 2005)

And after selecting hand hygiene as the example of practice this research achieved its aim:

To develop and test a theory-based diagnostic instrument to accurately and prospectively assess the barriers and levers to hand hygiene practice to inform subsequent tailoring of implementation strategies.

A feasibility study using this instrument demonstrated it's potential and it is possible to conclude that it is feasible to assess barriers and levers and tailor theoretically based implementation strategies using this instrument. The work presented in this thesis has shown that such an approach looks promising but no firm conclusions can be made with regard to whether this leads to effective and sustained change in practice and further research is required to test this.

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Appendices

NHS
National Research Ethics Service
Leeds (East) Research Ethics Committee
Room 5.2, Clinical Sciences Building
St James's University Hospital
Beckett Street
Leeds
LS9 7TF

Telephone: 0113 2065662
Facsimile: 0113 2066772

16 April 2008

Mrs Judith Dyson
PhD Student
School of Healthcare
Third Floor
Baines Wing
University of Leeds
Leeds
LS2 9UT

Dear Mrs Dyson

Full title of study: **Using psychological theory to develop and test a tool for the implementation of evidence-based practice: the case of hand hygiene practice**

REC reference number: **08/H1306/31**

Thank you for your letter of 8 April 2008, responding to the Committee's request for further information on the above research and submitting revised documentation.

The further information has been considered on behalf of the Committee by the Vice-Chair.

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.

Ethical review of research sites

The Committee has designated this study as exempt from site-specific assessment (SSA). There is no requirement for other Local Research Ethics Committees to be informed or for site-specific assessment to be carried out at each site.

Conditions of approval

The favourable opinion is given provided that you comply with the conditions set out in the attached document. You are advised to study the conditions carefully.

Approved documents

The final list of documents reviewed and approved by the Committee is as follows:

Document	Version	Date
Application		01 March 2008

Investigator CV		
Protocol	1	03 March 2008
Letter from Sponsor		10 March 2008
Compensation Arrangements		24 September 2007
Interview Schedules/Topic Guides	1	03 March 2008
Letter of invitation to participant	Interview 1	03 March 2008
Participant Information Sheet: Questionnaire	2	08 April 2008
Participant Information Sheet: Delphi	2	08 April 2008
Participant Information Sheet: Interview	2	08 April 2008
Participant Consent Form: Interview	1	03 March 2008
Response to Request for Further Information		08 April 2008
Participant reply slip	1	03 March 2008
Invitation letter-Delphi	1	03 March 2008
Invitation letter-Questionnaire	1	03 March 2008
Supervisor's CV		

R&D approval

All researchers and research collaborators who will be participating in the research at NHS sites should apply for R&D approval from the relevant care organisation, if they have not yet done so. R&D approval is required, whether or not the study is exempt from SSA. You should advise researchers and local collaborators accordingly.

Guidance on applying for R&D approval is available from
http://www.rdforum.nhs.uk/rdform.htm.

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees (July 2001) and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

After ethical review

Now that you have completed the application process please visit the National Research Ethics Website > After Review

Here you will find links to the following

a) Providing feedback. You are invited to give your view of the service that you have received from the National Research Ethics Service on the application procedure. If you wish to make your views known please use the feedback form available on the website.
b) Progress Reports. Please refer to the attached Standard conditions of approval by Research Ethics Committees.
c) Safety Reports. Please refer to the attached Standard conditions of approval by Research Ethics Committees.
d) Amendments. Please refer to the attached Standard conditions of approval by Research Ethics Committees.
e) End of Study/Project. Please refer to the attached Standard conditions of approval by Research Ethics Committees.

We would also like to inform you that we consult regularly with stakeholders to improve our service. If you would like to join our Reference Group please email referencegroup@nationalres.org.uk

08/H1306/31	**Please quote this number on all correspondence**

With the Committee's best wishes for the success of this project

Yours sincerely

Ann Prothero

Dr John Holmes
Chair

Email: ann.prothero@leedsth.nhs.uk

Enclosures: Standard approval conditions

Copy to: Mrs Rachel De Souza

R&D Department, Leeds Teaching Hospitals NHS Trust

NHS

National Research Ethics Service
Leeds (East) Research Ethics Committee

Room 5.7, Clinical Sciences Building
St James's University Hospital
Beckett Street
Leeds
LS9 7TF

Tel: 0113 2065837
Fax: 0113 2068172

08 July 2008

Ms Judith Dyson
PhD Student
School of Healthcare
University of Leeds
Barnes Wing
Room 3.35
Leeds

Dear Ms Dyson

Study title:	**Using psychological theory to develop and test a tool for the implementation of evidence-based practice : the case of hand hygiene practice**
REC reference	**08/H1306/31**
Amendment number:	**1**
Amendment date	**30 June 2008**

Thank you for submitting the above amendment, which was received on 03 July 2008. It is noted that this is a modification of an amendment previously rejected by the Committee (our letter of 21/05/2008 refers).

The modified amendment was considered at the meeting of the Sub-Committee of the REC held on 07 July 2008. A list of the members who were present at the meeting is attached.

Ethical opinion

I am pleased to confirm that the Committee has given a favourable ethical opinion of the modified amendment on the basis described in the notice of amendment form and supporting documentation.

Approved documents

The documents reviewed and approved are:

Document	Version	Date
Questionnaire	Phase 1 2	24 June 2008
Protocol	3	24 June 2008
Participant Information Sheet	Health practitioner Focus groups 1	30 June 2008
Modified Amendment		30 June 2008

Interview Schedules/Topic Guides	Focus groups 2	30 June 2008
Covering Letter		30 June 2008

Membership of the Committee

The members of the Committee who were present at the meeting are listed on the attached sheet.

R&D approval

All investigators and research collaborators in the NHS should notify the R&D office for the relevant NHS care organisation of this amendment and check whether it affects R&D approval of the research

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees (July 2001) and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK

08/H1306/31:	**Please quote this number on all correspondence**

Yours sincerely

Mrs Elaine Hazell
Acting Co-ordinator

E-mail: Elaine.hazell@leedsth.nhs.uk

Enclosures: List of names and professions of members who were present at the meeting and those who submitted written comments

Copy to: University of Leeds

R&D, LTHT

NHS
National Research Ethics Service
Leeds (East) Research Ethics Committee
Room 5.3, Clinical Sciences Building
St James's University Hospital
Beckett Street
Leeds
LS9 7TF

Tel [redacted]
Fax [redacted]

16 December 2009

Mrs Judith Dyson
PhD Student School of Healthcare and Institute of Psychological Sciences
School of Healthcare University of Leeds
PhD Student School of Healthcare and Institute of Psychological Sciences
Third Floor, Baines Wing
University of Leeds
Leeds
LS2 9UT

Dear Mrs Dyson

Study title	**Using psychological theory to develop and test a tool for the implementation of evidence-based practice: the case of hand hygiene practice**
REC reference:	**08/H1308/31**
Amendment number:	
Amendment date	**08 December 2009**

The above amendment was reviewed at the meeting of the Sub-Committee held on 15 December 2009 by the Sub-Committee in correspondence.

Ethical opinion

The members of the Committee taking part in the review gave a favourable ethical opinion of the amendment on the basis described in the notice of amendment form and supporting documentation

Approved documents

The documents reviewed and approved at the meeting were:

Document	Version	Date
Instrument	1	08 December 2009
Protocol	4	01 October 2009
Notice of Substantial Amendment (non CTIMPs)	1	08 December 2009

Membership of the Committee

The members of the Committee who took part in the review are listed on the attached sheet.

R&D approval

All investigators and research collaborators in the NHS should notify the R&D office for the relevant NHS care organisation of this amendment and check whether it affects R&D approval of the research.

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees (July 2001) and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

08/H1306/31:	Please quote this number on all correspondence

Yours sincerely

Miss Laura Milnes
Assistant Committee Co-ordinator

E-mail: laura.milnes@leedsth.nhs.uk

Enclosures.	*List of names and professions of members who took part in the review*
Copy to.	*Ms Rachel de Souza*
	Research and Development - Airedale General Hospital

School of Healthcare

Dr Janet Holt
0113 343 1266
holt@leeds.ac.uk

Baines Wing
University of Leeds
PO Box 214
Leeds LS2 9UT

UNIVERSITY OF LEEDS

30th June 2008

Mrs. Judith Dyson
Room 3.35
Third Floor
Baines Wing
University of Leeds
Leeds
LS2 9UT

Dear Mrs. Dyson,

Research Projects for Ethical Approval (SHREC/RP/132)

Thank you for submitting further information on your research proposal *"Using Psychological theory to develop and test a tool for the implementation of evidence based practice: the case of hand hygiene"*

This has been reviewed and I can confirm that the issues raised by the School of Healthcare Research Ethics Committee (SHREC) have been fully addressed and consequently ethical approval is granted.

The committee wishes you every success with your project.

Yours sincerely

Dr. Janet Holt
Chair
School of Healthcare Research Ethics Committee

Professor Dawn Freshwater
Head of School of Healthcare

Airedale NHS
NHS Trust

Research & Effectiveness
Fleming House
Airedale General Hospital
Steeton
KEIGHLEY
W Yorks
BD20 6TD

Tel: 01535 294656
Fax: 01535 294655

20 January 2010
Ref: EPS 0473

Mrs Judith Dyson
PhD Student, School of Healthcare and
Institute of Psychological Sciences
Third Floor, Baines Wing
University of Leeds
Leeds
LS2 9UT

Dear Mrs Dyson

Re: Using psychological theory to develop and test a tool for the implementation of evidence-based practice: the case of hand hygiene

I have received details of the above research project and after consideration am pleased to confirm that this has received Research Management approval.

Please note that this approval is conditional on compliance with the following requirements:

- That all research activity should comply with the requirements of the Research Governance Framework. It is your responsibility to ensure that Health and Safety and Data Protection policies are adhered to where appropriate.
- That you submit a progress report annually and that we are notified of the completion or early termination of the study.
- That you consent to project audit.
- That payment of project funding (where applicable) is made to Airedale NHS Trust.
- That ethics approval has been obtained from the relevant NHS Research Ethics Committee. **http://www.nres.nposa.nhs.uk/**

I hope all goes well with the study and look forward to hearing about your progress.

Yours sincerely

Carole Paley
Research Manager

On behalf of
Dr R Pope
Research & Effectiveness Director

Hull and East Yorkshire Hospitals NHS

NHS Trust

Research & Development Departme
Clinical Governance Director
Medical Research, Teaching and Day Surgery Buildi
Castle Hill Hosp

10/1/2008

Mrs Judith Dyson
3rd Floor, Baines Wing
University of Leeds
LEEDS
LS2 9UT

Dear Mrs Judith Dyson

Re: R0695 - 08/H1306/31
Using psychological theory to develop and test a tool for the implementation of evidence-based practice: the case of hand hygiene practice

I am pleased to notify you formally that this study has been approved by the Trust and may now proceed

Hull and East Yorkshire Hospitals NHS Trust conducts all research in accordance with the requirements of the Research Governance Framework, and the NHS Intellectual Property Guidance. In undertaking this study, you agree to comply with all reporting requirements, systems and duties of action put in place by the Trust to deliver research governance. In addition, you agree to accept the responsibilities associated with your roles which are outlined within the Research Governance Framework as follows:

- the study should follow the agreed protocol;
- all potential subjects should have enough information to make a free and informed decision about participation;
- participants should receive appropriate care while involved in the study;
- the integrity and confidentiality of clinical and other records and data generated by the study will be maintained;
- all serious adverse events must be reported forthwith to the Trust and other authorities specified in the protocol;
- any suspected misconduct by anyone involved in the study must be reported.

We would be grateful if you would copy the R&D Department into your annual and completions reports to the local ethics committee

I would like to wish you every success with this project.

Yours sincerely

James Illingworth
R&D Manager

Copy to

Professor Francine Cheater
Professor in Public Health Nursing
School of Healthcare
Baines Wing
University of Leeds
LEEDS
LS2 9UT

The Leeds Teaching Hospitals NHS
NHS Trust

Research & Development Directorate
A/B Corridor, Old Site

The General Infirmary at Leeds
Great George Street
Leeds
West Yorkshire
LS1 3EX

Tel: 0113 392 2878
Fax: 0113 392 6397

www.leedsteachinghospitals.com

18/04/2008

Mrs Judith Dyson
Third Floor, Barnes Wing
University of Leeds
Leeds
LS2 9UT

Dear Mrs Judith Dyson

Re: LTHT R&D Approval of UI08/8576: Using psychological theory to develop and test a tool for the implementation of evidence-based practice: the case of hand hygiene practice

I write with reference to the above research study. I can now confirm that this study has R&D approval and the study may proceed at The Leeds Teaching Hospitals NHS Trust (LTHT). This organisational level approval is given based on the information provided in the documents listed below

As principal investigator you have responsibility for the design, management and reporting of the study. In undertaking this research you must comply with the requirements of the *Research Governance Framework for Health and Social Care* which is mandatory for all NHS employees. This document may be accessed on the Department of Health website at http://www.dh.gov.uk/research

R&D approval is therefore given on the understanding that you comply with the requirements of the *Framework* as listed in the attached sheet 'Conditions of Approval'

If you have any queries about this approval please do not hesitate to contact the R&D Department on telephone 0113 392 2878

Indemnity Arrangements

The Leeds Teaching Hospitals NHS Trust participates in the NHS risk pooling scheme administered by the NHS Litigation Authority 'Clinical Negligence Scheme for NHS Trusts' for: (i) medical professional and/or medical malpractice liability; and

(ii) general liability NHS Indemnity for negligent harm is extended to researchers with an employment contract (substantive or honorary) with the Trust The Trust only accepts liability for research activity that has been managerially approved by the R&D Department

The Trust therefore accepts liability for the above research project and extends indemnity for negligent harm to cover you as principal investigator and the researchers listed on the R&D approval form provided that each member of the research team has an employment contract (substantive or honorary) with the Trust Should there be any changes to the research team please ensure that you inform the R&D Department and that s/he obtains an employment contract with the Trust if required

Yours sincerely

Dr D R Norfolk
Associate Director of R&D

Approved documents
The documents reviewed and approved are listed as follows

Document	*Version*	*Date of document*
Protocol	1	03/03/08
SSI Form	5.5	03/03/08
NHS REC Application Form	5.5	03/03/08

Appendix 2 Health care practitioner interview and focus group schedule: BPS format (study one)

UNIVERSITY OF LEEDS

Health care practitioner interview and focus group schedule: BPS format

Domain	Interview questions
Knowledge	• What do you know about infection control and hand hygiene practices and where this information has come from? • Can you tell me a bit about any policies or protocols or guidance on this please?
Skills	• Do you know how to wash/disinfect your hands according to protocol? • How easy or difficult is it to do this in practice?
Social/professional role and identity	• To what extent is following guidelines for hand hygiene or infection control part of your professional role? • Would this be true of all professional groups involved? • Are you happy in your role to abide by these guidelines?
Beliefs about capabilities	• How easy is it for you to carry out hand hygiene practice (prompts – internal external capabilities/constraints)? • What difficulty do you have in achieving good practice with regard to hand hygiene? • What would help? (With difficulties encountered and generally). • How confident are you that you can achieve a good practice in hand hygiene?
Beliefs about consequences	• What are the advantages of hand hygiene practice? (Prompt, long term and short term) • What are the disadvantages of hand hygiene practice? (Prompt, long term and short term) • Do you think the advantages outweigh the disadvantages?
Motivation and goal priorities	• Are there other things that you want or need to do or achieve that might interfere with consistently carrying out good hand hygiene practice? • To what extent is infection control a priority in your practice? • Are there any incentives to good hand hygiene

	practice? • When do you intend to wash your hands and struggle to do so?
Cognitive processing - memory, attention and decision process	• Are there times when you find it difficult to clean your hands when you should? • Why is that? • What are the times and situations when you are most likely to forget to carry out hand hygiene? • Are there prompts in the environment to remind you? (Prompt, posters, gel) • Do habits or automatic behaviours influence hand hygiene practice?
Environmental context and resources	• What are the resources in the environment that help you with hand hygiene? • What environmental factors hinder hand hygiene? (Prompt, alcohol gel, soap, local sinks, staffing levels)
Social Influences	• Do people that you work with encourage you to adopt good hand hygiene practices? (Prompt, peers, managers, other professional groups, patients, relatives). • Do the people you work with carry out good hand hygiene practices themselves?
Emotion regulation	• How does it make you feel when you think about hand hygiene? • How does it make you feel when you think about the consequences of not washing your hands?
Action Planning	• Do you get any feedback when you wash your hands or when you forget? • Are there any systems to monitor hand hygiene in your ward/unit?

Preferred method? Interview/focus group/questionnaire. Why?

Appendix 3 Health care practitioner interview and focus group schedule: non-BPS format (study one)

UNIVERSITY OF LEEDS

Health care practitioner interview and focus group schedule: non-BPS format

Area	Interview Questions
The Innovation: Hand hygiene	• What do you know about infection control and hand hygiene practices and where has this information come from? • Can you tell me a bit about any policies or protocols or guidance please? • Do you know how you are supposed to wash/disinfect your hands according to protocol? • How easy or difficult is it to do this in practice? • What do you think about these rules for washing /disinfecting hands? • Do you think some hospital workers experience more difficulties than others? (Probe: who)? • How important do you think hand hygiene is? • Why? (prompt: advantages and disadvantages)
The Individual	• What helps or stops you from following good hand hygiene practice? (Prompt: training, time, information, capabilities, constraints) • What would help? (With difficulties encountered and generally) • Do you sometimes fail to wash your hands when you should? • What are the reasons for this?
Social Factors	• Do you think teamwork is important if hospital workers are to follow good hand hygiene practice? (prompts praise, role models, encouragement, managers involvement) • Do you think different groups/teams/areas perform hand hygiene better than others? (prompts are there any trends/themes; why do you think X tend to be better/worse?). • What happens if someone does not wash their hands?
Organisational Factors	• Are there times when you may find it hard to clean your hands when you should? • Why is that? • Is infection control a priority in the hospital? • What measures have you seen to promote or help you/other staff follow good hand hygiene practices? • Is there anything about the environment (e.g. ward)

	that would help support good hand hygiene? • And what might prevent good hand hygiene?
Other	• Overall, what do you think helps you follow good hand hygiene practice? • What stops good hand hygiene practice? • What measures are you aware of that the hospital is taking to improve hand hygiene practice? • What would you do to improve hand hygiene practice in hospitals?

Preferred method? Interview/focus group/questionnaire. Why?

Appendix 4 Patient interview schedule: BPS format (study one)

UNIVERSITY OF LEEDS

Patient interview schedule: BPS format

Domain	Interview questions
Knowledge	• What do you know about infection control and hand hygiene practices and where this information has come from? (prompt rules)
Skills	• Do you know how health care practitioners/patients/visitors should wash/disinfect your hands according to protocol? • How easy or difficult does this seem in practice?
Social/professional role and identity	• To what extent is following guidelines for hand hygiene or infection control part of professional roles? • Are all professional groups involved similar in abiding by hand hygiene?
Beliefs about capabilities	• How easy is it for health care practitioners to carry out hand hygiene practice (prompts – internal external capabilities/constraints)? • What difficulty do staff/visitors/patients have in achieving good practice with regard to hand hygiene? • What would help? (With difficulties encountered and generally). • How confident are you that staff (you/visitors) can achieve a good practice in hand hygiene?
Beliefs about consequences	• What are the advantages of hand hygiene practice? (Prompt, long term and short term) • What are the disadvantages of hand hygiene practice? (Prompt, long term and short term) • Do you think the advantages outweigh the disadvantages?
Motivation and goal priorities	• Are there other things that staff (you/visitors) want or need to do or achieve that might interfere with consistently carrying out good hand hygiene practice? • To what extent is infection control a priority based on your experience? • Are there any incentives to good hand hygiene practice that you have noticed? • When do you notice that staff (you/visitors)

	intend to wash your hands and struggle to do so?
Cognitive processing - memory, attention and decision process	• Are there times when staff (you/visitors) find it difficult to clean their hands when they should? • Why is that? • What are the times and situations when they (you/visitors) are most likely to forget to carry out hand hygiene? • Are there prompts in the environment to remind people? (Prompt, posters, gel) • Do habits or automatic behaviours influence hand hygiene practice?
Environmental context and resources	• What are the resources in the environment that help staff (you/visitors) with hand hygiene? • What environmental factors hinder hand hygiene? (Prompt, alcohol gel, soap, local sinks, staffing levels)
Social Influences	• Do you see healthcare practitioners encouraging each other to adopt good hand hygiene practices? (Prompt, peers, managers, other professional groups, other patients, relatives). • Do you encourage health care practitioners to adopt good hand hygiene practice?
Emotion regulation	• How does it make you feel when you think about hand hygiene? • How does it make you feel when you think about the consequences of not washing your hands or people caring for you not washing theirs?
Action planning	• Do you get any feedback when you wash your hands or when you forget? • Are there any systems to monitor hand hygiene in hospital?

Preferred method? Interview/focus group/questionnaire. Why?

Appendix 5 Patient interview schedule: non-BPS format (study one)

UNIVERSITY OF LEEDS

Patient interview schedule: non-BPS format

Area	Interview Questions
The Innovation: Hand hygiene	• What do you know about infection control and hand hygiene practices and where has this information come from? • Can you tell me a bit about any policies or protocols or guidance please? • Do you know how hospital workers/you/visitors are supposed to wash/disinfect your hands according to protocol? (prompt: Dr, nurse, porter etc) • How easy or difficult is it to do this in practice? • What do you think about these rules for washing /disinfecting hands? • Do you think some hospital workers experience more difficulties than others? (Probe: who)? • How important do you think hand hygiene is? • Why? (prompt: advantages and disadvantages) • Do you think hospital workers have difficulties with sticking to the rules for good hand hygiene practice?
The Individual	• What do you think helps or stops hospital workers following good hand hygiene practice? (Prompt: training, time, information, capabilities, constraints) • What would help? (With difficulties encountered and generally) • When do staff sometimes fail to wash their hands when they should? • What are the reasons for this? • When do you/visitors sometimes fail to wash their hands when they should? (probe: reasons for this)
Social Factors	• Do you think teamwork is important if hospital workers are to follow good hand hygiene practice? (prompts praise, role models, encouragement, managers involvement) • Do you think different groups/teams/areas perform hand hygiene better than others? (prompts are there any trends/themes) • What happens if someone does not wash their hands?
Organisational Factors	• Are there times when staff and visitors may find it hard to clean their hands when they should? • Why is that? • Based on your experience is infection control a priority in the hospital? • What measures have you seen to promote or help staff

	follow good hand hygiene practices? • Is there anything about the environment (e.g. ward) that would help support good hand hygiene? • And what might prevent good hand hygiene?
Other	• Overall, what do you think helps visitors and hospital workers follow good hand hygiene practice? • What stops good hand hygiene practice? • What measures are you aware of that the hospital is taking to improve hand hygiene practice? • What would you do to improve hand hygiene practice in hospitals?

Preferred method? Interview/focus group/questionnaire. Why?

Appendix 6 Questionnaire: BPS format (study one)

Town distributed to:

UNIVERSITY OF LEEDS

Your Views on Hand Hygiene Practice

Questionnaire

- Thank you for taking part in this research study.
- The overall aim of the study is to extend knowledge of the barriers and levers to implementing best practice for hand hygiene practice in hospital.
- The purpose of this questionnaire is to find out what hospital staff think helps them follow best hand hygiene practice as well as what makes it difficult for them to do so.
- Your views are important so we hope you will consider taking part.
- If you decide to take part, please complete the questionnaire and send it back to me in the enclosed FREEPOST envelope within the next 7 days.
- There are no right or wrong answers we are simply interested in your views.
- Even if you do not complete the questionnaire, I would be grateful if you would return it in the envelope provided.

Once again, thank you for your help with this study.

Judith Dyson
PhD Student
School of Healthcare
University of Leeds
Baines Wing
LEEDS
LS2 9UT
0113343 3397
hcjd@leeds.ac.uk

Your Views on Hygiene Practice

1. What is your job title? (E.g. Consultant Surgeon) .....

2. Are you Male/Female? (delete as applicable)

3. What area do you work in? (E.g. Care of the Elderly) .....

Please put the answers to the following questions in the box below. If you need more space please feel free to attach a separate sheet.

Please note the time, at the end you will be asked how long this questionnaire took to complete.

4. What do you know about infection control and hand hygiene practices and where has this information come from?
5. Can you tell me a bit about any policies or protocols or guidance please?
6. Do you know how you are supposed to wash/disinfect your hands according to protocol?
7. How easy or difficult is this to do in practice? Why?
8. To what extent is following guidelines for hand hygiene or infection control part of your professional role?

9. Would this be true of all professional groups involved? If not, which groups? Why?
10. Are you happy in your role to abide by these guidelines? Why?
11. How easy is it for you to carry our hand hygiene practice? (for example having other priorities, or your own outlook and motivation)
12. What difficulty do you have in achieving good practice with regard to hand hygiene?
13. What would help? With difficulties encountered and generally.
14. How confident are you that you can achieve good practice in hand hygiene?
15. What are the advantages of hand hygiene? (long and short term)
16. What are the disadvantages of hand hygiene? (long and short term)

17. Do you think the advantages outweigh the disadvantages?
18. Are there other things that you want or need to achieve that might interfere with consistently carrying out good hand hygiene?
19. To what extent is infection control a priority in your practice?
20. Are there any incentives to good hand hygiene practice?
21. When do you intend to wash your hands and struggle to do so?
22. Are there times when you find it difficult to clean your hands when you should? Why?
23. What are the times and situations when you are most likely to forget to carry out hand hygiene?

24. Are there any prompts in the environment to remind you? (for example posters, gel)
25. Do habits or automatic behaviours influence hand hygiene practice?
26. What are the resources in the environment that help you with hand hygiene?
27. Do the people that you work with encourage you to adopt good hand hygiene practice? (for example colleagues, managers, other professionals, patients, relatives)
28. Do the people you work with carry out good hand hygiene practices themselves?
29. How does it make you feel when you think about hand hygiene?
30. How does it make you feel when you think about the consequences of not washing your hands?

31. Do you get any feedback when you wash your hands of when you forget?
32. Are there any systems to monitor hand hygiene in your ward/unit?
33. How long did it take for you to fill in this questionnaire?

When asked about your views on what helps or interferes with your ability to undertake your work, which method would you prefer?

Questionnaires like this one ☐

An interview with a researcher ☐

A group discussion with colleagues ☐

Thank you for taking the time to help. Please return this completed questionnaire in the envelope provided.

Judith Dyson
PhD Student
School of Healthcare
University of Leeds
Baines Wing
LEEDS
LS2 9UT
0113343 3397
hcjd@leeds.ac.uk

Appendix 7 Questionnaire: non-BPS format (study one)

Town distributed to:

UNIVERSITY OF LEEDS

Your Views on Hand Hygiene Practice

Questionnaire

- Thank you for taking part in this research study.
- The overall aim of the study is to extend knowledge of the barriers and levers to implementing best practice for hand hygiene practice in hospital.
- The purpose of this questionnaire is to find out what hospital staff think helps them follow best hand hygiene practice as well as what makes it difficult for them to do so.
- Your views are important so we hope you will consider taking part.
- If you decide to take part, please complete the questionnaire and send it back to me in the enclosed FREEPOST envelope within the next 7 days.
- There are no right or wrong answers we are simply interested in your views.
- Even if you do not complete the questionnaire, I would be grateful if you would return it in the envelope provided.

Once again, thank you for your help with this study.

Judith Dyson
PhD Student
School of Healthcare
University of Leeds
Baines Wing
LEEDS
LS2 9UT
0113343 3397
hcjd@leeds.ac.uk

Your Views on Hygiene Practice

1. What is your job title? (E.g. Consultant Surgeon) .....

2. Are you Male/Female? (delete as applicable)

3. What area do you work in? (E.g. Care of the Elderly) .....

Please put the answers to the following questions in the box below. If you need more space please feel free to attach a separate sheet.

Please note the time, at the end you will be asked how long this questionnaire took to complete.

4. What do you know about infection control and hand hygiene practices and where has this information come from?
5. Can you tell me a bit about any policies or protocols or guidance please?
6. Do you know how you are supposed to wash/disinfect your hands according to protocol?
7. How easy or difficult is this to do in practice?

8. What do you think about these rules for washing/disinfecting hands?
9. Do you think some hospital workers experience more difficulties than others? Why?
10. How important do you think hand hygiene is? Why?
11. What helps or stops you from following good hand hygiene practice (for example, training, time, information, capabilities, constraints)
12. What would help with difficulties encountered and generally?
13. When do you sometimes fail to wash your hands when you should?

14. What are the reasons for this?
15. Do you think teamwork is important if hospital workers are to follow good hand hygiene practice? (for example praise, role models, encouragement, managers involvement)
16. Do you think different groups/teams/areas perform hand hygiene any better than others? If so, are there any trends? And, why is this the case?
17. Do you get any feedback if you wash your hands of if you forget?
18. Are there times when you find it hard to clean your hands when you should? Why?

19. Is infection control a priority in the hospital?
20. What measures have you seen to promote or help you/other staff follow good hand hygiene practices?
21. Is there anything about your environment (e.g. the ward) that would help support good hand hygiene?
22. Overall, what do you think helps you follow good hand hygiene practice?
23. What stops good hand hygiene practice?

24. What measures are you aware of that the hospital is taking to improve hand hygiene practice?
25. What would you do to improve hand hygiene practice in hospitals?
26. How long did it take you to complete this questionnaire?

When asked about your views on what helps or interferes with your ability to undertake your work, which method would you prefer?

Questionnaires like this one ☐

An interview with a researcher ☐

A group discussion with colleagues ☐

Thank you for taking the time to help. Please return this completed questionnaire in the envelope provided.

Judith Dyson
PhD Student
School of Healthcare
University of Leeds
Baines Wing
LEEDS
LS2 9UT
0113343 3397
hcjd@leeds.ac.uk

Appendix 8 Invitation to interview/focus group: practitioner (study one)

Judith Dyson
0113 343 33397
hcjd@leeds.ac.uk
Room 3.35
School of Healthcare
Baines Wing
University of Leeds
PO Box 214
Leeds LS2 9UT

UNIVERSITY OF LEEDS

Date

Dear Colleague

Implementation of evidence-based practice: the case of hand hygiene

We would like to invite you to take part in a research study that is being carried out at the University of Leeds.

The overall aim of the study is to extend knowledge of the barriers and levers to implementing best practice for hand hygiene practice in secondary care.

The purpose of this stage of the study is to explore the views of practitioners themselves on what helps and hinders them implementing best practice with regard to hand hygiene.

You will find enclosed a Participant Information Sheet about this research study and we would ask you to read through this information sheet. If after reading the information you think that you might be interested in taking part, then please fill in the Participant Reply Slip and send it back to the University in the Freepost envelope as soon as possible enclosed. Alternatively you can email us at hcjd@leeds.ac.uk.

You will then be contacted by telephone in order to give you an opportunity to ask any questions and to arrange a convenient time to carry out a face to face interview *(for you to attend a focus group)*. You can change your mind about participating at any time.

You will also find enclosed a Consent Form. When you have had an opportunity to ask questions, prior to the interview, you will be asked to complete two of these, one to keep and one for us to take away.

We look forward to hearing from you.

Yours faithfully

Judith Dyson
PhD student
Tel: 0113 343 3397
Email: hcjd@leeds.ac.uk

Francine Cheater
Professor in Public Health Nursing

Appendix 9 Participant information sheet interview/focus group: practitioner (study one)

UNIVERSITY OF LEEDS

PARTICIPANT INFORMATION SHEET

Study title: Implementation of evidence-based practice: the case of hand hygiene

- We are inviting you to take part in a research study. Before you decide it is important that you understand why the research is being done and what it will involve.
- Please take time to read the following information carefully.
- Discuss it with others if you wish.
- Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

PART 1
What is the study about?

The overall aim of the study is to extend knowledge of the barriers and levers to implementing best practice for hand hygiene practice in secondary care.

The purpose of this stage of the study is to explore the views of practitioners on what helps and hinders them implementing best practice with regard to hand hygiene.

Why have I been chosen?

We are inviting 70 - 75 health care practitioners working in different clinical areas in the hospitals within Leeds Teaching Hospitals NHS Trust, Harrogate and District NHS Foundation Trust and Hull NHS Trust to participate. We would like to speak to as wide a range of people as possible including nurses, health care assistants, doctors, porters, therapists and other health care practitioners.

Do I have to take part?

No it is up to you to decide. If you do decide to participate you can change you mind at any time without giving a reason.

What will happen to me if I do take part?

If you do decide to take part, you will be contacted to discuss the study and to arrange a time for the interview *(focus group)* to take place. You will be given an opportunity to ask questions at this time. If you do decide to participate you will be asked to two copies of the enclosed *(attached)* consent form. You will be interviewed face to face (*attend a focus group with about 7 other health care practitioners from other areas of the NHS trust*). The interview will last

approximately 20 minutes *(focus group will last approximately 1 hour)* but this will vary depending on how much you have to say. After this interview *(focus group)* your participation in the study stops.

What are the advantages and disadvantages of taking part?

There will be some demands on your time as described above. We don't think any of the questions we want to ask you are embarrassing or upsetting. But if any question is asked that you do not wish to answer that is absolutely fine.

If you take part you will be helping us understand the issues that help and hinder health care practitioners working in hospital settings care from implementing best practice in relation to hand hygiene. This information will help the successful transfer of knowledge about hand hygiene practice to secondary care practitioners in the future resulting in increased hand hygiene practice and the potential to reduce the transfer of hospital acquired infections.

What do I do now?

- If you wish to take part please complete and return the enclosed reply slip and send it back to us in the freepost envelope as soon as possible. Or, you can email us with your reply (hcjd@leeds.ac.uk), or you can simply telephone us (0113 343 3397).
- You will then be contacted by telephone within the next 3-7 days (at a time convenient to you) to allow you to ask any questions and to arrange a time to interview you.
- You will be asked to complete 2 copies of the enclosed consent form
- You will be interviewed at a time that is convenient to you.

Who can I talk to for more information or advice about the study?

The investigator will do her best to answer any questions you may have (Judith Dyson – contact details below).

PART 2

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

If you withdraw from the study we will keep your data that you have consented to provide unless you disagree with this.

What if there is a problem?

If you have a concern about any aspect of this study you should ask to speak with one of the investigators who will do her best to answer your questions (contact Judith Dyson or Francine Cheater – details below). If you remain unhappy and wish to complain formally you can do this through Clare Skinner, Faculty Research Manager, Faculty of Medicine and Health, University of Leeds, Tel. 0113 343 4897.

Will the information I give be kept confidential?

Your interview *(focus group)* will be recorded for transcription purposes. The tape recording will be destroyed within 3 months of the anonymous transcription and the anonymous transcription itself will be retained for 15 years after the study has finished. All information collected about you during the research will be kept strictly confidential and will be stored securely. No names will be mentioned in any spoken or written reports of the study. Care will be taken to ensure that individuals cannot be identified from details in reports. Our procedures for processing, storing and destroying your data comply with the Data Protection Act 1998. You will be given an ID number and at the end of the study your contact details linking you to your ID number will be destroyed.

What will happen to the results of the research study?

Talks will be given to health care practitioners and academics during the study period and afterwards. Results from the study will be published in journals during the study period and afterwards.

Health care practitioners that take part in this study will be offered a summary of the final report. If you would like a copy you can tell us now or later at the address below.

No identifying information from any participant will be in any report or talk or publication.

Who has reviewed this study?

This study has been reviewed by the Leeds East Research Ethics committee and the School of Healthcare Research Ethics Committee. The study is being funded by the Medical Research Council as part of a PhD.

Thank you for your time!

Contact details:

Judith Dyson, PhD Student
Address: School of Healthcare, Room 3.35, Baines Wing, University of Leeds, LEEDS, LS2 9UT
Telephone: 0113 343 3397.
Email: hcjd@leeds.ac.uk

Professor Francine Cheater
Address: School of Healthcare, Baines Wing, University of Leeds, LEEDS, LS2 9UT
Telephone: 0113 343 6877
Email: f.m.cheater@leeds.ac.uk

Appendix 10 Consent form interview/focus group (study one)

School of Healthcare
Judith Dyson Tel: 0113 343 33397
hcjd@leeds.ac.uk
Room 3.35
Baines Wing
University of Leeds
PO Box 214
Leeds LS2 9UT

UNIVERSITY OF LEEDS

Study Number: 08/H1306/31
Participant Identification Number:

CONSENT FORM FOR INTERVIEW

Title of Project: **Implementation of evidence-based practice: the case of hand hygiene**

Name of Researcher: Judith Dyson
Please initial box

1. I confirm that I have read and understand the information sheet dated x/x/xx (version x) 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 I am free to withdraw at any time without giving any reason, without my legal rights being affected. Information I have given before I withdraw from the study will be used. ☐
3. I understand that the any information I give may be included in published documents but my identity will be protected by the use of pseudonyms. ☐
4. I understand that the interview will be transcribed and stored safely ☐
5. I agree to take part in the above study ☐

Name of participant	Date	Signature
Name of person taking consent	Date	Signature

Appendix 11 Participant information sheet interview: patient (study one)

UNIVERSITY OF LEEDS

PARTICIPANT INFORMATION SHEET

Study title: Implementation of evidence-based practice: the case of hand hygiene

- We are inviting you to take part in a research study. Before you decide it is important that you understand why the research is being done and what it will involve.
- Please take time to read the following information carefully.
- Discuss it with others if you wish.
- Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

PART 1
What is the study about?

The overall aim of the study is to extend knowledge of what helps and hinders health care practitioners implementing best practice for hand hygiene practice in secondary care.

The purpose of this stage of the study is to explore the views of members of the public that have experience of being in hospital on what they think helps and hinders health care staff from implementing best practice with regard to hand hygiene.

Why have I been chosen?

We are inviting 20 - 25 members of the public to participate. We would like to speak to as wide a range of people as possible, including both men and women and adults of all ages.

Do I have to take part?

No it is up to you to decide. If you do decide to participate you can change you mind at any time without giving a reason.

What will happen to me if I do take part?

If you do decide to take part, you will be contacted to discuss the study and to arrange a time for the interview to take place. You will be given an opportunity to ask questions at this time. After this we will ask you to complete a form confirming that you understand and consent to be interviewed. You will be interviewed either by telephone, or if you prefer, face to face. The interview will last approximately 20 to 30 minutes but this will vary depending on how much you have to say. After this interview your participation in the study stops.

What are the advantages and disadvantages of taking part?

There will be some demands on your time as described above. We don't think any of the questions we want to ask you are embarrassing or upsetting. But if any question is asked that you do not wish to answer that is absolutely fine.

If you take part you will be helping us understand the issues that help and hinder health care practitioners working in hospital settings care from implementing best practice in relation to hand hygiene. This information will help the successful transfer of knowledge about hand hygiene practice to secondary care practitioners in the future resulting in increased hand hygiene practice and the potential to reduce the transfer of hospital acquired infections.

What do I do now?

- If you wish to take part please complete and return the enclosed reply slip and send it back to us in the freepost envelope as soon as possible. Or, you can email us with your reply (hcjd@leeds.ac.uk), or you can simply telephone us (0113 343 3397).
- You will then be contacted by telephone within the next 3-7 days (at a time convenient to you) to allow you to ask any questions and to arrange a time to interview you.
- You will be asked to complete 2 copies of the enclosed consent form and return in the second free post envelope enclosed.
- You will be interviewed at a time that is convenient to you.

Who can I talk to for more information or advice about the study?

The Investigator will do her best to answer any questions you may have (Judith Dyson – contact details below).

PART 2

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

If you withdraw from the study we will keep your data that you have consented to provide.

What if there is a problem?

If you have a concern about any aspect of this study you should ask to speak with one of the investigators who will do her best to answer your questions (contact Judith Dyson or Francine Cheater – details below). If you remain unhappy and wish to complain formally you can do this through Clare Skinner, Faculty Research Manager, Faculty of Medicine and Health, University of Leeds, Tel. 0113 343 4897.

Will the information I give be kept confidential?

Your interview will be recorded for transcription purposes. The tape recording will be destroyed within 3 months of the anonymous transcription and the anonymous transcription itself will be retained for 15 years after the study has finished. All information collected about you during the research will be kept strictly confidential and will be stored securely. No names will be mentioned in any spoken or written reports of the study. Care will be taken to ensure that individuals cannot be identified from details in reports. Our procedures for processing, storing and destroying your data comply with the Data Protection Act 1998. You will be given an ID number and at the end of the study your contact details linking you to your ID number will be destroyed.

What will happen to the results of the research study?

Talks will be given to health care practitioners and academics during the study period and afterwards. Results from the study will be published in journals during the study period and afterwards.

People that take part in this study will be offered a summary of the final report. If you would like a copy you can tell us now or later at the address below.

No identifying information from any participant will be in any report or talk or publication.

Who has reviewed this study?

The overall study has been reviewed by the Leeds East Research Ethics committee. This part of the study has been reviewed by the School of healthcare research ethics committee. The study is being funded by the Medical Research Council as part of a PhD study.

Thank you for your time!

Contact details:

Judith Dyson, PhD Student
Address: School of Healthcare, Room 3.35, Baines Wing, University of Leeds, LEEDS, LS2 9UT
Telephone: 0113 343 3397.
Email: hcjd@leeds.ac.uk

Professor Francine Cheater
Address: School of Healthcare, Baines Wing, University of Leeds, LEEDS, LS2 9UT
Telephone: 0113 343 6877
Email: f.m.cheater@leeds.ac.uk

Appendix 12 Participant information sheet Delphi survey (study two)

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PARTICIPANT INFORMATION SHEET

Study title: Implementation of evidence-based practice: the case of hand hygiene

- We are inviting you to take part in a research study. Before you decide it is important that you understand why the research is being done and what it will involve.
- Please take time to read the following information carefully.
- Discuss it with others if you wish.
- Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

PART 1

What is the study about?

The overall aim of the study is to extend knowledge of the barriers and levers to implementing best practice for hand hygiene practice in secondary care.

The purpose of this stage of the study is to reach consensus on where established barriers and levers (from the literature and from interviews, focus groups and questionnaires with health care practitioners and interviews with patients) to hand hygiene practice best fit within a group of 11 psychological domains (such as knowledge, skills or memory).

Why have I been chosen?

We are inviting 30 people with experience in the fields of Psychology, Infection Prevention and control and Clinical Governance to take part.

Do I have to take part?

No it is up to you to decide. If you do decide to participate you can change you mind at any time without giving a reason.

What will happen to me if I do take part?

Your involvement in the study will be over a period of approximately two months.

Initially you will be sent (by email) a list of barriers and levers to hand hygiene. Examples of barriers include a lack of training and not enough facilities. Examples of levers include good clear policies and having enough time.

You will be asked to sort these according to a set of 11 psychological domains (for example knowledge, skills or memory) that you will also be sent. This is likely to take approximately 15 minutes.

Your answers and those of other participants will be analysed to assess the level of agreement for each of the barriers/levers and the corresponding psychological domains and summarised and then sent back to you to look at for a second time.

At this time you will be asked to repeat the same exercise as the first time (i.e. sort the barriers and levers according to the 11 psychological domains). The list will be slightly different from the first round as your and other participant's answers will have allowed us to refine them. This is expected to take around 10 minutes.

What are the advantages and disadvantages of taking part?

There will be some demands on your time as described above. These should be minimal – we do not expect the process to take long to complete. We estimate that the first round of the Delphi survey will take approximately 15 minutes and the second round will take approximately 10 minutes.

If you take part you will be helping us gain a much better understanding of the issues that help and hinder health care practitioners working in hospitals, to comply with best hand hygiene practice. This study will help to determine whether an approach that uses a more systematic, 'diagnostic' approach, informed by what we know from psychological theories is a useful way of supporting health care practitioners to change

What do I do now?

If you wish to take part please reply to the email you have been sent requesting your participation.

Who can I talk to for more information or advice about the study?

The Investigator will do her best to answer any questions you may have (Judith Dyson – contact details below).

PART 2

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

If you withdraw from the study we will keep any data that you have consented to provide unless you disagree with this.

What if there is a problem?

If you have a concern about any aspect of this study you should ask to speak with one of the investigators who will do her best to answer your questions (details below). If you remain unhappy and wish to complain formally you can do this

through Clare Skinner, Faculty Research Manager, Faculty of Medicine and Health, University of Leeds, Tel. 0113 343 4897.

Will the information I give be kept confidential?

All information collected about you during the research will be kept strictly confidential and will be stored securely. No names will be mentioned in any spoken or written reports of the study. Care will be taken to ensure that individuals cannot be identified from details in reports. Our procedures for processing, storing and destroying your data comply with the Data Protection Act 1998. You will be given an ID number and at the end of the study your contact details linking you to your ID number will be destroyed.

What will happen to the results of the research study?

Talks will be given to health care practitioners and academics during the study period and afterwards. Results from the study will be published in journals during the study period and afterwards.

Health care practitioners that take part in this study will be offered a summary of the final report. If you would like a copy you can tell us now or later at the address below.

No identifying information from any participant will be in any report or talk or publication.

Who has reviewed this study?

This study has been reviewed by the Leeds East Research Ethics committee. The study is being funded by the Medical Research Council as part of a PhD.

Thank you for your time!

Contact details:

Judith Dyson, PhD Student
Address: School of Healthcare, Room 3.35, Baines Wing, University of Leeds, LEEDS, LS2 9UT
Telephone: 0113 343 3397.
Email: hcjd@leeds.ac.uk

Dr Cath Jackson
Address: School of Healthcare, Baines Wing, University of Leeds, LEEDS, LS2 9UT
Telephone: 0113 343 1576
Email: c.j.jackson@leeds.ac.uk

Appendix 13 The process of collating all barriers and levers for the Delphi survey (study 2)

The process of collating all barriers and levers for Delphi survey

Theme: ***Sub-theme***	**Barrier/Lever included** ***Barrier/Lever not included***	**Included in Delphi as** ***Not included because***
Environmental:		
Financial	*Funding frozen, no money for improvements, lots of money for IPC needs*	*Cost of infection appears in theme consequences. Expense/money for improvements appear in theme environment, sub-theme practical resources*
Staff	Training lag	Training lag – staff are insufficiently trained for specialist posts
	Staff not aware of guidelines	*This appears in and overlaps with the theme knowledge, sub-theme source of knowledge*
	Full hands	Full hands e.g. carrying equipment makes HH difficult
	Staff and staff mix	Staff/skill mix is important if HH is to be carried out
	Staffing levels	Poor staffing levels
	Works in different areas/departments	Working in more than one area makes HH difficult (e.g. hospital and community)
	Staff turn over, agency staff, problems recruiting	*These were mentioned few participants and in only one trust and were therefore not considered generalisable*
Time	Gel	Gel is always available
	Frequency of HH	It is not possible to do HH as frequently as needed
	Inefficient routines	Inefficient systems of care inhibit HH
	No time for courses/training	No time to attend HH courses
Ward/ department	Different areas have different needs e.g. elderly higher levels of Clostridium difficile, ICU more invasive procedures, outpatients higher patient throughput	Type of ward environment
Practical resources	Resources/improvements are expensive	Necessary equipment is too expensive
		There is no money for the improvements that would help HH
	Sinks	There are not enough sinks for good HH
	Facilities e.g. gloves, gel, lever taps	Facilities are inadequate for HH
	High Bed occupancy	*Appears in improvement strategies/conflicting policies*
	Clutter	A cluttered environment prohibits HH
	Unusual or a mix of strategies	*Appears in the theme improvement strategies, sub-theme multifaceted approach*

Social/Cultural:	Prompt others is difficult	Afraid to ask others to carry out HH
Individual	Difficult to prompt seniors	Reluctant to prompt senior staff with HH
Manager or IPC team	Good ward manager, expectations, manager/IPC/others set good example, Encouraged, Disapproval	Strong leadership makes HH more likely
		Opinion leaders promote HH
		Supervision from seniors improves HH
		IPC teams influence HH
		Encouragement helps HH compliance
		Criticised when HH missed
		Challenged when HH not carried out
		Praise makes HH more likely
	Disciplinary action	*Appears in the theme incentives, sub-theme sanctions*
Team and peers	Team spirit, let the team down	Reluctant to let the team down by omitting HH
	Peer pressure	The influence of peer pressure on HH
	Ward culture supports HH	Positive ward culture increases the likelihood of HH
	Role Models	Good role models improve HH
Patients	Patients prompt, patient expectation	Patients expect good HH from staff
	Respect for patients	*This appears in the theme attitude*
Knowledge/skills:	E learning	E learning about HH
Source of knowledge	HH champions	Champions help HH compliance
	Patients aware of information	Information for patients helps improve their HH
	Adverts	Adverts relating to HH prompt practice
	Newsletters	A HH newsletter improves practice
	Basic training not good enough	Basic training does not cover HH sufficiently
	Training is according to professional group	HH training is tailored according to professional group and need
	Courses, induction	Good HH training helps
	Guidelines	Available HH guidelines
	Glow and show box	Using the "glow and show" light box identifies unclean hands and influences HH
	Notice boards	Infection prevention notice boards prompt HH
		Infection prevention notice boards inform HH
	Link professionals	A practitioner (link) is responsible for communicating with the IPC team
	IPC team give information that motivates	Managers and IPC team are motivating with HH
	Guidelines are too long	HH guidelines are too long

	Intranet, posters, meetings, email, publicity, journals, screen savers	*It was considered that these additional sources of knowledge were covered elsewhere or overlapped significantly with sources already mentioned*
Literacy	Not computer literate	Not computer literate
	Poor literacy	*It was expected that one item relating to literacy would capture all relevant barriers/levers and therefore only computer literacy was included*
Belief in effectiveness	Don't believe the research, HH doesn't reduce HCAI, conflicting information	Don't believe that HH reduces infection in hospitals
	Disagree with guidelines/part of guidelines	Disagree with HH guidelines
Self efficacy	Confident about HH	A confidence in HH ability aids good practice
	Glow and show gives confidence in procedure for HH	*Appears in knowledge/skills*
Complexity of procedure	*Easy to do, difficult to fit it in, difficult integrating into practice*	*This was covered in theme habit/routine*
Improvement Strategies:	Name and shame regarding audits or HH	Name and shame, being made an example of for bad HH
		Blame from others if HH not carried out
Audit and Feedback	Zero tolerance	There is zero tolerance for poor HH
	Audit, feedback, information from audit and feedback	Audit and feedback improves HH
	Embarrassed about results	*This is covered in the theme emotion*
Conflicting Policies	Bed occupancy	Some government policies make HH more difficult (e.g. bed occupancy)
	Other (a range of conflicting policies are outlined in section 3.3.2.)	*It was considered that one example would be sufficient*
Infection prevention Team	*For information and support and because they co-ordinate improvement strategies*	*Appears in the themes incentives, sub-theme sanction, in the theme cultural, but-theme manager or IPC team, in the theme knowledge/skills, subtheme source of knowledge*
Multifaceted	A number of approaches mixed together (individual approaches included are listed below)	Several improvement strategies at the same time make HH more likely
Visual	*Notice boards, adverts, posters, media, advertising, circulars, screen savers*	*Appears in theme knowledge/skills, sub-theme source of knowledge*
Other	Non-negotiable	HH is a non-negotiable part of the job
	Gel	*Appears in the theme environmental, sub-theme time*
	Board to ward policy	Board to ward responsibility improves practice
	Certificates	A certificate for good HH
	Matrons	Reintroduction of matrons improves HH
	Targets and surveillance	Government and organisational targets mean HH is more likely
Professional: Professional Role	Doctors less likely, porters may have full hands, nurses more likely than others to clean hands	Some professional groups are more likely to clan hands than others
	Community AND hospital based, work several areas of hospital	*Appears in the theme environmental, sub-theme ward/department*

Professionalism	*Literacy problems with some groups such as porters/domestic staff* *Embedded into professional practice* Professionalism, part of professional role	*Appears in the theme knowledge/skills, sub-theme literacy* *Appears in the theme habit/routine* Professional culture influences HH
Consequences: Organisation Patient Staff	Cost Ward closure Loss of status, targets not met *Reputation* Infections, prolonged hospital stay, death Sore hands, irritation to gel or soap Infection Patients complain Hand cream *Guilt* Occupational health *Bad reputation*	The thought of the cost of infections in hospital improves HH Fear of ward closure due to infection if HH omitted The organisation would lose status if HH not carried out *Appears in the theme incentives, sub-theme sanctions* Patient may catch an infection and die if HH omitted Sore hands reduces HH HH is carried out to prevent an infection to self HH is carried out to prevent complaint from patients Hand cream encourages HH *Appears in the theme emotion* Advice from occupational health regarding sore hands improves HH *Appears in the theme incentives, sub-theme sanctions*
Motivation	*Enthusiastic* Good intentions It's not important Conflicting priorities such as emergencies, falls, cardiac arrest It is important, a priority *Complacency, poor morale, worn out by HCAI, lazy, can't see the benefit, determined, self motivated, try to motivate the team*	*Appears in the theme emotion* Good intentions to HH result in better HH Belief that HH is not important Emergencies and other priorities prevent HH HH is a priority *Appears in the theme attitude*
Habit/routine	Embedded into practice Automatic, do it without thinking, routine, innate, "hammered into us", second nature, ingrained Bad habits v good habits	HH is embedded into professional practice It is automatic to clean hands HH is a good habit
Attitude	More important things to do, couldn't care less Respect for patient Think it's important, dedicated, caring ,conscientious, committed Complacent/indifferent Cant be bothered/lazy/arrogance	More important things to do than HH Respect for patient improves HH Good attitude promotes HH Cant be bothered to carry out HH No body else bothers with HH
Memory	Forget when busy, distracted, routine changes Forget when tired/stressed/under pressure Reminded by posters/screen savers/audits/gel	Forgets HH Forget HH when tired Adverts relating to HH inform practice

Emotion: Pride	Pride, sense of achievement when audit is good, when a good job is done	HH is better when the practitioner takes a pride in their work
Anticipated regret	Shame/regret/ guilt at the thought of not doing HH, at the thought of infection patients or at the thought of bad audit results	Ashamed if HH omitted Anticipated guilt or regret if hands are not cleaned Feel guilty when HH omitted Don't want to feel responsible for infecting patients so carry out HH Self blame if HH omitted Embarrassed to fail HH audits
Other	Reassuring for patients Enthusiastic *Respect for patient, empathy with patient* Frustrates *Complacency, demoralised, lazy* Angry/upset when omitted (by self or others)	HH creates patient confidence Enthusiastic about HH *Appears in the theme attitude* Frustrated when other omit HH *Appears in the theme motivation* Angry if HH not carried out
Incentives: Rewards	*Certificate, day off, better patient outcomes, reputation, praise, regard from others, good audit results, pride, other positive emotion*	*Appears in the theme improvement strategies, sub-theme other*
Sanctions	Fear of disciplinary action, disciplinary action *"Told off", disapproval from others* *Name and shame*	Fear of disciplinary action if HH not carried out *Appears in the theme social/cultural, sub-theme manager/IPC team* *Appears in the theme emotion*

Appendix 14 Delphi survey: round one (study two)

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Delphi Survey: Consensus on Classification of the Barriers and Levers to Hand Hygiene

INFORMATION

What is the Study about?

The overall aim of the study is to produce a "diagnostic tool" that will accurately and reliably assess barriers and levers to hand hygiene. This tool will be developed to enable health care practitioners working in secondary care to tailor interventions to improve hand hygiene based on identified barriers and levers.

The purpose of this stage of the study is to reach consensus on where identified barriers and levers (from the literature and talking to health care practitioners and patients) fit within a group of 11 categories (psychological domains such as knowledge, skills or memory (adapted from Michie et al. 2005).

Why have you been chosen?

We are inviting 30 people with expertise in the fields of Health Psychology, Infection Prevention and Control, and Clinical Governance to participate in the Delphi Survey. You have been selected because you can provide an expert opinion.

What will happen?

Your involvement will require you to complete this survey on two occasions.

Full instructions are given overleaf.

On the first occasion this will take approximately 15 minutes. Your answers and those of the other participants will be analysed to assess the level of agreement. The results will be summarised and then sent back to you to look at for a second time to repeat the same task as in the first round. The list of barriers and levers will be slightly different from the first round as your and the other participants answers will have allowed us to refine them. It is expected that it will take less time to complete on the second occasion.

More information

An information sheet is attached with further information. Full instructions on how to carry out this survey are on the next page. If you would like any other information you can contact us (details below).

Thank you for taking part!

Judith Dyson (PhD Student),
Address: School of Healthcare, Room 3.35, Baines Wing, University of Leeds, Leeds, LS2 9UT.
Email: hcjd@leeds.ac.uk **Telephone** 0113 343 3397

INSTRUCTIONS

- Please look at the categories below and the explanations that go with them. You can refer to these later if you need to.
- This list of numbered categories will be shown on each page.
- There will be lists of barriers and levers to hand hygiene on each of the following pages. Next to each barrier or lever please write/type the number of the category within which you consider the barrier or lever best fits.
- **If you select "0" (there is no suitable category) you will be given an opportunity at the end of the survey suitable categories.**
- **It is possible that you may consider a barrier or lever will fit into MORE THAN ONE category. If this is the case please chose the ONE category that you think best.**
- There are no right or wrong answers; it is your expert opinion that is important.
- When you have finished please save your answers and email back to hcjd@leeds.ac.uk or send to the FREEPOST address at the end of the survey

An example of what you are being asked to do is given on the next page.

Category Number	Category (Psychological Domain)	Explanation/Definition
0	None	There is no suitable category.
1	Knowledge	Knowledge about hand hygiene as a procedure or the scientific rationale for it.
2	Skills	Ability to clean hands according to guidelines.
3	Professional Role	Identity, role or professional standards in relation to hand hygiene.
4	Capabilities	Self confidence, empowerment or self esteem about hand hygiene. How easy or difficult hand hygiene is.
5	Consequences	Expected outcome of hand hygiene or neglecting hand hygiene. Incentives/rewards/punishment/sanctions. Attitudes. Perceived risk/threat.
6	Motivation and goals	Intention to clean hands, goal setting, priority, commitment to hand hygiene. Other goals conflicting with hand hygiene.
7	Memory and Attention	Memory, attention, decision making that may affect hand hygiene.
8	Environmental Resources	Physical resources for hand hygiene. Available time and other resources.
9	Social Influences	The influence of leadership or team work on hand hygiene. Power/hierarchy. Social support.
10	Emotion	Mood, stress, fear, burn-out, anxiety, regret in regard to hand hygiene. Anticipated regret.
11	Action Plans	Making specific plans for hand hygiene, target setting, creating routine.

Number	Category
0	None
1	Knowledge
2	Skills
3	Professional role
4	Capabilities
5	Consequences
6	Motivation and priority
7	Memory and attention
8	Environmental
9	Social Influences
10	Emotion
11	Action Plans

*HH = Hand Hygiene

Please scroll to the right to see all four columns.

Barrier or Lever	Category
Example Positive ward Culture	*9*
Criticised when hand hygiene missed	
Type of ward environment (e.g. elderly v ICU) makes HH difficult	
Good role Models	
Necessary equipment is too expensive	
More important things to do than hand hygiene	
Strong leadership makes HH more likely	
Encouragement helps HH compliance	
Reluctant to let the team down by omitting HH	
Positive ward culture increases likelihood of HH	

Barrier or Lever	Category
Inefficient systems of care inhibit HH	
Embarrassed to fail HH audit	
It is automatic to clean hands	
There are not enough sinks for good HH	
Several improvement strategies at the same time make HH more likely	
Respect for patient improves likelihood of HH	
Training lag – staff insufficiently trained for specialist posts	
Sore hands reduce HH	
Infection promotion notice boards prompt HH	

Barrier or Lever	Category
Angry if HH not carried out	
Don't believe that HH reduces infections in hospitals	
Fear of ward closure due to infection if HH omitted	
Nobody else bothers with HH	
Anticipated guilt or regret if hands are not cleaned	
Good attitude promotes HH	
HH avoids getting a bad reputation	
HH is a good habit	
Forget HH when tired	
Can't be bothered with HH	

Number	Category
0	None
1	Knowledge
2	Skills
3	Professional role
4	Capabilities
5	Consequences
6	Motivation and priority
7	Memory and attention
8	Environmental
9	Social Influences
10	Emotion
11	Action Plans

*HH = Hand Hygiene

Please scroll to the right to see all four columns.

Barrier or Lever	**Category**
Don't want to feel responsible for infecting patient so carry out HH	
Praise makes HH more likely	
Staff/skill mix is important if HH is to be carried out	
Patient may catch an infection and die if HH omitted	
Name and shame – being made and example of if HH omitted	
Full hands (e.g. carrying equipment) makes HH difficult	
Working in more than one area makes HH difficult (e.g. hospital and community based)	

Barrier or Lever	Category
It is impossible to do HH as frequently as needed	
There is no money for the improvements that would help HH	
HH forgotten when feeling stressed	
HH carried out to prevent an infection to self	
Government and organisational targets mean HH more likely	
Fear of disciplinary action if HH not carried out	
HH carried out to avoid complaints from patients	
Belief that HH is not important	

Barrier or Lever	Category
Self blame if HH omitted or a hospital acquired infection occurs	
HH is embedded into professional practice	
Challenged if HH not carried out	
Facilities are inadequate for HH	
Afraid to ask others to carry out HH	
Not computer literate and therefore cannot access HH training	
The influence of peer pressure on HH	
Poor staffing levels make HH difficult	
Feel guilty when HH omitted	
Infection promotion notice boards inform HH	

Number	Category
0	None
1	Knowledge
2	Skills
3	Professional role
4	Capabilities
5	Consequences
6	*Motivation and* priority
7	Memory and attention
8	Environmental
9	Social Influences
10	Emotion
11	Action Plans

*HH = Hand Hygiene

Please scroll to the right to see all four columns.

Barrier or Lever	***Category***
Frustrated when others omit HH	
Adverts relating to HH inform practice	
The organisation would lose status if HH not carried out	
Enthusiastic about HH	
Complacent about HH	
There is zero tolerance to poor HH	
Some government policies make HH difficult (e.g. bed occupancy)	
Adverts relating to HH prompt practice	
HH is a non negotiable part of the job	
Good HH training helps	
Ashamed if HH omitted	

Barrier or Lever	Category
Hand hygiene champions help HH compliance	
Available HH guidelines	
The reintroduction of matrons improves HH	
A certificate for good HH	
Some professional groups are more likely to clean hands than others	
A HH newsletter helps improve practice	
No time to attend HH update courses	
Advice from occupational health regarding sore hands improves HH	
Blame from others if HH not carried out	

Barrier or Lever	Category
The thought of cost of infections in hospital improves HH	
E-learning about HH	
Audit and feedback encourages HH	
Patients expect good HH from staff	
Hand cream encourages HH	
Gel is always available	
A cluttered environment prohibits HH	
Emergencies and other priorities prevent HH	
HH guidelines are too long	

Number	Category
0	None
1	Knowledge
2	Skills
3	Professional role
4	Capabilities
5	Consequences
6	Motivation and priority
7	Memory and attention
8	Environmental
9	Social Influences
10	Emotion
11	Action Plans

*HH = Hand Hygiene

Please scroll to the right to see all four columns.

Barrier or Lever	Category
Supervision from seniors improves HH	
HH is a priority	
Information for patients improves their HH	
Board to ward responsibility for HH	
Infection prevention and control teams influence HH	
Good intentions to HH result in better HH	
HH better when practitioner takes a pride in their work	
Using the "glow and show" light box identifies unclean hands and influences HH	

Barrier or Lever	Category
A confidence in HH ability aids good practice	
HH training is tailored to professional group and need	
Forgets HH	
Disagree with HH guidelines	
A practitioner (link) responsible for communicating with the infection prevention team	
Reluctant to prompt senior staff with HH	
Managers and the Infection Prevention team are motivating with HH	
Professional culture influences HH	
Basic training does not cover HH sufficiently	

Barrier or Lever	Category
Opinion leaders promote HH	
HH creates patient confidence	

If you categorised any barrier or lever "0" please list below suggestions for alternative categories.

?

?

?

Thank you for completing this survey. Please save your answers and email or send back to:

Judith Dyson (PhD Student),
Address:
School of Healthcare
The University of Leeds
FREEPOST LS 3018
LEEDS LS2 3YY
Email: hcjd@leeds.ac.uk
Telephone 0113 343 3397

Appendix 15 Delphi survey: round two (study two)

UNIVERSITY OF LEEDS

Delphi Survey - Second Round: Consensus on Classification of the Barriers and levers to Hand Hygiene practice

INFORMATION

What happened in the first round?

Thank you for completing the first round of this survey. We very much appreciate all of the responses and comments that we have received.

Participants (experts in the fields of Psychology and Infection Prevention) sorted barriers and levers to hand hygiene practice into 11 categories (Psychological domains such as knowledge, skills or memory), or they suggested alternative categories.

What we did with your responses

We have sorted out all of the responses and consensus was reached (at a level of 70% and more) for approximately half of these barriers or levers.

The second round of the Delphi Survey

We now aim to achieve consensus on the remaining barriers and levers where possible.

This is the second and final round. Full instructions are given below. It is expected that completing this survey will take approximately 15 minutes. An information sheet is attached with further details. If you would like more information you can contact me (details below).

Instructions

There are a number of questions below, you are asked once again to categorise barriers or levers. On this occasion you are offered a choice of fewer categories (domains). Simply place an "x" below the statement you think most accurately reflects your expert opinion. You can either complete this electronically, save your answers and return by email, or print off and send to the FREEPOST address at the end of this survey.

The following page offers further instructions and definitions of all of the categories. **It may be helpful to print out this page for reference as you complete the survey.**

Thank you for taking part!

Judith Dyson (PhD Student),
Address: School of Healthcare, The University of Leeds, FREEPOST LS 3018, LEEDS, LS2 3YY
Email: hcjd@leeds.ac.uk Telephone: 0113 343 3397

INSTRUCTIONS

- Please look at the categories and definitions below (**it may help to print out this page**).
- Please note, although there are more pages to this survey that the one you completed in round one, this is because the relevant categories (domains) are shown next to each question. This survey should take less time to complete.
- On the next pages you will see statements about that are barriers or levers to hand hygiene practice.
- Below this there are a list of between 2 and 6 categories (domains). These are the categories that were chosen in the first round of the survey.
- You are reminded of your own response and you are also shown the aggregated responses from round one. The aggregated responses do not add up to 100% as outliers (responses far away from most others) have been removed.
- Having considered responses from round one and the definitions below, you are asked to place an x in the box under the statement you most agree with. An example is provided. PLEASE PLACE AN x UNDER A STATEMENT FOR EACH DOMAIN GIVEN.
- Any additional comments are very welcome.
- When you have finished please save your answers and email back to hcjd@leeds.ac.uk or send to the FREEPOST address at the end of the survey.

Category Number	Category (Psychological Domain)	Explanation/Definition
1	Knowledge	Knowledge about hand hygiene as a procedure or the scientific rationale for it.
2	Skills	Ability to clean hands according to guidelines.
3	Professional Role	Professional identity, role or standards in relation to hand hygiene.
4	Capabilities	Self confidence, empowerment or self esteem about hand hygiene. How easy or difficult hand hygiene is to do.
5	Consequences	Expected outcome of hand hygiene or neglecting hand hygiene. Incentives/rewards/punishment/sanctions. Perceived risk/threat.
6	Motivation and goals	Intention to clean hands, goal setting, priority, commitment to hand hygiene. Other goals conflicting with hand hygiene.
7	Memory and Attention	Remembering or forgetting hand hygiene. Decision making that may affect hand hygiene.
8	Environmental Resources	Physical resources for hand hygiene. Available time and other resources.
9	Social Influences	The influence of leadership or team work on hand hygiene. Power/hierarchy. Social support.
10	Emotion	Mood, stress, fear, burn-out, anxiety, regret or anticipated regret in regard to hand hygiene.
11	Action Plans	Making specific plans for hand hygiene, target setting, creating routine. Cleaning hands becomes habitual.

Example
Praise makes HH more likely

Category	*Your response*	*All responses*	*Very Good Fit*	*Good Fit*	*Barely Fits*	*Poor Fit*	*Very Poor Fit*
Social influences	√	*35%*	*x*				
Consequences		*30%*			*x*		
Motivation and goals		*25%*			*x*		

- Your response = the category you chose in round one is marked with √
- All responses = aggregated from participants in the first round of the Delphi survey
- HH = Hand Hygiene

1. Criticised when HH missed

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Consequences		58%					
Social Influences		26%					
Emotion		16%					

2. Inefficient systems of care inhibit HH

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Environmental resources		37%					
Action Plans		16%					

3. It is automatic to clean hands

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Action Plans		35%					
Memory and Attention		35%					
Social Influences		10%					

4. Respect for patient improves HH

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Professional Role		45%					
Consequences		25%					
Motivation and goals		15%					
Emotion		10%					

5. Infection promotion notice boards prompt HH

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Environmental Resources		32%					
Knowledge		21%					
Memory and attention		16%					
Action plans		10%					

6. Don't believe that HH reduces infections in hospitals

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Knowledge		47%					
Social Influences		37%					

7. Good attitude promotes HH

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Motivation and Goals		35%					
Consequences		30%					
Professional role		10%					

8. HH avoids getting a bad reputation

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Consequences		50%					
Professional role		20%					
Motivation and goals		15%					
Social Influences		10%					

9. HH is a good habit

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Memory and attention		25%					
Action Plans		20%					
Motivation and goals		20%					
Professional role		15%					

10. Forget HH when tired

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Memory and attention		58%					
Emotion		37%					

11. Can't be bothered with HH

Category	Your resp-onse	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Motivation and goals		53%					
Emotion		32%					

12. Praise makes HH more likely

Category	Your resp-onse	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Social influences		35%					
Consequences		30%					
Motivation and goals		25%					

13. Staff/skill mix is important if HH is to be carried out

Category	Your resp-onse	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Environmental Resources		42%					
Social Influences		21%					
Professional role		16%					
Skills		10%					

14. Name and shame – being made an example of if HH is omitted

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Consequences		55%					
Social influences		25%					
Emotion		20%					

15. Full hands e.g. carrying equipment makes HH difficult

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Capabilities		35%					
Skills		20%					
Environmental Resources		15%					
Motivation and goals		10%					

16. It is impossible to do HH as frequently as needed

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Capabilities		32%					
Motivation and goals		26%					
Knowledge		10%					
Environmental resources		10%					
Skills		10%					

17. Government and organisational targets mean HH more likely

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Action Plans		37%					
Professional role		26%					
Social Influences		16%					
Consequences		10%					

18. Belief that HH is not important

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Motivation and goals		33%					
Knowledge		22%					
Professional role		17%					
Memory and attention		11%					

19. Challenged if HH not carried out

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Consequences		53%					
Social Influences		36%					

20. Afraid to ask others to carry out HH

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Capabilities		42%					
Emotion		21%					
Consequences		10%					
Professional role		10%					
Social influences		10%					

21. Not computer literate

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Skills		55%					
Capabilities		20%					
Knowledge		10%					

22. Infection promotion notice boards inform HH

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Memory and attention		26%					
Knowledge		20%					
Action Plans		13%					
Environmental resources		13%					

23. Adverts relating to HH inform practice

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Knowledge		33%					
Memory and attention		20%					
Consequences		13%					
Motivation and goals		13%					
Environmental resources		13%					

24. Complacent about HH

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Motivation and goals		50%					
Memory and attention		15%					
Knowledge		10%					
Professional role		10%					

25. Adverts relating to HH prompt practice

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Memory and attention		41%					
Action plans		12%					

26. There is a zero tolerance to poor HH

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Consequences		40%					
Social Influences		35%					
Professional role		15%					

27. The reintroduction of matrons improves HH

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Social Influences		45%					
Professional role		25%					
Environmental resources		20%					

28. A certificate for good HH

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Consequences		45%					
Professional role		20%					
Motivation and goals		15%					
Knowledge		15%					
Capabilities		10%					

29. A HH newsletter helps improve practice

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Knowledge		53%					
Memory and attention		26%					

30. No time to attend HH courses

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Environmental resources		42%					
Motivation and goals		32%					
Capabilities		21%					

31. Advice from occupational health regarding sore hands improves HH

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Knowledge		45%					
Consequences		15%					
Action Plans		15%					
Capabilities		15%					

32. Audit and feedback encourages HH

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Action Plans		21%					
Consequences		21%					
Motivation and goals		16%					
Social Influences		16%					
Skills		10%					

33. Emergencies and other priorities prevent HH

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Motivation and goals		55%					
Environmental resources		20%					
Memory and attention		10%					

34. HH guidelines are too long

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Knowledge		42%					
Memory and attention		26%					
Capabilities		10%					

35. Board to ward responsibility for HH improves practice

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Professional role		37%					
Social Influences		26%					
Action Plans		21%					
Consequences		10%					

36. Infection prevention and control teams influence HH

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Social Influences		58%					
Professional role		21%					
Action plans		16%					

37. Using the "glow and show" light box identifies unclean hands and influences HH

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Consequences		23%					
Environmental resources		16%					
Skills		16%					
Motivation and goals		10%					
Knowledge		10%					

38. HH training is tailored to professional group and need

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Professional role		25%					
Skills		25%					
Knowledge		20%					
Action plans		15%					

39. Disagree with HH guidelines

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Motivation and goals		30%					
Knowledge		30%					

40. A practitioner (link) is responsible for communicating with the infection prevention team

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Social influences		50%					
Professional role		30%					
Knowledge		10%					

41. Angry if HH not carried out

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Emotion		60%					
Consequences		25%					
Social Influences		10%					

42. Reluctant to prompt senior staff with HH

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Social Influences		40%					
Professional role		15%					
Capabilities		15%					

43. Managers and infection prevention team are motivating with HH

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Social influences		55%					
Memory and attention		35%					

44. Professional culture influences HH

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Social Influences		47%					
Professional role		47%					

45. Frustrated when others omit HH

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Emotion		60%					
Social Influence		10%					
Consequences		10%					

46. The organisation would lose status if HH not carried out

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Consequences		60%					
Professional Role		15%					
Motivation and Priority		10%					

47. Information for patients improved their HH

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Knowledge		65%					
Social Influences		15%					

48. HH is better when practitioner takes pride in their work

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Professional Role		60%					
Motivation And priority		10%					
Emotion		10%					

49. Basic training does not cover HH sufficiently

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Knowledge		55%					
Skills		30%					

50. Training lag – staff are insufficiently trained for specialist posts

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Knowledge		50%					
Skills		15%					
Professional role		10%					

51. Good HH training helps

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Skills		40%					
Knowledge		35%					
Capabilities		10%					

52. Available HH guidelines

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Knowledge		55%					
Skills		20%					
Action Plans		10%					
Environmental resources		10%					

53. Embarrassed to fail HH audit

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Emotion		45%					
Consequences		35%					

54. Good role models improve HH

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Social Influences		65%					
Professional role		25%					

55. Encouragement helps HH compliance

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Social Influences		60%					
Motivation and Priority		15%					
Capabilities		10%					

56. Don't want to feel responsible for infecting patient so carry out HH

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Consequences		55%					
Emotion		30%					
Professional role		10%					

57. Nobody else bothers with HH

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Social Influences		60%					
Motivation and priority		15%					

58. Working in more than one area makes HH difficult (e.g. hospital and community based)

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Environmental Resources		60%					
Capabilities		25%					

59. Blame from others if HH not carried out

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Consequences		58%					
Emotion		21%					
Social influences		21%					

60. Poor staffing levels make HH difficult

Category	Your response	All Responses	Very Good Fit	Good Fit	Barely Fits	Poor Fit	Very Poor Fit
Environmental resources		60%					
Motivation and priority		10%					

Thank you for completing this survey.
Please save your answers and email or send back to:

Judith Dyson (PhD student)
Address: School of Healthcare, The University of Leeds, FREEPOST LS 3018 LEEDS LS2 3YY
Email: hcjd@leeds.ac.uk
Telephone: 0113 343 3397

Appendix 16 Covering letter Questionnaire (study three)

School of Healthcare

UNIVERSITY OF LEEDS

Judith Dyson
0113 343 33397
hcjd@leeds.ac.uk

Room 3.35
School of Healthcare
Baines Wing
The University of Leeds
FREEPOST LS 3018
LEEDS

date

Dear Colleague

Implementation of evidence-based practice: the case of hand hygiene

We would like to invite you to take part in a research study that is being carried out at the University of Leeds.

The overall aim of the study is to extend knowledge of the barriers and levers to implementing best practice for hand hygiene practice in secondary care.

The purpose of this stage of the study is to develop and test a questionnaire. This is because research tells us that hand hygiene will vary from hospital to hospital, between different wards and departments and also according to the role of different practitioners.

You will find enclosed a Questionnaire. The first page offers you information about the study. Please read through this information. If after reading the information you think that you might be interested in taking part, then please fill in the Questionnaire and send it back to the University in the Freepost envelope by *date*.

Yours faithfully

Judith Dyson
PhD student

Tel: 0113 343 3397
Email: hcjd@leeds.ac.uk

Appendix 17 Questionnaire: round one (study three)

UNIVERSITY OF LEEDS

NHS Trust:

Barriers and Levers to Hand Hygiene – Draft Questionnaire (1)

Information and Instructions

- Thank you for taking part in this research study.
- We are developing this questionnaire because research tells us that hand hygiene will vary from hospital to hospital, between different wards and departments and also according to the role of different practitioners.
- The information you give will enable the identification of the improvement strategies that will be the most effective in improving hand hygiene.
- Simply consider each statement in the light of your own hand hygiene and circle the number that demonstrates to what extent you agree or disagree with the statements given.
- It is anticipated that this will take no more than 10 minutes.
- Your responses will be anonymous as you do not need to put your name on the questionnaire.
- When complete, please return the questionnaire in the FREEPOST envelope to me at the address below within the next 7 days. Please feel free to contact me with any comments or questions.
- This study has been reviewed by the Leeds East Research Ethics committee. The study is being funded by the Medical Research Council as part of a PhD.

Thank you for participating!

Judith Dyson (PhD student),

Address: Room 3.35, School of Healthcare, Baines Wing, The University of Leeds, FREEPOST, LS 3018, LEEDS, LS2 3YY.

Email: hcjd@leeds.ac.uk **Telephone:** 0113 343 3397

1. What is your job title? (e.g. staff nurse) .....

2. How long have you worked in health care? (In full years) [ ]

3. What area of the hospital do you work in? .....
(e.g. elderly care)

4. Are you male or female (please circle) M F

5. To what extent do you consider you usually comply with good practice guidelines for hand hygiene? (Times you clean your hands compared with opportunities to do so) (0 to 100%) [ ]

6. To what extent do you consider your colleagues in your department comply with good practice guidelines for hand hygiene? (0 to 100%) [ ]

Please consider your own hand hygiene. Then circle the number between 1 and 7 that best reflects your opinion at present.

	Strongly agree						Strongly disagree
7. Hand hygiene is embedded into my professional practice	1	2	3	4	5	6	7
8. Hand hygiene is easier because there is zero tolerance to lack of hand hygiene in my work place	1	2	3	4	5	6	7
9. I would blame myself for infections if I omitted hand hygiene	1	2	3	4	5	6	7
10. Sometimes I have more important things to do than hand hygiene	1	2	3	4	5	6	7
11. Sometimes I miss out hand hygiene simply because I forget it	1	2	3	4	5	6	7
12. There is no evidence that hand hygiene reduces infections in hospital	1	2	3	4	5	6	7
13. Hand hygiene audits are regularly carried out in my work place	1	2	3	4	5	6	7
14. I am more likely to forget hand hygiene if I am tired	1	2	3	4	5	6	7
15. I am confident in my ability to carry out hand hygiene	1	2	3	4	5	6	7
16. Alcohol gel is readily available to me for hand hygiene	1	2	3	4	5	6	7
17. I feel angry if hand hygiene is not carried out by others	1	2	3	4	5	6	7
18. Supervision from senior staff means that carrying out hand hygiene is easier for me	1	2	3	4	5	6	7

	Strongly agree						Strongly disagree
19. Hand hygiene is a non-negotiable part of my role	1	2	3	4	5	6	7
20. Doing hand hygiene gives me sore hands	1	2	3	4	5	6	7
21. I have sufficient knowledge about hand hygiene	1	2	3	4	5	6	7
22. There are good role models for hand hygiene in my work place	1	2	3	4	5	6	7
23. I feel ashamed if I omit hand hygiene	1	2	3	4	5	6	7
24. Peer pressure influences my hand hygiene	1	2	3	4	5	6	7
25. There are adverts or newsletters about hand hygiene in my workplace	1	2	3	4	5	6	7
26. My professional group is less likely to engage in hand hygiene than others	1	2	3	4	5	6	7
27. I take pride in my hand hygiene	1	2	3	4	5	6	7
28. I have sufficient skills for hand hygiene	1	2	3	4	5	6	7
29. I engage in hand hygiene out of respect for my patients	1	2	3	4	5	6	7
30. I am enthusiastic about hand hygiene	1	2	3	4	5	6	7
31. There is strong clinical leadership in my area	1	2	3	4	5	6	7
32. I feel guilty if I omit hand hygiene	1	2	3	4	5	6	7
33. It is difficult to prompt senior staff when they miss out hand hygiene	1	2	3	4	5	6	7
34. The frequency of hand hygiene required makes it difficult for me to carry it out as often as necessary	1	2	3	4	5	6	7
35. Hand hygiene is a habit for me	1	2	3	4	5	6	7
36. Emergencies and other priorities make hand hygiene more difficult at times	1	2	3	4	5	6	7
37. Feedback from audits encourages me to do good hand hygiene	1	2	3	4	5	6	7
38. Hand hygiene is a priority to the organisation	1	2	3	4	5	6	7

	Strongly agree						Strongly disagree
39. There are some practical barriers to hand hygiene because of my particular job/role	1	2	3	4	5	6	7
40. Improvement strategies that are unusual have a greater impact on my hand hygiene than those I am used to	1	2	3	4	5	6	7
41. Hand hygiene is part of my professional culture	1	2	3	4	5	6	7
42. I engage in hand hygiene in order to prevent patients catching infections	1	2	3	4	5	6	7
43. I engage in hand hygiene because I am embarrassed if we do poorly in hand hygiene audits	1	2	3	4	5	6	7
44. Facilities are inadequate for hand hygiene in my area of work	1	2	3	4	5	6	7
45. My hand hygiene is encouraged by others	1	2	3	4	5	6	7
46. I feel frustrated when others omit hand hygiene	1	2	3	4	5	6	7
47. I engage in hand hygiene because I do not want to let the team down	1	2	3	4	5	6	7
48. Basic training doesn't cover enough about hand hygiene	1	2	3	4	5	6	7
49. Infection prevention teams have a positive influence on my hand hygiene	1	2	3	4	5	6	7
50. It is difficult for me to attend hand hygiene courses due to time pressure	1	2	3	4	5	6	7
51. I am sometimes praised about my hand hygiene	1	2	3	4	5	6	7
52. There is a positive culture towards hand hygiene in my workplace	1	2	3	4	5	6	7
53. Hand hygiene is more difficult because of the type of ward I work in	1	2	3	4	5	6	7
54. I am reluctant to ask others to engage in hand hygiene	1	2	3	4	5	6	7
55. There are infection prevention notice boards in my work place	1	2	3	4	5	6	7
56. I have good intentions regarding hand hygiene	1	2	3	4	5	6	7
57. I cannot be bothered with hand hygiene	1	2	3	4	5	6	7
58. I engage in hand hygiene to avoid disciplinary action	1	2	3	4	5	6	7
59. Hand hygiene is more difficult for me because I work in several areas of the hospital	1	2	3	4	5	6	7

	Strongly agree							Strongly disagree
60. Hand hygiene guidelines are easily accessible	1	2	3	4	5	6	7	
61. I engage in hand hygiene to prevent myself from catching an infection	1	2	3	4	5	6	7	
62. Board to ward responsibility for hand hygiene influences my practice	1	2	3	4	5	6	7	
63. If I do not engage in hand hygiene patients will complain	1	2	3	4	5	6	7	
64. I do not consider hand hygiene to be important	1	2	3	4	5	6	7	
65. Government targets have led to improvements in my hand hygiene	1	2	3	4	5	6	7	
66. Hand cream is available to me	1	2	3	4	5	6	7	
67. I engage in hand hygiene because infections are expensive to the hospital	1	2	3	4	5	6	7	
68. I engage in hand hygiene to improve patient confidence	1	2	3	4	5	6	7	
69. Hand hygiene is a priority for me	1	2	3	4	5	6	7	
70. Some strategies designed to improve hand hygiene influence my practice	1	2	3	4	5	6	7	
71. Hospital targets relating to infection or hand hygiene has led to improvements in my hand hygiene	1	2	3	4	5	6	7	
72. I disagree with some parts of the hand hygiene guidelines	1	2	3	4	5	6	7	
73. My environment is cluttered making hand hygiene more difficult	1	2	3	4	5	6	7	
74. The staff skill mix is just right in my work place	1	2	3	4	5	6	7	
75. If I do not engage in hand hygiene I may be named and shamed	1	2	3	4	5	6	7	
76. Hand hygiene training is available to me	1	2	3	4	5	6	7	
77. I am challenged when I miss out hand hygiene	1	2	3	4	5	6	7	
78. I feel complacent about hand hygiene	1	2	3	4	5	6	7	
79. Some government targets make hand hygiene more difficult (such as high bed occupancy)	1	2	3	4	5	6	7	
80. My patients expect good hand hygiene from me	1	2	3	4	5	6	7	

	Strongly agree						Strongly disagree
81. Our area of work has a practitioner "link" who communicates with the infection prevention team about hand hygiene	1	2	3	4	5	6	7
82. My area of work has poor staffing levels making hand hygiene more difficult	1	2	3	4	5	6	7
83. Nobody else bothers with hand hygiene where I work	1	2	3	4	5	6	7

84. If any of the statements above (7 to 83) were difficult to understand please note the item numbers and reasons below

.....

.....

.....

83. This tool is in the early stages of development and will undergo many changes until it accurately measures barriers and levers to hand hygiene. We would like it to be as simple and easy to use as possible. If you have any comments about how we could change it please write them in the space below. (Attach extra sheets if you wish).

.....

.....

.....

.....

Thank you for participating!

Please return this questionnaire in the FREEPOST envelope provided.

Judith Dyson (PhD student),
Address: Room 3.35, School of Healthcare, Baines Wing, The University of Leeds,
FREEPOST,
LS 3018, LEEDS,
LS2 3YY.
Email: hcjd@leeds.ac.uk **Telephone:** 0113 343 3397

Appendix 18 Questionnaire: round two (study three and study four)

NHS trust:

UNIVERSITY OF LEEDS

Barriers and Levers to Hand Hygiene – Draft Questionnaire (2)

Information and Instructions

- Thank you for taking part in this research study.
- We are developing this questionnaire because research tells us that hand hygiene will vary from hospital to hospital, between different wards and departments and also according to the role of different practitioners. We are trying to identify the factors that influence hand hygiene.
- The information you give will enable the identification of the improvement strategies that will be the most effective in supporting good hand hygiene.
- Simply consider each statement in the light of your own hand hygiene and circle the number that demonstrates to what extent you agree or disagree with the statements given.
- It is anticipated that this will take about 10 minutes.
- Your responses will be anonymous as you do not need to put your name on the questionnaire.
- When complete, please return the questionnaire in the FREEPOST envelope to me at the address below within the next 7 days. Please feel free to contact me with any comments or questions.
- If you have previously completed this questionnaire thank you very much for your help. This questionnaire is being tested in three rounds so will have changed slightly since you last completed it. Please feel free to complete it again.
- This study has been reviewed by Leeds East Research Ethics Committee. The study is being funded by the Medical Research Council as part of a PhD.

Thank you for participating!

Judith Dyson (PhD student),

Address: Room 3.35, School of Healthcare, Baines Wing, The University of Leeds, FREEPOST, LS 3018, LEEDS, LS2 3YY.

Email: hcjd@leeds.ac.uk **Telephone:** 0113 343 3397

1. What is your job title? (e.g. staff nurse) .....

2. How long have you worked in health care? (In full years) [ ]

3. What area of the hospital do you work in? .....
(e.g. elderly care)

4. Are you male or female (please circle) M F

5. To what extent do you consider you usually comply with good practice guidelines for hand hygiene? (Times you clean your hands compared with opportunities to do so) (0 to 100%) [ ]

6. To what extent do you consider your colleagues in your department comply with good practice guidelines for hand hygiene? (0 to 100%) [ ]

Please consider your own hand hygiene. Then circle the number between 1 and 7 that best reflects your opinion at present.

	Strongly agree						Strongly disagree
7. Hand hygiene is embedded into my professional practice	1	2	3	4	5	6	7
8. If I omitted hand hygiene I would blame myself for infections	1	2	3	4	5	6	7
9. Sometimes I have more important things to do than hand hygiene	1	2	3	4	5	6	7
10. Sometimes I miss out hand hygiene simply because I forget it	1	2	3	4	5	6	7
11. Hand hygiene audits are regularly carried out in my work place	1	2	3	4	5	6	7
12. I am more likely to forget hand hygiene if I am tired	1	2	3	4	5	6	7
13. I am confident in my ability to carry out hand hygiene	1	2	3	4	5	6	7
14. I feel angry if hand hygiene is not carried out by others	1	2	3	4	5	6	7
15. Supervision from senior staff means that carrying out hand hygiene is easier for me	1	2	3	4	5	6	7
16. Hand hygiene is a non-negotiable part of my role	1	2	3	4	5	6	7
17. If I do hand hygiene it gives me sore hands	1	2	3	4	5	6	7
18. I have sufficient knowledge about hand hygiene	1	2	3	4	5	6	7
19. I feel ashamed if I omit hand hygiene	1	2	3	4	5	6	7

	Strongly agree						Strongly disagree
20. Peer pressure influences my hand hygiene	1	2	3	4	5	6	7
21. There are adverts or newsletters about hand hygiene in my workplace	1	2	3	4	5	6	7
22. My professional group is less likely to engage in hand hygiene than others	1	2	3	4	5	6	7
23. I take pride in my hand hygiene	1	2	3	4	5	6	7
24. I have sufficient skills for hand hygiene	1	2	3	4	5	6	7
25. I engage in hand hygiene out of respect for my patients	1	2	3	4	5	6	7
26. I am enthusiastic about hand hygiene	1	2	3	4	5	6	7
27. I feel guilty if I omit hand hygiene	1	2	3	4	5	6	7
28. It is difficult to prompt senior staff when they miss out hand hygiene	1	2	3	4	5	6	7
29. The frequency of hand hygiene required makes it difficult for me to carry it out as often as necessary	1	2	3	4	5	6	7
30. Hand hygiene is a habit for me	1	2	3	4	5	6	7
31. Emergencies and other priorities make hand hygiene more difficult at times	1	2	3	4	5	6	7
32. Feedback from audits encourages me to do good hand hygiene	1	2	3	4	5	6	7
33. There are some practical barriers to hand hygiene because of my particular job/role	1	2	3	4	5	6	7
34. Improvement strategies that are unusual have a greater impact on my hand hygiene than those I am used to	1	2	3	4	5	6	7
35. Hand hygiene is part of my professional culture	1	2	3	4	5	6	7
36. I engage in hand hygiene because I am embarrassed if we do poorly in hand hygiene audits	1	2	3	4	5	6	7
37. Facilities are inadequate for hand hygiene in my area of work	1	2	3	4	5	6	7
38. My hand hygiene is encouraged by others	1	2	3	4	5	6	7
39. I feel frustrated when others omit hand hygiene	1	2	3	4	5	6	7
40. I engage in hand hygiene because I do not want to let the team down	1	2	3	4	5	6	7

	Strongly agree						Strongly disagree
41. Newly qualified staff have not been properly instructed in hand hygiene in their training	1	2	3	4	5	6	7
42. Infection prevention teams have a positive influence on my hand hygiene	1	2	3	4	5	6	7
43. It is difficult for me to attend hand hygiene courses due to time pressure	1	2	3	4	5	6	7
44. When staff engage in hand hygiene they are praised	1	2	3	4	5	6	7
45. Hand hygiene is more difficult because of the type of ward I work in	1	2	3	4	5	6	7
46. I am reluctant to ask others to engage in hand hygiene	1	2	3	4	5	6	7
47. Infection prevention notice boards remind me to do hand hygiene	1	2	3	4	5	6	7
48. I cannot be bothered with hand hygiene	1	2	3	4	5	6	7
49. If I miss out hand hygiene I will be subject to disciplinary action	1	2	3	4	5	6	7
50. I work in several areas of the hospital	1	2	3	4	5	6	7
51. Hand hygiene guidelines are easily accessible	1	2	3	4	5	6	7
52. If I do not engage in hand hygiene I may catch an infection	1	2	3	4	5	6	7
53. Hand hygiene is a priority for every single member of staff in this organisation irrespective of their role	1	2	3	4	5	6	7
54. Government targets have led to improvements in my hand hygiene	1	2	3	4	5	6	7
55. Hand cream is available to me	1	2	3	4	5	6	7
56. If I engage in hand hygiene it improves patient confidence	1	2	3	4	5	6	7
57. Some strategies designed to improve hand hygiene influence my practice	1	2	3	4	5	6	7
58. I am sometimes distracted from hand hygiene by the other things patients need	1	2	3	4	5	6	7
59. Hospital targets relating to infection or hand hygiene has led to improvements in my hand hygiene	1	2	3	4	5	6	7
60. I feel positive about hand hygiene	1	2	3	4	5	6	7
61. I disagree with some parts of the hand hygiene guidelines	1	2	3	4	5	6	7
62. Hand hygiene is not second nature for me	1	2	3	4	5	6	7
63. My environment is cluttered	1	2	3	4	5	6	7
							Strongly

	Strongly agree						disagree
64. I have control over whether or not I do hand hygiene	1	2	3	4	5	6	7
65. The staff skill mix is just right in my work place	1	2	3	4	5	6	7
66. If I do not engage in hand hygiene I may be named and shamed	1	2	3	4	5	6	7
67. Hand hygiene training is available to me	1	2	3	4	5	6	7
68. If I were to miss out hand hygiene I would be challenged	1	2	3	4	5	6	7
69. I feel complacent about hand hygiene	1	2	3	4	5	6	7
70. Some government targets make hand hygiene more difficult (such as high bed occupancy)	1	2	3	4	5	6	7
71. My patients expect good hand hygiene from me	1	2	3	4	5	6	7
72. Our area of work has a practitioner "link" who communicates with the infection prevention team about hand hygiene	1	2	3	4	5	6	7
73. My area of work has poor staffing levels	1	2	3	4	5	6	7
74. Other staff don't bother with hand hygiene where I work	1	2	3	4	5	6	7

75. In which of the following situations should hand hygiene be performed (circle as many letters as apply).

a. Before having direct contact with a patient
b. Before inserting an invasive device (e.g. catheter)
c. When moving from a contaminated body site to a clean body site during an episode of patient care
d. After having direct contact with a patient or with items in the immediate vicinity of the patient
e. After removing gloves

76. If your hands are not visibly soiled or visibly contaminated with blood or other material, which is most effective for reducing the number of disease causing bacteria? (circle one letter corresponding to the single best answer)

a. Washing hands with plain soap and water
b. Washing hands with an antimicrobial soap and water
c. Applying 1.5ml to 3 ml of alcohol-based hand rub to the hands and rubbing hands together until they feel dry

77. How are antibiotic-resistant bacteria most frequently spread from one patient to another in health care settings? (circle one letter corresponding to the single best answer)

a. Airborne spread resulting from patients coughing or sneezing
b. Patients coming in contact with contaminated equipment
c. From one patient to another via the contaminated hands of clinical staff
d. Poor environmental maintenance

78. Which of the following infections can be potentially transmitted from patients to clinical staff if appropriate glove use and hand hygiene are not performed? (circle one letter corresponding to the single best answer)

a. Herpes simplex virus infection
b. Colonisation or infection with MRSA (methicillin-resistant Staphylococcus aureus)
c. RSV (Respiratory syncytial virus infection)
d. Hepatitis B virus infection
e. All of the above

79. Clostridium difficile (the cause of antibiotic-associated diarrhoea) is readily killed by alcohol based hand hygiene products. (circle one letter corresponding to the single best answer)

a. True
b. False

80. Which of the following bacteria readily survive in the environment of the patient for days to weeks? (Circle as many letters as apply).

a. E coli
b. Klebsiella
c. Clostridium difficile
d. MRSA
e. VRE (Vancomycin-resistant enterococcus)

81. Which of the following statements about alcohol-based hand hygiene products is accurate? (circle one letter corresponding to the single best answer)

a. They dry the skin more than repeated hand washing with soap and water
b. They cause more allergy and skin intolerance than chlorhexidine products
c. They cause stinging of the hands in some practitioners due to pre-existing skin irritation
d. They are effective even when the hands are visibly soiled
e. They kill bacteria less rapidly than chlorhexidine and other antiseptic containing soaps

Thank you for participating!
Please return this questionnaire in the FREEPOST envelope provided.

Judith Dyson (PhD student),
Address: Room 3.35, School of Healthcare, Baines Wing, The University of Leeds, FREEPOST,
LS 3018, LEEDS,
LS2 3YY.
Email: hcjd@leeds.ac.uk **Telephone:** 0113 343 3397

Questions 75 to 81 are adapted from: Institute for healthcare improvement, How to guide: A guide for improving practices among health care workers, 2009. http://www.shea-online.org/Assets/files/IHI_Hand_Hygiene.pdf

Appendix 19 Covering letter from MD (study three and study four)

Airedale NHS
NHS Trust
Airedale NHS
NHS Trust

24th March 2010

Medical Directors Unit
Dr Andrew Catto Executive Medical Director
Consultant in Stroke Medicine
Airedale General Hospital
Skipton Road
Steeton
Keighley
West Yorkshire
BD20 6TD

Tel 01535 294187
Fax 01535 294184
Direct Line PA 01535-294021 Chris Ellis
Web www.airedale-trust.nhs.uk

AC/co/All juniordoctorshandwashing

ALL JUNIOR DOCTORS MEDICAL AND SURGICAL

Dear Colleague,

HAND HYGIENE

I am writing to you about the importance of hand hygiene. Interestingly although we acknowledge the importance of hand hygiene, it doesn't translate into practice. You might be interested to know that junior doctors are even less likely than Consultants to wash their hands. The purpose of this letter is not to moan about this, but instead try to take an intelligent approach to understand some of the reasons why junior doctors in particular do not wash their hands. To that end you will find enclosed a request by our colleagues at the University of Leeds to participate in a very simple research programme.

The purpose of this work is to try and explore the reasons why doctors and other health professionals do and don't wash their hands. This is a really important piece of work and I very much hope you will be able to give a little time to help with this. As with all forms of clinical research however, your participation is entirely voluntary, but I hope in your busy schedule you will find a little time to help us out with this really important piece of work. You should find the enclosed letter from the researchers self explanatory but please do not hesitate to get in touch with them if you need any clarification.

Many thanks for your cooperation with this important issue.

Yours sincerely

Best wishes

Dr Andrew Catto BSc PhD MBChB FRCP (London) *GMC Number 3313617*
Executive Medical Director /Consultant in Stroke Medicine & Honorary Senior Lecturer in Medicine
Airedale NHS Trust & University of Leeds

Appendix 20 Test/retest Questionnaire: round 3 (study three)

UNIVERSITY OF LEEDS

NHS trust:

Barriers and Levers to Hand Hygiene – Draft Questionnaire (3)

Information and Instructions

- Thank you for taking part in this research study.
- We are developing this questionnaire because research tells us that hand hygiene will vary from hospital to hospital, between different wards and departments and also according to the role of different practitioners. We are trying to identify the factors that influence hand hygiene.
- The information you give will enable the identification of the improvement strategies that will be the most effective in supporting good hand hygiene.
- Simply consider each statement in the light of your own hand hygiene and circle the number that demonstrates to what extent you agree or disagree with the statements given.
- It is anticipated that this will take about 10 minutes.
- Your responses will be anonymous as you do not need to put your name on the questionnaire.
- When complete, please return the questionnaire in the FREEPOST envelope to me at the address below within the next 7 days. Please feel free to contact me with any comments or questions.
- If you have previously completed this questionnaire thank you very much for your help. This questionnaire is being tested in three rounds so will have changed slightly since you last completed it. Please feel free to complete it again.
- This study has been reviewed by Leeds East Research Ethics Committee. The study is being funded by the Medical Research Council as part of a PhD.

Thank you for participating!

Judith Dyson (PhD student),
Address: Room 3.35, School of Healthcare, Baines Wing, The University of Leeds, FREEPOST, LS 3018, LEEDS, LS2 3YY.
Email: hcjd@leeds.ac.uk **Telephone:** 0113 343 2222

1. What is your job title? (e.g. staff nurse) .....

2. How long have you worked in health care? (In full years) [ ]

3. What area of the hospital do you work in? .....
(e.g. elderly care)

4. Are you male or female (please circle) M F

5. To what extent do you consider you usually comply with good practice guidelines for hand hygiene? (Times you clean your hands compared with opportunities to do so) (0 to 100%) [ ]

6. To what extent do you consider your colleagues in your department comply with good practice guidelines for hand hygiene? (0 to 100%) [ ]

Please consider your own hand hygiene. Then circle the number between 1 and 7 that best reflects your opinion at present.

	Strongly agree						Strongly disagree
7. I engage in hand hygiene out of respect for my patients	1	2	3	4	5	6	7
8. Government targets have led to improvements in my hand hygiene	1	2	3	4	5	6	7
9. Hand hygiene is a non-negotiable part of my role	1	2	3	4	5	6	7
10. It is difficult for me to attend hand hygiene courses due to time pressure	1	2	3	4	5	6	7
11. I feel complacent about hand hygiene	1	2	3	4	5	6	7
12. Sometimes I miss out hand hygiene simply because I forget it	1	2	3	4	5	6	7
13. Hand hygiene is not second nature for me	1	2	3	4	5	6	7
14. I feel angry if hand hygiene is not carried out by others	1	2	3	4	5	6	7
15. When staff engage in hand hygiene they are praised	1	2	3	4	5	6	7
16. I am more likely to forget hand hygiene if I am tired	1	2	3	4	5	6	7
17. Hand hygiene training is available to me	1	2	3	4	5	6	7
18. There are some practical barriers to hand hygiene because of my particular job/role	1	2	3	4	5	6	7

	Strongly agree						Strongly disagree
19. If I do not engage in hand hygiene I may catch an infection	1	2	3	4	5	6	7
20. I cannot be bothered with hand hygiene	1	2	3	4	5	6	7
21. Some government targets make hand hygiene more difficult (such as high bed occupancy)	1	2	3	4	5	6	7
22. If I omitted hand hygiene I would blame myself for infections	1	2	3	4	5	6	7
23. I engage in hand hygiene because I do not want to let the team down	1	2	3	4	5	6	7
24. There are adverts or newsletters about hand hygiene in my workplace	1	2	3	4	5	6	7
25. I am reluctant to ask others to engage in hand hygiene	1	2	3	4	5	6	7
26. The frequency of hand hygiene required makes it difficult for me to carry it out as often as necessary	1	2	3	4	5	6	7
27. I disagree with some parts of the hand hygiene guidelines	1	2	3	4	5	6	7
28. I am confident in my ability to carry out hand hygiene	1	2	3	4	5	6	7
30. Hospital targets relating to infection or hand hygiene has led to improvements in my hand hygiene	1	2	3	4	5	6	7
31. I feel frustrated when others omit hand hygiene	1	2	3	4	5	6	7
32. If I engage in hand hygiene it improves patient confidence	1	2	3	4	5	6	7
33. Hand hygiene guidelines are easily accessible	1	2	3	4	5	6	7
34. Hand hygiene is part of my professional culture	1	2	3	4	5	6	7
35. My environment is cluttered	1	2	3	4	5	6	7
37. I feel guilty if I omit hand hygiene	1	2	3	4	5	6	7
38. I feel ashamed if I omit hand hygiene	1	2	3	4	5	6	7
39. My area of work has poor staffing levels	1	2	3	4	5	6	7
40. Supervision from senior staff means that carrying out hand hygiene is easier for me	1	2	3	4	5	6	7
41. Some strategies designed to improve hand hygiene influence my practice	1	2	3	4	5	6	7
42. My hand hygiene is encouraged by others	1	2	3	4	5	6	7
43. If I miss out hand hygiene I will be subject to disciplinary action	1	2	3	4	5	6	7

44. In which of the following situations should hand hygiene be performed (circle as many letters as apply).

a. Before having direct contact with a patient

b. Before inserting an invasive device (e.g. catheter)

c. When moving from a contaminated body site to a clean body site during an episode of patient care

d. After having direct contact with a patient or with items in the immediate vicinity of the patient

e. After removing gloves

45. If your hands are not visibly soiled or visibly contaminated with blood or other material, which is most effective for reducing the number of disease causing bacteria? (circle one letter corresponding to the single best answer)

a. Washing hands with plain soap and water

b. Washing hands with an antimicrobial soap and water

c. Applying 1.5 to 3ml of alcohol-based hand rub to the hands and rubbing hands together until they feel dry

46. How are antibiotic-resistant bacteria most frequently spread from one patient to another in health care settings? (circle one letter corresponding to the single best answer)

a. Airborne spread resulting from patients coughing or sneezing

b. Patients coming in contact with contaminated equipment

c. From one patient to another via the contaminated hands of clinical staff

d. Poor environmental maintenance

47. Which of the following infections can be potentially transmitted from patients to clinical staff if appropriate glove use and hand hygiene are not performed? (Circle as many letters as apply)

a. Herpes simplex virus infection

b. Colonisation or infection with MRSA (methicillin-resistant Staphylococcus aureus)

c. RSV (Respiratory syncytial visus infection)

d. Hepititis B virus infection

48. Clostridium difficile (the cause of antibiotic-associated diarrhoea) is readily killed by alcohol based hand hygiene products. (Circle one letter corresponding to the single best answer)

a. True

b. False

Thank you for participating!
Please return this questionnaire in the FREEPOST envelope provided

Judith Dyson (PhD student),
Address: Room 3.35, School of Healthcare, Baines Wing, The University of Leeds, FREEPOST, LS 3018, LEEDS, LS2 3YY.
Email: hcjd@leeds.ac.uk **Telephone:** 0113 343 2222

Questions 75 to 81 are adapted from: Institute for healthcare improvement, How to guide: A guide for improving practices among health care workers, 2009. http://www.shea-online.org/Assets/files/HH_Hand_Hygiene.pdf

Appendix 21 Covering letter test questionnaire: round 3 (study three)

School of Healthcare

Judith Dyson
0113 343 33397
hcjd@leeds.ac.uk

Room 3.35
School of Healthcare
Baines Wing
The University of Leeds
FREEPOST LS 3018
LEEDS

UNIVERSITY OF LEEDS

date

Dear Colleague

Implementation of evidence-based practice: the case of hand hygiene

We would like to invite you to take part in a research study that is being carried out at the University of Leeds.

The overall aim of the study is to extend knowledge of the barriers and levers to implementing best practice for hand hygiene practice in secondary care.

The purpose of this stage of the study is to develop and test a Questionnaire. This is because research tells us that hand hygiene will vary from hospital to hospital, between different wards and departments and also according to the role of different practitioners.

You will find enclosed a copy of this Questionnaire. The first page offers you information about the study. Please read through this information. If after reading the information you think that you might be interested in taking part, then please fill in the Questionnaire and send it back to the University in the Freepost envelope by *date*.

Because we are checking the reliability of this questionnaire, we would also like you to complete this on a second occasion. Therefore, in one months time I will send an identical, second questionnaire for you to complete.

Thank you for considering participating in this study.

Yours faithfully

Judith Dyson
PhD student
Tel: 0113 343 3397
Email: hcjd@leeds.ac.uk

Appendix 22 Covering letter re-test questionnaire: round 3 (study three)

School of Healthcare

Judith Dyson
0113 343 33397
hcjd@leeds.ac.uk

UNIVERSITY OF LEEDS

Room 3.35
School of Healthcare
Baines Wing
The University of Leeds
FREEPOST LS 3018
LEEDS

date

Dear Colleague

Implementation of evidence-based practice: the case of hand hygiene

Thank you for completing and returning the questionnaire we sent you last month.

You may remember that the overall aim of the study is to extend knowledge of the barriers and levers to implementing best practice for hand hygiene practice in secondary care.

The purpose of this stage of the study is to develop and test a Questionnaire. This is because research tells us that hand hygiene will vary from hospital to hospital, between different wards and departments and also according to the role of different practitioners.

Because we are checking the reliability of this questionnaire, we would also like you to complete this on a second occasion. Therefore, please find a second Questionnaire for you to complete and return within 7 days in the freepost envelope incuded.

Thank you for participating in this study.

Yours faithfully

Judith Dyson
PhD student
Tel: 0113 343 3397
Email: hcjd@leeds.ac.uk

Appendix 23 Thank you/intervention letter MD (study four)

Airedale NHS
NHS Foundation Trust
Medical Director's Unit
Airedale General Hospital
Skipton Road
Steeton
Keighley
West Yorkshire
BD20 6TD

Tel: 01535 652511
Fax: 01535 655129
Web: www.airedale-trust.co.uk

1st July 2010

AJC/ce/hand hygiene

TO ALL F1 DOCTORS

Dear Doctor

RE: Hand Hygiene: Help Shape Trust Policy

Thank you for attending and contributing to the above tutorial. The results of the questionnaires you completed demonstrated three areas that posed barriers to hand hygiene for Junior Doctors. These were the areas of Social Processes, Memory and Motivation.

We have collated all of the suggestions that were made and summarise these below. I am working with the Infection Prevention and Control team to implement these interventions to support hand hygiene among Junior Doctors in Airedale Foundation Trust.

- **Hand Hygiene Monitoring to be more visible**
- **Audit results to be emailed out to Junior Doctors routinely**
- **Hospital Acquired Infection/Health Care Associated Infection rates to be easily available to junior doctors**
- **More posters to be displayed as reminders (and posters to be changed/refreshed regularly)**
- **Recognition of improvements or exemplary practice among Junior Doctors**
- **Targets to be set for Junior Doctors hand hygiene compliance (as measured by audit)**
- **Ensure hand gel available on all trolleys including notes trolleys**
- **Routine use of the "glow and show" light box**

Once again let me take this opportunity to thank you for your commitment to good hand hygiene practice within the Trust and your valuable suggestions made at the tutorial.

Best wishes

Yours sincerely

Dr Andrew Catto BSc PhD MBChB FRCP (London) *GMC Number: 3313617*
Executive Medical Director /Consultant in Stroke Medicine & Honorary Senior Lecturer in Medicine, Airedale NHS Trust & University of Leeds