Influencing Infection Control Practice: Assessing the Impact Of a Supportive Intervention for Nurses

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ABSTRACT

The aim of this research was to examine nurses' and health care assistants' perspectives of infection control practice on one hospital ward and use this as the basis for the development, implementation and evaluation of an education and support programme for improving practice on the ward.

In Phase I of the study, nurses and health care assistants were interviewed using a semi-structured interview schedule to explore their views and anxieties about infection control practice and identify their priorities for practice development. Qualitative and quantitative analysis of these data revealed that respondents' concerns related primarily to the use of Contact Precautions for patients with *Clostridium difficile* associated diarrhoea (CDAD) and Methicillin resistant *Staphylococcus aureus* (MRSA). Structured observations of practice were employed to confirm the prevalence of the issues raised in relation to this and provide an understanding of their context. The findings of Phase I informed the design of an intervention to improve practice. This involved the development of a practice guideline on Contact Precautions and the availability of practical instruction and support during its implementation.

In Phase II of the study, participant observations of practice were conducted to gain an understanding of nurses' and health care assistants' behaviour and in particular, their responses to the supportive intervention. Their perceptions of its impact on their practice were ascertained in Phase III using semi-structured interviews. Qualitative analysis of these data revealed that participants experienced great difficulty understanding and implementing infection control recommendations. Factors that may help explain this include nurses' and health care assistants' knowledge and skills in infection control, their personal belief systems and self-preservation instincts. In addition, the recommendation to use Contact Precautions for patients with infectious conditions such as CDAD and MRSA may itself counteract attempts to promote the routine use of infection control precautions in clinical practice.

It is suggested that in relation to infection control, there may be a need to radically re-think the ways in which health care workers are educated and supported in practice. Moreover, it is argued that until the ambivalent evidence base relating to the use of Contact Precautions is resolved, messages about infection control are likely to generate confusion amongst health care workers.

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INTRODUCTION

The issue of non-adherence to infection control precautions in health care practice has received increasing attention over the last twenty or so years. However, to date, intervention studies designed to address the problem have largely met with limited success (Pittet, 2000). The reasons for this remain uncertain, since in general, this research has been outcome-orientated and little attention has been given to understanding the perspectives of the health care workers whose practice has been targeted for improvement. Recently, attention has focused on the importance of aiming intervention strategies at individual, group and organisational levels in order to provide an appropriate framework for practice development (Pittet, 2000; Larson and Kretzer, 1995). In addition, there is growing emphasis on the application of theoretical models in an attempt to offer possible explanations of the problem of non-adherence (Kretzer and Larson, 1998). However, owing to the lack of research on health care workers' own perspectives of the problems associated with implementing infection control recommendations, the relevance of these theories remains unclear.

Curtis (2001) has asserted that research on hygiene has focused predominantly on the outside (or 'etic') perspective, that is, from the scientific observers' point of view. She argues that we are much less used to trying to see hygiene from the point of view of the people who practice it (the 'emic' perspective). Her own work has adopted an anthropological approach to the study of hygiene motivation in a wide range of non-health care settings around the world. On this basis, Curtis (2001) suggests that to make a difference in terms of hygiene promotion, there is a need to understand what hygiene is in peoples' minds. In a similar way, the lack of in-depth exploration of health care workers' own perspectives of infection control in health care settings has limited our understanding of their behaviour in clinical practice.

The research presented in this thesis reports an in-depth study of nurses' and health care assistants' perspectives of infection control practice. The study was undertaken on one hospital ward and comprised a detailed exploration of participants' perceptions of the problems associated with implementing infection control practice in the context of an intervention to improve practice. It aimed to identify participants' priorities in relation to improving infection control practice and gain an understanding of their views and anxieties about this in order to determine the most appropriate form of support required to change practice. This provided the basis on which to design, implement and evaluate an education and support programme for improving practice on the study ward.

The use of Contact Precautions for patients with *Clostridium difficile* associated diarrhoea (CDAD) and Methicillin resistant *Staphylococcus aureus* (MRSA) was identified as the focus for practice development, since participants' concerns about infection control were found to centre primarily on this issue. In view of this, Chapters 1 and 2 of the thesis contain a review of the literature in relation to Contact Precautions and the prevention of contact transmission of infection in hospitals. In Chapter 1, the evidence base for hand hygiene and glove use is examined, since this forms a key component of infection control practice both routinely and as part of Contact Precautions. Chapter 2 provides a review of the evidence base for precautions to prevent contact transmission via clothing and the inanimate environment. It also considers the limited evidence available on the effectiveness of Contact Precautions over the routine infection control precautions recommended for all patients.

In Chapters 3 and 4, a review of the literature on adherence to infection control precautions in health care practice is presented. In Chapter 3, the evidence from observation and self-report studies is examined. This aspect of the review revealed the widespread problem of non-adherence to infection control practice and the wide range of factors that have been associated with this. It also highlighted the need to better understand how health care workers make decisions about infection control in clinical practice. In Chapter 4, a further aspect of the review is presented in which the intervention studies designed to improve adherence to infection control practice are examined. This part of the review revealed that in general, there has been a lack of emphasis on the process of change and in particular, on health care workers' own perspectives of the difficulties associated with improving infection control practice.

Chapter 5 details the methods employed in this study to examine this issue. It describes these according to the three phases of the research. In Phase I, the pre-implementation phase, semi-structured interviews with nurses and health care assistants and structured observations of their infection control practice were analysed to inform the design of an education and support programme to improve practice. The programme consisted of a practice guideline on Contact Precautions and the availability of practical instruction and support during its implementation. In Phase II, the implementation phase, two approaches were used to determine participants' responses to the education and support programme. These were the analysis of a process record of participants' questions, comments and concerns raised in relation to the practice guideline and the analysis of participant observations of practice. In addition to this, the semi-structured interviews undertaken in Phase III, the post-

implementation phase, were analysed to ascertain participants' perceptions of the impact of the programme on their practice.

In Chapters 6 to 9, the findings from the initial interviews, structured observations of practice, participant observations of practice and final interviews respectively are presented. The concluding chapter offers a discussion and explanation of these findings in relation to two key areas, one concerning how best to develop health care workers' knowledge and skills in relation to infection control and the other concerning how best to promote improvements in infection control practice. A number of possible practical and theoretical explanations for the findings are explored and relationships with previous relevant research literature are examined. The implications of the findings for clinical practice, education and training and future research are also considered.

CHAPTER 1

CONTACT PRECAUTIONS AND THE PREVENTION OF CONTACT TRANSMISSION OF INFECTION IN HOSPITALS

Part I: The Evidence Base for Hand Hygiene and Glove Use

Introduction

In the hospital setting, a variety of infection control precautions are used to minimise the risk of transmission of infection to patients and health care workers. These precautions are directed towards both recognised and unrecognised sources of infection. The latest advice on isolation precautions (Garner et al, 1996) has integrated previous infection control recommendations into two levels of precautions. More specifically, 'Standard Precautions', which incorporate 'Universal Precautions' and 'Body Substance Isolation' are designed to apply routinely to all patients regardless of their diagnosis, in order to minimise the risk of transmission of infection from both recognised and unrecognised sources (Garner et al, 1996). They are required routinely when in contact with patients' blood, body fluids, non-intact skin and mucous membranes to reduce the risk of transmission of both blood-borne pathogens and pathogens from moist body substances. The main emphasis is on hand hygiene and the use of gloves, along with additional protective clothing such as aprons/gowns, masks and eye protection during procedures likely to generate splashes or sprays of blood or body fluids or soiling of clothing. Other measures include the routine cleaning of patient care equipment and the environment, careful handling and transport of used linen and safe handling and disposal of sharp instruments and devices.

Additional isolation precautions known as 'Transmission-based Precautions' are designed to apply to patients with a known or suspected infectious disease or condition in an attempt to further reduce the risk of infection transmission (Garner et al, 1996). These Transmission-based Precautions involve the use of a single room to physically isolate the patient, increased use of protective clothing and special measures concerning the use, decontamination and disposal of equipment. There are three categories of Transmission-based Precautions according to the route of spread of micro-organisms: airborne, droplet and contact (Garner et al, 1996).

Airborne Precautions are designed for patients with infections such as 'open' pulmonary tuberculosis (TB), varicella (chicken pox) and measles, as the pathogens concerned can remain suspended in the air within small airborne droplets or particles for long periods and can be transmitted when a person inhales them (Garner et al, 1996). The patient is confined to a single room, preferably one with specially designed ventilation that extracts air from the room to the outside of the building. Non-immune staff members are excluded from contact with the patient and the use of filtering respiratory protective masks by staff for particular procedures is sometimes required in addition to hand hygiene and the use of gloves and aprons.

Droplet Precautions are designed for patients with infections spread by large particle droplets containing the pathogen, such as pertussis, meningococcal meningitis and diphtheria (Garner et al, 1996). Droplet transmission can occur when droplets containing the pathogen are propelled through the air when a patient talks, coughs or sneezes and come into contact with another person's conjunctivas, nasal mucosa or mouth (Garner, 1996). Use of a single room is advocated as part of Droplet Precautions, although as the droplets do not remain airborne, there is no need for special air handling or ventilation (Garner et al, 1996). Hand hygiene and the use of gloves and aprons is also emphasised, since many of these infections are also spread by the contact route (Wilson, 2001).

Contact Precautions are designed for patients colonised or infected with multidrug-resistant bacteria of special clinical and epidemiological significance such as methicillin resistant *Staphylococcus aureus* (MRSA). They also apply to various other micro-organisms transmitted easily by the contact route, including *Clostridium difficile* (Garner, 1996). In view of the prevalence of such micro-organisms within the hospital setting (Ayliffe et al, 1998; Cooke et al, 1994), Contact Precautions are likely to be the most frequently employed of the three categories of Transmission-based Precautions. Contact transmission can occur directly, usually via the hands following physical contact with the infected or colonised person and subsequent transfer to a susceptible patient (Garner, 1996). It may also occur indirectly, when a susceptible patient comes into contact with equipment or surfaces contaminated by the micro-organism (Garner, 1996). Use of a single room is considered preferable, although not essential as part of Contact Precautions and emphasis is placed on hand hygiene after patient contact, increased glove and gown/apron use for physical contact with the patient or their environment and the dedicated use of reusable patient care

equipment. However, whilst there is abundant evidence for the role of hands in contact transmission of infection, the role of clothing and the inanimate environment is less clear. In view of this, the use of Contact Precautions remains controversial, since owing to the lack of definitive scientific studies, it is not clear whether it offers any additional benefit to Standard Precautions or whether it serves more as a reminder to staff to adhere to good practice (Jackson and Lynch, 1996).

In this review, the evidence base for Contact Precautions is examined, since this is of particular relevance to the present study, which focuses on the infection control procedures relating to the care of patients with MRSA and *Clostridium difficile* associated diarrhoea (CDAD). This chapter comprises the first part of the review. It examines the evidence for the role of hands in the transmission of infection and the value of hand hygiene and glove use to minimise contact transmission via hands. The second part of the review is presented in Chapter 2, where the evidence for the role of clothing and the inanimate environment in the spread of infection and the value of precautions to minimise contact transmission via clothing, equipment and the environment is examined. The limited evidence available on the effectiveness of Contact Precautions over the Standard Precautions recommended for all patients is also considered in Chapter 2.

Approach to Literature Search

A rigorous research of the literature was conducted using studies identified from two main sources: the MEDLINE electronic database and screening of reference lists of studies and guidance documents that relate to the control of hospital-acquired infection. The search strategy employed using the MEDLINE database encompassed a thirty-six year period from 1966-2002. It involved combinations of the following key words, subjects and title words: aprons/gowns, body substance isolation, cleaning/decontamination, contact precautions, environment, gloves, handwashing/hand hygiene, infection control, isolation precautions, patient care equipment, protective clothing, single room, standard precautions. The review focuses on studies which are methodologically sound and contribute to the body of knowledge on contact transmission of infection and its prevention.

Evidence for the Role of Hands in Contact Transmission of Infection

The importance of hands as vectors of infection in hospitals and other settings has long been recognised (Larson, 1988). Indeed, hand hygiene is frequently cited as the single most

important procedure in preventing hospital-acquired infection (Zaragoza et al, 1999; Newman and Seitz, 1990; Albert and Condie, 1981; Steere and Mallison, 1975). As such, guidance on hand hygiene forms a key component of infection control policies in healthcare settings (ICNA, 2002; Boyce and Pittet, 2002). This includes those relating to Contact Precautions, although in this context, emphasis is placed primarily on cleansing or disinfecting hands after contact with the 'infectious' patient or their environment (Ayliffe et al, 2000; Garner et al, 1996), thus shifting the focus away from the usual indications for hand hygiene before and during as well as after patient care.

When examining the evidence for the role of hands in the transmission of infection, it is important to distinguish between 'resident' and 'transient' micro-organisms, since they differ with respect to pathogenicity. Resident micro-organisms reside permanently on the hands, throughout the complete depth of healthy skin (Price, 1938). They are usually composed of species of low pathogenicity and as such, they pose little threat of infectious disease transmission from health care personnel to patients other than those who are immunocompromised (Paulson et al, 1999). In contrast, transient micro-organisms commonly reside only temporarily on hands (Price, 1938), being acquired from the animate or inanimate environment and from other sites on the same individual such as the nose (Hoffman and Wilson, 1994). They are frequently pathogenic in nature and thus represent a major threat to patients (Paulson et al, 1999). In view of this, the following account focuses on the evidence for the role of hands in the transmission of infection in relation to transient micro-organisms.

The evidence to support the role of hands in the transmission of infection is provided by laboratory and clinically-based studies. In the laboratory, Marples and Towers (1979) demonstrated that transient micro-organisms are easily acquired on the hands, especially when the object touched is moist. Mackintosh and Hoffman (1984) modelled the transfer of transient micro-organisms from hands to the next object touched. They demonstrated that such transfer could achieve efficiencies of up to 86%, implying that hands may be very efficient vectors of infection. Although often only present on the hands temporarily, Ayliffe et al (1988) demonstrated that various transient micro-organisms and in particular, Gram positive ones are able to survive for upwards of 150 minutes after artificial inoculation, allowing ample opportunity for cross-contamination to occur during normal nursing duties. Whilst in general, Gram negative micro-organisms survive less well (Ayliffe et al, 1988),

certain species, for example *Klebsiella aerogenes* do survive more readily (Ayliffe et al, 1988; Casewell and Phillips, 1977).

In the clinical environment, it has been demonstrated that hands acquire micro-organisms during a wide range of patient care activities. Casewell and Phillips (1977) demonstrated the ease with which Klebsiella species colonising or infecting patients in an intensive care unit were transferred to nurses' hands. On 17 of 47 occasions when nurses attended to these patients, their hands became contaminated with 100-1000 Klebsiellae per hand, even during activities involving minimal physical contact, such as touching the patient's hand and taking their oral temperature. On almost all of these occasions, the Klebsiella type was the same as the patient's and was not found on hands before the start of the procedure.

Similarly, Ojajarvi (1980) demonstrated that nurses' hands became contaminated with *Staphylococcus aureus* (*S. aureus*) and Gram negative bacilli (GNB) when attending to patients colonised with these micro-organisms in a burns unit. The extent of contamination was compared following dry contamination (bedmaking) and moist contamination (changing of dressings) and it was found that after moist contamination, the mean counts of both *S. aureus* and GNB were about four times higher than after dry contamination. This corroborated findings of the above-mentioned laboratory study by Marples and Towers (1979).

To further elucidate the kinds of patient care activities that result in bacterial contamination of hands, Sanderson and Weissler (1992) carried out sampling of nurses' fingertips before and after eight different nursing activities. They quantified the extent of contamination with coliform-type micro-organisms following contact with patients on general orthopaedic wards and a spinal injuries unit. The findings revealed that hands were contaminated to varying extents during all eight of the activities investigated. Not surprisingly, the highest rates of contamination occurred following the handling of patients' wash flannels, towels and washbowls. Other frequent sources of contamination were patients' clothing, bedmaking, urinary catheters and the sluice room. However, 'clean' activities such as handling clean linen and dispensing medication during 'drug rounds' also led to contamination of hands, albeit to a lesser extent. Whilst the identification of only coliform-type micro-organisms overcame the need to distinguish between transient and resident skin flora (since coliforms are not part of the resident flora of hands), the study findings were nonetheless limited, as the

extent to which hand contamination with transient organisms other than coliforms occurred during the various nursing activities was not ascertained.

Pittet et al (1999) also investigated the extent to which health care workers' hands became contaminated with bacteria during routine patient care in a large teaching hospital. In all, 417 episodes of patient care were observed and after each of these, fingertips were sampled and bacterial counts quantified. The patient care activities associated with significant bacterial contamination included direct patient contact, respiratory care (including endotracheal tube or tracheostomy site care) and handling body fluid secretions. As the duration of each episode of patient care was monitored, it was possible to determine the rate at which micro-organisms were acquired, which on ungloved hands was estimated to be on average, 16 colony forming units per minute. However, whilst the study did demonstrate that the duration and type of patient care affects hand contamination, no distinction was made between resident and transient flora and it was therefore not clear to what extent transient flora alone accounted for the findings.

The above evidence from laboratory and clinical studies is highly suggestive of the role of hands in the transmission of infection, but does not actually demonstrate that this occurs. However, the provision of direct evidence in the form of prospective clinical trials poses great difficulty, since it would necessitate intentionally exposing a group of subjects to the unwashed hands of health care staff, which presents an obvious ethical problem. Nonetheless, one set of controlled experiments that did appear to overlook this problem was undertaken by Mortimer et al (1966). The study took place in a hospital nursery for newborn babies and involved monitoring the transmission of *S. aureus* amongst them. The babies, none of whom were colonised with *S. aureus* at the outset of the study, shared a room with 'index' babies who were known to be *S. aureus* carriers. They were divided into two groups. In one group, health care workers were instructed to wash their hands for ten seconds using an antiseptic soap after attending to each baby, whereas in the other, they were instructed not to wash their hands at all unless absolutely necessary, in which case only a rinse with running water was permitted. In the 'no handwash' group, nurses were also required to handle an index baby by changing its nappy before handling the other babies. The acquisition of *S. aureus* was monitored on a daily basis by sampling the nose and umbilicus of each baby. Findings revealed that the rate of acquisition of *S. aureus* was forty-three percent in the 'no handwash' group compared to fourteen percent when handwashing was done. This provided

strong evidence of the role of unwashed hands in the transmission of *S. aureus* and the value of antiseptic handwashing to prevent this. However, it also revealed a clear role for airborne transmission of *S. aureus* in the nursery setting, which although less efficient than contact transmission, occurred at a rate of ten percent.

Evidence for Hand Hygiene as a Means of Preventing Contact Transmission of Infection

Additional evidence to support hand hygiene as a means of preventing contact transmission of infection is provided by laboratory and clinically-based studies. The main value of laboratory studies has been to test the relative effectiveness of various hand hygiene products in the removal of micro-organisms from skin. This work has enabled the control of factors such as the microbial contamination of hands and handwashing technique so that actual differences between products such as plain soap, antiseptic soap and alcohol-based handrubs can be reliably detected. Clinical studies are much less able to control these factors, but are nonetheless essential to determine the value of hand hygiene in clinical practice.

Effectiveness of Skin Cleansing and Disinfection

There has been extensive research on the microbial flora on hands and the effectiveness of skin cleansing and disinfecting agents on its removal. The products commonly used for this purpose are plain soap, to assist the physical removal of microbes from skin, alcohol-based handrubs to destroy or inhibit microbes on skin and antiseptic soap preparations that do both (Larson, 1995). With regard to the removal of transient micro-organisms, much of the work regarding the effectiveness of handwashing products has been conducted in the laboratory setting using artificially inoculated micro-organisms. In general, the findings of this work suggest that skin disinfection is superior to plain soap and water. For example, Ayliffe et al (1988) compared the effectiveness of plain soap, various antiseptic soaps and alcohol-based handrubs on the removal of a test micro-organism (*Escherichia coli*) from hands. They found that alcohol-based handrubs were most effective, followed by antiseptic soaps, then plain soap.

Likewise, Paulson et al (1999) investigated the effectiveness of plain soap, an antiseptic soap containing alcohol and an alcohol-based handrub on the removal of a test micro-organism (*Serratia Marcescens*) from hands. In addition, they tested the combination of either plain or antiseptic soap followed by alcohol handrub and assessed the effect of repeated use of each

of these products and product combinations on skin irritation. Their findings confirmed those of Ayliffe et al (1988), since alcohol handrub was the most effective single product, followed by antiseptic soap, then plain soap. However, the combinations of either plain or antiseptic soap with alcohol handrub were the most effective overall, since both of these configurations produced dramatic reductions in transient micro-organisms as a result of mechanical removal by the soap handwash coupled with the microbicidal properties of the alcohol handrub. As none of the product regimens were found to induce skin irritation, they were all considered to be suitable for use in clinical practice.

Whilst both of these studies demonstrated the superiority of antiseptic preparations over plain soap for the removal of transient micro-organisms from hands, the authors acknowledged that the use of plain soap alone, whilst not optimal, did achieve an appreciable reduction of these micro-organisms, which may be sufficient enough for routine use in clinical practice. However, it is clearly not possible to determine the actual impact of differences in the effectiveness of hand hygiene products on the transmission of infection based on laboratory studies alone.

The research by Ayliffe et al (1988) did in fact include a study of the effectiveness of plain soap, a chlorhexidine-based antiseptic soap and an alcohol-based handrub in a clinical setting. The study was undertaken on an isolation unit where patients were nursed in isolation due to MRSA, tuberculosis, gastroenteritis and other communicable diseases. During a forty-five month period, the hands of nurses were sampled randomly, without prior washing or disinfection, to determine the extent of carriage of *S. aureus* and GNB. During the course of the study, specific hand hygiene products were used exclusively for defined time periods. The only exception to this was the time period when alcohol-based handrub was in use, as plain soap was also provided during this time, since the alcohol handrub could not be used for hand cleansing. Findings revealed that the agent used for hand hygiene made little or no difference to the frequency of numbers of either *S. aureus* or GNB recovered from the hands of nurses during the use of each of the products, with the exception of a lower incidence of GNB hand carriage during the period when alcohol handrub was used. Clearly, there are limitations to these findings, since it was not possible to control all the variables that may have influenced them, such as hand hygiene frequency and the microbial challenge during each of the time periods. However, they do lend support to the assertion that for routine hand hygiene, the occurrence of any type of handwash at an appropriate time to interrupt the

transfer of infection is far more important than the specific technique used (Hoffman and Wilson, 1994).

Ojajarvi (1980) conducted a more specific investigation of the effectiveness of various hand hygiene products on the removal of *S. aureus* and GNB from nurses' hands. The study took place on a burns unit to compare the effectiveness of plain soap, three different alcohol-based handrubs, three different antiseptic soaps and combinations of plain soap followed by one of each of the alcohol handrubs. Each product regimen was tested by nurses according to a standardised handwashing technique following dry or moist contamination of their hands whilst bedmaking or changing a patient's dressings respectively. The findings revealed that all hand hygiene methods greatly reduced the bacterial counts of *S. aureus* and GNB, although in general, alcohol-based handrubs were the most effective single products, followed by antiseptic soaps, then plain soap. However, the use of plain soap followed by alcohol handrub more often completely removed *S. aureus* from hands after moist contamination than the use of alcohol alone. These findings corroborate the evidence derived from the laboratory studies described above.

The Link between Hand Hygiene and the Reduction of Infection

As the above account illustrates, there is strong evidence to support the effectiveness of the various skin cleansing and disinfecting agents on the removal of transient micro-organisms from hands. However, it is clearly important to establish that a causal relationship exists between hand hygiene and the reduction of infection, although direct evidence of this kind from prospective clinical trials is virtually impossible to produce for several reasons that have been outlined by Larson (1988). Firstly, as mentioned above, there is a major ethical objection concerning clinical trials to demonstrate the extent to which hand hygiene reduces the transmission of infection, since there would be a need to expose patients to the unwashed hands of health care staff and in so doing, place them at a potentially greater risk of acquiring an infection. Whilst the above-mentioned study by Mortimer et al (1966) actually did this, the rate of *S. aureus* acquisition rather than infection was reported and it was therefore not possible to link hand hygiene with a reduction of infection per se. Secondly, as infections are associated with many interacting host and environmental factors, it is difficult to single out the effect of hand hygiene alone (Larson, 1988). Thirdly, the low rates of infection in hospitals would necessitate huge sample sizes in order to attain adequate statistical power (Larson, 1988). Finally, it would be imperative to monitor and maintain compliance with

hand hygiene protocols, which may prove extremely difficult on such a large scale, especially given the known problems with achieving optimal hand hygiene practice amongst health care staff (Larson and Kretzer, 1995).

However, somewhat ironically, the problem of sub-optimal hand hygiene practice has provided opportunities to examine indirectly the impact of improved hand hygiene practice on infection rates. Indeed, a study by Doebbeling et al (1992) to compare the effectiveness of hand hygiene with an antiseptic soap (4% chlorhexidine solution) versus an alcohol-based handrub with the optional use of plain soap reported a difference in hand hygiene compliance levels between the two regimens, with an associated difference in the rate of hospital-acquired infection. The study comprised an eight-month prospective multiple crossover trial in three intensive care units and reported a reduction in the rate of hospital-acquired infection when chlorhexidine was used as compared with soap and alcohol hand rub. The authors concluded that chlorhexidine was superior to alcohol in this respect. However, they also reported improved compliance with hand hygiene instructions when chlorhexidine was used, which they acknowledged may have partly explained the reduced rate of hospital-acquired infection.

In a subsequent review by Bryan et al (1995), this chance finding of a difference in hand hygiene compliance levels was considered to clearly demonstrate the significant impact of hand hygiene on rates of hospital-acquired infection. Indeed, they suggested that the difference in infection rates could have been explained by the difference in compliance levels alone. Even so, as Doebbeling et al (1992) acknowledged, it was not possible to determine the relative importance of improved compliance versus and the use of chlorhexidine. It was also difficult to draw accurate conclusions from the study findings for two reasons. Firstly, it was not clear whether health care workers were ever observed washing their hands with soap alone during the periods when soap and alcohol hand rub were available for use and if so, whether this was considered to be compliance or non-compliance with the hand hygiene protocol. Secondly, although the study findings demonstrated a significant increase in hand hygiene compliance levels when chlorhexidine was available for use, the actual number of handwashes observed was almost the same in both treatment groups, the difference in rate of compliance being due to a higher number of occasions when hand hygiene was indicated in the soap and alcohol hand rub group. Whilst this difference may have occurred purely by

chance, it may also have indicated that there were other differences in study conditions between the two groups that remained unrecognised.

A study by Pittet et al (2000) that was specifically designed to improve the hand hygiene practice of health care workers linked their findings to the rate of hospital-acquired infection. The hospital-wide study took place over a three-year period during which a hand hygiene campaign was implemented. The campaign produced a sustained improvement in compliance with hand hygiene as confirmed by direct observation of practice before and during the implementation period. One of the key initiatives was the provision of an alcohol-based handrub at each patient's bedside as well as individual bottles for health care workers to carry on their person. A substantial increase in the frequency with which this product was used produced an overall improvement in hand hygiene compliance from forty-eight percent to sixty-six percent. Throughout the duration of the study, the rate of MRSA transmission was monitored. In addition, annual prevalence surveys for hospital-acquired infection were undertaken. The findings revealed a statistically significant reduction in the incidence of MRSA infections from 2.16 to 0.93 episodes per 10,000 patient days. Also, the prevalence of hospital-acquired infection decreased from 16.9% to 9.9%. Whilst the authors acknowledged that the design of the study precluded ascertainment of the proportion of reduction in infection rates that was attributable to the hand hygiene campaign alone, the study nonetheless provided persuasive evidence for hand hygiene as a means of preventing contact transmission of infection.

Evidence Related to the Required Frequency of Hand Hygiene

Despite the undisputed importance of hand hygiene on the control of hospital-acquired infection, there remains a lack of consensus on when it should be done. Whilst several studies have attempted to establish the patient care activities which result in contamination of hands (Pittet et al, 1999; Sanderson and Weissler, 1992; Ojajarvi, 1980), it is not clear whether hand hygiene can ever be safely omitted in clinical practice, as there is an absence of research on this issue. One study by Rossoff et al (1995) has explored whether hand hygiene is always necessary by nurses on an intensive care unit before donning gloves (both sterile and non-sterile). Nurses' fingertips were sampled after donning gloves, with or without prior antiseptic handwashing and little difference was found in the level of microbial contamination, which was low whether or not hands had been washed. This led the authors to

conclude that hand hygiene confers no additional advantage and could be safely omitted in this situation. Clearly, further research is needed to elucidate this issue more fully.

In the meantime, in view of the lack of evidence to the contrary, hand hygiene guidelines generally stipulate the need for hand hygiene before and after all patient contact as well as before and after specific procedures on the same patient (Boyce and Pittet, 2002). Perceval (1993) has suggested that such standards may be too encompassing and as a result, are not well adhered to by health care workers. This point has also been recognised by other researchers investigating the extent of non-adherence to hand hygiene guidelines (Pittet et al, 1999; Thompson et al, 1997). Voss and Widmer (1997) questioned whether it is reasonable to expect one hundred percent compliance with handwashing given its time consumption. They used a model to predict the time spent on hand hygiene by health care workers on an intensive care unit, depending on the level of compliance and the duration of hand hygiene using medicated soap or alcohol-based handrub. Calculations revealed that for one hundred percent compliance to be attained by twelve health care workers on an eight-hour shift, handwashing would demand up to sixteen hours (or two full-time equivalent nurses) compared to only four hours for alcohol-based handrub. They concluded that one hundred percent compliance was achievable if handwashing at a sink was replaced with alcohol-based handrub at the patients' bedside, since this would require one hour less than presently needed for handwashing at forty percent compliance. Many other researchers agree that the use of alcohol-based handrub offers a considerable advantage over conventional handwashing in this respect (Harbarth et al, 2002; Hugonnet et al, 2002; Girard et al, 2001; Girou et al, 2001; Bischoff et al, 2000; Maury et al, 2000; Pittet et al, 2000) and its introduction has formed the basis of several intervention studies to improve adherence to hand hygiene measures by health care workers (see Chapter 4).

The consensus from the above studies and review articles is that there is compelling evidence to support the role of hands in contact transmission of infection and the effectiveness of hand hygiene to prevent this. Hand hygiene is therefore considered to be an essential component of infection control practice, both routinely (Boyce and Pittet, 2002; ICNA, 2002; Pratt et al, 2001) and as part of Contact Precautions (Garner et al, 1996). Whilst there are differences in the effectiveness of the various hand hygiene products, the occurrence of any type of handwash at an appropriate time is generally considered to be more important than the product used (Ayliffe et al, 2000; Hoffman and Wilson, 1994). However, there is a lack of

consensus regarding the required frequency of hand hygiene and published guidance is frequently all-encompassing in this respect. As a Contact Precaution, emphasis is frequently placed on the importance of hand hygiene after contact with the 'infectious' patient or their environment (Ayliffe et al, 2000; Garner et al, 1996), thus shifting the focus away from the usual indications for hand hygiene before and during as well as after patient care. However, this may result in these indications being overlooked by health care workers, particularly when gloves are worn.

Evidence for the Role of Gloves in Preventing Contact Transmission of Infection

As hands are known to be an important vehicle for transmission of micro-organisms in hospitals, the use of gloves in addition to hand hygiene is frequently advocated to reduce the transfer of micro-organisms to and from the hands (ICNA, 2002; Pratt et al, 2001; Garner et al, 1996; Kjolen and Andersen, 1992; Wilson and Breedon, 1990; Lynch et al, 1987; CDC, 1987; Ojajarvi, 1980). In particular, they are recommended for three reasons: to prevent gross soiling and heavy microbial contamination of hands, to protect the patient from micro-organisms present on the health care worker's hands (e.g. during invasive procedures) and to protect the health care worker from exposure to potentially hazardous micro-organisms such as blood-borne viruses. As a Contact Precaution, gloves are recommended to serve the first of these purposes in order to minimise the microbial contamination of hands during contact with an infectious patient. In this context, glove use has been advocated for all contact with the patient rather than for specific activities involving only heavy microbial contamination (Garner et al, 1996), thus shifting the focus away from selective use to routine use irrespective of the activity to be undertaken. However, this contradicts recommendations about avoiding prolonged and indiscriminate glove use in view of the problem of adverse reactions and skin sensitivity (Pratt et al, 2001) and may result in health care workers failing to recognise the need to change gloves between different procedures on the patient.

The Use of Gloves to Prevent Microbial Contamination of Hands

The value of gloves in reducing microbial contamination of hands in clinical practice has been demonstrated by two in-use studies. Pittet et al (1999) investigated bacterial contamination of health care workers' hands during routine patient care in a hospital setting. They found a positive association between duration of patient care and amount of bacterial contamination when health care workers did not wear gloves (average acquisition rate of

sixteen colony forming units (CFUs) of bacteria per minute) compared to when gloves were worn (average acquisition rate of only three CFUs per minute). This indicated the protective effect of gloves against bacterial contamination of hands over time, although due to resource implications, no attempt was made to distinguish between transient and resident skin flora.

Olsen et al (1993) overcame this problem in a cleverly designed study to test the effectiveness of vinyl and latex examination gloves as barriers to hand contamination. Instead of distinguishing between transient and resident flora, the researchers studied only bacteria which could be readily differentiated from the normal microbial flora of hands (namely Gram negative bacteria and enterococci). They identified three clinical procedures involving extensive contact with oral or rectal mucosa, where these bacteria were likely to be present in large numbers, and tested for their presence on hands before and after each procedure and on the exterior surface of gloves after use. Analysis was restricted to those contacts where enterococci or Gram negative bacteria were found on gloves after use, but were not found on hands prior to the procedure. Findings demonstrated that the contamination of hands by these micro-organisms was prevented on 75/86 (87%) of occasions. Even when hands were contaminated, the bacterial counts on the skin were considerably lower than those on the glove surface.

The fact that hands can become contaminated when using and removing gloves (Olsen et al, 1993; Weinstein and Kabins, 1987) indicates that gloves cannot be regarded as a substitute for hand hygiene. Indeed, several studies have demonstrated the presence of leaks in both vinyl and latex examination gloves (Olsen, 1993; Korniewicz et al, 1992; Korniewicz et al, 1990; Kotilainen et al, 1989). Differences in leakage rates have been attributed to glove material (e.g. Olsen et al, 1993), manufacturer (e.g. Kotilainen et al, 1989), type of activity undertaken (e.g. Korniewicz et al, 1990) and duration of use (e.g. Korniewicz et al, 1992). Although much has been made of the potential for gloves to leak as a basis for glove selection for different activities (Larson, 1989; ICNA, 1999), Olsen et al (1993) demonstrated the lack of a strong correlation between presence of leaks and subsequent bacterial contamination of hands and found that hand contamination also occurred in the absence of detectable leaks. Whilst gloves do minimise bacterial contamination of hands in clinical practice, it is clearly important that they are used in addition to rather than instead of hand hygiene (Larson, 1983) and that they are changed between patients and different

procedures on the same patient (Jackson and Lynch, 1991; Patterson et al, 1991; Weinstein and Kabins, 1987).

The Use of Gloves to Prevent Contact Transmission of Infection

Although Goldmann (1991) asserted it was hard to imagine that thorough handwashing would be less efficacious than gloves, it has been established that hand hygiene alone is not always enough to remove all transient organisms when hands are heavily contaminated, even when antiseptic agents are used (Kjolen and Andersen, 1992; Ojajarvi, 1980). Whilst the impact of this on transmission of infection in clinical practice remains unclear, it would seem rational that the reductions in microbial contamination of hands when gloves are used are of some benefit in this respect. However there is a lack of clinically-based studies to demonstrate this, as the effect of gloves has rarely been evaluated separately from other measures such as hand hygiene and aprons / gowns and has been complicated by compliance problems (e.g. Madge et al, 1992). Goldmann (1991) also highlighted the difficulty with evaluating infection prevention strategies such as the use of gloves, given that hospital-acquired infections are not usually restricted to one route of spread and that these routes may be complex or incompletely understood.

A study by Johnson et al (1990) did attempt to evaluate prospectively the use of vinyl gloves to interrupt transmission of *C. difficile* infection in a hospital setting. It took place over a twelve month period and involved the use of two intervention wards where glove use was actively promoted for contact with body substances and two control wards where no attempt was made to influence glove use. A decrease in the incidence of *C. difficile* diarrhoea from 7.7 cases/1000 patient discharges to 1.5/1000 was reported on the intervention wards compared to no significant change on the control wards (5.7/1000 to 4.2/1000). This was accompanied by a higher rate of glove use on the intervention wards compared to the control wards post-intervention, although the rates of glove use prior to the intervention was not known. The authors claimed that their findings supported the efficacy of vinyl glove use to prevent spread of *C. difficile* and in so doing, provided indirect evidence of the importance of hand carriage as a means of transmission. However, whilst glove usage rates were higher on the intervention wards than on the control wards post-intervention, their increased use specifically to prevent *C. difficile* transmission was not actually confirmed by direct observation of practice.

Whilst there is a lack of clinically-based studies to demonstrate the effectiveness of gloves in reducing contact transmission of infection, their potential contribution to infection control efforts by preventing gross soiling and contamination of hands is evident. What is less clear is the extent to which glove use during various patient care activities offers an advantage over hand hygiene alone. This issue is especially pertinent in relation to Contact Precautions, since glove use has been recommended routinely for all contact with the patient rather than on a selective basis (Garner et al, 1996). Whilst this may be considered to be a good way of ensuring adherence to Contact Precautions, it is not entirely rational and does little to promote hand hygiene as the single-most important infection control measure. It also contravenes the recommendation to avoid prolonged and indiscriminate glove use in order to minimise adverse reactions and skin sensitivity (Pratt et al, 2001). Moreover, emphasis on glove use throughout the duration of patient care may result in health care workers overlooking the importance of changing gloves and washing hands between 'dirty' and 'clean' procedures.

Summary

This chapter has examined the evidence base for the role of hands in contact transmission of infection and the value of hand hygiene and glove use as the means to interrupt this. The consensus from the literature reviewed is that there is compelling evidence to support the role of hands in contact transmission of infection. In addition, there is no doubt that hand hygiene is a hugely important element of infection control practice in health care settings. Whilst the occurrence of any type of handwash at an appropriate time is generally considered to be more important than the product used (Ayliffe et al, 2000; Hoffman and Wilson, 1994), it is clear that antiseptic preparations and in particular, alcohol-based hand rubs are a valuable adjunct to the use of plain soap and water. The use of gloves as the means by which to prevent heavy soiling and microbial contamination of hands is also of clear importance. It is therefore imperative that health care workers understand the significance of these simple procedures and incorporate them as a fundamental part of their practice in order to minimise contact transmission of infection via hands.

Whereas the indications for hand hygiene in routine practice (i.e. as a 'Standard Precaution') are also applicable in relation to Contact Precautions, as a Contact Precaution emphasis is frequently placed on the importance of hand hygiene after contact with the 'infectious' patient or their environment (Ayliffe et al, 2000; Garner et al, 1996). This shift of focus away

from the usual indications for hand hygiene before and during as well as after patient care may result in these indications being overlooked by health care staff, particularly when gloves are worn. Indeed, the recommendation to use gloves routinely as a Contact Precaution throughout the duration of patient care (Garner et al, 1996) may encourage this, since health care workers may fail to recognise the need to change gloves and wash hands between 'dirty' and 'clean' procedures on a patient. In view of this, it is clear that the way in which health care workers interpret guidance on Contact Precautions in relation to hand hygiene and glove use is critically important. In particular, there is a clear need to ensure that the emphasis on protecting others from exposure to the micro-organisms harboured by 'infectious' patients does not result in failure adhere to the usual indications for hand hygiene and glove changing during the care of these patients.

The following chapter moves on from the issue of hand hygiene and glove use and provides a review of the evidence for the role of clothing and the inanimate environment in the spread of infection. The value of precautions to minimise contact transmission via clothing, equipment and the environment is also explored, along with the limited evidence available on the effectiveness of Contact Precautions over the Standard Precautions recommended for all patients.

CHAPTER 2

CONTACT PRECAUTIONS AND THE PREVENTION OF CONTACT TRANSMISSION OF INFECTION IN HOSPITALS

Part II: The Evidence Base for Precautions to Prevent Contact Transmission via Clothing and the Inanimate Environment

Introduction

As described in Chapter 1, Contact Precautions are recommended for patients colonised or infected with multidrug-resistant bacteria of special clinical and epidemiological significance such as methicillin resistant *Staphylococcus aureus* (MRSA) (Garner et al, 1996). They also apply to various other infections transmitted easily by the contact route including *Clostridium difficile* (Garner et al, 1996). In addition to emphasising hand hygiene and glove use, Contact Precautions also require the known infectious patient to be accommodated in a single room whenever possible, along with gown/apron use for physical contact with the patient or their environment and the dedicated use of reusable patient care equipment (Garner et al, 1996). In Chapter 1, the evidence for the role of hands in the transmission of infection and the value of hand hygiene and glove use to minimise contact transmission via hands was examined. This chapter comprises a review of the evidence for the role of clothing and the inanimate environment in the spread of infection and the value of precautions to minimise contact transmission via clothing, equipment and the environment. The limited evidence available on the effectiveness of Contact Precautions over the Standard Precautions recommended for all patients is also considered. The search strategy employed to retrieve the relevant research literature on these aspects of Contact Precautions can be found in Chapter 1.

Evidence for the Role of Clothing in the Transmission of Infection and the Value of Aprons / Gowns to Prevent This

It has long been recognised that clothing such as nurses' uniforms can become contaminated with pathogenic micro-organisms such as *S. aureus* derived from infected or colonised patients during routine care (Babb et al, 1983; Hambraeus, 1973; Speers et al, 1969). Whilst levels of contamination may be low (Babb et al, 1983), heavy contamination with *S. aureus* has been associated with nursing heavy dispersers such as burned patients (Hambraeus, 1973), eczematous patients, heavy carriers and patients with discharging wounds (Babb et al, 1983; Speers et al, 1969). The potential for contaminated clothing to act as a vehicle for

transmission of micro-organisms between patients was demonstrated by Hambraeus (1973), who established that *S. aureus* could be transferred from one patient's room to another on heavily contaminated nurses' clothing. Lidwell et al (1974) also found evidence that *S. aureus* on nurses' clothing could be transferred to patients and their bedclothes and that use of a plastic apron prevented this. However, the clinical relevance of these findings in terms of reducing the risk of infection is unclear.

There is a lack of more recent evidence for the role of clothing in the transmission of infection. Nonetheless, the use of an apron or gown has been recommended as an infection control measure to reduce the transfer of micro-organisms to and from clothing (Pratt et al, 2001; Garner et al, 1996; Curran, 1991). In particular, apron or gown use is recommended for three reasons: to protect clothing from microbial contamination, to minimise the dissemination of micro-organisms from the skin or clothing of the wearer to immunocompromised or severely debilitated patients such as those in intensive care (Klein et al, 1989; Agbayani et al, 1981; Nystrom, 1981) and to protect the health care worker's clothing when there is a risk of extensive splashing of blood or body fluids (Pratt et al, 2001). As a Contact Precaution, an apron or gown is recommended to serve the first of these purposes in order to minimise microbial contamination of clothing during contact with an infectious patient (Zachary et al, 2001; Garner et al, 1996; LeClair et al, 1989).

The Use of Aprons / Gowns to Prevent Microbial Contamination of Clothing

The value of aprons and gowns in preventing microbial contamination of clothing has been assessed by two key studies, one in a burns unit (Hambraeus, 1973) and the other in an isolation ward (Babb et al, 1983). Hambraeus (1973) carried out a series of experiments on the contamination of nurses' uniforms with *S. aureus*, using four types of protective gown. She found that uniforms became heavily contaminated when nursing burned patients, particularly those identified as heavy dispersers. The effectiveness of gowns in preventing microbial contamination of uniforms was found to vary considerably, irrespective of the type of gown used. This was thought to be due to variations in the work performed by the nurse, according to whether the patient was extensively burned, a baby or nearly well. During separate experiments, when the degree of air contamination in patients' rooms was accounted for (as an indication of the level of contamination to which the nurse was exposed), it was estimated that the use of a gown afforded an eight to twenty-five fold protection against contamination of nurses' uniforms. However, the experimental conditions required that the clothing was worn for a limited time period, which is unrepresentative of in-

use situations, when clothing and gowns (unless single-use disposables) would be worn for longer. The use of a gown was found to reduce the transfer of *S. aureus* from nurses' clothing to 'model' patients, although Hambraeus (1973) concluded that this level of protection was insufficient for patients in a burns unit.

A decade later, Babb et al (1983) published findings from an in-use study of the microbial contamination of cotton gowns, plastic aprons and nurses' uniforms on an isolation ward. They established that fewer micro-organisms were recovered from the front of uniforms when plastic aprons instead of gowns were worn, but that gowns provided better shoulder protection. However, when they looked specifically at isolates of *S. aureus* and Gram negative bacteria (rather than total bacterial counts), they found little difference in the number of isolates between the sites sampled or the type of protective clothing used. Since *S. aureus* was mostly found in small numbers on uniforms, plastic aprons and gowns, and Gram negative bacteria were infrequently found, the role of clothing in the spread of these micro-organisms and the importance of aprons or gowns in reducing this risk was considered to be questionable. On the few occasions when counts of *S. aureus* on protective clothing were found to be high, this was linked to prior close contact with a heavy disperser, leading the authors to recommend the use of protective clothing in this situation.

Evidence for the Role of Aprons / Gowns in Preventing the Transmission of Infection

There has been limited study of the role of gowns and aprons in preventing the transmission of infection. Their traditional use by health care staff and visitors in hospital nurseries and neonatal intensive care units to protect newborn babies from infection has been refuted (Rush et al, 1990; Pelke et al, 1994). Aside from this, evaluation of their use in hospitals has not usually been considered separately from other infection control measures such as use of gloves, which in combination, have been associated with reductions in hospital-acquired infection (Slota et al, 2001; Klein et al, 1989; LeClair et al, 1989). Slaughter et al (1996) did attempt to investigate prospectively the use of gloves and disposable gowns compared to the use of gloves alone in the prevention of vancomycin-resistant enterococci (VRE) transmission in a medical intensive care unit.

The study involved monitoring of one hundred and eighty-one patients admitted to the unit for acquisition of VRE. Half of these patients were assigned to a 'glove and gown' policy and the other half to a 'glove only' policy throughout the duration of their stay on the unit. The rate of acquisition of VRE amongst patients in the two groups was found to be

comparable and the authors concluded that there was no added benefit to the use of gowns in addition to gloves in a situation where VRE was endemic and where environmental contamination was found to be low. The similarity in VRE acquisition rates between the two groups occurred even though compliance with the glove and gown policy was observed to be significantly higher than with glove use alone. However, as compliance with infection control measures was sub-optimal in both groups and one quarter of all patients in the study were found to have acquired VRE, it was difficult to elucidate the true impact of these measures, particularly in the presence of other risk factors which were identified, such as enteral feeding and the use of sucralfate.

A study by Boyce et al (1994) to investigate an outbreak of VRE in an intensive care unit did report termination of the outbreak only when use of gowns in addition to gloves and a private room were recommended. Prior to this, the recommendation to use gloves and a private room had failed to control the outbreak and contamination of environmental surfaces with VRE, particularly when affected patients had diarrhoea, led to concern about the potential for the environment to be acting as a reservoir for the organism. The effectiveness of gowns as an additional measure was considered to support this possibility, although as the infection control practices of staff were not actually observed as part of the study, the extent to which recommendations were complied with was not clear. In fact, the investigators commented that an alternative explanation may have been that gloves were not being changed appropriately between patients and the requirement to use gowns as well as gloves led to better compliance with glove use.

In summary, there has been limited prospective evaluation of the use of aprons and gowns as an infection control measure. Whilst they have been found to reduce the microbial contamination of clothing during contact with patients and prevent transfer of these organisms to other patients, their role in reducing the risk of infection remains unclear. Since most studies have focused on specific micro-organisms, such as *S. aureus* and VRE, their applicability more generally to other micro-organisms is questionable. The degree of contamination of clothing appears to depend in part on the extent to which micro-organisms are dispersed by patients and also on the type of patient care activity undertaken. In view of this and in the absence of evidence to the contrary, the use of aprons and gowns based upon an assessment of the level of risk associated with a specific patient care activity or intervention has been advocated (Pratt et al, 2001, Curran, 1991).

In relation to Contact Precautions, there is no consensus on the value of routinely donning an apron or gown on entry to an isolation room versus its use for specific activities only. As Wilson (1995) has argued, the routine use of protective clothing regardless of the activity to be undertaken does seem illogical. However, until more is known about the value of aprons and gowns as an infection control measure, their use is likely to remain controversial.

Evidence for the Role of the Inanimate Environment in the Transmission of Infection

It is known that many of the micro-organisms associated with hospital-acquired infection can contaminate equipment and the environment and remain viable for some time (Talon, 1999). For this reason, the use of dedicated patient care equipment is often recommended as a Contact Precaution and the use of a single room is considered preferable (Ayliffe et al, 1998; Garner et al, 1996; Cooke et al, 1994). In a prospective study of environmental contamination with MRSA, Boyce et al (1997) found that the level of environmental contamination in the rooms of patients with MRSA was frequently sufficient to cause contamination of nurses' gloves when they touched surfaces and equipment, despite having had no direct contact with the patient. This demonstrated the potential of the environment to act as a reservoir of pathogenic micro-organisms in the hospital setting. The investigators expressed concern that health care workers may not appreciate the need to wash their hands after such contact. However, the extent of this problem and its potential to result in transmission of MRSA to patients was not explored.

Other studies have established that environmental contamination may be extensive in the case of heavy dispersers of micro-organisms, such as patients with diarrhoea who are colonised or infected with VRE (Boyce et al, 1994) or *C. difficile* (McFarland et al, 1989) and patients with MRSA in a wound or urine (Boyce et al, 1997). However, other than in burns units, where the use of laminar airflow techniques to minimise bacterial contamination of the environment has been found to reduce infection in seriously burned patients (Demling et al, 1978; Burke et al, 1977), there is a lack of direct evidence to implicate the inanimate environment as a reservoir of infection, even though its potential to act as such is clear (Talon, 1999; Weber and Rutala, 1997).

Maki et al (1982) conducted a prospective study to examine the relationship between environmental contamination and endemic hospital-acquired infection. By capitalising on the transfer of a hospital from its old facility to a newly built one, it was possible to determine

the impact of the changed environment on the rate of hospital-acquired infection. Microbiological sampling of the two hospital environments revealed a difference in the levels of microbial contamination of surfaces other than floors, there being substantially lower contamination in the new hospital after six to twelve months of occupancy than in the old one. Despite this, the incidence of hospital-acquired infection remained unchanged, suggesting that organisms in the inanimate hospital environment contributed negligibly to endemic infection. However, the design of the study precluded identification of specific circumstances when environmental contamination may have contributed to the transmission of infection.

A more detailed investigation of the association between environmental contamination with *C. difficile* and its subsequent acquisition by patients on a general medical ward was undertaken by McFarland et al (1989). The ward environment was sampled extensively for *C. difficile* and both symptomatic and asymptomatic carriers of the organism were identified prospectively using rectal swab cultures. All positive *C. difficile* isolates were typed by immunoblotting. Findings revealed that the hospital rooms occupied by patients who were colonised or infected with *C. difficile* were frequently contaminated with the same type of the organism. Whilst environmental contamination was more common when the patient had diarrhoea (49%), it also occurred when the patient was an asymptomatic carrier (29%). Patients exposed to a room mate with positive *C. difficile* culture had more frequent and earlier acquisition of the same type of the organism than those who were not. Acquisition rates were also found to be markedly higher in some rooms than in others, although the reason for this was not clear. These findings suggest a possible role for environmental contamination in the transmission of *C. difficile*, although the routes of spread were not fully delineated.

More recently, Fawley and Wilcox (2001) undertook DNA fingerprinting of *C. difficile* isolates from patients and the environment of two elderly medicine wards to investigate the relationship between environmental contamination and patient acquisition. Two strains of *C. difficile* were identified as causing both patient infection and ward contamination, but as the majority (90%) of these were the same epidemic strain, it was not possible to establish whether infected patients or contaminated environments were the prime source for cross-infection. The study was also limited as no attempt was made to identify asymptomatic carriers of the organism. Nonetheless, during the course of the investigation, a cluster of six cases of *C. difficile* infection by a distinct non-epidemic strain was identified, but was only

isolated from the environment after the sixth patient became symptomatic, suggesting patient to patient or staff to patient spread rather than spread by the environment.

Decontamination of the Environment as a Means of Interrupting the Transmission of Infection

Two hospital-based studies have reported the containment of an outbreak of infection following enhanced efforts to decontaminate the environment (Das et al, 2001; Rampling et al, 2001). Das et al (2001) undertook environmental sampling during an outbreak of a multiple antibiotic resistant strain of *Acinetobacter baumanii* amongst patients in an intensive care unit. They demonstrated that the strain of the organism acquired by patients was also present on environmental surfaces, including bed linen and the curtains surrounding patients' beds. The outbreak was contained following measures including increased frequency of cleaning of the environment with a disinfectant solution and twice-weekly changing of curtains along with restricting the use of a specific antibiotic. The authors considered that environmental surfaces and in particular, dry fabrics such as curtains were an important reservoir for dissemination of acinetobacter species, although the evidence presented in support of this was only circumstantial.

Rampling et al (2001) monitored the effect of increased environmental cleaning on the acquisition of MRSA by patients on a general surgical ward during a prolonged outbreak of colonisation/infection. Owing to the failure of infection control measures to contain the outbreak, domestic cleaning time was increased by fifty-seven hours per week, with emphasis on removal of dust by vacuum cleaning and allocation of responsibility for the routine cleaning of shared medical equipment. This was associated with a marked reduction in the rate of acquisition of the outbreak strain of MRSA by patients on the ward from approximately three new cases per month over a twenty-one month period to three cases in six months. In addition, this strain was no longer detectable in the environment, having previously been found to be widespread. The authors postulated that the normal infection control and outbreak measures, which included isolation of patients found to be colonised or infected with MRSA, failed because of the environmental reservoir. Their findings appeared to support this, although a follow-up period of longer than six months may have been more convincing, particularly as part way through the outbreak, before the start of the intervention, there was an equivalent six-month period when only three new cases of the outbreak strain were identified. Also, it was unclear what other factors may have contributed to the outbreak and whether the localised infection control team that was established at the same time as the

enhanced cleaning to tackle the problem had any effect on this. Nonetheless, the study highlighted the value of routine environmental cleaning and the clear assignment of cleaning tasks, which as Jackson and Lynch (1996) argue, should provide the basis of hospital infection control programmes rather than linking special cleaning with Contact Precautions.

The Role of Equipment in the Transmission of Infection

There are numerous examples of the transmission of infection associated with patient care equipment (Harnett et al, 2001; Yardy and Cox, 2001; van den Berg et al, 2000; Weems, 1993; Livornese et al, 1992; Hartstein et al, 1988). Procedures for the appropriate decontamination of reusable equipment are a key part of hospital infection control policies (Ayliffe et al, 2000; Rutala, 1996a) and are defined according to the risk of infection involved in the use of the item. These procedures are designed to be applied routinely to equipment used by all patients irrespective of whether or not they are known to have an infectious disease or condition. Nonetheless, the dedicated use of equipment that is considered to be low-risk with regard to infection transmission, such as commodes, blood pressure cuffs and stethoscopes has been recommended for patients requiring Contact Precautions (Ayliffe et al, 2000; Garner et al, 1996) to minimise the risk of mistakes occurring as a result of improper decontamination.

The microbial contamination of equipment deemed to be low-risk has been widely reported (Zachary et al, 2001; Leprat et al, 1998; Base-Smith, 1996; Manian et al, 1996; Layton et al, 1993; Breathnach et al, 1992). For example, Zachary et al (2001) conducted a prospective study to investigate the rate of contamination of stethoscopes (as well as gowns and gloves) with VRE during routine physical examination of patients colonised with the organism. VRE was isolated from thirty-one percent of stethoscopes, none of which were contaminated immediately prior to use. However, their potential to transfer VRE to patients was not investigated. In reality, such equipment has rarely been associated with the transmission of infection, hence its classification as low-risk (Rutala, 1996b), since it only comes into contact with intact skin, which is an effective barrier to micro-organisms. However, as Rutala (1996b) points out, contaminated equipment may contribute to infection transmission via health care workers' hands, although again, the extent to which this occurs in practice is unknown.

Zachary et al (2001) did report that disinfection with an alcohol wipe was an effective method of decontaminating the stethoscope diaphragm and suggested that this may be a

useful infection control strategy if practised routinely after all patient contacts. The routine application of recommendations to decontaminate patient care equipment is an approach supported by Jackson and Lynch (1996), who questioned the value of dedicating equipment to the use of patients requiring Contact Precautions given the frequency with which patients harbouring infectious micro-organisms remain unrecognised. In addition to this, Zachary et al (2001) highlighted a practical problem with regard to the use of dedicated stethoscopes, since many physicians and other practitioners may prefer to use their own instruments, particularly if those provided are of suboptimal quality. In the absence of scientific evidence on the role of low-risk patient care equipment in the transmission of infection, recommendations on its decontamination and dedicated use have been based on theoretical and practical considerations, which clearly require local interpretation to overcome problems with their implementation.

The Value of Single Room Isolation

In hospitals, the single room is considered to play a key role in preventing the transmission of pathogens spread by the airborne route (Ayliffe et al, 2000; Garner et al, 1996; Nicas et al, 1993) and has also been recommended for patients who soil their environment with body substances (Lynch et al, 1987). It is considered a preferable rather than essential requirement of Contact Precautions (Ayliffe et al, 2000; Garner et al, 1996), although its necessity in this respect is controversial (Sanderson and Richardson, 1997; Jackson and Lynch, 1996) since its effectiveness remains unsubstantiated. Indeed, any beneficial effect associated with single room isolation may have more to do with it serving as a reminder to health care staff to adhere to measures such as hand hygiene rather than its function as a physical barrier. Thus, guidelines and recommendations that emphasise the importance of single room isolation as part of Contact Precautions are based largely upon expert opinion and anecdotal evidence rather than rigorous scientific inquiry (e.g. Ayliffe et al, 1998; Edmond et al, 1996; Garner et al, 1996; Cooke et al, 1994).

Early studies of the effect of the single room on the transmission of micro-organisms were conducted by Lidwell and Towers (1972) and Ayliffe et al (1971). Lidwell and Towers (1972) reported their experience of using a two-bed isolation room ventilated by horizontal, unidirectional airflow. Over a period of two and a half years, over one hundred patients were nursed in the room and the rate of acquisition of *S. aureus* and Gram negative bacteria amongst them was monitored and compared to that amongst patients on the open part of the ward. Throughout the course of the study 'normal' nursing procedures were employed rather

than isolation precautions. Findings revealed that whilst the air within the isolation room was estimated to contain one hundred-fold less bacteria than on the open ward, the rate of acquisition of new strains of micro-organisms was only slightly reduced. This led the authors to conclude that acquisition of *S. aureus* was largely a consequence of nursing contacts and that the apparent acquisition of new strains of Gram negative species was probably due to redistribution of the patient's own flora.

Ayliffe et al (1971) compared the use of single rooms with one of three different forms of ventilation with the open ward environment over a four-year period to determine their effect on acquisition of multiple-resistant *S. aureus* by patients. One of the rooms was window-ventilated, two had partial recirculation ventilators giving seven to ten air changes per hour and two were self-contained isolation suites with plenum ventilation (twenty air changes per hour), ultraviolet barriers at doorways and airlocks. Normal nursing procedures were employed throughout the study. Findings revealed that airborne counts of bacteria were significantly higher in the open ward than in the single rooms, the mean counts being reduced in proportion to the number of air changes. However, there were no significant differences in nasal acquisition of multiple-resistant *S. aureus* other than in the plenum ventilated rooms, indicating that a reduction in acquisition rates was only possible when extensive measures were taken to minimise bacterial contamination of the environment. This led the authors to conclude that when airborne bacterial contamination is low (as was the case during most of the study), measures to reduce contact transfer of micro-organisms are more important and may be sufficient to exclude most pathogens. The exception to this was the presence of staphylococcal dispersers (patients who disseminate large numbers of staphylococci into the environment), since their presence resulted in an unusually high level of environmental contamination.

More recently, other investigators have evaluated the effect of single rooms on infection rates following renovations of previously open style ward environments (Shirani et al, 1986; Preston et al, 1981). Shirani et al (1986) reported a significant reduction in the rate of infection amongst burn patients from 58.1% to 30.4% when an open intensive care unit with no single rooms was converted to one with almost all single rooms. The reduction was attributed to the changed environment, although it was not linked specifically to the effect of physical segregation. This was because other possible contributory factors, including changes in infection control practice were not accounted for. For example, the researchers highlighted that there may have been an improvement in handwashing practice in the new

unit, which had nineteen sinks compared to only five in the old one, although this was not actually monitored as part of the study. The infection rates reported in this study were very high, reflecting the unique susceptibility of burn patients to infection with a wide range of pathogens, including those spread via the airborne route (Ayliffe and Lowbury, 1982). In view of this, the study findings are unlikely to apply more generally to patients other than those with burns.

Preston et al (1981) did attempt to account for the infection control practices of health care staff in their study of an intensive care unit. The study involved sequential investigation of a six-bedded open style ICU, which was subsequently transferred to a new facility with fourteen single rooms. It was designed to investigate the value of single rooms in preventing colonisation and infection with six hospital pathogens. Observation of the infection control practices of staff was combined with monitoring for infection and selected risk factors for infection, collection of surveillance cultures from patients and air sampling. The findings revealed little difference in the patient care practices of staff and related handwashing frequency (which was low in both units), although the number of interactions with patients per hour was reduced when single rooms were in use. Colonisation and infection rates also remained unchanged, other than respiratory tract infections, which were reduced from 5.4 per 100 patients in the open unit to 3.6 in single rooms. Over half of all infections were caused by organisms already colonising the patient at the time of admission and although air sampling detected higher colony counts of bacteria in the open unit compared to single rooms (14.7 per 60 cubic feet vs 7.0), the numbers of study organisms found was low in both situations. The study therefore established that single rooms did not significantly reduce the transmission of hospital pathogens within an ICU. However, as the unit changed from six to fourteen beds, this may have given rise to other changes, which limited the comparability of the two study settings. The study also demonstrated a lack of alteration in the infection control behaviour of staff, although this may have been because the rooms were not being used specifically as an isolation precaution.

The above studies have investigated the effect of the single room as a means of protecting the patient within it from exposure to pathogenic micro-organisms and generally conclude that it offers little benefit in the absence of a specific risk of dispersal of micro-organisms or a vulnerable patient group. However, the purpose of a single room as part of Contact Precautions is to segregate the infectious patient from others, but there has been very little research into its effectiveness in this respect. Selkon et al (1980) attributed the control of an

outbreak of an epidemic phage type of MRSA in a district general hospital to the establishment of an isolation unit. Over a six-year period from 1972-78, the number of patients infected with MRSA fell from one hundred and seventy-seven per year to fourteen per year. The use of single rooms with controlled ventilation and wearing of a gown on room entry were believed to have brought about this reduction. Air sampling revealed lower colony counts of *S. aureus* outside the room compared with inside, which was considered to support the findings. However, since there was no description or monitoring of the other infection control measures in use at the time of the study, it was not possible to ascertain the impact of physical segregation alone on the reduction of MRSA infection rates. In addition, it was not clear whether the decline in MRSA may also have been accounted for by other factors such as changing antibiotic usage, as experienced elsewhere at the time of the study (Teare and Barrett, 1997).

More recently, van Rijn et al (1997) attributed the absence of cross-contamination of multi-resistant micro-organisms between patients with burns to the use of a 'quarantine and isolation unit', although there was no prospective data to support this finding. In contrast, a retrospective study by Fazal et al (1996) investigated the prevalence of MRSA in an acute hospital following discontinuation of an isolation policy. The authors concluded that there was no evidence of an increase in prevalence of MRSA when the practice of placing colonised or infected patients into single rooms ceased. However, the study was limited, as the detection of MRSA carriage relied on clinical rather than surveillance cultures. Also, the infection control practices of staff before and after the change in policy were not observed and it was therefore not possible to determine their influence on the prevalence of MRSA. Clearly, if compliance with infection control measures was poor throughout the study, this may have accounted at least in part for the lack of impact of discontinuing patient isolation.

In a similar way, Duncan and Batchelor (1993) investigated the effect of discontinuing traditional isolation precautions in a large teaching hospital and replacing it with a system of 'body substance precautions' for all patients. As part of this process, patients with *C. difficile* and antibiotic-resistant Gram negative bacteria were no longer placed in single rooms. Handwashing, gloves and gowns were recommended whenever health care workers anticipated contact with the blood or body fluids of any patient. There was no increase in cases of *C. difficile* or antibiotic-resistant Gram negative bacteria and no change in nosocomial infection rates, other than bloodstream infections which increased significantly (although this was considered to be caused by an increase in the severity of illness of patients

admitted after implementation of the body substance precautions system). The authors therefore concluded that single room isolation of patients infected or colonised with 'hospital' bacteria was not warranted providing body substance precautions were maintained. However, although it was stated that the performance of health care workers had been carefully monitored to ensure that the new system was being carried out consistently, there was no data to substantiate this or to compare it to previous practice. In addition, it was not clear whether there had been any changes in antibiotic usage, which may have influenced the findings. Interestingly, all patients with MRSA continued to be isolated in single rooms throughout the study due to concern about the potential for spread of infection by the airborne route, even though this is not considered necessary as part of body substance isolation (Lynch et al, 1987).

The value of single room isolation in preventing the spread of *C. difficile* has been the subject of debate. Whilst Sanderson and Richardson (1997) reported a lack of increase in the incidence of *C. difficile* diarrhoea on medical wards of a hospital after discontinuation of source isolation, Wilcox et al (1997) raised concern about the adoption of such a policy. They questioned the validity of the study findings, given the lack of data on the strains of *C. difficile* involved and highlighted other points which were also not addressed, including potential differences in infection control practices and antibiotic prescribing. They also referred to their own experience of an outbreak of *C. difficile* diarrhoea amongst patients on a hospital ward, where the environment was found to be contaminated with an indistinguishable strain of the organism. However, despite their concern about the importance of single room isolation for patients with *C. difficile* diarrhoea, they acknowledged the lack of data currently available to support this view.

In summary, the evidence for the role of the inanimate environment in the transmission of infection is incomplete. Many of the micro-organisms associated with hospital-acquired infection have been found to contaminate equipment and the environment and the level of contamination may be particularly extensive in the case of heavy dispersers of micro-organisms. Contaminated equipment and environmental surfaces have been associated with the acquisition of micro-organisms by patients, although the routes of spread are often poorly defined. Nonetheless, the potential of the inanimate environment to act as a reservoir of infection is clear, particularly as a source of contamination of health care workers' hands. Evidence of the impact of measures to minimise environmental contamination on the transmission of infection is largely circumstantial and is complicated by the lack of control

of other potential influences such as the infection control behaviour of health care staff. Indeed, when considering the value of a single room as a Contact Precaution, its effectiveness either as a physical barrier to the transmission of infection or as a reminder to staff to adhere to infection control measures is unclear. In view of this, recommendations which advocate the need for single room isolation of patients with micro-organisms spread by the contact route remain controversial, as control of such organisms is thought to be possible on open wards providing there is good compliance with routine infection control measures, including decontamination of the environment (McDougall, 1999; Jackson and Lynch, 1996). However, this has yet to be demonstrated scientifically.

Evidence for the Role of Contact Precautions as a Whole in Preventing the Transmission of Infection

The above account has provided a review of the evidence available to support the use of each of the major separate components of Contact Precautions, namely hand hygiene, use of gloves and aprons/gowns and environmental controls such as the use of a single room. However, given that procedures such as hand hygiene, the use of protective clothing and cleaning of equipment and the environment are also required routinely for all patients as part of Standard Precautions, it is important to establish whether their enhanced use as part of Contact Precautions has any additional value in preventing the transmission of infection. In particular, there is a need to determine whether the use of Contact Precautions as a whole for patients with known or suspected infectious diseases or conditions has any advantage over the Standard Precautions that are applicable to all patients.

However, owing to the lack of definitive trials to compare the two approaches, the available evidence is limited. Moreover, it is not possible to compare the few studies that have attempted to establish whether the enhanced use of infection control precautions for patients with particular infectious diseases or conditions has any advantage over a less stringent approach, since they differ with regard to the infectious disease or condition studied and the infection control precautions tested. In addition to this, the interpretation of study findings has proved difficult in view of the lack of monitoring or variations in health care workers' adherence to infection control precautions.

For example, Montecalvo et al (1999) conducted a prospective study of VRE transmission in an oncology unit to compare the effectiveness of enhanced infection control measures with standard infection control measures on the rate of VRE acquisition. The use of enhanced

infection control measures involved the application of fifteen separate strategies, among which were the routine use of gloves and gowns on room entry and spatial separation of patients according to whether or not they harboured VRE. This was associated with a significant reduction in the rate of VRE colonisation and bloodstream infections. However, health care workers' adherence to infection control measures was only monitored when the enhanced system was in use and it was therefore not possible to determine whether the reduction in VRE transmission was attributable to the measures themselves or a difference in the level of adherence to them. Also, as the enhanced system incorporated twelve additional strategies to those used in the standard group, one of which was a significant reduction in the use of antimicrobial agents, it was not clear which of these were effective. The study's longitudinal design may also have given rise to changes in study conditions that remained unaccounted for.

Similarly, Madge et al (1992) reported a significant reduction in the transmission of respiratory syncytial virus (RSV) at a paediatric hospital when a combination of cohort nursing (isolating patients with the same infection together in a separate ward or section of a ward), together with gowns and gloves were used. Conversely, neither cohort nursing alone nor the use of gowns and gloves alone resulted in a reduction in cross-infection with RSV. However, no attempt was made to monitor adherence to infection control measures and the authors speculated that an improvement in compliance with the combination of cohort nursing plus glove and gown use as compared with the other approaches may itself have led to the reduction in RSV transmission.

LeClair et al (1987) did incorporate monitoring of health care workers' adherence to glove and gown use during a prospective study of RSV infection on a paediatric ward. Over a three-year period, measures to increase adherence to glove and gown use resulted in a significant improvement, which was associated with a significant reduction in the rate of RSV infection. However, the extent to which this reduction in infection was attributable to the use of gloves and gowns alone was unclear, particularly as there was no description of health care workers' handwashing practice and the use of single rooms and cohort nursing varied throughout the course of the study according to their feasibility at any given time. The study's longitudinal design may also have given rise to changes in study conditions, although in their discussion of the findings, the authors did account for several possible variables.

Whilst the above-mentioned studies relied solely upon acquisition rates of infectious micro-organisms to establish the effectiveness of the various infection control measures undertaken, Jernigan et al (1996) conducted molecular typing of MRSA surveillance cultures to determine the probable source for each transmission of MRSA amongst neonates in a neonatal intensive care unit. The study was undertaken to compare the MRSA transmission rate amongst unisolated neonates with that of isolated neonates over a seven-month period during an outbreak of MRSA. Results of surveillance cultures revealed fifteen new cases of MRSA acquisition, all of which were considered to be linked epidemiologically. The rate of transmission of MRSA from patients on contact isolation precautions was found to be half that from unisolated patients, since unisolated patients were considered to be the source of ten transmissions compared to five from isolated patients. This led the authors to conclude that contact isolation precautions, which involved single room isolation, the use of gloves, gowns and masks and handwashing with chlorhexidine antiseptic soap were more effective than routine infection control measures in preventing MRSA transmission. However, these findings were confounded by the use of a treatment regimen to eradicate MRSA colonisation amongst isolated cases. In addition, since there was no direct observation of practice, the degree to which routine and contact isolation precautions were adhered to by staff was unknown. Conversely, the study findings do lend support to the argument put forward by Lynch et al (1987) that the diagnosis-driven system of isolation precautions is insufficient to prevent the transmission of infectious micro-organisms such as MRSA when clinically unapparent (undiagnosed) cases are a major reservoir.

For this reason, Lynch et al (1987) devised an alternative system to that of traditional isolation precautions, known as Body Substance Isolation (BSI), which has since been incorporated into Standard Precautions (Garner et al, 1996). However, to date, the effectiveness of this approach as an alternative rather than an adjunct to Contact Precautions has not been established. In view of the ongoing controversy surrounding the effectiveness of BSI or Standard Precautions as compared with Contact Precautions, Saint et al (1999) highlighted the urgent need for a definitive trial to compare the two approaches. They referred to their own experience of these systems at two similar medical centres, one of which used contact isolation precautions and the other only BSI. A retrospective comparison of data from the centres was undertaken to determine whether there was a difference in the cumulative incidence of VRE acquisition over a three-year period. Findings revealed a significant difference, there being a higher cumulative incidence of VRE acquisition at the centre using Contact Precautions than the one using BSI. The authors recognised the

methodological limitations of this retrospective analysis, which nonetheless suggested that there was no benefit to the use of contact precautions over BSI, hence their call for randomised controlled trials to be undertaken.

In summary, there is still a great deal of controversy surrounding the use of Contact Precautions (Saint et al, 1999; Jackson and Lynch, 1996; Olmsted et al, 1996; Garner and Hierholzer, 1993). This is because there is a lack of definitive trials to support its effectiveness over the Standard Precautions recommended for all patients to prevent the transmission of infection. There is clearly an urgent need for a definitive trial to compare the use of Contact Precautions with Standard Precautions (Saint et al, 1999) and to determine whether there are situations in which the use of Contact Precautions is advantageous. However, it would be essential as part of any such trial to monitor health care workers' infection control behaviour, preferably by direct observation, since it would be difficult to evaluate the effectiveness of these approaches unless adherence to the infection control recommendations under study is found to be optimal.

Summary

This chapter has examined the evidence base for the role of clothing and the inanimate environment in the spread of infection and the value of precautions to minimise contact transmission via clothing, equipment and the environment. It has also considered the limited evidence available on the effectiveness of Contact Precautions over the Standard Precautions recommended for all patients. Whereas Part I of the review presented abundant evidence to support the role of hands in contact transmission of infection and the value of hand hygiene and glove use to prevent this, the role of clothing and the inanimate environment is less clear. Nonetheless, given the potential for clothing and the inanimate environment to act as vehicles for the transmission of infection, the use of aprons and gowns and the decontamination of equipment and the environment are considered to be an essential component of routine infection control practice (Pratt et al, 2001; Ayliffe et al 2000).

Whether or not these measures should be enhanced as part of Contact Precautions remains highly controversial (Jackson and Lynch, 1996), as does the use of single room isolation (Jackson and Lynch, 1996). Indeed, until a definitive trial is undertaken to compare Contact Precautions with the Standard Precautions recommended for all patients, it will remain unclear whether there are situations in which the use of Contact Precautions is advantageous. The use of Body Substance Isolation as an alternative rather than an adjunct to Contact

Precautions has gained support, since it promotes a more rational set of principles to health care workers, who may otherwise disregard the need for infection control measures when patients are not being nursed in isolation (Preston, 1996) and carry out rituals when they are (McDougall, 1999). However, although this approach has a sound theoretical basis, its effectiveness in practice has not yet been established.

Until further research is conducted in this area, the decision to employ the latest advice on Contact Precautions (Garner et al, 1996) or to opt for an alternative approach such as BSI must be based more on expert opinion, preference and practical considerations than on a sound evidence base. A critically important consideration is the potential impact of either system on health care workers' adherence to infection control practice. Indeed, the system of Contact Precautions may encourage infection control efforts to be targeted more towards patients with infectious conditions than other patients, thus potentially increasing the risk of transmitting infection from unrecognised sources. Likewise, a more generic system such as BSI may be limited by sub-optimal infection control practice for all patients, including those with recognised infectious conditions. It is therefore imperative to understand the issue of adherence to infection control practice by health care workers, since the success of these systems of infection control ultimately lies in their ability to realize maximum impact on health care workers' adherence to recommendations.

In the next two chapters, the literature on health care workers' adherence to infection control practice is examined. The following chapter considers evidence on this issue from observation studies and self-reported practice and sheds some light on the possible reasons for non-adherence.

CHAPTER 3

ADHERENCE TO INFECTION CONTROL PRECAUTIONS IN HEALTH CARE PRACTICE

Part I: Evidence from Observation and Self-Report Studies

Introduction

The problem of non-adherence to infection control precautions in health care practice is a longstanding one that has received increasing attention in the literature over the last twenty or so years. Indeed, there has been a proliferation of observational studies to describe the problem, questionnaire studies to investigate possible reasons behind it and intervention studies designed to address it. Most of this work has focused on specific aspects of infection control practice and in particular, hand hygiene and glove use as a means to prevent the transmission of infection between patients or Universal Precautions to protect health care workers from exposure to blood-borne pathogens. Comparatively little research has been undertaken in relation to other aspects of infection control practice, including isolation precautions.

In this chapter a review of the evidence is examined from observation and self-report studies in relation to adherence to hand hygiene and glove use, adherence to Universal Precautions and adherence to isolation precautions. It begins with a description of the observational studies on adherence to these infection control practices. The evidence in relation to health care workers' knowledge, attitudes and self-reported practice is then considered. In Chapter 4, a further aspect of the review is presented, in which the intervention studies designed to improve adherence to infection control practice are examined.

Approach to Literature Search

A rigorous research of the literature was conducted using studies identified from two main sources: the MEDLINE electronic database and screening of reference lists of studies that relate to the issue of adherence to infection control practice. The search strategy employed using the MEDLINE database encompassed a thirty-six year period from 1966 to 2002. It involved combinations of the following key words, subjects and title words: infection control, handwashing/hand hygiene, Universal Precautions, isolation precautions, protective clothing, compliance, adherence/guideline adherence, knowledge, attitudes, practice, attitude

of health personnel, observation, intervention, education and change. Articles were limited to those written in English.

The review covers the evidence related to adherence to hand hygiene and glove use, adherence to Universal Precautions and adherence to isolation precautions. It begins with a description of the observational studies on adherence to these infection control practices. The evidence in relation to health care workers' knowledge, attitudes and self-reported infection control practice is then considered.

Observational Studies Describing Adherence to Infection Control Precautions

There have been a large number of observational studies, published mainly in the 1990s, to describe the infection control practices of health care workers in various health care settings. In addition, many of the intervention studies to improve practice have also included baseline descriptive data. However, since these baseline data generally confirm the findings of observational studies rather than adding to them, they are not considered further in this section of the review. As will be seen, the vast majority of the observational studies have focused on hand hygiene and glove use (see Table 1) or Universal Precautions (see Table 2), there being comparatively few studies to investigate health care workers' infection control practice in relation to isolation precautions (see Table 3). Direct comparison of observational studies is difficult owing to variations in study methodology. However, the information that has been gained provides a useful basis on which to examine the factors that influence practice.

Adherence to Hand Hygiene and Glove Use

The problem of non-adherence to hand hygiene has been encountered amongst health care workers in a variety of settings (see Table 1). Indeed, average compliance rates have rarely exceeded fifty percent, although studies have generally used a demanding definition of appropriate practice, requiring a handwash after any direct contact with patients or support equipment. In practice, hand hygiene rates have been found to vary according to the type of patient care activity undertaken, as described in more detail below. Adherence to glove use has proved less problematic, with average compliance rates ranging between forty-three and one hundred percent, although the changing or removal of soiled gloves has presented a greater challenge (Thompson et al, 1997; Denman et al, 1993).

Table 1: Observational Studies of Health Care Workers' Infection Control Practice in Relation to Hand Hygiene and Glove Use

Researchers	Year	Topic and Subjects	Setting	Average adherence
Albert et al	1981	Hand hygiene by HCWs	2 medical ICUs	28-41%
Kaplan et al	1986	Hand hygiene by HCWs	1 medical ICU and 1 surgical ICU	19-63%
DeCarvalho et al	1989	Hand hygiene by nurses and physicians	Neonatal ICU	44-51%
Khakoo	1989	Hand hygiene by HCWs	All hospital wards	41%
Linden	1991	Hand hygiene and glove use by nurses	ICU	47-54% (HH) 68-95% (gloves)
Stringer et al	1991	Hand hygiene and glove use by nurses and laboratory staff	All hospital wards and laboratory	27-52% (HH) 59-90% (gloves)
Larson et al	1992	Hand hygiene by HCWs	2 paediatric units	29%
Denman et al	1993	Hand hygiene and glove use by nurses	Chronic care ward	66% (HH) 84% (gloves)
Meengs et al	1994	Hand hygiene by physicians and nurses	Emergency department	32%
Lund et al	1994	Hand hygiene and glove use by HCWs	All hospital wards and ICUs	33% (HH) 55% (gloves)
Roach et al	1995	Hand hygiene by nurses undertaking IV site care	5 ICUs in 2 hospitals	43-50%
Thompson et al	1997	Hand hygiene and glove use by HCWs	2 wards of a long term care facility	38% (HH) 82-100% (gloves)
Cohen et al	1998	Hand hygiene by physicians	Paediatric clinic	49%
Roberts et al	1998	Hand hygiene by HCWs	Aged care hospital	55%
Watanakunakorn et al	1998	Hand hygiene and glove use by HCWs	All hospital wards and ICUs	23-56% (HH) 43-78% (gloves)
Arenas Jiménez et al	1999	Hand hygiene and glove use by HCWs	Haemodialysis unit	3-32% (HH) 81% (gloves)
Nishimura et al	1999	Hand hygiene by HCWs and visitors entering unit	ICU	71-74% (HCWs) 94% (visitors)
Pittet et al	1999	Hand hygiene by HCWs	All hospital wards and ICUs	48%
Chandra et al	2001	Hand hygiene and glove use by HCWs	Neonatal unit	59% (HH) 79% (gloves)
Sharir et al	2001	Hand hygiene by HCWs	Community hospital	76%
Karabey et al	2002	Hand hygiene by HCWs	ICU	13%

Direct comparison of studies investigating the hand hygiene and gloving practices of health care workers is difficult owing to wide variations in study methodology. In addition to this, the majority of the studies identified in Table 1 did not address the reliability of their findings. All but one of the studies involved the use of human observers and only four of these (Pittet et al, 1999; Thompson et al, 1997; Roach et al, 1996; Larson et al, 1992) reported the use of tests to ensure the inter-observer reliability of study findings. A further two (Karabey et al, 2002 and Linden, 1991) mentioned that reliability tests were undertaken during pilot work only. However, the other fourteen studies provided no information in this respect. One study (Nishimura et al, 1999) employed the use of a video camera to record

hand hygiene behaviour, which offers a more straight-forward means of assessing inter-observer reliability, although no mention was made of an attempt to do this.

This lack of attention to reliability issues was especially problematic in the study by Sharir et al (2001), in view of the large number of observers employed. Ten nursing students were instructed to conduct unobtrusive observations of hand hygiene practice in all wards and departments of a community hospital during random fifteen-minute observation periods, presumably whilst conducting their usual duties. Health care workers were unaware of the study and were selected randomly for observation, although it was not clear how this was done or whether the approach used was consistent between the observers. Indeed, the authors did not comment on whether or not the distribution of those selected for observation accurately represented that of the health care workers employed in the study hospital. The findings revealed a comparatively high rate of hand hygiene adherence (76%), with a particularly high rate in the intensive care units (97%), which as the authors pointed out, was the highest reported to date. However, the inability to demonstrate inter-observer reliability of the findings casts some doubt on their validity.

Notwithstanding, amongst the studies identified in Table 1, there were some interesting findings, some of which were common to more than one study. For example, the frequency of hand hygiene has been found to vary before, during and after patient care. Denman et al (1993) found that health care workers in a long-term care facility were significantly more likely to wash their hands when indicated after patient care (sixty-four percent) than beforehand (thirty-two percent). In addition, hand hygiene was only performed on one occasion during patient care between a 'dirty' and 'clean' procedure, even though this was indicated on one hundred and eighty-two separate occasions. Gloves were used on eighty-four percent of the occasions required, although they were only changed or removed when soiled fifteen percent of the time. These findings were later confirmed by Thompson et al (1997), who undertook a similar study at the same health care facility. They also concur with those of Pittet et al (1999) who found that health care workers in an acute hospital were significantly less compliant with hand hygiene before and during patient care than afterwards and that compliance was particularly low (eleven percent) during care between 'dirty' and 'clean' procedures. This suggests that health care workers may not appreciate the risk of infection to patients from unwashed hands prior to and during patient care. However, it has also led to concern that full compliance with hand hygiene guidelines may be unrealistic in

practice (Pittet et al, 1999; Thompson et al, 1997). Indeed, Thompson et al (1997) found that hands were only washed at every required instance before, during and after a patient care interaction on four percent of occasions.

Another finding of some observational studies is that rates of hand hygiene differ according to type of patient contact (Arenas Jiménez et al, 1999; Pittet et al, 1999; Watanakunakorn et al, 1998; Thompson et al, 1997; Lund et al, 1994; Meengs et al, 1994; Denman et al, 1993; Larson et al, 1992). For example, in a study of the hand hygiene practices of health care workers in an emergency department, Meengs et al (1994) found that hand hygiene was significantly less likely to occur when indicated after 'clean' contact such as taking a blood pressure than 'dirty' contact such as touching bodily secretions (with or without gloves on). This led the authors to conclude that the difference in compliance may have been due to the relative perceived infection risks of these activities. Likewise, Larson et al (1992) found that hand hygiene frequency varied significantly by the level and duration of patient contact, indirect patient contact and contact lasting less than one minute being associated with lower hand hygiene rates than direct and longer patient contact.

Similar findings have also been found regarding glove use, since differential adherence based on the type of patient care activity performed has been reported (Arenas Jiménez et al, 1999; Watanakunakorn et al, 1998; Thompson et al, 1997; Lund et al, 1994; Denman et al, 1993). For example, Thompson et al (1997) found that health care workers were significantly less likely to use gloves during gastrostomy care or wash their hands afterwards than for wound care. Similarly, Watanakunakorn et al (1998) found that health care workers were more likely to wear gloves for some practices such as drawing blood, suctioning and wound care than for others such as respiratory treatment, insertion of peripheral intravascular lines and emptying a urinary drainage bag. These findings suggest that health care workers adjust their hand hygiene and gloving practices according to their own perception of risk, which may differ from recommended procedures. Whilst observational studies have not established how individual health care workers assess infection control risks in practice, their findings do suggest that self-protection is a key element in the decision to employ infection control measures and that this may take priority over risks to the patient, given that adherence to glove use is generally high, but that failure to change or remove soiled gloves and wash hands is problematic (Thompson et al, 1997; Denman et al, 1993).

Other findings relating to hand hygiene in particular suggest additional factors that may influence adherence levels, including type and gender of health care worker, type of work environment, workload and accessibility of sinks. Many studies have found nurses to be significantly more compliant with hand hygiene recommendations than medics and other health care staff (Karabey et al, 2002; Sharir et al, 2001; Pittet et al, 1999; Meengs et al, 1994; Khakoo, 1989; Kaplan and McGuckin, 1986; Albert and Condie, 1981). However, one study by Watanakunakorn et al (1998) reported a higher rate of hand hygiene amongst medical staff than nurses. The influence of gender is less clear. Sharir et al (2001) reported a higher adherence rate amongst female health care workers than males, although the validity of this finding is questionable owing to limitations in the design of the study (as outlined above). Meengs et al (1994) reported increased adherence rates amongst nurses as compared to physicians and conducted contingency table analysis to determine if this finding was created by a gender bias, since the majority of nurses in their study were women, whereas the majority of physicians were men. The analysis revealed that the observed difference between nurses and physicians was not caused by the gender ratios of the nurses and physicians observed, although the overall sample size of male nurses and female physicans was small.

Different types of work environment have been associated with differences in hand hygiene frequency. For example, Khakoo (1989) found that adherence to hand hygiene was higher on paediatric units than adult units. Likewise, Pittet et al (1999) found that non-adherence to hand hygiene was more problematic on surgical wards and an intensive care unit (ICU) than on medical wards. These differences in work environment are likely to reflect factors such as workload, which has also impacted on hand hygiene practice. Indeed, Pittet et al (1999) found that intensity of patient care (as defined by the number of observed opportunities for hand hygiene per hour) was inversely related to hand hygiene frequency, since compliance rates fell during busier times of the day and during the care of critically ill patients. The effect of structural differences may also influence hand hygiene frequency, since Kaplan and McGuckin (1986) observed higher hand hygiene rates on a medical ICU with a bed to sink ratio of one-to-one than on a surgical ICU with a bed ratio of four-to-one.

Adherence to Universal Precautions

Observational studies of health care workers' adherence to Universal Precautions have taken place mainly in settings such as emergency departments and dental clinics, where anticipated exposure to patients' blood is high. Direct comparison of study findings is not possible

however, as the definition of adherence was inconsistent across the studies, ranging from use of any of the required barriers to all of the required barriers. Nonetheless, adherence to glove use as a universal precaution has generally been found to be fairly high, ranging between fifty and one hundred percent (see Table 2).

Table 2: Observational Studies of Health Care Workers' Infection Control Practice in Relation to Universal Precautions

Researchers	Year	Topic and Subjects	Setting	Average adherence
Baraff et al	1989	Barrier precautions used by HCWs	Emergency department	53-100% (gloves) 15-19% (goggles) 27-30% (gowns) 0-2% (masks)
Kelen et al	1990	Barrier precautions used by HCWs	Emergency department	44%
Kaczmarek et al	1991	Glove use by HCWs	22 hospitals and 4 out-patient departments	71-92%
Henry et al	1992	Barrier precautions and needle re-capping practices of HCWs	Emergency department	60% (barrier precautions) 49% (not re-capping needles)
McKay et al	1992	Glove use and needle re-capping practices of anaesthesia providers	Operating department	55% (gloves) 3% (not re-capping needles)
Scully et al	1992	Barrier precautions used by dentists, dental and hygiene students and dental assistants	Dental care clinic	96% (gloves) 50 % (goggles) 62% (masks)
Marcus et al	1993	Glove use by HCWs	6 emergency departments	62-98%
Roane	1993	Barrier precautions used by nurses	Paediatric emergency department	72%
Henry et al	1994	Barrier precautions and needle re-capping practices of HCWs	Emergency department	67% (gloves) 51% (goggles) 15% (gowns) 16% (masks) 66% (not re-capping needles)
Rydman et al	1994	Barrier precautions used by HCWs	Emergency department	93% (gloves) 15% (goggles) 12% (gowns) 20% (masks)
Eustis et al	1995	Barrier precautions and sharps handling by paramedics and ambulance technicians	Ambulance runs	86-100% (gloves) 0-14% (goggles) 0% (gowns) 0% (masks) 37% (proper sharps handling)
Picheansathian	1995	Barrier precautions and needle re-capping practices of nurses	Emergency department	54% (gloves) 0.3% (goggles) 0.3% (gowns) 0.3% (masks) 90% (not re-capping needles)
Porter et al	1995	Barrier precautions used by dentists and dental students	Dental care clinic	87% (gloves) 29% (goggles) 38% (masks)

Table 2 (continued)

Researchers	Year	Topic and Subjects	Setting	Average adherence
Ben-David et al	1997	Glove use by anaesthetists	Operating department	50%
DiGiacomo et al	1997	Barrier precautions used by HCWs during trauma resuscitations	Emergency department	89%
Roup	1997	Barrier precautions used by nurses	Critical care	67%
Helfgott et al	1998	Barrier precautions used by medical staff and students	Obstetrics and gynaecology department	89%
Moore et al	1998	Barrier precautions used by medical staff	Children's hospital	54%
Akduman et al	1999	Barrier precautions and needle handling practices of HCWs	Operating department	100% (gloves) 76% (goggles) 9% (passage of sharps announced)
Evanoff et al	1999	Barrier precautions used by HCWs	Emergency department	76-97% (gloves) 56-78% (goggles) 83-94% (gowns) 46-68% (masks)
Friere et al	2000	Barrier precautions and needle re-capping practices of dental students	Dental care clinic	100% (gloves) 60% (goggles) 100% (gowns) 63% (masks) 17% (not re-capping needles)
Madan et al	2001	BPs used by HCWs	Emergency department	98% (gloves) 51% (goggles) 41% (gowns) 10% (masks)

Conversely, the majority of studies that have also investigated the use of other types of barrier precautions such as goggles, gowns and masks have found adherence to these precautions to be much lower (Madan et al, 2001; Eustis et al, 1995; Picheansathian, 1995; Porter et al, 1995; Henry et al, 1994; Rydman et al, 1994; Henry et al, 1992; Kelen et al, 1990; Baraff et al, 1989). For example, Henry et al (1992) investigated the use of barrier precautions by health care workers in an emergency department and found that whilst adherence to glove use was relatively high (seventy-four percent), the use of goggles, gowns and masks was low (thirteen percent, twelve percent and one percent respectively). Findings of a further study by the same researchers (Henry et al, 1994) were similar, although there was a much higher adherence to the use of goggles (fifty-one percent). The reasons for low adherence to the use of goggles, gowns and masks have not been elicited by observational studies, although it would seem as though health care workers do not believe that such protection offers additional benefits over glove use alone in most situations.

In addition to the use of barrier precautions, seven studies also investigated the prevalence of safe needle-handling practices as part of the approach to Universal Precautions. Five of these monitored the practice of needle re-capping, which is not recommended owing to the very high risk of needlestick injuries (Morgan et al, 1993). Adherence to this recommendation varied widely between studies, ranging from three to ninety percent. Other practices relating to safe passage and disposal of sharps were monitored in two studies (Akduman et al, 1999 and Eustis et al, 1995) and revealed low levels of adherence by the health care workers observed, possibly indicating a lack of appreciation of the risk of exposure to blood-borne pathogens associated with the handling of sharps.

The studies presented in Table 2 provide an overview of the extent of the problem of non-adherence to Universal Precautions amongst health care workers in a variety of different settings. However, as with the observational studies of hand hygiene and gloving practices, direct comparison of study findings is not possible owing to wide variations in methodology. In addition, the validity of the majority of studies is questionable, as they did not address the reliability of their findings. Indeed, only four studies appeared to consider this. Two of these (Evanoff et al, 1999 and Henry et al, 1994) specifically reported the use of tests to assess the inter-observer reliability of their findings, one of which (Henry et al, 1994) was restricted to the pilot work. In the other study (Evanoff et al, 1999) intra-observer reliability was also assessed, as a video camera was used to record infection control behaviour, making such a check possible. DiGiacomo et al (1997) also used a video camera to record infection control behaviour and two researchers reviewed the data, although it was not clear whether this was done jointly or independently. Friere et al (2000) reported the use of four "previously calibrated" researchers to undertake observations of practice, but no assessment appeared to have been made of the reliability of the data presented.

Nonetheless, amongst the studies identified, there were some interesting findings, some of which were common to more than one study. As with observational studies of hand hygiene and glove use, adherence to Universal Precautions has been found to vary according to the type of procedure undertaken (Moore et al, 1998; Kaczmarek et al, 1991; Kelen et al, 1990; Baraff et al, 1989). For example, Moore et al (1998) found that adherence to Universal Precautions among paediatric physicians was significantly lower when they undertook intravenous cannula insertions than either arterial puncture or venipuncture. Similarly, Kaczmarek et al (1991) found that the use of gloves by health care workers was much higher

when undertaking arterial blood gas sampling (ninety-two percent) than either intravenous care (seventy-eight percent) or phlebotomy (seventy-one percent). They concluded that this variation in glove use may be related to the likelihood of health care worker contact with the patient's blood, since this is likely to be highest for arterial blood gas sampling. However, the reliability of this finding is questionable, since although the overall sample size of the study was large, it comprised of very small numbers of observations (between ten and twenty) at each of twenty-six health care facilities. Additionally, the observations made at each centre were inconsistent with each other, as they involved different types of health care workers in a range of different clinical settings.

Notwithstanding, exposure to blood has been associated with increased use of Universal Precautions in other studies (Evanoff et al, 1999; Henry et al, 1994). Henry et al (1994) found an increase in the use of gloves by health care workers in an emergency department when in contact with blood, indicating that these staff were able to determine when hand contact with blood was more likely to occur. However, as contact with blood also occurred in approximately one in every twenty procedures for which gloves were not used, this selective approach to glove use was clearly not failsafe. Similarly, Evanoff et al (1999) reported significant improvements in the use of gloves, masks and eye protection by health care workers in an emergency department when trauma patients were visibly bleeding compared to those without visible bleeding. They suggested that emergency department personnel may make judgements about their own potential risk instead of following a consistent policy, which may account in part for variations in adherence to Universal Precautions.

Findings of several of the observational studies of Universal Precautions have also suggested that there is a variation in adherence rates according to the perceived risk of exposure to blood-borne pathogens such as Human Immunodeficiency Virus (HIV) (Moore et al, 1998; Picheansathian, 1995; Marcus et al, 1993; Henry et al, 1992; Kaczmarek et al, 1991). For example, Moore et al (1998) found a significantly higher rate of adherence to Universal Precautions amongst paediatric physicians when patients were judged to be at increased risk for blood-borne pathogens (as defined by established or suspected diagnosis of hepatitis or HIV infection or history of an illness that frequently required multiple blood transfusions). Likewise, Picheansathian (1995) reported that nurses working in an emergency department were more likely to apply Universal Precautions for patients known to be HIV infected. Marcus et al (1993) found that the percentage of observed procedures in which health care

workers wore gloves was significantly higher in emergency departments with high HIV seroprevalence rates than in those where HIV seroprevalence rates were much lower. Clearly, these findings are limited, since they are unable to prove causation or rule out alternative explanations. However, an observational study by Henry et al (1992) provided further evidence of health care workers' selective implementation of Universal Precautions on the basis of perceived infection risk, since a higher rate of glove and gown use was observed amongst health care workers in an emergency department for interactions with patients who were younger, male and non-white. This led the authors to surmise that health care workers attempt to determine which patients are likely to be infected and exercise discriminate caution. Indeed, findings of a questionnaire survey of health care workers' self-reported practice that formed part of the same study revealed that patient appearance was one of the three most common reasons given for non-adherence to Universal Precautions (i.e. health care workers were less likely to use Universal Precautions if they considered that a patient "appeared" to be at lower risk of being infected with a blood-borne pathogen).

Several other variables have been associated with adherence to Universal Precautions. These include type and age of health care worker, age of patient and workload. Evanoff et al (1999) found statistically significant variations in use rates of barrier precautions among different types of health care workers within an emergency department, with surgical residents being most likely to use full precautions, attending surgeons least likely and nurses between the two. In a study of nurses' adherence to Universal Precautions in an emergency department, Picheansathian (1995) found there to be significantly higher adherence amongst registered nurses as compared with practical nurses.

Findings of a study by Ben-David et al (1997) suggest that the age of a health care worker as well as the age of the patient they treat may influence adherence to Universal Precautions. In their observational study of the Universal Precautions practices of anaesthetists, it was found that adherence levels were lower among older anaesthetists than their younger colleagues. They were also lower when the patient was a child rather than an adult. Kelen et al (1990) also found a significant difference in adherence amongst health care workers in an emergency department, being lowest in paediatric patients and highest in patients aged between fifteen and forty-four years of age.

Only two studies (Moore et al, 1998 and DiGiacomo et al, 1997) examined the impact of time availability on adherence to Universal Precautions, even though health care workers commonly identify lack of time as a reason for non-adherence (see below). Moore et al (1998) observed adherence to Universal Precautions by paediatric physicians and found that non-adherence was significantly associated with increased workload. DiGiacomo et al (1997) examined the risk factors associated with non-adherence to barrier precautions by health care workers involved in trauma resuscitations within an emergency department. Of the sixty-nine non-compliant health care workers identified, approximately half (forty-five percent) were "first responders" to the resuscitation attempt, the majority (eighty-eight percent) of whom were subsequently relieved by fully compliant colleagues. Both pre-notification of patient arrival and the presence of the trauma team before arrival of the patient were associated with compliance, reflecting the advantage of adequate forewarning in allowing personnel to fully protect themselves. The exceptionally high rate of compliance with Universal Precautions (eighty-nine percent) recorded in this study was attributed to several factors. These included an institutional mandate, which also incorporated a protocol for the rapid relief of unprotected health care workers, easy access to protective clothing and a comprehensive quality assurance programme involving regular review of video-taped recordings of resuscitation attempts as part of a formal education programme, which allowed individual staff members to observe and critique their own behaviour. This illustrates the importance of a multi-dimensional approach to promoting optimal infection control practice, as discussed later in the chapter.

Adherence to Isolation Precautions

As mentioned above, very few observational studies have been undertaken to investigate health care workers' infection control practice in relation to isolation precautions. Among the studies that have been carried out, there is wide variation in the average adherence rates reported (see Table 3). However, none of these findings are directly comparable owing to differences between the studies in relation to the method of observation used, the infection control practices observed and the criteria used to assess their appropriateness.

One such difference relates to the way in which observations were conducted. Whereas in two studies (Vidal-Trecan et al, 2001 and Kellerman et al, 2001), health care workers were aware that their infection control practice was being observed, this was not the case in four of the other five studies (the fifth by Sutton et al (2000) being unclear in this respect), as the

purpose of the observations was deliberately concealed in order to minimise possible distortions in health care workers' behaviour. Indeed, in one of these (Pettinger and Nettleman, 1991) the observer's role was concealed completely, as the observer was a member of the nursing staff on the surgical intensive care unit where the study took place. Whilst this was considered to be an advantage with regard to eliminating the "Hawthorne" effect, the observer was required to concentrate on her routine nursing duties in addition to observing her colleagues' practice, which may have influenced the accuracy of the data collected. However, no attempt appeared to have been made to assess the inter-observer reliability of the study findings in this or indeed any of the other studies listed in Table 3. Nonetheless, there were some interesting findings, some of which were common to more than one study.

Table 3: Observational Studies of Health Care Workers' Infection Control Practice in Relation to Isolation Precautions

Researchers	Year	Topic and Subjects	Setting	Average adherence
Larson	1983	Category-based isolation precautions by HCWs	All hospital wards	44-46%
Pettinger et al	1991	Category-based isolation precautions by HCWs and visitors	Surgical ICU	41% (HCWs) 88% (visitors)
Watanakunakorn et al	1998	Contact Precautions by HCWs	All hospital wards and ICUs	88%
Sutton et al	2000	Use of respiratory protection by HCWs for *Mycobacterium tuberculosis* (TB)	Three hospitals	94%
Kellerman et al	2001	Use of respiratory protection by HCWs and visitors for TB	Two paediatric hospitals	89-91% (HCWs) 41% (visitors)
Vidal-Trecan et al	2001	Contact Precautions by HCWs for multidrug-resistant bacteria	All hospital wards	22-88%
Afif et al	2002	Contact Precautions by HCWs and visitors for MRSA	All hospital wards	4-89% (HCWs) 11% (visitors)

A frequent reason for non-adherence to isolation precautions was failure to wash hands on leaving an isolation room after contact with an isolated patient or their environment. This was reported in all four of the studies in which hand hygiene practice was observed (Afif et al, 2001; Vidal-Trecan et al, 2001; Pettinger and Nettleman, 1991; Larson, 1983), although in two of these, (Afif et al, 2001; Pettinger and Nettleman, 1991) it was not possible to determine the extent of the problem amongst health care workers alone, since the data presented did not differentiate between the observations of health care workers' and visitors' hand hygiene behaviour. In the other two studies (Vidal-Trecan et al, 2001; Larson, 1983)

hand hygiene rates were found to vary between different types of health care worker, with registered nurses washing their hands more frequently than doctors and other health care workers. Similar findings have been reported in relation to hand hygiene practice in general (see below).

This difference in adherence according to the type of health care worker was also found in two of the studies in relation to glove and gown use (Vidan-Trecan et al, 2001) and overall adherence to isolation precautions (Afif et al, 2002). Vidan-Trecan et al (2001) found that registered nurses were significantly more likely to adhere to the use of gloves and gowns than either health care assistants or physicians. Similarly, Afif et al (2002) found wide variations in adherence to isolation precautions amongst different types of health care worker, with occupational therapists/physiotherapists being by far the most compliant group of staff, followed by registered nurses, doctors, health care assistants and housekeeping staff. However, the reasons for such variations remain unknown.

Hand hygiene and the use of protective clothing has also been found to vary according to the type of isolation precautions employed (Pettinger and Nettleman, 1991; Larson, 1983). In the study by Larson (1983), hand hygiene frequency was significantly lower when skin/wound isolation precautions were in place than for other types of isolation precautions. Similarly, glove and gown use was significantly lower for wound/skin isolation precautions than for other types. Pettinger and Nettleman (1991) found that overall adherence to isolation precautions and in particular, hand hygiene was significantly better for strict isolation than for other types, although as the findings included observations of both health care workers' and visitors' practice, it was not clear whether health care workers' practice alone differed in this respect. Nonetheless, these findings suggest that health care workers may alter their infection control practice according to their own perception of risk rather than following recommended procedures.

Indeed, the study by Kellerman et al (2001) also illustrates this point in relation to the use of respiratory protection when attending to patients with known or suspected pulmonary *Mycobacterium tuberculosis* (TB). The study revealed that health care workers were significantly more likely to protect themselves when confronted with a known risk than when the risk was less certain, even though respiratory protection was recommended on all of these occasions. This association was not investigated in a similar study by Sutton et al (2000).

None of the studies were able to shed light on whether or not there is a difference in adherence to infection control practices such as hand hygiene and glove use when applied as part of isolation precautions, as compared with their use during the care of patients without recognised infectious conditions. Indeed, only one study (Watanakunakorn et al, 1998) monitored the prevalence of hand hygiene and glove use in general. However, these findings were not comparable, as hand hygiene was not included in the observations of isolation precautions and the use of gloves as an isolation precaution was not reported separately from the use of gowns and face masks.

Another limitation common to all of the studies was that none of them described the types of patient care activities undertaken during observations of practice. Consequently, it is not known whether this influences adherence to infection control measures, as is the case with hand hygiene and Universal Precautions practice in general (see below). Pettinger and Nettleman (1991) did report a significant increase in adherence to isolation precautions from twenty-nine percent to fifty-eight percent when subjects spent more than ten minutes in the patient's room. However, further work is clearly needed to establish whether health care workers' adherence to isolation precautions alters according to the type of patient care activity undertaken.

Only one study (Larson, 1983) reported a problem regarding the accessibility of supplies of protective clothing, which was lacking on forty-two percent of the occasions observed. This undoubtedly contributed to the problem of non-adherence reported in the study, although as the author pointed out, practice in relation to hand hygiene, for which equipment was readily accessible on all occasions was also frequently lacking. Nonetheless, the provision of equipment is clearly an essential pre-requisite to optimal infection control practice.

Owing to the limited research available on health care workers' infection control practice in relation to isolation precautions, it is not possible to draw accurate conclusions about the nature or extent of the problem of non-adherence. However, from the studies that are available, it would seem that practice is sub-optimal and that adherence levels may differ according to type of health care worker and type of isolation precautions. Clearly further research is required to gain a better understanding of the factors that influence health care workers' adherence to isolation precautions.

As the above account reveals, there is a long-standing history of non-adherence by health care workers to infection control precautions and in particular, hand hygiene, glove use and Universal Precautions. Adherence to hand hygiene and glove use is associated with type of patient contact. In addition, adherence to hand hygiene may vary by type and gender of health care worker, work environment and workload. Similarly, adherence to Universal Precautions is associated with type of patient care procedure and risk of exposure to blood. It may also vary by type of barrier, risk of exposure to blood-borne pathogens, type and age of health care worker and time availability. The factors affecting adherence to isolation precautions are less clear in view of the limited research in this area.

Health Care Workers' Knowledge, Attitudes and Self-Reported Practice in Relation to Infection Control

In view of the problem of non-adherence by health care workers to infection control precautions, it is not surprising that there has been a great deal of research, mainly in the form of questionnaire studies to investigate health care workers' knowledge, attitudes and self-reported practice in relation to infection control. Most of this work has focused on hand hygiene and Universal Precautions in various different health care settings.

Generally, health care workers' self-reported infection control behaviour has confirmed the findings of observational studies, since they too have revealed deficiencies in practice, even though adherence levels are likely to have been over-estimated in view of the data being self-reported. Indeed, both Henry et al (1992) and Madan et al (2002) compared the observed and self-reported behaviour of health care workers in relation to Universal Precautions and found that discrepancies existed between the two, the latter being overstated. This tendency was also revealed by Crow and King (1991), who surveyed physicians' and nurses' perceptions of infection control and found that whilst over one-third of respondents surmised that lack of hand hygiene is a major infection control problem, almost all believed that they personally washed their hands correctly and appropriately.

Despite the obvious limitation regarding the accuracy of self-reported infection control practice, questionnaire studies have also provided information on health care workers' knowledge and attitudes towards infection control. Findings relating to knowledge have varied considerably between studies, with some reporting high levels of knowledge amongst health care workers (Helfgott et al, 1998; Gershon et al, 1995; Parsons et al, 1995; Snyder et

al, 1993) and others reporting deficiencies (Chan et al, 2002; Epstein et al, 1995). There has been little research to investigate specifically health care workers' knowledge of isolation precautions. However, those that are available indicate that deficits do exist (Perry and Gore, 1997; Gould, 1985).

The information provided by questionnaire studies on health care workers' knowledge about infection control has been limited by the extent to which respondents' beliefs and understanding about the spread of infection have been explored. However, there has been little in-depth exploration of this area using methods other than questionnaires. Courtenay (1998) conducted semi-structured interviews with qualified nurses, nursing students and health care assistants to ascertain their understanding of infection transmission in clinical practice. The interviews were part of an ethnographic study to investigate the teaching, learning and use of infection control knowledge in nursing and revealed that only four of the seventeen nurses interviewed were found to possess an accurate understanding of how infection is spread. Many of the respondents were found to have misconceptions about the motility of micro-organisms, including beliefs that they could move of their own accord through sheets and bedclothes, across hands and through the air, at will, to cause infection in patients. Some respondents also had an unrealistic understanding of the survival of micro-organisms, including the misconception that they are capable of surviving in the absence of moisture, warmth and nutrients and are capable of causing infection under any circumstances. The observational component of the study revealed nurses' uncertainty about infection control practices, which were implemented ritualistically and inconsistently. It also uncovered difficulties with inadequate ward management and supervision of clinical practice by more experienced nursing staff. Limitations in the structure and content of nurse education programmes with respect to infection control were considered to contribute to poor practice.

Macqueen (1995) also highlighted the irrational beliefs that gave rise to ritualistic infection control behaviour amongst health care staff on a paediatric intensive care unit. The anthropological approach to the study revealed the importance of cultural influence on the interpretation of infection control practices, a dimension rarely addressed in other studies of infection control practice. For example, health care workers' cultural concept of the perceived degree of 'dirtiness' of body fluids was found to vary according to their location on the body (body fluids from the upper body, such as vomit or sputum being considered more

'dirty' than urine) and also the patient's age (body fluids such as vomit or faeces being considered less polluting when from a baby than an older child), even though these concepts do not equate with the scientific knowledge that underpins infection control practice (Macqueen, 1995).

The studies by Courtenay (1998) and Macqueen (1995) demonstrate that health care workers may hold erroneous beliefs about infection control, which are reinforced by social and cultural influences and ultimately result in suboptimal practice. As Courtenay (1998) points out, a better understanding of health care workers' beliefs about microbiology and infection control is essential so that educational efforts can be directed towards challenging them directly. Otherwise, information which does not tie in with an individual's own understanding may be rejected by them. However, to date, methodological approaches such as those employed by Courtenay (1998) and Macqueen (1995) to explore factors that influence infection control practice in their wider context have rarely been used and health care workers' own perspectives of the problem of non-adherence remains poorly understood.

The questionnaire studies that form a large proportion of the research into health care workers' knowledge, attitudes and self-reported practice in relation to infection control have identified some valuable insights into apparent links between these three elements that warrant further research. Several investigators have found there to be a lack of association between knowledge and self-reported adherence to infection control practices such as hand hygiene and Universal Precautions (Chan et al, 2002; Gershon et al, 1995; Alvaran et al, 1994; Linden, 1991; Gruber et al, 1989). Gruber et al (1989) found no correlation between increased knowledge about HIV/AIDS and reported use of Universal Precautions. Likewise, Alvaran et al (1994) found that qualified nurses, who had higher knowledge levels in relation to infection control than unqualified nursing assistants reported significantly lower levels of hand hygiene.

Gershon et al (1995) found that health care workers were extremely knowledgeable about univeral precautions, but this in itself was not associated with good levels of self-reported compliance. However, there was an association between the amount of training received and compliance scores, since those health care workers who had received training on Universal Precautions were more likely to report compliant behaviour than those who had not and the more training they had received, the higher their compliance scores. Others have also found

an association between the amount of training received and the level of self-reported compliance with infection control precautions (McCarthy et al, 1999; O'Boyle Williams et al, 1994), although as Gershon et al (1995) point out, this may reflect health care workers' increased perceptions of an organisation's commitment to safety (as demonstrated by the provision of a training programme) rather than increased knowledge levels, since this has been found to be associated with higher levels of adherence (Gershon et al, 1999; Gershon et al, 1995).

The extent to which health care workers apply their knowledge of infection control to practice is clearly questionable. In a study involving interview-administered questionnaires and focus group interviews, Parsons et al (1995) found that nurses had accurate knowledge about infection control and in particular, HIV, but had limited trust of that knowledge. They gave rationales for why they sometimes departed from infection control procedures, which revealed that their decisions were based on their perception of risk from occupational exposure to infection. For example, some nurses reported a failure to wear masks when attending to patients with infectious tuberculosis due to their perceptions of low risk of infection. Domestic staff and nurse attendants who were also included in the study had lower levels of accurate knowledge and less trust of that knowledge than qualified nurses and many considered themselves to be at risk from normal duties in their workplace. The authors surmised that all health care workers continually assess or interpret their work contexts as high, medium or low risk and modify their infection control practice accordingly. They considered that this alteration of best practice on the basis of perceptions of relative risk seemed critical to the understanding of infection control practice and required further research.

The observational studies reviewed at the beginning of the chapter also suggest that adherence to Universal Precautions in particular appears to be influenced by a health care worker's own perception of risk of exposure to blood-borne pathogens and findings of recently published questionnaire studies have confirmed that this is the case. For example, Gershon et al (1995) identified that adherence to Universal Precautions among health care workers strongly correlated with their perception of risk and also their personality with respect to risk-taking. Health care workers who believed that practicing Universal Precautions reduced their risk of exposure to blood-borne pathogens were significantly more likely to adhere to them than those who were not convinced of their effectiveness.

Compliance was also statistically associated with fear of occupational transmission of HIV. Respondents with a low perception of personal risk and those with a higher risk-taking personality profile were less likely to comply with Universal Precautions.

Other studies have repeatedly demonstrated that there is an increase in the self-reported use of barrier precautions by health care workers when a patient is known to be infected with a blood-borne pathogen (Madan et al, 2002; Preston et al, 2002; Naing et al, 2001; McCarthy et al, 1999; Ramsey et al, 1996; Wilson Young et al, 1996; Danchaivijitr et al, 1995; Picheansathian, 1995; O'Boyle Williams et al, 1994). In addition, the selective reporting of needlestick injuries on the basis of the patient's diagnosis of infection with a blood-borne pathogen has also been found to occur (Kim et al, 1999; Jackson et al, 1986). This increased use of infection control measures in the presence of a known risk contravenes the fundamental principle of Universal Precautions which are designed to be used consistently for all patients whether or not an actual risk of blood-borne virus infection has been identified.

A similar finding regarding the self-reported increase in the use of barrier precautions for patients with MRSA was found by Hartley-Troya et al (1991), who investigated the knowledge, attitudes and self-reported practices of nurses in relation to a system of body substance isolation (BSI). Although the BSI approach to infection control was designed to replace traditional isolation precautions with a system requiring standard infection control precautions for all patients, questionnaire responses revealed a tendency amongst nurses to use more extensive infection control precautions once a diagnosis of MRSA was known. The researchers commented that this reflected a difficulty in overcoming long-standing traditions associated with doing more for diagnosed infectious conditions such as MRSA, although it was not clear whether respondents perceived a need for additional measures for their own protection or that of their patients. Indeed, a study by Tufnell (1988) revealed that over half of nurses responding to a questionnaire about MRSA considered that it had affected their personal lives and one-third were concerned about contracting it themselves and passing it onto their families, even though the risk to health care workers and their families from MRSA are considered to be negligible (Ayliffe et al, 1998).

Studies to determine the factors that influence health care workers' hand hygiene practice have also revealed that contact with infectious patients is an important variable (Harris et al,

2000; Zimakoff et al, 1992; Larson and Killien, 1982). Harris et al (2000) found that certain infectious conditions such as HIV/AIDS, scabies and diarrhoea led to increases in self-reported hand hygiene amongst health care workers, although in the case of HIV/AIDS, it was not clear whether this was intended as a means to protect the patients themselves given their increased susceptibility to infection as a result of being immunocompromised or to protect the health care worker/other patients. Zimakoff et al (1992) found that the two most important reasons identified by health care workers for washing their hands were to prevent the spread of infection between patients and to protect themselves from acquiring infection. Minimal contact with infectious patients and perceived low risk of acquiring infection from patients were among the factors identified that deterred hand hygiene.

Larson and Killien (1982) also found that whilst health care workers identified "preventing the spread of infection among patients" and "prevents me from acquiring an infection" as the two main reasons for washing their hands, "minimal contact with infectious patients" and "not at risk of acquiring an infection from patients" were two of the reasons given for not washing their hands. This implies that health care workers may fail to appreciate the need for infection control measures such as hand hygiene between every patient and not just those with recognised infectious conditions. In addition, concern amongst health care workers about protecting themselves from infection is clearly an important motivator. Both of these issues counteract attempts to promote a generic approach to infection control for all patients.

Whilst there is evidence to suggest that health care workers consider the risks to themselves when deciding whether or not to employ Universal Precautions (Gershon et al, 1995; Parsons et al, 1995), it is not clear to what extent they consider the risks to patients in relation to infection control practices such as hand hygiene. Jenner et al (2002) conducted a questionnaire study of hospital-based health care workers to identify psychological constructs predictive of hand hygiene behaviour based on a model developed using the Theory of Planned Behaviour. The model was extended to incorporate the construct of personal responsibility, since this was postulated to be a predictor of intention to wash hands. Personal responsibility was measured by a single item: "I believe that I have a role to play in reducing the risk of cross-infection by washing my hands before and after every patient contact". The findings revealed that personal responsibility was a significant predictor of intention to wash hands, indicating that health care workers who intend to wash their hands do consider this in relation to the risk to patients. However, the relationship between intention and observed behaviour was not explored - a critically important point, since a similar study by O'Boyle et

al (2001) that included an observational component to examine the relationship between intention and observed hand hygiene behaviour found that none of the variables within the Theory of Planned Behaviour model, including intention to practice were able to predict observed behaviour.

Several other factors that influence the hand hygiene behaviour of health care workers have been identified by Larson and Killien (1982) and have since been confirmed by Zimakoff et al (1992). These include perceived barriers such as lack of time, patient needs taking priority, detrimental effect of frequent hand hygiene and hand hygiene agents on skin and negative influence of non-compliant work colleagues. In addition, the inconvenient location of sinks as a barrier has been confirmed by Kaplan and McGuckin (1986). Larson and Killien (1982) also found that health care workers who reported washing their hands eight or fewer times a day placed significantly greater emphasis on reasons that argued against hand hygiene than those health care workers who reported washing their hands more frequently. In view of this, they suggested that efforts to promote optimal hand hygiene behaviour should be directed towards minimising deterrents.

Similar deterrents have been identified in relation to Universal Precautions, including lack of time (Madan et al, 2002; Ganguly et al, 1999; Picheansathian, 1995; O'Boyle-Williams et al, 1994; Kelen et al, 1990), interference with patient care (Madan et al, 2002; Michalsen et al, 1997; Gershon et al, 1995; Picheansathian, 1995), interference with technical skills (e.g. reduced tactile sensation when using gloves) (Naing et al, 2001; Ganguly et al, 1999; Adegboye et al, 1997; Nelsing et al, 1997; O'Boyle-Williams et al, 1994; Kelen et al, 1990), negative influence of non-compliant work colleagues (O'Boyle-Williams et al, 1994), perceived work stress (Gershon et al, 1999; Michalsen et al, 1997), low levels of job satisfaction (Gershon et al, 1999), adverse effects such as latex allergy (Adegboye et al, 1997) and insufficient or inaccessible supplies of protective equipment (Naing et al, 2001; Adegboye et al, 1997; Nelsing et al, 1997; Picheansathian, 1995; O'Boyle-Williams et al, 1994). O'Boyle-Williams et al (1994) found that health care workers who identified more than three perceived obstacles to Universal Precautions were less likely to use gloves if contact with blood was anticipated. Osterman (1995) has suggested that in addition to these perceived obstacles, repeated exposure to familiar dangers such as exposure to blood often results in cavalier attitudes rather than encouraging appropriate precautions. Indeed, Kristensen et al (1992) found that health care workers in a hospital setting who reported complying with Universal Precautions had a significantly lower rate of contact with blood

than those who did not. Likewise, Kim et al (1999) found that health care workers in an emergency department often underestimated their risk of exposure to blood-borne viruses and many were desensitised to the bloody conditions they encountered.

Two other variables that have been associated with self-reported adherence to infection control precautions are gender and age. Zimakoff et al (1992) found that women, regardless of profession, reported significantly higher levels of adherence to hand hygiene than did men. This finding has been confirmed by others (Nobile et al, 2002; Alvaran et al, 1994). McCarthy et al (1999) found the same to be true in relation to adherence to Universal Precautions by dentists. They also found that younger respondents were significantly more likely to report high levels of adherence to Universal Precautions, a finding that has also been reported by others in relation to the use of Universal Precautions (Gershon et al, 1999; Godin et al, 1998; Michalsen et al, 1997). Conversely however, one study by Chan et al (2002) found the reverse to be the case, since older nurses aged forty-one and above reported higher rates of compliance with Universal Precautions than those aged between twenty and twenty-five years.

Aside from the influence of gender and age, the above findings do appear to indicate that, as suggested by Parsons et al (1995), health care workers assess or interpret their work contexts according to perceived risks of occupational exposure to infection and modify their infection control practice according to this, as well as various other perceived benefits or barriers. This has been demonstrated especially in relation to Universal Precautions. However, whilst there is evidence to suggest that health care workers consider the risks to themselves when deciding whether or not to employ infection control measures, the extent to which they are motivated by the need to prevent the spread of infection between patients remains unclear. There appears to be a lack of association between knowledge and self-reported adherence to infection control practice. However, there has been little in-depth exploration of health care workers' beliefs and understanding about the spread of infection or their own perspectives of the problem of non-adherence.

Summary

This chapter has examined the issue of adherence to infection control precautions in relation to the evidence from observation and self-reported practice. The review of observational studies has revealed that health care workers' infection control practice in relation to hand

hygiene, glove use and Universal Precautions is frequently sub-optimal, placing both patients and health care workers at increased risk of exposure to infection in the health care environment. Much less is known about health care workers' practice in relation to isolation precautions, owing to the limited research in this area. This lack of research is surprising, since isolation precautions has long been advocated as the cornerstone of hospital infection control practice to reduce the risk of transmitting infection from patients with recognised infectious conditions (Garner et al, 1996; Jackson and Lynch, 1985).

Non-adherence to hand hygiene, glove use and Universal Precautions has been associated with a wide range of factors, including type of patient contact or procedure, type of health care worker, demographic characteristics of the health care worker such as age and gender and pressures within the work environment such as workload. In addition, the findings of questionnaire studies suggest that rather than necessarily adhering to recommended procedures, health care workers decide for themselves whether or not to employ infection control precautions according to their own perception of the risks of occupational exposure to infection, as well as various other perceived benefits and barriers. The increase in self-reported use of barrier precautions by health care workers when a patient is known to be infected with a blood-borne pathogen is a good example of this. However, such decisions may not necessarily be based on an accurate understanding of these risks. Indeed, the decision to adopt Universal Precautions only for patients perceived to be at increased risk of harbouring a blood-borne virus infection may reflect a lack of appreciation of the risks of exposure to these pathogens from unidentified sources. Moreover, it is not known to what extent health care workers consider the risks to patients as well as themselves when deciding whether or not to employ infection control precautions such as hand hygiene and glove use, that are designed to protect patients, as well as health care workers, from exposure to infection.

These matters are of crucial relevance to the issue of adherence to infection control practice. Indeed, given the limited evidence available to date, they clearly warrant further research, since there is a need to better understand how health care workers make decisions about infection control in clinical practice. In relation to isolation precautions, it is not known whether or not health care workers tend to target their infection control efforts more towards patients identified as being 'infectious' than other patients, as has been found with Universal Precautions, since there has been little, if any research in this area. This critically important

information is urgently required, particularly in relation to Contact Precautions in order to inform the ongoing controversy about the value of this approach as compared with the Standard Precautions recommended for all patients. Indeed, as discussed in Chapter 2, until more is known about this, the use of Contact Precautions will remain controversial and efforts to enhance the routine use of practices such as hand hygiene and glove use for all patients may be of limited success.

The following chapter presents Part II of this review, which examines the findings of intervention studies designed to improve adherence to infection control precautions in health care practice.

CHAPTER 4

ADHERENCE TO INFECTION CONTROL PRECAUTIONS IN HEALTH CARE PRACTICE

Part II: Evidence from Intervention Studies

Introduction

As the first part of this review has revealed, the problem of non-adherence to infection control practice in health care is widespread. Not surprisingly, there has been a proliferation of intervention studies designed to address this. In this chapter, the evidence is examined from these studies in relation to adherence to hand hygiene and glove use, adherence to Universal Precautions and adherence to isolation precautions. It begins with an overview of the studies retrieved and then focuses on a more selective review of those studies considered to be particularly noteworthy with regard to their contribution to the body of evidence. Most of this work has focused on hand hygiene and glove use as a means to prevent the transmission of infection between patients or Universal Precautions to protect health care workers from exposure to blood-borne pathogens. Comparatively little research has been undertaken in relation to isolation precautions, or indeed any other aspect of infection control practice. The search strategy employed to retrieve the relevant research literature on adherence to infection control precautions can be found in Chapter 3.

Overview of the Studies Retrieved

In all, fifty-eight intervention studies were identified (see Appendix 1) that were published between the years of 1982 to 2002. Studies in which the only outcome measure was the rate of infection were excluded from this review, since they were unable to relate the impact of the intervention to the behaviour of health care workers. Most of the intervention studies undertaken to date have focused on improving infection control practice in relation to hand hygiene or Universal Precautions. In contrast, only three studies focused on improving the implementation of isolation precautions. Many interventions involved some form of educational programme. Others included performance feedback, reminder posters, use of opinion leaders, use of an administrative mandate to adhere to recommended procedures and structural changes such as the introduction of a new hand hygiene product, improved access to protective clothing and installation of an automated sink.

With regard to the design of the interventions used to improve practice, relatively few studies, particularly those published before the late 1990s, articulated the rationale for the intervention used. This point has been highlighted both by Larson and Kretzer (1995) and Levin (1995) in their reviews of adherence to infection control practice. Levin (1995) reviewed adherence to Universal Precautions over an eleven-year period from 1983 to 1994 and identified thirteen intervention studies. Education as an intervention was used in all but one study. Other interventions included performance feedback, reminder posters and equipment purchases. However, only one study reported any form of conceptual framework guiding the research. Levin (1995) found that no conclusions could be made about the effect of interventions given the small number of articles reporting significant results, lack of power and weaknesses in study design.

The review by Larson and Kretzer (1995) encompassed the same time period from 1984 to 1994 and considered adherence to hand hygiene in addition to Universal Precautions. They identified fifteen intervention studies, only four of which were those also identified by Levin (1995). Their analysis revealed that didactic education sessions alone were associated with improved knowledge, but had little or no effect on attitudes or behaviour unless accompanied by other interventions. The effect of feedback on sustained success was considered equivocal, particularly as most of the studies reviewed did not include periods of long-term follow-up. The authors pointed out that researchers appeared not to be making use of data gathered from previous studies when planning their own interventions. They concluded that interventions to change the infection control behaviour of health care workers will continue to meet with minimal success unless they are theoretically sound and multidimensional. Recently, greater attention has been given to this issue (Larson et al, 2000; Pittet et al, 2000; Larson et al, 1997), as described later in the chapter.

As a general observation, the majority of studies identified in Appendix 1 had methodological limitations. Direct observation of practice was employed in forty-nine of the fifty-eight studies as the means to measure change. However, the validity of a large number of these is in question because the reliability of the observational data was not addressed. Indeed, only a quarter of the studies reported that measurement of the inter-observer reliability of study findings had been undertaken. In addition to this, the sample size of some studies was problematic, either because of the small number of observations made, the small number of staff observed or the small amount of time spent observing. For example, in a study by Mayer et al (1986), evaluation of the long-term impact of an intervention to

improve hand hygiene practice was based on only fourteen observations. DeVries et al (1991) observed only four nurses in their study of glove use and in a study of hand hygiene practice, Conly et al (1989) measured changes in practice based on only one four-hour observation session before and after each of two intervention periods. Among the nine studies that did not measure change by direct observation of practice (Colombo et al, 2002; Conrad et al, 2001; Larson et al, 2000; Kidd et al, 1999; McGuckin et al, 1999; Stevens et al, 1991; Ribner et al, 1990; Seto et al, 1989; Williams and Buckles, 1988), alternative measures were used such as usage rates of hand hygiene products or self-reported practice. However, these were limited in their ability to accurately reflect practice and most were unable to ascertain the circumstances in which behavioural change occurred.

The potential problem of introducing bias by the presence of an observer was illustrated in a study by Bittner et al (2002), since the presence of an observer was associated with increased hand hygiene in both the intervention and the control unit under study. In most studies, this problem was addressed either by concealing the role of the observer or by not disclosing the nature of the observations being undertaken. For example, Raju et al (1991) employed a nurse within a neonatal unit to unobtrusively observe her colleagues' hand hygiene practices whilst also performing her regular duties. However, as the authors acknowledged, this posed problems with regard to the accuracy of the data collected, owing to the constraints of the nurse's regular duties. It also posed a potential ethical dilemma given the lack of informed consent, although the findings were later fed back to staff in an anonymous fashion during educational sessions and they were informed that future monitoring would continue periodically.

Concealing the real purpose of the observer's presence was used as an alternative approach in the majority of studies. However, in many of these, the intervention strategy involved the provision of feedback of observed practice to staff and in view of this, it is difficult to see how the nature of the observations could remain concealed. Moreover, revealing the purpose of observations part way through a study is likely to confound any observed improvement in practice. For example, LeClair et al (1987) conducted an intervention study on a paediatric medical ward to assess whether increased adherence to glove and gown isolation precautions by nurses would influence the incidence of Respiratory Syncytial Virus (RSV) infection. Whilst baseline measures of adherence were made without the knowledge of staff, the intervention to improve practice involved participation of the study ward's head nurse in the promotion and overt observation of glove and gown use when attending to patients with

known or suspected RSV infection. This brought about an improvement in observed glove and gown use from thirty-nine percent (20/52 contacts) to eighty-one percent (73/90 contacts), which was associated with a significant reduction in the rate of hospital-acquired RSV infection. However, it was not possible to distinguish the effect of the head nurse's influence as a role model from that of conspicuous observation of practice.

Selective Review of Seminal Studies

Notwithstanding the limitations discussed above, there are some notable examples of well-planned intervention studies amongst those identified in Appendix 1. The following account focuses on these studies in particular, since they have contributed significantly to the growing body of evidence on improving adherence to infection control practice. The first of these was reported by Lynch et al (1990). These authors described a detailed conceptual framework for the implementation of a system of generic infection control precautions applicable to all patients known as Body Substance Isolation (BSI). The system was developed to replace traditional isolation precautions following the failure of an initial attempt to promote the consistent use of barrier precautions for all patients. Indeed, although their initial efforts resulted in the increased use of barrier precautions, it was found that this was only being applied to patients with recognised infectious conditions who were already being nursed in isolation. Thus, there were two standards of practice, one for patients who were designated as being on isolation precautions and another for patients who were not. In order to address this, the traditional system of isolation precautions was replaced with BSI.

An extensive planning and implementation programme took place over a twelve-month period, which involved wide consultation with hospital staff, a range of structural changes such as the provision of glove box holders, revision of policies and procedures and in-service education. Observation of glove use before and after implementation of BSI revealed significant increases in the appropriate use of gloves, both by physicians and nurses, which persisted up to eighteen months after the intervention. This was coupled with a significant decrease in the incidence of colonisation and infection with two 'marker' organisms, *Serratia marcescens* and amikacin-resistant Gram negative bacilli, although the validity of this observation has since been questioned by Goldmann (1991), who has suggested that other interventions or long-term secular trends may have accounted at least in part for the findings given the progressive decline in the recovery of these two organisms in the subsequent two years. A survey of health care workers conducted to test knowledge of the BSI system before and immediately after in-service training revealed improvements in

knowledge. Although staff were also consulted regarding their concerns about implementing the new system, no details of this were reported and the extent to which their concerns about such a radical change of approach to infection control were addressed was unclear.

Larson et al (1997) published findings of a twelve-month study designed to improve hand hygiene practice in an ICU that was based on the PRECEDE health education model. Factors that predisposed non-adherence to hand hygiene practice were identified by means of a survey of health care workers' practices, beliefs and opinions both before and after the intervention. Findings of the first survey were reviewed with staff during focus group sessions that were designed to meet their educational needs as well as to develop a unit-based plan to improve practice. The intervention also incorporated the installation of an automated sink and feedback to staff on their hand hygiene performance, along with active support from unit managers. However, despite these intensive efforts to influence hand hygiene behaviour, there was no significant increase in the rate of hand hygiene two months after the intervention. In addition, there were no discernable differences in survey responses before and after the intervention, which presumably reflected an overall lack of impact of the intervention on the attitudes of staff. These findings led the authors to conclude that intensive, focused and continuous education to improve hand hygiene frequency were expensive, time-consuming and probably not cost-effective and that an alternative approach such as the use of an administrative mandate may be warranted.

The effect of an administrative mandate has been investigated in three intervention studies (Larson et al, 2000; Sahdev et al, 1994; Kelen et al, 1991). Kelen et al (1991) reported a substantial improvement in overall compliance with Universal Precautions by health care workers in an emergency department following the institution of a strict legislative policy in which non-compliant health care workers were liable to disciplinary action. Likewise, Sahdev et al (1994) reported significant improvements in the use of barrier precautions by health care staff involved in trauma resuscitations following an intervention that involved a legislative mandate in addition to in-service training and improved access to protective clothing. The researchers performed a multi-varied analysis of their data to establish the relative significance of the mandate as compared with the combination of in-service training plus improved access to equipment and found that both approaches were separately associated with improvements in the use of mask and eye protection and gowns.

In the study by Larson et al (2000), top-level management was involved in an administrative intervention to improve hand hygiene practice hospital-wide, based on a theoretical framework for changing organizational culture. The intervention involved active support for a culture change by top management, medical and nursing leaders. In addition, managers responsible for implementation were involved in developing the specific elements of the intervention according to the five major components of the framework. This included the use of a hand hygiene performance competency for all staff and continued visible administrative support for hand hygiene. The effect of the intervention was monitored in two ICUs by measuring estimates of hand hygiene frequency using counting devices inside soap dispensers. Two similar ICUs in another hospital were used as controls.

Whilst hand hygiene frequency increased in both hospitals throughout the study, the mean hand hygiene frequency per patient-care day in the study units was more than double that of the control units six months after formal implementation of the intervention. This was associated with significantly reduced rates of VRE in the intervention hospital during implementation as compared with the control hospital. These findings suggested that the intervention had positively influenced hand hygiene practice in the two study ICUs, although this was based on estimates of hand hygiene frequency rather than direct observation of practice. The impact of the intervention on hand hygiene practice across the rest of the hospital was not described, although it was reported that the major components of the intervention had become an integral part of the organizational climate. However, no data was presented to support this assertion. Also, no description was given of the issues encountered during the process of implementing the intervention, even though this was monitored on an ongoing basis by one of the researchers.

In the same year, Pittet et al (2000) reported the success of a hospital-wide education programme to improve health care workers' hand hygiene practice, which achieved sustained improvement as a result of an equally sustained intervention. This was associated with a significant reduction in the rate of hospital-acquired infection and MRSA cross-transmission over the four-year study period and was deemed cost-effective on the basis of crude estimates. The programme was supported by senior hospital management and was designated as a hospital-wide priority. It involved a promotional campaign using seventy different posters displayed in two hundred and fifty strategic areas that were designed by hospital staff and changed once to twice a week throughout the course of the study. Large-scale distribution of an alcohol-based hand rub was also undertaken to facilitate easy access to the

product at patients' bedsides and the use of individual pocket-sized bottles by staff. In addition, adherence to hand hygiene practice was monitored twice yearly and fed back to staff through the hospital newsletter and with their salary slips. As the authors acknowledged, it was not possible to ascertain which part of the strategy was most effective or whether improved hand hygiene practice would outlast the intervention. In addition, whilst there was a significant improvement in the hand hygiene practices of nurses and nursing assistants, average adherence remained low among other health care workers and in particular, medical staff, with no significant improvement over time. Nonetheless, the study provided important evidence of a hospital-wide, sustained improvement in hand hygiene adherence.

Whilst the experience of Pittet and colleagues (2000) illustrates the apparent difficulty associated with influencing the hand hygiene behaviour of medical staff, Tibballs (1996) has reported success in this respect. The study was based in a paediatric ICU and involved sixty-one medical staff in an intervention to improve hand hygiene using overt observation of practice and performance feedback. This brought about a significant increase in hand hygiene rates, which peaked during the intervention and remained more than four times higher than baseline levels seven weeks after the intervention. A difference was found between the group of medical staff as a whole compared to a cohort within the group who worked on the ICU or visited frequently. This cohort achieved and maintained a higher hand hygiene rate than the group overall and although the reason for this was uncertain, the researcher suggested that it may have been attributed to staff turnover outside the cohort, greater exposure to the intervention or a consequence of having been asked to estimate their own hand hygiene rate prior to overt observation of their practice.

Conversely, Muto et al (2000) observed a significant decrease in the rate of hand hygiene amongst physicians in a medical ICU following the introduction and promotion of an alcohol-based hand rub, although the sample size was small. By comparison, there was no change in hand hygiene behaviour among other health care workers as a result of the intervention. The decreased rate of hand hygiene amongst physicians was accounted for in part by a change in rotations, which occurred prior to the post-intervention observations. In addition, the researchers noted that on team rounds, hand hygiene adherence appeared to be influenced by the attending physician, since when they washed their hands, all other physicians in the team usually did too. Likewise, when the attending physician failed to wash their hands, so too did all of the other physicians. This influence of senior medical staff on

their more junior colleagues may present opportunities to promote infection control practice amongst this group of health care workers.

In view of the difficulties associated with improving infection control practice, it is surprising that the majority of intervention studies identified in Appendix 1 have focused solely upon outcome measures, providing little, if any data on the process of change. As a result, it is difficult to draw conclusions from most studies about why an intervention succeeded or failed, owing to the lack of contextual information other than anecdote to account for this. In addition, few studies have sought to understand the perspectives of health care workers and fewer still have incorporated this information into either the planning or evaluation of an intervention.

This lack of consideration of health care workers' perspectives has no doubt accounted in part for the lack of success of interventions, particularly when the subjects themselves have not recognised that their practice is in need of improvement. In a study by Simmons et al (1990) that was designed to improve hand hygiene practice amongst nurses in an intensive care unit, the nurses themselves perceived that they were washing their hands appropriately about eighty to ninety percent of the time (as determined by a questionnaire survey), even though direct observation of their practice revealed that this was not the case. Subjects only became aware of this deficiency when the infection control nurse openly observed and critiqued them, although this did not result in a significant improvement in practice.

This illustrates a compelling problem with regard to improving infection control practice, since health care workers must first be convinced of the need to change their practice before real improvements can be made. However, even in studies incorporating some form of consultation with health care workers, this has generally been an attempt to promote ownership of a pre-defined problem rather than to establish the priorities of the health care workers themselves. As a result, little is known about the priorities and concerns of health care workers in relation to improving their infection control practice.

In addition to this, initiatives to improve infection control practice frequently have to compete with other priorities within health care settings. For example, in a study by Harbarth et al (2002) to promote the use of an alcohol-based hand rub by health care workers in three paediatric ICUs, the researchers found that health care staff and their managers on each of the units had already established their own quality improvement (QI) priorities based on their

immediate concerns and long-term strategic goals. Even though moderate improvements in hand hygiene practice were achieved, which persisted over the two and a half month follow-up period, the authors commented on the limitation of "grafting research onto existing QI efforts". They concluded that to achieve truly superior, sustainable results, detailed personnel-orientated planning combined with a strong ongoing commitment from opinion leaders and multidisciplinary quality improvement teams are required.

This level of commitment was apparent in a study by White and Lynch (1997). The study was part of a larger multi-centre investigation of blood exposures among health care workers in the operating department. It involved an intervention to reduce the risk of blood exposures among operating department staff in three hospitals. These staff had already implemented all health and safety requirements to limit blood exposures and were looking for precise information to further limit risks. The findings of initial data collection and analysis were fed back to each hospital for discussion amongst operating department staff and surgeons so that they could design further interventions that were specific to the types of exposures they encountered.

On this basis, a variety of interventions were implemented, which differed in each of the hospitals according to the problems identified. These included encouragement of double-gloving, use of leg coverings in urology and orthopaedic cases, consideration of changes in gowns and other protective attire and the development of methods for no-touch passage of used instruments. Significant reductions in blood exposure rates were achieved in all three hospitals, although the findings were limited owing to the possibility of observer bias as the observations of practice were conducted by circulating nurses who relied upon colleagues' self-reports of blood exposure at the end of each procedure. Indeed, as the authors acknowledged, staff may have reported less contacts in the second period of data collection in order to look better. Nonetheless, the approach to the study demonstrated the value of engaging health care workers in the planning and implementation of changes in infection control practice.

Involving health care workers in the evaluation of an intervention also provides important information about the reasons why it succeeded or failed, yet few studies have incorporated this element into their design. Girou and Oppein (2001) conducted an evaluation by health care workers in the form of a survey six months after implementation of an intervention to improve hand hygiene practice. The study took place on two ICUs and two medical wards of

a hospital. It involved the introduction of an alcohol-based hand rub along with an education programme and performance feedback on initial observations of hand hygiene practice. Observational data recorded six months after the intervention demonstrated a significant improvement in hand hygiene practice. However, the survey revealed that health care workers remained doubtful about the effectiveness of the alcohol-based hand rub and were concerned about its potential to cause skin irritation and dryness. In addition, they were also unclear about the indications for hand cleansing. In view of this, the authors suggested that there may be a need to provide educational sessions for health care workers at the bedside during their routine practice to enable these issues to be discussed in context at the point of delivery of patient care. Indeed, to date, there is a lack of detailed information in the literature about the issues and concerns encountered by health care workers in relation to infection control in the context of their routine practice.

In a recent review of adherence to hand hygiene, Pittet and Boyce (2001) suggested that improvement in infection control practice requires the questioning of basic beliefs, continuous assessment of a group's or individual's stage of behavioural change, an intervention with an appropriate process of change and support of individual and group creativity. However, to date, no intervention study has systematically monitored all of these elements as part of its design. Indeed, as mentioned above, most of the research in this area has placed emphasis on measuring the outcome but not the process of an intervention. In view of this, the reasons for the success or failure of interventions are frequently unknown. There is wider recognition in the literature of the complexity of changing infection control practice within the health care industry and of the importance of designing strategies aimed at individual, group and organisational levels. However, there is a clear need to focus greater attention on the processes involved in changing practice in order to better understand health care workers' behaviour in this respect.

Summary

This chapter has examined the issue of adherence to infection control precautions in relation to the evidence from intervention studies designed to improve practice. As described in Part I of the review, non-adherence to infection control practice arises as a result of a wide range of factors, some of which are potentially amenable to alteration and have been exploited in intervention studies designed to improve practice. For example, the introduction of an alcohol-based hand rub has been employed with varying degrees of success to overcome the

problem of time constraint and the inaccessibility of sinks, both of which have been associated with non-adherence to hand hygiene practice.

Until recently, intervention studies, particularly those based on a single strategy aimed only at individual health care workers have achieved limited, if any success. Latterly, there has been greater success among studies that have incorporated multiple interventions targeted at individual, group and organisational levels. However, these studies have offered only limited anecdotal explanations of the factors contributing to improved practice, owing to a lack of emphasis on the process of change. Most importantly, there has been a lack of in-depth exploration of health care workers' own perspectives of the problem of non-adherence and the difficulties associated with improving infection control practice. As a result, little is known about their priorities and concerns in relation to this, which cannot be assumed to be the same as those of infection control professionals.

As discussed in Part I of the review, there is a need to better understand how health care workers make decisions about infection control in clinical practice. This is also imperative in the context of intervention studies designed to improve infection control practice in order to understand health care workers' responses to the change process. Indeed, given the lack of attention to this issue to date, there is a clear need for detailed research to investigate the contextual factors that influence health care workers' adherence to infection control practice and the reasons for the success or failure of intervention programmes. The importance of engaging practitioners in the planning, implementation and evaluation of programmes designed to improve their infection control practice is also evident in order to ensure that their own perspectives are understood and addressed.

The present study has addressed these issues by providing a detailed exploration of nurses' and health care assistants' perspectives of the problems associated with implementing infection control practice during the implementation of an intervention programme designed specifically to meet their needs. The following chapter describes the methods used to accomplish this.

CHAPTER 5

METHODS

Introduction

As discussed in Chapter 4, there is a paucity of previous research which has examined the perspectives of health care practitioners in relation to infection control practice. Consequently, the limited impact of intervention studies designed to improve practice cannot be explained. This study was therefore designed as a case study of practice to gain insights into infection control practice on one hospital ward by exploring the perspectives and experiences of registered nurses and health care assistants. These data would then be used as a basis for the development, implementation and evaluation of an education and support programme for improving practice on the ward. More specifically, the study was designed to answer two research questions:

- What are nurses' and health care assistants' perspectives of the problems associated with implementing infection control practice?
- What is the impact of a supportive intervention on nurses' and health care assistants' infection control practice?

The study's aims were as follows:

1. To explore nurses' and health care assistants' views and anxieties about infection control practice on the study ward and identify specific areas of practice considered by them to be in need of improvement.
2. To observe nurses' and health care assistants' infection control practice in relation to these areas in order to confirm the nature and extent of the problems identified.
3. To identify the support needed by nurses and health care assistants to improve their infection control practice and on this basis, design a supportive intervention tailored to their needs.
4. To develop a practice guideline, as requested by study participants, to provide clear, research-based recommendations on the implementation of infection control procedures for patients nursed in isolation due to Methicillin Resistant *Staphylococcus aureus* (MRSA) and *Clostridium difficile* associated diarrhoea (CDAD).

5. To implement the practice guideline on the study ward with the availability of one-to-one support and instruction by the researcher to assist nurses and health care assistants to improve their practice.
6. To maintain a process record of the questions, comments, concerns and practices of nurses and health care assistants in relation to the practice guideline during the course of the implementation process.
7. To evaluate nurses' and health care assistants' perceptions of the impact of the supportive intervention on their infection control practice and the reasons for this.

Approach to the Study

In view of the multiple aims of the study, it was apparent that no one single approach would enable all of the research aims to be met and it was therefore necessary to exploit both qualitative and quantitative methods. Moreover, the pursuit of detailed insights into processes of infection control practice required a methodological stance which would facilitate the engagement of both the researcher and the study participants. Robson (1997) suggests that looking at an enquiry in case study terms encourages the use of multiple methods of investigation and licences the enquirer to adopt a flexible and overtly involved stance, such that the researcher's own impressions and perceptions about the processes being studied can be brought out into the open. This is of relevance to the study, since the role adopted by the researcher required a great deal more involvement in the process of the research than that of neutral observer. Indeed, it involved the researcher acting as a consultant, in her capacity as a specialist infection control nurse, to interpret the preliminary study findings in relation to the changes that were required to improve infection control practice and facilitate study participants both to act and reflect on this. This continued and prolonged period of contact, which is characteristic of the case study approach, was necessary in order to understand the process of changing infection control practice.

The engagement of both the researcher and study participants in the research process aligns the study with features of the participatory research paradigm (Cornwall and Jewkes, 1995). More specifically, the research achieved a high level of in-depth participation at certain stages, since participants' perspectives formed the basis of problem identification and their reflection on practice provided the means to understand the process of improving it. The emphasis on process is also characteristic of participatory research. However, as Cornwall and Jewkes (1995) argue, the key difference between participatory and conventional

methodologies lies in the location of power in the research process. In this respect, the study conformed more with the conventional approach to research, since the researcher maintained ultimate control, taking responsibility for analysis and representations of outcomes. Nevertheless, the high level of participation of participants during the research process conveys the advantages associated with the participatory research paradigm in relation to face validity and the appropriateness of the intervention employed (Cornwall and Jewkes, 1995).

Study Design: Detailed Case Study of Nurses' and Health Care Assistants' Infection Control Practice on a General Medical Ward

An outline of the study design is shown in Figure 1. The study involved a detailed investigation of the infection control practices of nurses and health care assistants on one general medical ward. It involved the design and implementation of a supportive intervention to improve practice and was divided into three phases: pre-implementation, implementation and post-implementation. Phase I, the pre-implementation phase, comprised semi-structured interviews with all of the nurses and health care assistants on the study ward, which included a ranking exercise to identify their priorities with regard to developing infection control practice. This was followed by the development of a structured observation tool and structured observations of participants' infection control practice. Based on these findings, a practice guideline was developed for use during the implementation stage of the study, the content of which was subject to a process of peer review.

Phase II, the implementation phase, involved implementing the practice guideline over a six-month period. During this time, the researcher worked alongside each of the study participants on an individual basis to offer practical instruction and support. As a participant observer, the researcher maintained a process record of all the questions, comments and concerns raised by participants throughout this period. In addition, a record was made of the researcher's observations of nurses' and health care assistants' infection control practice. Phase III, the post-implementation phase, comprised semi-structured interviews with all nurses and health care assistants who participated in Phase II of the study to identify self-reported changes in practice and to evaluate participants' perceptions of the impact of the supportive intervention on their practice.

Figure 1: Outline of the Study Design

Phase I: Pre-Implementation

Stage 1: *Semi-Structured Interviews*
Semi-structured interviews with all nurses and health care assistants (19) including ranking exercise

Stage 2: *Development of Structured Observation Tool*
Development and piloting of structured observation tool to monitor nurses' and health care assistants' infection control practice in relation to patients nursed in isolation due to MRSA and CDAD

Structured Observations of Practice
60 hours of structured observations of nurses' and health care assistants' infection control practice in relation to isolation precautions

Stage 3: *Development of Practice Guideline*
Development of practice guideline on isolation precautions for patients with MRSA and CDAD, including peer review of content

Phase II: Implementation

Stage 4: *Implementation of Practice Guideline*
Implementation of practice guideline during a 6-month period with one-to-one support and instruction given to all nurses and health care assistants (18)

Process record of questions, comments and concerns raised by study participants in relation to the practice guideline

Participant observations of nurses' and health care assistants' infection control practice in relation to isolation precautions

Phase III: Post-Implementation

Stage 5: *Semi-Structured Interviews*
Semi-structured interviews with all nurses and health care assistants (18) who participated in Phase II

Nursing students and temporarily employed 'bank' or 'agency' nurses were not included in the sample of nurses studied. This was because those nurses and health care assistants who participated in Phases II and III of the study defined the study sample. It was recognised that due to the transient nature of their employment, student nurses and 'bank' or 'agency' nurses would not be on the study ward for a long enough time period to participate fully in the process of changing practice. In addition, they were less likely to be able to offer insights into infection control practice on the study ward and the changes that occurred as a result of

Phase II of the study. Indeed, they may instead have been inclined to draw upon their experiences more generally of working on a variety of different wards.

Negotiating Access to the Study Ward

The process of negotiating access took place over a period of six months from July 1996. Firstly, written permission was gained for the study to take place, both from the Chief Executive and the Director of Nursing of the Health Care Trust. Following this, the Director of Nursing appointed a senior nurse manager from the Trust's Medical Directorate to facilitate the study. Contact was also made with the local Infection Control Team, who indicated their support and offered the researcher a base within their department from which to work.

Simultaneous with this process, the local Research Ethics Committee was approached regarding the proposed research. The Committee requested that details be submitted for approval to them prior to proceeding with the study. The research was approved without any major ethical concerns, given that the researcher stressed the importance of informed consent and confidentiality of the data collected.

The selection of a suitable study ward was guided by the senior nurse manager's view of a potential ward team that may be willing to participate and who were not otherwise engaged in project work. From the researcher's perspective, there were no particular requirements with regard to infection control, since this is a fundamental aspect of clinical practice on all hospital wards. Therefore, the only pre-requisites for suitability of a study ward were an interest amongst the ward manager and staff in developing infection control practice and a willingness to actively engage in the research. With this in mind, the researcher approached the ward sister of a particular ward, as recommended by the senior nurse manager, and undertook a series of consultation meetings both with this ward sister and all of the permanently employed nurses and health care assistants. Staff were enthusiastic and in consequence, this was identified as the study ward.

Description of the Study Ward

The study ward was located in a district general hospital, which was one of four hospitals comprising an acute Health Care Trust. The hospital was situated at a separate location from the main Trust hospital and accommodated predominantly health care of the elderly patients

and patients in need of non-acute medical intervention. The ward was a twenty-two bed male medical ward catering for patients with a wide variety of general medical conditions. These included critically ill patients, such as those who had suffered cerebral vascular accidents, as well as patients requiring rehabilitation, patients admitted for diagnostic purposes and those with acute social breakdown or multiple pathology. Most patients were admitted from the main Trust hospital, either from the Accident and Emergency Department or from an in-patient ward following an acute illness or investigations. The ward layout was an open, 'Nightingale' style, with nineteen beds in the main ward area. There were also three single rooms at the entrance to the ward, adjacent to the ward office, which were frequently used to accommodate patients in need of isolation for infection control purposes.

At the beginning of the study, the staffing profile of the study ward comprised both nurses and health care assistants in almost equal number (as shown in Table 4). This changed towards the implementation phase of the study when the proportion of nurses was higher than health care assistants. Apart from the ward sister, all nurses worked both on day and night duty on a rotational basis. In contrast, health care assistants worked permanently on either day or night duty. Attached to the Trust was a university-based School of Nursing, which had both a diploma and a degree course in operation for pre-registration student nurses. The study ward had a regular intake of student nurses, all of whom had supernumerate status.

Table 4: Staffing Profile of the Study Ward during Phase I and Phase II of the Study

Phase I		Phase II	
'G' grade Ward Sister	n=1	'G' grade Ward Sister	n=1
'F' grade Senior Staff Nurse	n=1	'F' grade Senior Staff Nurse	n=1
'E' grade Staff Nurses	n=3	'E' grade Staff Nurses	n=2
'D' grade Staff Nurses	n=3	'D' grade Staff Nurses	n=4
'D' grade Enrolled Nurses	n=2	'D' grade Enrolled Nurses	n=5
Health Care Assistants	n=9	Health Care Assistants	n=5
	n=19		n=18

There was no particular system of nursing on the study ward such as primary or team nursing. Instead, nursing care was organised by the ward sister or the most senior nurse on duty who was 'in charge' for that shift. Registered nurses were allocated patients at the

beginning of each shift according to certain geographical portions of the ward. Student nurses were usually allocated to work alongside a trained member of staff and preferably their preceptor whenever possible. Health care assistants were either allocated to work alongside a particular nurse or were instructed to help out wherever needed during the course of the shift.

Ethical Issues

The nature of the research and the methods of data collection used gave rise to a number of ethical issues. The first of these centred around the notion of informed consent. It was essential that all nurses and health care assistants included in the research were fully informed about it and gave their individual consent to participate. At the outset of the study, this was addressed as part of the process of negotiating access to the study ward. As described above, the process of negotiating access involved consulting not only with the ward sister, but also all of the other permanently employed nurses and health care assistants. To achieve this, the ward sister arranged for the researcher to meet with each of the nurses and health care assistants either on an individual basis or in small groups in order to disseminate information about the proposed research and enable individuals to ask questions. Following this, all of those concerned were asked to confirm their decision to participate in the study with either the researcher or the ward sister.

Even though all of the nurses and health care assistants employed on the ward at the outset of the study did in fact give their permission for the study to proceed, the researcher remained aware of the need to respect any subsequent decisions to decline. This was particularly important given the anticipated duration of the study and the intention to use several different data collection methods with the same group of staff. The researcher therefore re-negotiated the informed consent of individuals to continue their involvement in the study at each stage. In addition, informed consent was sought from any newly appointed staff members who commenced work on the study ward during the course of the study. Decisions to decline to participate in any part of the research due to workload or for any other reasons were respected.

As well as establishing the informed consent of nurses and health care assistants to participate in the research, it was important to ensure that patients likely to be affected by it also gave their informed consent. There were two parts of the study that involved patients. These were the structured observations of practice during Phase I and the participant

observations of practice during Phase II. Individual patients whose nursing care the researcher wished to observe were approached and given a verbal explanation of the study prior to seeking their consent to participate. This excluded patients who were unable to give their consent for any reason. Such patients were identified in advance by nursing staff who were asked by the researcher to inform her when this was the case.

It was recognised that a period of illness and hospital admission places patients in a particularly vulnerable position and that obligation to participate in research may add further to any stress experienced. To this end, the researcher emphasised to each individual patient that they would not be required to do or say anything that would not ordinarily take place. It was also made clear that it was the actions of nursing staff that were being observed rather than the patient's own behaviour. Both nursing staff and patients were given assurances that if an interaction were to become particularly sensitive or either party were to experience undue distress, they would be free to request that the observation be terminated. In practice, this situation did not arise during either Phase I or Phase II, but the researcher remained sensitive to this possibility at all times.

The second ethical issue that required consideration was that of confidentiality. This was pertinent not only in relation to the recording of the data collected, but also in view of the need to feed back study findings to participants at various stages of the study. Data was in the form of tape-recorded interviews, observation records and field notes. These were made anonymous by the coding of individual participants' names on all of the records held, including the audio-cassettes used to tape record the interviews. Confidentiality of the data was protected by ensuring that it was used only for the purposes of the research itself and that it could only be accessed by the researcher.

In terms of providing feedback to study participants, this took place at various stages of the study. For example, findings of the pre-implementation interviews were fed back verbally and in the form of a written report to confirm respondents' consensus of opinion with regard to the infection control practice selected as the focus of Phase II of the study. Findings of the observations of practice were also fed back to study participants during a meeting that was held to plan Phase II and also to individuals as part of the implementation process. On all such occasions, the researcher ensured that information was presented anonymously. In this

way, individuals were able to decide for themselves whether or not they wished to openly express their views about the content of the feedback in the presence of their colleagues. The issue of confidentiality of the data also manifested itself in relation to a third area of ethical concern - the researcher's dilemma in the event of observing or recording "bad practice" on the study ward. Essentially, respect for confidentiality needed to be balanced against judgements about what was in the best interests of patients and the public at large. The Code of Professional Conduct (UKCC, 1993) in force at the time of the study requires that a nurse disclose information when it is in the public interest. The researcher was also faced with decisions regarding not only when to disclose information, but also when to intervene in events being observed or recorded on the study ward. Intervention in a situation in which the researcher was essentially an observer has implications for the reliability and validity of the data collected. To an extent, these dilemmas arose as a result of the investigator being both a nurse and a researcher. As a nurse researching nursing, the researcher is more likely to be sensitive to omitted or bad practices and is also bound by a professional code of conduct relevant to the research situation in which he/she is involved. It was therefore necessary to give consideration to these issues prior to commencement of data collection and to make decisions that would guide the researcher's actions.

The researcher decided that in the event of observing practice that was deemed to have serious or life-threatening consequences, disclosure or intervention would take place. It was agreed that this would involve the ward sister in the first instance, who would assist in deciding upon the most appropriate course of action. Fortunately, during the course of data collection, no such incident arose. The infection control practices that were identified by the researcher as being in need of improvement were brought to the attention of study participants as part of the implementation process.

PHASE I: PRE-IMPLEMENTATION

There were three stages to Phase I of the study. The first was to explore nurses' and health care assistants' perceptions of infection control practice with particular reference to the nature of problems encountered and to identify specific issues requiring practice development. The second was to observe participants' infection control practice in relation to the issues identified for practice development to confirm their prevalence and understand the context. The third was to develop a practice guideline on the basis of the findings of the data

collected in stages one and two to use as the focus of Phase II of the study. The following account describes each of these stages in detail.

Phase I - Stage 1: Semi-Structured Interviews

The first part of the pre-implementation phase of data collection focused on the exploration of nurses' and health care assistants' views and anxieties about infection control practice and the identification of key issues for practice development. Interviews were the most appropriate form of data collection and the format used was semi-structured in nature (see Appendix 2). That is, open-ended questions were formulated for use with each participant in a standardised manner following a certain set sequence. May (1991) discusses the challenge of maintaining a balance between flexibility and consistency in data collection posed by the use of qualitative interviews. She states:

> "Flexibility in topic selection and in questioning is essential for discovery and for eliciting the individual informant's story. However, some consistency is also essential in types of questions asked, depth of detail and the amount of exploration versus confirmation covered in an interview in order for conclusions to be drawn"
>
> (May, 1991: 192).

The researcher considered that the use of a semi-structured schedule would help achieve the necessary balance between flexibility and consistency. The inclusion of ten different infection control practices as topic areas and the standardisation of questions asked in relation to these guaranteed that the areas of interest pertinent to the research aim would be covered by each of the respondents. In addition, the use of open-ended questions allowed each topic to be explored from the respondents' perspectives without constraining responses by pre-determined criteria. This has been a criticism of previous work in this area (see Chapter 3). The use of a ranking exercise to rank the infection control practices according to the extent to which they were considered problematic with regard to achieving 'good' practice also enabled the meaningful quantification of this aspect of the data to elicit the key issues for practice development.

A decision was taken to audio-tape the interviews, as this provided greater depth and detail of response for later transcription than would have been possible through the use of note-taking. It also allowed the researcher to maintain the flow of the interview without the inevitable disruption involved in note taking. Tape-recording the interviews provided a

method of ensuring the reliability of the data. Indeed, Deatrick and Faux (1991) suggest that interviews recorded in this way:

> "increase data reliability by preventing selective filtering of data due to investigator recall or summarization"
>
> (Deatrick and Faux, 1991: 217).

However, the use of a tape recorder also poses some disadvantages that may influence the validity of the data collected. That is, it has the potential to distort the natural responses of the interviewee due to the latter's awareness of its presence, which may cause embarrassment and a reluctance to disclose potentially sensitive or confidential information. Attempts were made to overcome these problems by the use of several measures. Unobstrusive recording equipment was used such that there was no necessity for the respondent to have a microphone or wires attached to their person. This was in the form of a small tape cassette recorder (Sony Walkman Professional WM D6C) with a separate microphone, which could be positioned discreetly at some distance from the interviewee without affecting the quality of the recording. Each respondent was also assured of the confidentiality of the interview and of the anonymous way in which findings would be fed back in an attempt to minimise responses being constrained by concerns over this. Any decision to decline to be tape-recorded due to anxiety or embarrassment was respected, although no such refusals actually occurred. Indeed most respondents did not appear unduly concerned by the request to record the interview. Many also commented at the end of the interview that they had ceased to be aware of its presence. Overall, it was considered that the advantages of recording the interview outweighed the potential problems that may arise as a result of the presence of a tape-recorder.

In summary, a semi-structured interview was considered the most appropriate method of data collection for Stage 1 of the study. This enabled the research aim of eliciting nurses' and health care assistants' perceptions about infection control practice and identifying key issues for practice development to be addressed, whilst at the same time facilitating comparison and quantification of responses.

Data Collection Procedure

Between January and March 1997, interviews were conducted with nineteen members of staff on the study ward. This included all nurses and health care assistants working either full

or part-time hours on either day or night duty. The interviews were conducted in a quiet room away from the ward during work time and lasted for approximately forty-five minutes, although some were longer as some interviewees described their concerns in great detail. They were tape-recorded with the interviewee's consent and were later transcribed verbatim.

The interview schedule (Appendix 2) was structured around a set of ten 'cue' cards, each naming an aspect of nursing practice with an infection control component (see Table 5). These were identified in the literature as commonly forming the basis of hospital infection control policies (Wilson, 1995; Philpott-Howard and Casewell, 1994).

Table 5: Semi-Structured Interviews: Infection Control Topics Discussed	
Aseptic technique	Isolation precautions
Cleaning of equipment	Linen handling and disposal
Clinical waste and sharps disposal	Universal Precautions (to protect staff)
Hand hygiene	Urinary catheter care
Intravascular therapy care	Use of gloves and aprons (to protect patients)

At the beginning of the interview, respondents were asked to arrange the cards in rank order according to the extent to which they considered there to be difficulties with achieving 'good' practice. At this point, they were asked if any of the terms used in relation to each infection control practice required clarification and this was given if necessary. Each topic area was then explored according to its position in the rank order, starting with the one perceived to be most problematic. A set of key questions and associated prompts were used to ascertain individuals' perspectives of the problems encountered (see Appendix 2). The first of these required the respondent to clarify what they understood the term used in relation to the infection control practice to mean in order to ensure that this was comparable with the intended meaning. Subsequent questions were directed towards exploring the nature of problems and the measures needed to address them.

At the end of the interview, an opportunity was given to amend the original rank order and it was the amended version that was analysed. Respondents were also asked to highlight any additional concerns about infection control practice on the study ward that that had not been covered elsewhere in the interview. Finally, respondents were asked which practice they would most like to improve as a ward-based project and the reason for this.

Issues Emerging During Phase I Interview Data Collection

During the course of data collection, there was some difficulty with one or two respondents who appeared reluctant to acknowledge problems with infection control practice. This may have been indicative of a social desirability bias, whereby the respondent seeks to present a positive image. In an attempt to minimize any distortion from the researcher's position as an outsider, the researcher emphasized that she was interested in an account of reality and the difficulties involved in implementing infection control guidance. As previously mentioned, it was made clear that the interview was confidential and that findings from individual participants would not be shared with their colleagues in a way that may identify them personally. Nonetheless, the researcher was always aware of the threat to validity posed by her position, as this source of bias could not be eliminated.

Analysis of the Phase I Interview Data

The approach to the analysis of the interview data was two-fold. Firstly, the findings of the rank order exercise were analysed quantitatively to produce a mean average ranking of each of the infection control practices. Secondly, the interview transcripts were analysed qualitatively to identify the obvious and recurrent issues emerging from the data. In both analyses, a distinction was made between the responses of nurses and health care assistants to enable comparison of these two groups.

Analysis of the ranking exercise involved allocating a score to each infection control practice according to its position within the individual rank order of each respondent. To do this, one point was given to the practice ranked highest (i.e. most problematic) through to ten points for the practice ranked lowest (i.e. least problematic). The scores for each practice were then collated and a mean average score calculated. Two of the practices, namely aseptic technique and intravenous therapy were considered by health care assistants to be beyond their scope of practice. In view of this, they were not ranked and were therefore excluded from the analysis of the rank orders of health care assistants.

In addition to producing a rank order, respondents were also asked which of the infection control practices they would most like to develop as the focus of the study. The frequency with which each practice was selected was calculated accordingly and the findings were used alongside those of the rank order exercise to confirm the selection of the infection control

practice that was to become the focus of practice development during the implementation phase of the study.

The interview transcripts were analysed qualitatively using a manual approach. This involved reading each transcript repeatedly and making notes in the margin at the side of the obvious and recurrent issues raised. These were then organised in relation to each of the ten infection control practices. For each practice, the key issues for practice development were identified. This included respondents' concerns about the factors that inhibit 'good' practice and their views about the measures required to improve practice.

Following analysis of the interview data, the findings were fed back to all of the study participants to confirm the project focus. The findings revealed that the topic of isolation precautions, that is, the infection control practices relating to the isolation of patients with infectious conditions, was most frequently identified as the most problematic area of infection control practice on the study ward. Indeed, isolation precautions was ranked highest overall, both by nurses and health care assistants. In addition, it was selected by sixteen of the nineteen respondents as the area of practice they most wished to address during Phase II of the study. In view of this, the isolation precautions used during the care of patients with CDAD and MRSA was agreed to be the focus of the study.

The main indications for isolating patients on the ward were *Clostridium difficile* associated diarrhoea (CDAD) and infection or colonisation with methicillin resistant *Staphylococcus aureus* (MRSA). Indeed, these were the two conditions referred to by respondents during their interviews. As described in Chapter 1, the category of isolation precautions relating to these conditions is Contact Precautions, since both micro-organisms are transmitted principally by the contact route (Garner et al, 1996). In view of this, during the remainder of the chapter, the term 'Contact Precautions' will be used in place of the more general term 'isolation precautions', since this more accurately reflects the study focus.

Phase I - Stage 2: Structured Observations of Practice

The second part of the pre-implementation phase of data collection focused on the observation and description of nurses' and health care assistants' infection control practice in relation to Contact Precautions. This involved the development and use of a structured observation tool. The use of observation in this study has obvious relevance to the research

aims as a means to confirm the prevalence and understand the context of the issues identified from the interviews, since it enabled comparisons between participants' perceptions and the reality of practice to be made. It was also an important pre-requisite to Phase II of the study, as it allowed the researcher to become familiar with existing ward practice and informed the development of a practice guideline.

By using a structured approach to the recording of the Contact Precautions undertaken by nurses and health care assistants during interactions with patients in isolation, it was possible to provide a measure of the frequency and circumstances under which specific precautions were used. For example, it was possible to determine the number of times gloves were worn for different patient care activities and the number of times hands were washed before and after activities involving physical patient contact. This provided a way of quantifying nurses' and health care assistants' behaviour. The following account describes the exploratory work undertaken in order to develop an observation schedule, the pilot work to test the tool and the approach used in the main study for the collection and analysis of structured observation data.

Exploratory Work

The development of an observation schedule for undertaking structured observations of practice involved a period of exploratory work. Over the course of one month, the researcher spent time on the study ward to assess the feasibility of observing practice and to devise an observation schedule. Initially, this included time during early, late and night shifts in order to gain an overall picture of the way in which patient care was organised on the ward. It was established that most of the physical care of patients nursed in isolation was undertaken during the morning and in particular, between the hours of 08.00 – 10.00am. This was because patients tended to be assisted with their hygiene needs mainly at this time. A variety of other activities also took place, such as serving breakfast, dispensing medication, making the patient's bed and assisting with toileting needs. In view of this, a decision was made to conduct structured observations for periods of two hours between 08.00 – 10.00am, as this was the optimum time to observe a wide range of patient care activities representative of those typically undertaken by nurses and health care assistants.

In order to establish the required content of the observation schedule, the researcher spent some time observing and recording the Contact Precautions taken by nurses and health care

assistants during their interactions with isolated patients. There were three single rooms on the study ward that were used to isolate patients with CDAD and MRSA. They were located at one end of the ward, which was convenient for the purpose of observation. Prior to commencing observations, the researcher introduced herself to the patients in isolation and established their consent to the observations taking place. With the patients' permission, the researcher positioned herself on a chair immediately outside the isolation rooms and awaited opportunities to observe nurses' and health care assistants' practice.

Each infection control practice and patient care activity was recorded in the sequence in which it occurred so that the appropriateness of the Contact Precautions employed could be assessed as part of the analysis of the data. These initial observations informed the design of a draft observation schedule, which was further refined during subsequent observation sessions. The tool listed the Contact Precautions (i.e. glove use, apron use and hand hygiene) and the patient care activities undertaken (see Appendix 3). This enabled each observation to be recorded as a number according to the point at which it occurred during patient care. Space to record the date and time of each nurse-patient interaction, the condition that required the patient to be nursed in isolation and the designation of the participant observed (along with their personal identification code) was also incorporated. In addition, room was available to record any observations that were not pre-recorded on the schedule (such as an infrequently occurring patient care activity).

During the course of observing nurses' and health care assistants' practice, it was found that the procedure in place for the disposal of linen, clinical waste and bedpans/urine bottles was somewhat elaborate, involving the use of a 'double-bag' technique. This involved the nurse inside the patient's room placing the soiled linen/waste into a bag and then closing it. This nurse then placed the first bag into a second bag, frequently held open by a second "clean nurse" outside of the patient's room. To accurately record this process, a checklist was incorporated into the observation schedule to monitor the segregation and disposal of these items and whether or not a second member of staff was employed to assist.

To accompany the observation schedule, a numerical coding system was devised (see Appendix 4). This enabled the data to be entered into a 'Microsoft Excel' spreadsheet for the purpose of analysis. As mentioned above, an assessment of the appropriateness of the Contact Precautions employed by nurses and health care assistants was required as part of the

analysis. This was defined in accordance with recommendations in the local infection control policy and research-based evidence, as detailed in Appendix 5.

It was found necessary to apply two rules to the process of data collection to ensure consistency in the approach used. Firstly, if there was more than one patient being nursed in isolation at the time of the observation session, interactions with each of these patients was included as part of the data collected providing they occurred at different times from each other. When interactions did occur with more than one patient at a time, the one that was initiated first was observed. Likewise, on a regular basis, more than one nurse/health care assistant was involved in the care of a patient at a given point in time. Since it was difficult to accurately observe more than one person at a time, the person who first entered the patient's room was the one observed.

Consideration was given to the reliability issues associated with the use of structured observation during development of the tool. These were intra-observer reliability (or 'observer consistency') and inter-observer reliability. Robson (1997) has defined observer consistency as the extent to which an observer obtains the same results when measuring the same behaviour on different occasions, for example, when coding the same audio or video tape at an interval of a week. In this study, it was not possible to determine observer consistency, since each patient interaction could only be observed at the time it happened. However, it was possible to determine the inter-observer agreement of the tool using two observers and this was done both during the pilot work and the main study.

Pilot Work

A pilot study was undertaken to test the observation schedule prior to its use in the main study. This was conducted with a colleague in order to assess the level of inter-observer agreement. Robson (1997) has defined inter-observer reliability as the extent to which two or more observers obtain the same results when measuring the same behaviour. The ability to demonstrate good inter-observer agreement was considered important in this study to ensure that the researcher was not using the observation schedule in an idiosyncratic fashion. The use of a second observer also helped to minimise the potential effects of 'observer drift', a term used by Robson (1997) to describe changes in the way an observer uses a schedule over time as a result of increased familiarity with it.

The second observer was trained by the researcher to use the observation schedule during three separate two-hour sessions. Following this, the two observers conducted their observations independently during five two-hour sessions, which was considered to provide a reasonable sample of data, since it was anticipated that the main study would comprise sixty hours of observation. In all, twelve episodes of patient care were observed, involving a total of fifty different patient care activities and fifty-three infection control practices. The percentage of agreement between the observers was high (94%) and in view of this, the observation schedule was considered suitable for use in the main study.

As a result of the pilot work, one change was made to the observation schedule prior to its use in the main study. It concerned the inclusion of a section in the list of activities to indicate when the nurse came into direct contact with blood or other body substances. Previously, observations of this kind were required to be noted by hand on the schedule in relation to the activity being undertaken by the participant at the time. However, since the second observer's failure to record this event was the main source of disagreement between the two sets of observations, the schedule was amended to include it as a named event.

Main Study: Data Collection Procedure

Between October 1997 and July 1998, data were collected using the observation schedule that was developed and tested during the exploratory and pilot work. Observations took place between the hours of 08:00 - 10:00 in the morning, as it had been established during exploratory work that this was the most productive time to observe Contact Precautions during a wide range of patient care activities. A total of sixty hours of observation were conducted on thirty separate days when there were patients being nursed in isolation on the study ward who were agreeable to being observed.

Each interaction between a nurse/health care assistant and patient was observed from the point at which it was clear that an interaction was about to take place. This was usually on entry to the patient's room or when protective clothing was donned immediately prior to room entry. The Contact Precautions and patient care activities undertaken by the participant were then recorded on the schedule in the sequence in which they occurred. This involved accompanying the participant into the room so that their actions could be clearly seen and following them when they left the room until all activities related to care of the patient were completed. The end of the interaction was denoted as the point at which no further activity

relating to care of the patient was undertaken. This was usually self-evident, occurring either at the end of a specific task or procedure, on leaving the patient's room or at the onset of an unrelated activity such as caring for another patient.

In order to establish the reliability of the observations, a second observer was appointed to make independent observations of approximately twenty percent of the sample. This observer was an audit officer employed within the Health Care Trust, who was trained by the researcher to use the observation schedule during three separate two-hour sessions of observation. After training, both observers conducted their observations independently during five separate two-hour sessions, which amounted to thirteen of the sixty-three episodes of patient care observed. The two sets of findings were then compared to assess the level of inter-observer agreement between the observers, as described below (see under Analysis of the Structured Observation Data).

Issues with Structured Observation Data Collection

As described above, the process of conducting structured observations involved sitting outside the isolation rooms and accompanying nurses into the room whenever they interacted with the patient. In view of this, it was acknowledged that there was the potential for individuals to behave differently from usual as a result of the researcher's presence. It is difficult to assess whether or not study participants did become habituated to the researcher's presence, although the length of time spent conducting observations may have proved favourable in this respect. Also, the pattern of interactions observed was generally found to be consistent between participants and over time.

A practical problem that arose was that of limited space inside the isolation rooms. This meant that at times, it was difficult for the researcher to position herself completely out of the way, particularly when more than one participant was involved in the care of the patient. The problem was further compounded when two observers were present in order to conduct the inter-observer agreement checks. Although there was no obvious way to overcome the problem, it was minimised by the researcher remaining aware of her potential to cause an obstruction and moving herself out of the way whenever necessary. The researcher found that her presence inside the room was well tolerated, both by participants and patients and that the difficulty of limited space was handled in a good humoured way by all concerned.

Analysis of the Structured Observation Data

The data recorded on the observation schedules were entered into a 'Microsoft Excel' spreadsheet using a numerical coding system devised by the researcher during the exploratory work (see Appendix 4). This included the following parameters:

- Staff designation / personal ID code
- Infectious condition (CDAD or MRSA)
- Patient care activity
- Contact with body fluids/substances
- Infection control practice employed

In addition, as part of the process of analysing the data, an assessment was made of the appropriateness of each of the infection control practices observed in accordance with recommendations in the local infection control policy and research-based evidence (see Appendix 5). For example, a handwash was expected at each of the following times:

Table 6: Recommendations on Hand Hygiene used to Assess the Appropriateness of the Structured Observations of Hand Hygiene Practice

Local Infection Control Policy Hands should be washed: • after physical contact with the patient or their environment • after contact with faeces
Published Guidelines on Hand Hygiene (ICNA, 1998; Larson, 1995) Hands should be washed: • before invasive procedures • after patient contact • after contact with a source of micro-organisms (body fluids and substances, mucous membranes, non-intact skin, inanimate objects that are likely to be contaminated) • after visible soiling • after removing gloves

Nurses' and health care assistants' practice in relation to hand hygiene was considered to be appropriate when a handwash took place as indicated in Table 6, whereas failure to wash hands at these times was considered to be inappropriate. Similar criteria were used for each of the Contact Precautions observed, as defined during the exploratory work (see Appendix 5). In addition to this, as part of the analysis of the data, a distinction was made between

nurses and health care assistants and also CDAD and MRSA to enable comparisons to be made.

To analyse the data, 'queries' were generated and answered using the 'pivot tables' function in 'Excel'. For example, a query was generated regarding the frequency with which hand hygiene took place when indicated. This was further analysed to determine the proportion of appropriate and inappropriate practices by nurses and health care assistants when attending to patients with CDAD and MRSA. Figure 2 presents an example of the pivot table used to produce this analysis. An illustration of the results generated using this pivot table is given in Appendix 6.

Figure 2: Example of a Pivot Table used to Analyse the Appropriateness of the Contact Precautions Undertaken by Nurses and Health Care Assistants

	Column	
Row	Staff Designation ('Staff')	Infectious condition ('Bug')
Contact Precaution ('CP')	**Data** Sum of Data	
Appropriate ('OK')		
Reason ('Why')		

Inter-Observer Agreement Measures

Inter-observer agreement measures were recorded for ten of the sixty hours of observation time. During this time, simultaneous observations of thirteen patient care interactions took place, involving six registered nurses and seven health care assistants. This data was entered into a 'Microsoft Excel' spreadsheet. The spreadsheet used for the structured observation data was adapted to incorporate additional columns beside each of the existing ones so that the corresponding set of data recorded by the second observer could be entered. The two data sets were compared manually to identify any differences between them. The level of agreement was then calculated as a percentage of agreement of the total observations made. Whilst this method of calculation did not take into account the agreement between the observers that would be expected to occur by chance (Altman, 1991), it was considered to suffice, as the events being observed were generally unambiguous, the percentage of agreement was high (clearly above the traditional 90%) and the calculation was based on a reasonable sub-sample of the data (19%) (Bakeman and Gottman, 1986).

Table 7 presents a summary of the number of observations made as a proportion of the total observations over sixty hours.

Table 7: Number of Observations Made to Assess Inter-observer Agreement (as a proportion of total observations)			
	Patient care interactions (number / total observations)	Activities (number / total observations)	Contact Precautions (number / total observations)
Registered nurses	6 / 34	14 / 89	17 / 133
Health care assistants	7 / 29	43 / 206	43 / 190
Total	**13 / 63 (21%)**	**57 / 295 (19%)**	**60 / 323 (19%)**

As the table shows, fifty-seven activities and sixty Contact Precautions were observed. This represented nineteen percent of the data. The following table presents the level of agreement between the observations that were recorded.

Table 8: Level of Agreement Between Observers of the Activities and Contact Precautions Observed			
	Observations agreed	Observations disagreed	Total
Activities observed	56 (98%)	1 (2%)	57
Contact Precautions observed	58 (97%)	2 (3%)	60
Total	114 (97%)	3 (3%)	117

Of the one hundred and seventeen observations that were made one hundred and fourteen (97%) were in agreement, whilst three (3%) were not. One of the disagreements occurred because one observer (the researcher) recorded a health care assistant leaving the isolation room as an activity whilst the other observer did not. This discrepancy arose because the health care assistant left the room to collect something from the trolley situated immediately outside of the room and the second observer did not recognise that this counted as an activity (since the trolley was in such close proximity to the room). As no similar situations had previously arisen during the period of training undertaken by the second observer, this point had not been clarified.

The other two disagreements were concerned with observations of hand hygiene practice. In both cases, the second observer did not record that the health care assistant being observed had washed their hands. On the first such occasion, a handwash using the basin inside the room was missed. This was attributed in part to the practical difficulties encountered when

conducting observations in a confined space, since on this particular occasion there was more than one staff member inside the room and the two observers had to move around to allow them room to work. In so doing, the second observer did not record that the health care assistant under observation had washed her hands. On the second occasion, a nurse's use of alcohol hand rub on leaving the isolation room was not recorded. This was attributed to human error, as there was no other obvious explanation.

Phase I - Stage 3: Development of a Practice Guideline on Contact Precautions

Findings of the structured observations revealed that nurses' and health care assistants' practice in relation to Contact Precautions was sub-optimal. This confirmed the findings of the pre-implementation interviews, which uncovered the huge confusion amongst nurses and health care assistants surrounding the implementation of Contact Precautions. It was apparent that there was a real need for educational input and this was acknowledged by many of the study participants during their interviews. In particular, a request was made by respondents for the provision of a practice guideline containing clear instructions on Contact Precautions, as the existing infection control policy was considered to be insufficient in this respect. Indeed, the policy contained little practical information on the implementation of Contact Precautions, concentrating instead on the therapeutic management of CDAD and MRSA.

With the approval of the Hospital Trust's Director of Nursing and the Infection Control Team, a practice guideline was developed in consultation with study participants (see Appendix 7). It was informed by the latest research-based evidence and was designed to specifically address the concerns and deficiencies in practice identified during Phase I of the study. A draft version of the guideline was circulated for comments to all of the nurses and health care assistants on the study ward as well as other key personnel within the Trust, including the Infection Control Team and members of the Policies and Procedures Committee. The guideline was also subjected to a process of peer review by infection control nurses from across the United Kingdom. This involved devising an evaluation form and sending it along with the guideline to four infection control nurses in the first instance to test the appropriateness of the form. Following this, the guideline and evaluation form were sent to one hundred randomly selected infection control nurses (see Appendix 8) who were approached via their professional association, the Infection Control Nurses' Association (ICNA).

The guideline was widely approved by all those who provided feedback to the researcher and following some minor alterations, it was accepted for use on the study ward by the Trust's Policies and Procedures Committee. The peer review exercise yielded a total of fifty-seven responses from infection control nurses (a response rate of 55%). In general, there was broad agreement with the recommendations made within the guideline, which were considered to accurately reflect the available evidence on Contact Precautions for patients with CDAD and MRSA. However, the responses relating to one particular aspect of practice, namely the use of gloves and aprons, revealed a difference in interpretation of the evidence by some respondents. More specifically, twelve respondents (21%) considered it important to recommend the use of protective clothing routinely on entry to an isolation room, as advocated by Garner et al (1996), rather than on a more selective basis. Many of these individuals acknowledged the lack of scientific evidence to support this view, highlighting instead their own concern about the potential for non-adherence to glove and apron use. Interestingly, an almost equal number of respondents (ten) specifically stated their approval of the recommendation to use gloves and aprons selectively, with many commenting that routine use on entry to an isolation room is unwarranted. None of the respondents mentioned the problem of omissions in hand hygiene and changing of soiled gloves during patient care associated with the routine use of gloves. This was a key finding of the structured observations undertaken during Phase I of the present study, which, in addition to the scientific evidence, supported the recommendation for the selective use of gloves and aprons.

Several participants requested the provision of a summarised version of the guideline to enable quick reference to the key points. This was subsequently produced as an A4-sized poster and laminated versions were displayed inside each of the isolation rooms and also in the ward office. In addition, copies of each of the research articles on various aspects of Contact Precautions that were used to inform the content of the guideline were displayed on the notice board in the ward office to enable participants to read them first-hand.

PHASE II: IMPLEMENTATION

The purpose of the implementation phase of the study was to implement the practice guideline on Contact Precautions developed during Phase I of the study with the availability of support and instruction and to examine individual nurses' and health care assistants' responses to this process. This was achieved using participant observation, which as May (2001) suggests, has an advantage over other forms of research, since it enables an

understanding to be gained of peoples' actions and how and why they change. Indeed, as discussed in Chapter 4, this level of understanding has been lacking in previous intervention studies designed to improve the infection control practice of health care staff, since their focus has typically been outcome-oriented. The use of participant observation in the present study was therefore considered central to the research aims as a means to gain insights into the process of changing infection control practice from the perspectives of individual study participants. It also allowed further confirmation of the findings of data collected during Phase I of the study.

The researcher considered that the adoption of a participant-as-observer role as defined by Gold (1958) was the most appropriate approach to participant observation, since the researcher's role was inevitably more one of participant than observer in the research setting. Indeed, as mentioned at the beginning of the chapter, the researcher's role involved a great deal more involvement in the process of the research than that of neutral observer, since in addition to observing, she acted as a consultant, in her capacity as a specialist infection control nurse, by offering practical guidance and support to participants as they implemented the practice guideline. In nursing research, where the researcher is herself a nurse, the use of participant observation enables valuable subjective observations to be combined, in a flexible manner, with the use of professional skills and knowledge. Being an observer with specialist knowledge of infection control gave the researcher a clear role on the study ward, which was entirely credible to nurses as well as patients. The researcher's expertise also enabled her to evaluate observed actions in relation to best practice and to recognise when actions were omitted, which by their absence, would not have been observable by the uninitiated observer.

Leininger (1985), a nurse researcher, suggests that the observer's role in participant observation evolves through four phases: primarily observation, primarily observation with some participation, primarily participation with some observation and ultimately, reflective observation. The first phase, primarily observation, is considered by Leininger (1985) to be essential before interacting or participating more directly, since it permits the researcher to establish what is occurring before influencing the situation as a participant. In the present study, the researcher participated fully in nursing activities from the outset of the period of participant observation. However, having already conducted structured observations of practice as part of Phase I of the study, a detailed record had been made of nurses' and health care assistants' practice before Phase II. The approach to participant observation employed in

the present study aligned more closely with phases three and four of Leininger's model. Phase three, primarily participation, equated with the researcher's role whilst working alongside individual participants, since this involved recording issues and events that arose while participating in an activity. More specifically, participants were encouraged to ask questions and raise any issues and concerns they had about implementing the new guideline as they arose in practice. These were recorded in the form of a process record, along with the researcher's own observations.

The last phase of Leininger's observation-participation process involves the researcher undertaking reflective observations to determine the actual or potential impact upon the people in the situation or event. This is described as a process of looking back thoughtfully on what happened to recapture the situation and total process of what happened and how the people responded to the researcher. In the present study, participants themselves were engaged in the process of reflection. This took place during a reflective feedback session at the end of the shift, during which the researcher provided feedback about the observations she had made and encouraged participants to reflect critically on this. Participants' responses were included as part of the process record and contributed significantly to the data gathered during this phase of the research. Indeed, this approach enabled the researcher to clarify the processes observed in a more in-depth manner than was possible whilst actually engaging in the activity. It frequently elucidated participants' reasons for their actions and their understanding of the rationales for infection control practice. In addition, the researcher was able to check on interim findings and allow individuals to contribute their own analysis and interpretation of them. Whilst participants' perceptions of the researcher's influence on practice were not specifically explored at this point, this was addressed during the post-implementation interviews.

The approach to recording data in participant observation studies is generally in the form of a log or field notes. As Polit and Hungler (1997) point out, the success of such studies depends heavily on the quality of these records. Indeed, an obvious disadvantage of this form of data collection is that it is subject to loss or distortion due to memory. In view of this, it is essential for the researcher to record observations as quickly as possible. However, as Polit and Hungler (1997) discuss, it is not always possible to do this by openly carrying a clipboard, pens and paper or a tape recorder, since this may undermine the observer's role as an ordinary participant of the group. They suggest that the researcher must therefore develop

the skill of making detailed mental notes that can later be committed to paper or recorded on tape through dictation.

In the present study, the researcher was in fact able to make brief written notes at the time or shortly after observations were made. This did not appear to undermine her role, which was in any case distinct from that of other participants. Indeed, the researcher made clear to participants that she was interested in their views in relation to the practice guideline and as a result of this, they appeared accepting of her occasional note taking. Since nurses themselves were accustomed to making notes as they were working to act as an aide-memoire for later verbal and written reports, the researcher's behaviour did not seem particularly out of place. Additionally, as the notes made by the researcher were used to provide individual feedback to participants at the end of the shift, this helped to eliminate the suspicion that may have been created by this activity. Nonetheless, there was also a need to rely upon making detailed mental notes, which were drawn upon when the process record was written up in full.

The reliability of observational data is inevitably influenced by the use of the human self as the method of recording data. Therefore, it is influenced by the perceptions and cognitions of the researcher. Whilst these cannot be entirely eliminated, two checks were introduced. The first of these involved the use of a template for recording observations of participants' practice in relation to the practice guideline (see Appendix 9). This enabled a consistent approach to the researcher's assessment of participants' practice and provided a framework for giving them feedback. Secondly, during the reflective feedback sessions, the researcher was able to check with individuals that her notes in relation to the issues they raised during the shift had been interpreted accurately.

Data Collection Procedure

Between January and June 1999 the researcher worked for whole nursing shifts alongside each of the eighteen nurses and health care assistants who were permanently employed on the study ward, participating in the care of patients being nursed in isolation due to CDAD and MRSA. During the course of working with each individual, the researcher actively engaged in discussions about implementing the new guideline on Contact Precautions, offering advice and support by answering questions, discussing concerns, reinforcing good practice and correcting inappropriate practice. All such interactions were recorded in the form of a process record.

Maintenance of the process record involved making a brief note of all of the questions, comments and concerns raised by participants in relation to implementing the guideline at the time they were raised, or shortly afterwards. In addition, detailed mental notes were made of the context in which issues were raised. The researcher also recorded individual participants' infection control practice in relation to the practice guideline during the course of the shift spent working with them. This included occasions when the guideline was implemented correctly and incorrectly. Towards the end of the shift, the researcher made an overall assessment of the participant's infection control practice according to a template (see Appendix 9). The template ensured that the assessment was carried out in a consistent manner and provided a framework for giving feedback to participants about their practice.

Time was made at the end of each shift for a reflective feedback session. This took place in an unused day room on the ward, which provided a discrete environment with minimal interruption. The researcher facilitated a reflective conversation with each participant to provide them with feedback about the observations made in relation to their practice and encourage them to reflect critically on this. This provided an opportunity both to reinforce participants' knowledge and appropriate practice and to challenge their assumptions in relation to inappropriate practice. Brief notes were made at the time of the discussion. Immediately after the shift, the process record was written up in full in a quiet location in order to ensure the account was as accurate and complete as possible. This incorporated all of the issues raised by participants along with the relevant contextual details, the researcher's observations and assessment of participants' practice and participants' reflections on their practice.

Issues with Data Collection

The researcher's presence, both as an observer and a practitioner with expertise in infection control undoubtedly influenced participants' behaviour. Indeed, the purpose of the researcher's role during the implementation process was to actively promote best practice and ascertain participants' responses to this. During the course of data collection, the researcher found that there were differences between participants regarding the extent to which they engaged in this phase of the study. Most individuals participated fully and were willing to openly discuss their practice. However, certain others appeared reticent and seemed less comfortable about being involved. Whilst this in itself was an important finding, it also raised an ethical issue regarding the extent to which individuals felt able to opt out of

the study, since although the researcher made it clear that she would respect any individual's decision to decline to participate, nobody exercised their right to do this.

Analysis of the Process Record Data

The approach to the analysis of the process record data was both quantitative and qualitative. Quantitative analysis was undertaken to enable description of the findings as a whole. It involved organising the data under headings according to each of the infection control practices that comprise isolation precautions. In addition, two extra headings were used according to the data that was collected, one for issues about patients and their visitors and the other for general issues that did not fall within any of the other categories. Within each of these categories, the data was sub-divided into the questions, comments and concerns that were recorded. These were quantified to determine the proportion of entries recorded under each heading. In addition, the researcher's observations of practice were analysed quantitatively to determine the extent to which nurses' and health care assistants' practice was in accordance with the practice guideline.

Qualitative analysis involved examining the process record data and in particular, the questions, comments and concerns under each heading to identify the factors that influenced nurses' and health care assistants' decision-making during the care of patients nursed in isolation. Within each category, these were organised according to the themes that emerged during the analysis. Most of the data was elicited during the reflective feedback session between the researcher and each participant at the end of the shift spent working together. It revealed crucially important information about individual participants' own understanding of the rationales for infection control practice, the factors that influenced their practice and the concerns they had about changing their practice. As such, it was a critical part of the study, since it provided the explanations for practice in the context of a programme designed to improve practice. It also enabled confirmation of the findings elicited during the pre-implementation phase of the study, as the researcher checked these with individuals to allow them to contribute their own analysis and interpretation of them.

PHASE III: POST-IMPLEMENTATION

The purpose of Phase III of the study was to examine the impact of the supportive intervention on nurses' and health care assistants' practice in relation to Contact Precautions. An interview with each of the nurses and health care assistants who participated in Phase II

of the study was considered to be the most appropriate form of data collection to identify self-reported changes in infection control practice and to elucidate participants' perceptions of the impact of the supportive intervention on their practice. In so doing, it also provided a means to confirm the issues identified during Phase II of the study. As with the pre-implementation interviews, a semi-structured format was used to enable both flexibility and consistency in data collection. It involved a series of open-ended questions with associated prompts to enable consideration of each aspect of Contact Precautions and also each component of the supportive intervention (see Appendix 10). For the same reasons outlined earlier in the chapter, a decision was taken to audio-tape the interviews.

Data Collection Procedure

Between January and March 2000, six months after completion of Phase II of the study, interviews were conducted with fourteen of the eighteen nurses and health care assistants who had participated in it. In addition, the remaining four participants, who had left the ward before six months were interviewed on leaving their posts. The interviews were conducted in a quiet room away from the ward during work time and lasted for approximately thirty minutes. They were tape-recorded with the interviewee's consent and were later transcribed verbatim.

Analysis of the Interview Data

The interview transcripts were analysed qualitatively using a manual approach to examine the nature of any reported changes in practice and the factors that influenced this. In addition, an analysis was undertaken of nurses' and health care assistants' perceptions of the effectiveness of the support and instruction they received according to each aspect of the supportive intervention. The analysis involved reading each transcript repeatedly and making notes in the margin at the side of the responses relating to infection control practice and those concerning the supportive intervention. A distinction was made between nurses and health care assistants and also CDAD and MRSA to enable comparisons to be made.

Summary

In summary, the methods employed in this study enabled an in-depth exploration of nurses' and health care assistants' perspectives of infection control within the context of an intervention to improve their practice. This approach differed from previous research in this area, which has paid little attention to health care workers' own perspectives of the problems

associated with implementing infection control recommendations and has focused on the outcome rather than the process of change. In Phase I of the study, semi-structured interviews were conducted to explore study participants' views and anxieties about infection control practice and identify their priorities for practice development. Structured observations of practice were employed to confirm the prevalence of these issues and provide an understanding of their context. On this basis, a supportive intervention to improve practice in relation to Contact Precautions for patients with CDAD and MRSA was designed, incorporating the development of a practice guideline and the availability of practical instruction and support during its implementation.

In Phase II of the study, participant observations of practice were conducted to gain an understanding of study participants' behaviour and in particular, their responses to the supportive intervention. Their perceptions of its impact on their practice were ascertained in Phase III using semi-structured interviews. A detailed description of the findings of each phase of the study can be found in the following four chapters, with the findings of the semi-structured interviews undertaken during Phase I presented in Chapter 6.

CHAPTER 6

FINDINGS (1): THE RANKING EXERCISE AND INITIAL SEMI-STRUCTURED INTERVIEWS

Introduction

In this chapter, the results of the analysis of the ranking exercise and initial exploratory semi-structured interviews with nurses and health care assistants undertaken during the pre-implementation phase of the study are presented. As described in Chapter 5, the ranking exercise was undertaken to identify the area of infection control practice perceived by respondents to be the most problematic with regard to achieving 'good' practice. The interviews investigated respondents' perspectives of the problems associated with implementing infection control measures, along with their perceptions of need for support in relation to practice development. The following account presents an overview of the results of the ranking exercise and then describes the interview findings relating to each area of infection control practice. A brief description is given of the interview findings relating to the nine infection control practices that were not subsequently selected to become the focus of practice development during the implementation phase of the study. The remainder of the chapter then focuses on a detailed analysis of the interview findings relating to the practice of isolation precautions for patients with *Clostridium difficile* associated diarrhoea (CDAD) and Methicillin-resistant *Staphylococcus aureus* (MRSA), since this was found to be the main area of concern.

Characteristics of the Sample of Nurses and Health Care Assistants Interviewed

The sample consisted of all nurses and health care assistants who were permanently employed on a full or part-time basis on the study ward on either day or night duty. Analysis of the biographical details provided at the time of each interview revealed that the length of time respondents had been on the ward varied from one month to more than ten years.

Number of Interviews

Interviews were conducted with all nineteen nurses and health care assistants who met the sampling criteria, as none of the individuals approached were unwilling or unable to participate in an interview. The interviews were tape recorded and lasted on average forty-five minutes, ranging between twenty-five minutes and one hour and ten minutes. Table 9 shows the number of respondents according to their status and grade.

Table 9: Number of Interviews (Pre-Implementation)	
Status / Grade of Nurse	**Number of Interviews**
Ward Manager ('G' grade)	n=1
Senior Staff Nurse ('F' grade)	n=1
Registered Nurse ('E' grade)	n=3
Registered Nurse ('D' grade)	n=5
Health Care Assistant ('A / B' grade)	n=9
Total	**n=19**

As the table shows, there were five experienced nurses, ranging in seniority from 'E' grade Staff Nurse to 'G' grade Ward manager and five more junior 'D' grade nurses. The number of registered nurses and health care assistants on the ward was almost equal.

Results of the Ranking Exercise

As described in Chapter 5, the interviews were structured around ten key infection control practices that had been identified in the literature as forming the basis of common infection control policies. These practices were presented to respondents on pieces of card and were ranked by them according to the extent to which they perceived there to be difficulties with achieving 'good' practice on the study ward (starting with the one perceived as most problematic). At the end of the interview, an opportunity was given to amend the initial rank order and it is these amended results that are described below. There were in fact few changes to the initial findings and the changes that were made did not affect the overall outcome. The interview transcripts were also analysed qualitatively to identify the obvious and recurrent themes relating to each practice.

The quantitative analysis of the ranking exercise involved scoring each infection control practice according to its position in individual respondents' final rank order, with one point being given to the practice ranked highest (i.e. most problematic) through to ten points for the practice ranked lowest (least problematic). Respondents' scores were then collated and a mean average score for each practice calculated. In five instances, individuals were unable to rank between two and five practices separately from each other, as they perceived them to be of equal rank. For the purpose of the analysis, these practices were given identical scores according to their position. For example, one respondent considered that two practices should be ranked equally in fourth position. They were therefore both given a score of four and the remaining practices, which could be ranked separately from each other, were scored six, seven, eight, nine and ten.

Two of the practices, namely aseptic technique and intravascular therapy care were considered by the health care assistants to be beyond their scope of practice. As a result, these practices were excluded both from the ranking exercise and the main interviews with these respondents.

Table 10 presents the collated results of the ranking exercise according to nurses' and health care assistants' responses. It indicates the mean average score for each infection control practice and presents them in rank order according to the overall mean ranking.

Table 10 Results of the Rank Order Exercise: Responses of Registered Nurses (RNs) and Health Care Assistants (HCAs)

	RNs (10)		HCAs (9)		
Infection control practice	Total Score	Mean average	Total Score	Mean average	**Overall mean ranking**
Isolation precautions	24/100	2.4	15/90	1.7	**2.1**
Universal precautions (to protect staff)	45/100	4.5	33/90	3.7	**4.1**
Decontamination of equipment	53/100	5.3	32/90	3.6	**4.5**
Use of gloves and aprons (to protect patients)	49/100	4.9	48/90	5.3	**5.1**
Linen handling and disposal	67/100	6.7	38/90	4.2	**5.5**
Hand hygiene	46/100	4.6	60/90	6.7	**5.6**
Clinical waste and sharps handling and disposal	62/100	6.2	45/90	5.0	**5.6**
Urinary catheter care	66/100	6.6	46/90	5.1	**5.9**
Intravascular therapy care	62/100	6.2	-	-	**6.2**
Aseptic technique	66/100	6.6	-	-	**6.6**

As Table 10 shows, isolation precautions was identified as being the most problematic infection control practice, amongst both nurses and health care assistants. Indeed, five nurses and six health care assistants placed it at the top of their individual rank order and the remaining eight respondents ranked it within the top five most problematic areas of practice. The extent of concern in relation to isolation precautions was confirmed during the interviews, since it was discussed at length by all respondents, most of whom (16/19) identified it as the infection control practice most in need of development on the study ward. Among the other nine infection control practices, there were some differences between nurses' and health care assistants' responses as regards the mean average ranking, which are described below.

Overview of the Interview Findings Relating to the Nine Infection Control Practices Not Selected for Further Study

The following account briefly describes the findings of the qualitative analysis of interview transcripts in relation to the nine infection control practices that were not selected for further study. Whilst somewhat peripheral to the overall findings of the study, some of these findings are noteworthy in relation to isolation precautions, since they revealed a greater level of concern amongst respondents about the perceived infection risks associated with patients nursed in isolation as compared with other patients. This issue is of key importance to the present study, as revealed at various points throughout the thesis, and is discussed in detail in Chapter 10.

Universal Precautions

Universal Precautions involve the application of preventative measures, including the use of protective clothing such as gloves, gowns/aprons, protective eyewear and masks to reduce the likelihood of skin and mucous membrane exposure when contact with the blood or other body fluids of any patient is anticipated (Osterman, 1995). This practice was ranked second overall by nurses and third by health care assistants. The main problem identified by respondents was non-adherence to universal precautions and in particular, the lack of glove wearing by nurses and health care assistants on the study ward. Many respondents expressed concern that their colleagues did not always wear gloves to protect themselves from exposure to blood and body fluids. This was despite there being a good level of awareness amongst most respondents of the importance of gloves for this purpose. Very little was said in relation to other forms of protective clothing, as these were generally not considered to be necessary in most situations.

As discussed in Chapter 3, the problem of non-adherence to Universal Precautions has been widely recognised amongst health care workers in a range of health care settings. It has been attributed to various factors, including low perception of personal risk, lack of time, interference with patient care, negative influence of non-compliant work colleagues, perceived work stress and insufficient or inaccessible supplies of protective clothing (Madan et al, 2002; Preston et al, 2002; Gershon et al, 1999; Parsons et al, 1995; O'Boyle-Williams et al, 1994). In the present study, only a few respondents offered explanations for the problem, which included forgetfulness, lack of awareness and inadequate supplies of gloves. Several respondents also highlighted the difficulty with adhering to Universal Precautions in "urgent" situations, for example, when a patient is bleeding having inadvertently pulled out

their intravenous cannula. However, none of the respondents indicated that they were more likely to adhere to Universal Precautions in the presence of a known risk of blood-borne virus infection, even though this has been a key finding of other studies (Preston et al, 2002; McCarthy et al, 1999; Gershon et al, 1995). This possibly reflected the infrequency with which patients on the study ward were considered to be at risk of blood-borne virus infection.

One health care assistant acknowledged her own lack of adherence to the use of gloves when undertaking capillary blood sampling and went on to explain that in contrast to this, she always wore gloves for isolation nursing. She did not elaborate further on the reason for this difference risk perception other than to say that with isolation nursing, she wore gloves because she "didn't want to catch anything". Presumably she was far less concerned about the risk of exposure to pathogens such as blood-borne viruses, even though these represent a far more serious health threat to staff than micro-organisms such as MRSA (Ayliffe et al, 1998; Department of Heath, 1998). Interestingly, this finding concurs with those of Parsons et al (1995), who found that nurses' decisions to adhere to infection control precautions were based on their perception of risk from occupational exposure to infection.

Decontamination of Equipment

The decontamination of equipment at ward level refers to the need to thoroughly clean or disinfect patient care equipment such as washbowls and commodes between uses by different patients to minimise the risk of transmission of infection (Wilson, 2001). This procedure was ranked third overall, but was in fact second amongst health care assistants and fifth amongst nurses. This possibly reflected a difference in the priority given to this area of practice between the two groups of staff, since health care assistants were typically more involved in the decontamination of equipment as part of their day-to-day work. The main concern identified both by nurses and health care assistants was that patient care equipment such as washbowls and commodes were not always cleaned properly after use. The reasons for this included lack of time, lack of thought and lack of appreciation or concern about the risk of spreading infection via contaminated equipment. Interestingly, several respondents considered that attention was only given to this area of practice when equipment had been used by patients nursed in isolation. Others also drew attention to the difficulties encountered in relation to isolation nursing as nobody knew how equipment should be cleaned. This highlighted a difference in the level of concern amongst respondents between patients nursed

in isolation and those on the open ward, even though the procedures for decontaminating equipment should be consistent for all patients (Jackson and Lynch, 1996).

The Use of Gloves and Aprons

Aside from their use as part of Universal Precautions, gloves and aprons are used as a means to reduce the likelihood of transmitting micro-organisms from one patient to another by minimising the microbial contamination of hands and clothing in situations when this is likely to be heavy, such as washing a patient (Wilson, 2001). This practice was ranked in fourth position overall. However, there was a difference between nurses and health care assistants, as the nurses ranked it fourth whereas the health care assistants ranked it seventh out of eight. The main concern identified mostly by nurses, but also by two health care assistants, was that gloves and aprons were not being used routinely for specific patient care activities such as washing the patient. Nurses discussed this problem mainly in relation to health care assistants' practice. It was reported that gloves and aprons tended only to be used when attending to patients nursed in isolation and those with incontinence. Several respondents identified that apart from isolation nursing, aprons were hardly ever worn as an infection control measure, not even for dust-raising activities such as bed making. Reasons given for non-adherence included lack of appreciation of the rationales for glove and apron use, forgetfulness, lack of time, the discomfort of wearing gloves and aprons and inadequate supplies.

The reported non-adherence to the routine use of gloves and aprons for patients on the open ward as compared with those nursed in isolation highlighted a difference in the standard of infection control measures being applied to these two groups of patients. This is consistent with the experience of Lynch et al (1987), who identified the need for an alternative approach to traditional isolation precautions owing to the lack of emphasis on routine infection control measures for all patients when such a system is in operation. As mentioned above, this issue is of key importance to the present study and is discussed in detail in Chapter 10.

Linen Handling and Disposal

In view of the potential for used linen to be heavily contaminated with micro-organisms, its careful handling and disposal is considered an important aspect of good infection control practice (Overton, 1988). This practice was ranked in fifth position overall, although again, there was a difference between the responses of nurses and health care assistants. Indeed,

health care assistants ranked it in fourth position, whilst it was at the bottom of the nurses' mean ranking, being considered by them to be the least problematic infection control practice. The problems relating to linen handling and disposal were identified both by nurses and health care assistants and were largely concerned with sub-optimal practices such as putting used linen on the floor, carrying used linen across the ward rather than using a linen skip and incorrect segregation of linen prior to its disposal. Poor practice was attributed to lack of thought and also to there being an inadequate number of linen skips, particularly as those that were available were in a poor condition. Interestingly, no such problems were identified regarding the handling and disposal of linen from patients being nursed in isolation, which was considered to be carried out with utmost care.

Hand Hygiene

As undoubtedly the single most important infection control measure, hand hygiene is generally advocated before and after patient contact as well as before and after specific procedures on the same patient (Boyce and Pittet, 2002). However, despite the well-recognised problem of non-adherence to hand hygiene recommendations by health care workers (Pittet, 2001), in this study, the practice was ranked in only sixth position overall, possibly reflecting a difference between health care workers and infection control professionals regarding its perceived importance. Nonetheless, opinion was divided amongst the respondents regarding the degree to which it was considered problematic on the study ward. Indeed, it was ranked between first and fifth position by nine respondents (seven nurses and two health care assistants), whereas the remaining ten respondents (three nurses and seven health care assistants) ranked it between sixth and tenth position. Amongst those respondents who considered hand hygiene to be problematic, concern was expressed that nurses, health care assistants and other health care professionals did not always wash their hands when indicated in clinical practice. Reasons for this included forgetfulness, lack of time, lack of awareness of the importance of hand hygiene, the problem of sore hands and the impracticality of washing hands after every patient contact. These perceptions are consistent with those identified by health care workers in other studies (Zimakoff et al, 1992; Larson and Killien, 1982) and are among the issues that are frequently targeted for improvement by infection control professionals (Pittet, 2001). Respondents who were less concerned about handwashing in relation to other infection control practices expressed the view that nurses and health care assistants were good at it and that it was only doctors who did not wash their hands enough.

At the time when the interviews were conducted, there was in fact a major deficit in the provision of hand hygiene products on the study ward. More specifically, there was no liquid soap available at any of the clinical handwash basins. Also, there was very little alcohol-based hand rub available for use on the ward. Instead, bar soap was provided at handwash basins, even though this was not recommended by the Trust's Infection Control Team in view of the problem of microbial contamination with skin bacteria and Gram negative bacilli (Wilson, 2001). However, only five respondents (three nurses and two health care assistants) identified the absence of liquid soap as a problem and nobody at all referred to the lack of alcohol-based handrub. This reflected an apparent lack of concern about this problem amongst the majority of those interviewed.

Clinical Waste and Sharps Handling and Disposal

Waste from hospitals which may be toxic, hazardous or infectious is defined as clinical waste and its careful handling and disposal is considered an important aspect of good infection control practice (Wilson, 2001). Findings in relation to this practice revealed that sharps handling and disposal was considered by most respondents to be practiced correctly. This was reflected in its position in the ranking as seventh overall. There were no apparent differences between the views of nurses and health care assistants in this respect. Only two problems were highlighted. The first concerned a failure among doctors to dispose of sharp instruments after use, thus presenting a hazard to staff and patients. The second was the inadequacy of the storage area designated for clinical waste bags prior to removal from the ward, since this was in fact the fire escape.

Urinary Catheter Care

Urinary catheter care refers to the infection control measures taken to prevent urinary tract infection both by minimizing the duration of catheterisation and ensuring careful handling of the drainage system to avoid its contamination with pathogenic bacteria (Warren, 1997). This was ranked in eighth position overall. However, whilst most respondents (seven nurses and five health care assistants) considered that catheter care was carried out well by staff on the ward, others (three nurses and four health care assistants) identified areas of poor practice. In particular, problems were highlighted regarding the care of the drainage system such as incorrect placement of the catheter bag (either too high or on the floor), the re-use of overnight catheter bags and emptying of several catheter bags at the same time, using the same equipment, without washing hands in-between. Several nurses also highlighted a difficulty with ensuring that meatal cleansing was done, particularly as much of the nursing

care in relation to patient hygiene was carried out by health care assistants, who were unsupervised due to chronic staff shortages.

The sub-optimal practices identified by respondents in relation to urinary catheter care are among those targeted by infection control professionals to minimise the risk of catheter-related urinary tract infection (UTI) amongst hospitalised patients (Pratt et al, 2001). Indeed, catheter-related UTI is a significant cause of hospital-acquired infection (Pratt et al, 2001) and adherence to good standards of practice is essential to minimise this risk (Pratt et al, 2001). Nonetheless, most respondents in this study did not appear to appreciate this, as reflected by the low mean average ranking given to urinary catheter care despite reports of poor practice.

Intravascular Therapy Care

Intravascular therapy care refers to the careful management of intravascular devices in order to prevent device-associated infection and in particular, bloodstream infection (Wilson, 2001). As mentioned above, it was only considered by qualified nurses, since health care assistants identified that it was beyond their scope of practice. Amongst the qualified nurses, it was ranked in joint sixth position (with clinical waste and sharps handling and disposal), even though it was ninth overall. Problems identified by respondents included the lack of assessment and documentation regarding intravenous insertion sites, dressings and administration sets. However, most staff considered that these issues were being addressed by the provision of guidance and training. The only other comments made in relation to intravascular therapy care concerned the difficulty implementing routine cannula changes as recommended in local guidance, given that this relied upon doctors, who were not always willing to prioritise this. Several nurses were also critical of doctors' technique with regard to cannula insertion, having recently received training in this themselves.

Aseptic Technique

The aseptic technique aims to prevent micro-organisms on hands, surfaces or equipment from being introduced to susceptible sites on patients, such as wounds (Wilson, 2001). As with intravascular therapy care, aseptic technique was considered only by qualified nurses. This was ranked in tenth position overall and amongst qualified nurses it was in joint seventh position alongside urinary catheter care. Generally, aseptic technique was thought to work well, as most respondents considered that it had not changed much since they had first learned about it during their nurse training. Consequently, they felt confident about how to

do it and did not identify any problems. Two newly qualified nurses did express concern that they had not been formally assessed doing aseptic technique as part of their training and instead had to learn from colleagues. Both agreed that they would prefer to have been assessed in practice in accordance with the 'old-style' of nurse training, as they felt that this would have given them the confidence to know they were carrying out the technique correctly.

Summary

In summary, the rank order exercise provided a means to quantify the extent to which nurses and health care assistants considered each of the ten aspects of infection control practice to be problematic on the study ward. Whilst isolation precautions was considered to be by far the most problematic overall, difficulties were also identified with other areas of infection control practice, as described above. One theme that emerged from this data that is of particular relevance to the study findings as a whole was the apparent difference in perceived infection risks associated with patients nursed in isolation as compared with other patients. This difference in risk perception appeared to influence whether or not infection control procedures were carried out. Indeed, findings relating to the decontamination of equipment, use of gloves and aprons and linen handling and disposal indicated that two standards of infection control practice were in operation on the study ward, one for patients who were being nursed in isolation and another for patients who were not. A similar finding has been reported in other studies (Hartley-Troya et al, 1991; Lynch et al, 1990) as described in Chapter 3. This issue is of key importance to the present study, as revealed at various points throughout the thesis, and is discussed in detail in Chapter 10.

The remainder of this chapter focuses on a detailed analysis of the interview findings relating to isolation precautions. This area of practice was ranked highest overall and owing to the strong consensus of opinion amongst both nurses and health care assistants, it was agreed to be the focus for practice development on the study ward.

Interview Findings Relating to Isolation Precautions

As described above, quantitative analysis of the interview data revealed that the practice of isolation precautions was by far the greatest area of concern amongst respondents. Indeed, all respondents discussed the subject at length, with most (16/19) devoting more time to it than to any other subject. Moreover, most respondents (16/19) expressed a preference for improving isolation precautions as a ward-based practice development project. In view of

this, it was selected as the focus of the study. The following account presents a detailed analysis of the interview findings relating to the practice of isolation precautions. It concerns two infectious conditions in particular, *Clostridium difficile* associated diarrhoea (CDAD) and Methicillin resistant *Staphylococcus aureus* (MRSA), since these were the main indications for nursing patients in isolation on the study ward. As described in Chapter 1, the category of isolation precautions relating to these two conditions is Contact Precautions, since both of these micro-organisms are transmitted principally by the contact route (Garner et al, 1996). In view of this, the term 'Contact Precautions' will be used in place of the more general term 'isolation precautions', since this more accurately reflects the findings.

Findings of the qualitative analysis of the interview transcripts revealed that there were three main headings under which emergent themes could be organised. Table 11 presents the themes identified during the analysis according to each of these headings. The findings relating to each theme are described in more detail below.

Table 11: Interview data: Themes Arising From The Analysis of Interview Data on Contact Precautions

1. Confusion and conflict about Contact Precautions	2. Other issues / concerns about Contact Precautions	3. Measures required to promote good practice
• Inadequate knowledge base • Lack of information • Uncertainty about procedures and rationales for practice • Inconsistent practice • Doubts about the effectiveness of Contact Precautions • Risks to staff health	• Non-adherence to Contact Precautions • Inadequate isolation facilities • Detrimental effects on patients	• Educational input • Practice guideline • Support with practical implementation

1. Confusion and Conflict about Contact Precautions

A key finding that emerged repeatedly from the data was the huge confusion and conflict that was felt to exist amongst staff on the study ward regarding the correct way to implement Contact Precautions. For qualified nurses, this presented a major difficulty, as they were uncertain about the rationales for practice and were unable to provide clear instructions to more junior nursing staff, colleagues from other disciplines and patients and their visitors about the correct procedures to follow, despite being looked upon to do so. Health care assistants found the inconsistencies in practice amongst qualified nurses to be highly frustrating, not least because they felt obliged to adapt their own practice on a day-to-day basis according to the preferences of the individual nurse they were working with. The confusion that existed on the study ward was attributed to a lack of knowledge and

information. In addition to this, doubts were expressed about the effectiveness of Contact Precautions and there were concerns about the risks to staff from exposure to infection.

Inadequate Knowledge Base

Table 12 presents examples of the findings relating to the lack of knowledge amongst nurses and health care assistants. Data from the interview transcripts clearly demonstrated that there was a lack of knowledge with respect to basic microbiology and infection control principles among nurses and health care assistants alike. Some respondents openly admitted their own lack of knowledge and also referred to the problem as a general issue on the study ward. In order to practice safely, it would be reasonable to expect qualified nurses to have a basic understanding of how micro-organisms are transmitted in hospitals and the infection control practices required to prevent this. They should also be able to impart this knowledge to health care assistants, who may not have received any formal training on the subject. However, misconceptions about how infection is spread were commonplace among both nurses and health care assistants. This was especially true of MRSA, which was frequently thought to be spread via the air, with little or no apparent awareness that the contact route is its main route of spread. Potentially, this had huge implications for practice, since the infection control practices required to prevent contact transmission of infection may have been undervalued by study participants. Indeed, the fact that hand hygiene was rarely mentioned by them in the context of Contact Precautions nursing suggests that this may have been the case.

Whilst in general, there seemed to be greater awareness, both amongst nurses and health care assistants that *Clostridium difficile* is spread by contact, one respondent remained unconvinced of this, as the excerpt from 'HCA 04' in Table 12 demonstrates. In addition, several nurses and health care assistants expressed concerns in vague and inaccurate terms about the potential to spread *Clostridium difficile* or infection in general when taking items such as bedpans and linen bags through the ward, which demonstrated that they were not entirely clear about the ways in which the transmission of infection may occur. Again, this had clear implications for practice, as efforts to control the spread of infection appeared to be misplaced. For example, a great deal of emphasis was placed on the need to somehow 'contain' infection within the isolation room by the use of plastic bags and sacks to 'double-bag' linen, waste and bedpans before their removal and there was much concern about the risks involved with leaving the isolation room door open. Yet as mentioned above, very little was said about the importance of hand hygiene as a Contact Precaution.

Table 12: Examples of the Interview Findings Relating to Lack of Knowledge	
Lack of knowledge of basic microbiology and infection control principles	"There are a lot of question marks about a lot of things. And sometimes you probably feel that maybe I should know this and I feel a bit silly asking. So should I ask... probably not, and I just get on with it... Because all we know for barrier nursing is that you put gloves and aprons on, go in, wash your hands and come out. That's all we know about barrier nursing. This is the basic knowledge, which doesn't include cleaning of equipment or anything..." RN 503 "I would just like to know exactly what I'm going into and what I'm supposed to do. I think we all would." HCA 01
Misconceptions about the spread of infection	"...MRSA is airborne anyway, you know. You open the door and whoosh, that's it." RN 403 "If the door is left open, it's going to let infection out. It's a possibility. All it needs is a small draft and the door just unlatched and out it goes." HCA 06 "Well Clostridium, you only spread it by touching it don't you. Its just like diarrhoea, so you know what you're dealing with. Its in one place. Its as simple as that. Whereas MRSA, if that's sort of in the air and everywhere, its a different thing isn't it.... You know, its a bit like catching flu off other people." HCA 02 "I mean they say that Clostridium isn't airborne. I'm sorry, but I don't believe that. I don't believe it. Because how do people keep on getting infected all the time? You can't tell me that its the drugs every time. That because they're old, they have low resistance. I mean something's going wrong, dreadfully wrong." HCA 04
Vague and inaccurate descriptions of the spread of infection	"Because the thing is you know, you've got patients in the room and obviously you can't bring the laundry out, so you put it in the white bag and then inside the red bag and then you've got to drag it all the way down the ward to get rid of it down the fire escape.... Obviously that's a problem. Although its bagged and whatever in the appropriate bags, we're still having to bring that contaminated laundry down the ward passed all the other patients." RN 301 "But I still think something should be done, where you don't have to take faeces through the ward. I know you put it in the bag and then you carry it out, but you've still got to take it through the ward, haven't you?" HCA 01
Difficulty conceptualising germs when their effects are not apparent	"...sometimes you get people who have been on the ward for a couple of weeks and then get it [MRSA]. So you don't know whether they came with it or whether they got it on the ward. You'll never really know. Its all a bit invisible isn't it with MRSA? I mean Clostridium is different because you know where you are with that.... you can see it basically. Its as simple as that." HCA 02 "I find I'm much more willing to gown up and put my gloves on and things like that and barrier nurse a Clostridium patient than I am for an MRSA patient....Because I've rarely come across a patient with MRSA that seems any iller because they've got MRSA.....Something like Clostridium, probably because its a visible thing in terms of the effects of the Clostridium, you know when your patient's got Clostridium, but you don't know when your patient's got MRSA. .....Apart from maybe the odd raised temperature every now and then or you know. So maybe it is just that. Because you can see it, or see the effects of it, therefore its more important." RN 403

Some nurses and health care assistants described the difficulty they had making sense of MRSA in particular, due to its 'invisiblity'. This reflected the fact that MRSA more frequently colonises patients (i.e. is present in or on the patient but without clinical signs and symptoms of infection) than causes an infection (Ayliffe et al, 1998). As patients rarely seemed to suffer ill-effects as a result of being 'MRSA positive', respondents found the condition difficult to conceptualise. In contrast, *Clostridium difficile* was considered to be easier to understand due to the more 'visible' effect of diarrhoea. This difference between the two conditions also had an impact on adherence to infection control procedures, as several respondents indicated that they were more inclined to adhere to infection control measures for patents with CDAD than for those with MRSA. The issue of non-adherence to Contact Precautions is discussed in more detail below (see under 'Non-adherence to Contact Precautions).

Lack of Information

Findings regarding the information available to nursing staff about Contact Precautions revealed perceptions amongst both nurses and health care assistants that this was either lacking or inadequate. There was in fact an infection control policy on the ward that provided general guidance on the management of patients with CDAD and MRSA, although it included little practical information on the implementation of Contact Precautions. Among the nurses who were familiar with the policy, several highlighted its lack of clarity and the problem that it was not necessarily referred to in practice. Instead, there appeared to be much reliance upon verbal information, either from discussions with colleagues on the ward, nurses on other wards, senior nurses with managerial responsibility or the infection control team.

However, concerns were raised that this form of information was not always available and was not necessarily reliable, particularly when it came from other ward-based nurses. Several nurses identified the need for practice to be research-based, but referred to the difficulties they experienced gaining access to research-based information. Dissatisfaction was also expressed about the way in which 'official' information was disseminated, as this was perceived to be inadequate. Table 13 presents examples of the issues identified by nurses and health care assistants from the analysis of the interview data.

Table 13: Examples of Issues Regarding the Provision of Information	
Lack of awareness of infection control policy	"There's not enough information I don't think..... as to how you should clean the equipment or how you should dispose of things. I mean I might be totally wrong, but as far as I know, I don't know of anywhere that we've got that procedure written down that we can follow..... The only thing that we do is ring up the infection control people." HCA 05 "..... the policies are put away in a folder and I don't think many people do know about it, especially... I'm not saying all qualified nurses look at it, but I'm talking about probably auxillaries, nursing assistants, students, the staff who just come in for the day, agency, bank." RN 503
Infection control policy not referred to	"I think there's the folders on the ward with like the uhm... procedures in them. Principles for practice and things like that. There is one on MRSA, but I can't remember what other ones there are but I think there are a few things in there. Not everyone looks at them." RN 402
Infection control policy unclear	"There's no specific instructions about anything really. There is this policy there, which is not very clear about every single detail. Its just a basic policy just to give you a rough idea." RN 503
Relying on verbal information	"..... MRSA is forever changing, whether you wash walls down or you don't or... you know, all this information. And we're just getting it all hear say, or having to ring round all these different people to find out." RN 502 "I mean I've known times when there was something about an infected patient we weren't sure exactly what we were supposed to be doing. So we've tried to phone around the bleep holder and phone the wards and no one seems to know..... And like at weekends of course, you can't get hold of the infection people. So it makes things difficult. So you're back to square one and you're not sure whether you are carrying out the right procedures or not." HCA 05
Difficulty accessing research-based information	"...You don't want to look really silly in front of a student. You want to make sure that you know you're stuff and have research and stuff like this to back it up. But its quite difficult to find research to back it up in the first place. I personally haven't been looking deeply enough, but if I want just basic information, I can't get it." RN 503

Uncertainty about Procedures and Rationales for Practice

The lack of knowledge and perceived lack of information amongst both nurses and health care assistants resulted in a great deal of uncertainty about the correct way to implement Contact Precautions, as individuals were unclear about the rationales for practice. Table 14 presents examples of the issues raised in relation to this.

Several nurses could see that some of the procedures were irrational and having to continue doing them was potentially de-motivating. For example, the routine donning of protective clothing irrespective of the patient care activity being undertaken is illogical (Wilson, 1995), since there is little likelihood of heavily contaminating either hands or clothing when undertaking activities such as talking or delivering a meal, given that they involve minimal physical contact between the nurse and patient. As one nurse said:

"I think logically for Clostridium, I don't need to gown myself, glove myself if I just want to walk in the room. Whereas you see a lot of staff do it, either through lack of knowledge or whatever, but they do do it and you think that if they're doing it, why don't I do it. Because somebody else will come up and ask me, look she went in with gloves and you're not. So you just do it just to stop confusing people."

RN 503

Table 14: Examples of Procedures Causing Confusion and Conflict	
Isolating the patient	"I mean they have MRSA and we're doing all this barrier nursing and then I've seen them wheel a patient down to X-ray. I mean it seems daft doesn't it?" HCA 02
Cleaning of equipment	"Well, the one I find difficult is about the cleaning of the equipment when they take it out of the room, when a patient is in there who's infected with MRSA or Clostridium or whatever. What we should actually be doing with the equipment, and how it should be cleaned." HCA 05
Removing equipment from room	"And emptying urinals and things. I mean I don't know what the actual procedure is thinking about it, but I just cover it up as best I can and just carry it down the ward like that. Are you supposed to transfer it to another urinal or something through the door?" RN 506
Disposal of linen / waste	"Now, linen goes in one colour bag, what colour bag do you have for the rubbish? And its all silly little things, but its all things you need to know." HCA 01
Room cleaning	"Well its literally when the patient goes, how much of the room should be cleaned and with what. Literally the procedure of how the room should be cleaned, how well it should be cleaned and what it should be cleaned with." HCA 05
Protective clothing	"If you're just going in to give a tablet to a patient, to put it in a lay man's term, would you just catch it [MRSA] just by giving the tablet with your bare hands without gloves on?" RN 503 "If its airborne, you're practically breathing it in, so why do we not wear masks." RN 503
Crockery	"I mean there's problems with crockery sometimes and there's confusion over whether they're meant to have paper plates, so that can be a bit of a problem. RN 401
Unused disposable equipment	"If the patient is transferred elsewhere or whatever, that dressing... I mean I'd normally chuck it. I don't bring it out again. Now I don't know if you're supposed to chuck it or bring it out. I mean things that we haven't used. There's dressing packs that have been left there, NA dressings and things like that, that haven't been opened. But can we take it back to the clinical room, or do we have to discard it?" RN 302
Leaving the isolation room door open	"I've heard can you leave the patient's door open? A lot of patients want their door open, so you come on and find that it is left open and I know it should be kept shut." RN 403
Procedure when a patient dies	"I'm not sure about the disposal of bodies when they've got MRSA..... Its like we had one this morning who was MRSA positive and he died. I didn't know whether there was any special procedure for that. I mean nobody seems to know anything about that..... The body was taken away because we only just had the phone call through that he was MRSA positive. And of course we laid the body out and then the body was taken away. So whether we did the right thing or not, we're not sure." HCA 05

The situation was further compounded by perceptions that the recommendations kept changing and by the differing practices of individuals who had previously worked in other hospitals with different systems. As one nurse said:

"It was also different, so when I came here, if somebody said right this patient's being barrier nursed, you would think that the barrier nursing policy was the same everywhere, so you think its the same here. But then you go to find out and its different. And somebody will just say you haven't read the policy. But sometimes you feel that don't just say you haven't read the policy. Policies may be different from health authority to health authority and not the same."

RN 503

Inconsistent Practice

Not surprisingly, there were wide variations in practice between individuals, which were a cause of conflict and frustration for nurses and health care assistants alike. Table 15 presents examples of the issues raised in relation to this.

Table 15: Examples of Concerns Relating to Inconsistencies in Practice

Frustration arising from the inconsistent approach to practice	"I mean that's [isolation precautions] the only thing on our ward where people just get absolutely sick of it. You know, everybody doing it differently. One day your supposed to be doing it this way and the next day they say you don't have to do that any more." HCA 02
Difficulties for health care assistants and student nurses arising from the inconsistencies in practice amongst qualified nurses	"Well, some people stand in the room and hand it [bedpan] out to somebody who puts it in a yellow bag and takes it down to the sluice. Some people walk out of the room with their gloves and apron on, with the urine bottle or bed pan or whatever in the yellow bag and walk down to the sluice with it and empty it that way. I mean it just depends who you are and who you are working with and what ways they've got of doing it really. Its very difficult because you know, you feel as you though you've got to be on your toes all the time, because some trained staff think it should be done one way and some trained staff think it should be another, so depending on who you are working with, you've got to like, go to their ways of doing things, or else they say "why didn't you do it like that?" HCA 05 "They're [students] on their first placements and they just haven' t got a clue about any of it. So you know, its very difficult because if they work with one person, they are a bit similar to us. I mean, if they work with some people they'll tell them one procedure and if they work with somebody else the next day, then somebody else will tell them something completely different..... Which I think they find very confusing. But I mean it must be quite hard, even harder for them, because they are the ones that are supposed to be learning about it. And I mean they'll probably go to another ward and its totally different. Like I said, some wards don't bother to shut the doors or put gloves and apron on and things, so..." HCA 05
Qualified nurses' inability to provide clear instructions on Contact Precautions	"The isolation policy is confusing and a lot of other staff, students, come to me and I have to know about this to tell them. If I'm unsure, if I give them the wrong information, then they're going to carry on practising that." RN 506 "I had this problem once with a relative of one of the patients being barrier nursed for MRSA. She asked me why do I need to put on all this just to go in and I said that it's a precaution because MRSA is airborne. And she said in that case, why don't we have to wear a mask or something as well so you won't inhale it, which I couldn't answer. So I said that's a good question, but I'll have to find out about that." RN 503

The frustration caused by the unstandardised approach to practice was highly apparent from the interview data. Indeed, it was one of the main reasons given for selecting Contact Precautions as the area of practice most in need of development. Health care assistants identified the difficulties they experienced when working alongside different qualified nurses, as they felt obliged to adapt their own practice on a day-to-day basis according to the preferences of the individual nurse they were working with. The potential difficulty for student nurses was also highlighted, since they were also exposed to these inconsistencies. Nurses also recognised these problems and expressed concern about being expected to take the lead on implementing Contact Precautions, since they were advising more junior nursing staff, colleagues from other disciplines and patients and their visitors about the required infection control procedures without necessarily feeling equipped to do so.

Doubts about the Effectiveness of Contact Precautions

In addition to the uncertainty about the correct way to implement isolation precautions, there were doubts about the effectiveness of the infection control procedures being undertaken. Table 16 presents examples of the issues raised in relation to this.

Table 16: Examples of Doubts about the Effectiveness of Contact Precautions

Perceived inadequacy of gloves and aprons to prevent the spread of infection	"To be truthful, I can't honestly see how with the likes of MRSA, a pair of gloves and an apron can protect you..... because it an airborne thing and I mean it's on your hair, its on your face, its on your skin, your clothes. I mean just putting a plastic apron and a pair of gloves on, I've still got it on my uniform and then I come out of the room having washed my hands and whatever, and then go and deal with another patient, and its still going to be on me." HCA 05 "I mean I don't know where the information comes from that you know, the wearing of gloves and aprons does prevent the spread of MRSA. I don't know if its been like totally proven. It just seems a bit inadequate to me." RN 403
Perceived need to wear more in the way of protective clothing	"But I regard these plastic aprons as useless. .....Other staff think it's a waste of time too really, because to be honest, they only cover the front bit don't they? .....I think we should have proper gowns to be quite honest, especially when it's someone really infectious." HCA 01 "It just seems more of a show. Because it is so impractical, the actual... like I say wearing of aprons and gloves... gloves not so much, but wearing of an apron I think is totally impractical. Because in theory, you know, you should be wearing a spacesuit or something!" RN 403

Table 16 (continued)	
Perceived inadequacy of cleaning procedures	"When it [nebulising machine] was removed from the infected patient to the un-infected patient, all that was happened was it was wiped down with the alcohol wipes..... Well I'm not sure that that would be quite enough to actually clean it. I don't know. It's very difficult if you haven't got any other equipment you can use. I mean with equipment like that, you can't take it apart and clean all the insides and everything..... But I don't know. I mean you just have to hope that the other patient doesn't get MRSA." HCA 05 "Whether to use disposable plates and cutlery and things like that. I mean that's not happening with barrier nursing here now and that quite surprised me. I mean I would have thought that if people are eating with non-disposable crockery and if the standard of washing up isn't as good as it should be, then once again, we're all only human. There's no washing up machine or anything on the ward. I think its done in pretty hot water, but that's pretty scary really." RN 506 "But when a patient dies who's got MRSA, I'm very surprised that they don't fumigate the room, that anybody can wash the room. The nurses just wash the room, they don't fumigate it. They used to, but they don't seem to anymore. I think it should be done. At one time, they used to clean it, disinfect it and then just leave it for a couple of days or so. But now, you might get a patient going in there within an hour or so..... I wouldn't like to be the person going in that room." HCA 09

The main area of concern amongst both nurses and health care assistants was the perceived lack of coverage of protective clothing (i.e. gloves and aprons). Generally, respondents believed the protection given by gloves and aprons to be inadequate, both to prevent the spread of infection between patients and to protect themselves from exposure to infection. For MRSA in particular, the value of gloves and aprons was frequently questioned due to concerns about airborne spread. In view of these concerns, some respondents considered that there was a need to wear more in the way of protective clothing.

Other issues regarding the perceived ineffectiveness of Contact Precautions related to specific practices, such as the cleaning procedures for patient care equipment, crockery and the isolation room itself. Concerns were also raised about the inadequacy of isolation facilities on the study ward, which are described below (see under 'Inadequate facilities').

Risks to Staff Health

As the above findings about the perceived ineffectiveness of glove and apron use indicate, there was considerable anxiety amongst respondents, especially health care assistants, about the risk of catching an infection from patients being nursed in isolation. Fears were also expressed about the possibility of taking infection home and thereby exposing family members to it. The uncertainty amongst qualified nurses surrounding the risks associated with *Clostridium difficile* and MRSA meant that they were unable to provide reassurance to

more junior members of staff about the adequacy of the measures they were taking. It was also evident that decisions about when to use protective clothing were frequently based on the perceived need for personal protection from infection as opposed to the need to protect patients from infection. This had a major implication in practice, as revealed in Chapter 7 (Findings of the Structured Observations of Practice), since it transpired that study participants overlooked the need to change gloves and wash hands between 'dirty' and 'clean' procedures when nursing isolated patients. Several respondents commented on the lack of staff screening for MRSA, both out of concern for their own health and that of other patients. The following excerpts are examples of the issues raised.

Table 17: Examples of Concerns about Risks to Staff Health	
Lack of protection by gloves and aprons	"Well its just asking when they mentioned MRSA, because they use a lot of abbreviations and things like that, and I just said to them, well what is this? They said that you've got to barrier nurse and protect yourself and all that and I thought well I want to know what this is that I'm going into. And then that's when it was explained to me by the trained nurses what it is and why you're protecting yourself. But then when I saw what they were using, it was just a joke really." HCA 07
Taking infection home	"Well I feel angry at times, because I've got to wear this overall home and I could be taking it [MRSA] home to my husband. So you know, I could be taking it into my house." HCA 08
Use of protective clothing	"So I think possibly that the reason [why people wear gloves] is because if you could get anything from those bodily fluids, that tends to frighten people into it thinking I'd better put some gloves on, because I could get Clostridium or, I could get you know?" HCA 05 "....I mean if its something that you're only going to catch if you touch them, then maybe you don't need to put gloves and aprons on every time you go in there if you're just going to... not going to touch them or anything." RN 402
Lack of staff screening for MRSA	"But I don't feel there's enough protection for us. And as I say, when you've got patients with MRSA, I mean I've been here for two years and I've never been swabbed. I think all staff should be swabbed when its on the ward. At least it shows they're concerned about our protection as well." HCA 07
Avoiding isolation rooms	"People don't want to go into the siderooms too often really.... in case they catch anything." HCA 09

2. Other Issues / Concerns about Contact Precautions

Several other issues compounded the confusion and conflict experienced by respondents when attempting to implement contact precautions on the study ward. These are described below.

Non-Adherence to Contact Precautions

The issue of non-adherence to Contact Precautions was highlighted by almost all of those interviewed. This was mainly in relation to medical staff, who were considered to be the key offenders. Respondents found the problem frustrating and potentially de-moralising, as the examples in Table 18 illustrate.

Table 18: Examples of Concerns about Non-adherence to Contact Precautions

Respondents' frustration about non-adherence by medical staff	"I understand how they [micro-organisms] are taken from one hospital to another, because the consultants walk in there, even though they know its supposed to be gloves and aprons, they walk in there, see the patient and come back out again. And they go to another hospital, another patient, another ward and I can honestly see sometimes how it is taken from one place to another. But what can you say? Well, I find it very hard. What's the point of having a patient in isolation if its going to be carried around that way. I mean if you get consultants or doctors or anybody going in there without an apron and gloves and any other precautions that you can take, what's the point of having a patient in isolation ?" HCA 05
Doctors' lack of knowledge about Contact Precautions	"You'd think the doctors would know better, but they don't seem to know. Why I don't know. Perhaps they're not educated about it." HCA 02
Nurses' lack of confidence to correct doctors' poor practice	"I don't mind telling them [doctors] as long as I am sure and I know what I'm saying. I don't want to be saying something, then somebody come up and contradict me and make me feel like a fool. Or I'd wish I hadn't said anything in the first place." RN 503
Doctor's disregarding nurses' instructions	"Well doctors have just got no idea...I mean the others are not too bad, social workers and everything, once you've explained to them, they're OK with it. They'll do what they're supposed to do. Liaison sisters and any other multidisciplinary team members are fine once you've explained it to them. Its just the doctors really. They've got a law to themselves." RN 302
Inability to link poor practice to the spread of infection	"So of course you know, people who may go in without the gloves on just this one time, I won't bother just to do this little thing you know, they could well... and if someone ends up with Clostridium out on the main ward, it could be them. But then of course you're covered because it could be so many other people." RN 403

Non-adherence was attributed in part to the lack of knowledge amongst doctors and professionals allied to medicine as regards the correct way to implement Contact Precautions. Qualified nurses acknowledged their own role in informing colleagues from other disciplines about correct procedures, even though they themselves were not clear about them. However, whilst in general, most of these colleagues were considered to be receptive to the instructions given to them by nurses, some doctors seemingly disregarded them.

Very little was said about non-adherence to Contact Precautions amongst nurses and health care assistants on the study ward, which may imply that respondents generally believed themselves to be compliant. Notwithstanding, a few examples of sub-optimal practice were

described and were attributed to complacency, pressure of work and lack of thought. The inability to link the spread of infection to a given individual's poor practice was also considered to be a negative influence.

Inadequate Isolation Facilities

The facilities for isolating patients with infections were frequently identified as a problem by nurses and health care assistants. Table 19 presents examples of the issues raised in relation to this.

Table 19: Examples of Concerns about Inadequate Isolation Facilities	
Lack of an en-suite toilet	"I don't think its [the ward] very well laid out. I mean if you're really trying to isolate someone, its very difficult on our ward because for a start, you've got no toilet facilities near. You've got to carry commodes and empty them all the way down the ward and back up again and it's not really.... it's not really ideal. I mean ideally, I guess they'd have their own separate toilets and things like that. I think that's one of the main problems, having to carry things all the way down the ward." RN 402
Lack of an ante-room	"A lot of people actually say they can't see what the point of us actually isolating some of the patients any way. Because we never carry out the proper isolation procedures here, because of the rooms being as they are. I mean in other hospitals they have like double doors and things like that in between. So I mean some of the staff, I've heard them say you know, "Well, you can't do proper isolation procedures here, so..." HCA 05
Inadequate number of single rooms	"It [lack of isolation rooms] makes a mockery of it [the policy] I think. Because if its good for one it should be good for everybody. You either nurse them on the main ward or you nurse them in a single room. I mean if they've got the same problem, why is it alright for one and not alright for the other?" RN 302
Perceived need for a separate isolation ward	"What I would like to see is a ward maybe that's been closed down, opened up totally for isolation. You know, and put the people who have Clostridium in there. I mean its not their fault they've got it. Its not their fault they have MRSA, but it seems that there's an awful lot of people who are now getting MRSA and are getting Clostridium and you can't put them on a ward without infecting everybody else." HCA 04 "I think that people with infectious things that are considered serious, which I think CDT is, I don't think should be on a general ward. I really don't. I don't think we should be exposing everybody else to them. I think it would be good if it was actually recognised as a specialty in its own right, with its own ward." RN 506

Concerns were raised about the lack of en-suite toilets and about there being no 'ante-room' between the isolation rooms and the main ward. Many respondents also raised the problem of not always having enough single rooms to accommodate patients in need of isolation, as this was considered to make a mockery of the system of Contact Precautions. These difficulties were potentially de-motivating, as respondents considered that their own efforts to prevent the spread of infection were insufficient in the absence of what they regarded to be

'proper' facilities. Several respondents expressed the view that there should be a separate isolation ward for patients with conditions such as MRSA and *Clostridium difficile*. These findings suggest that study participants experienced a lack of control in relation to their perceived ability to minimise the risks of spreading CDAD and MRSA amongst patients on the study ward.

Detrimental Effects of Isolation on Patients

The potential for patients to experience detrimental effects as a result of their isolation was identified by most of the nurses and health care assistants interviewed. Concerns were expressed about patients becoming bored, lonely and depressed, due to the lack of social contact with staff and other patients. Respondents considered there to be inadequate time to spend with patients in isolation and acknowledged that often, only their physical needs were met. Table 20 presents examples of the concerns raised.

Table 20: Examples of Concerns about the Detrimental Effects of Isolation on Patients

Lack of social contact causing patients to become depressed	"I get concerned sometimes. I think the problem is that people get put into a side room and you go in and do what you have to do if they need care and assistance with washing or whatever, they get that input. But honestly, I'd say sometimes that they don't get a lot of input in the side rooms. They tend to spend many hours on their own, which I think can be very detrimental sometimes and a lot of them get very depressed, very down." RN 401
Lack of time to spend with isolated patients	"And they're saying why am I here and you're having to explain you've got this bug you know, and you can't spend the time with them because you've got people on the ward. And you only really go in there, to be honest, for cleaning them up or taking in their meals but you just don't go in there to sit, because you can't do it. You just don't have the time." HCA 04

3. Measures Required to Promote 'Good' Practice

During the interviews, respondents were asked what they thought was needed to improve practice on the study ward. Analysis of the findings revealed a real need for educational input. A practice guideline was also requested, along with support during practical implementation so that issues could be discussed on an on-going basis.

Educational Input

The perceived need for educational input was apparent, given the many requests, both from nurses and health care assistants, for some sort of training to be provided. Respondents were keen to establish how effective Contact Precautions actually are and what the correct procedures should be. Table 21 presents some examples of the comments made about this.

Table 21: Examples of the Perceived Need for Educational Input in Relation to Contact Precautions	
Need for educational input to clarify how to carry out Contact Precautions	"I think everybody should be told exactly what they should do, because some people haven't got any idea, really. And I think it would be nice if you could have a session on it where people could be told exactly how you should treat an isolated person.... It would make all the difference in the world if we knew exactly what's supposed to be done and what isn't supposed to be done..... And if you could explain to others when you got the details yourself properly, you know what I mean? Its the why's and wherefore's that I think that everyone should know about. Its not just do it, you should know why you have to do it. And I think that's very important." HCA 01 "I think it would be a subject worth bringing up and having formal or informal teaching sessions about it. Actually going through the procedures of isolating patients and looking at the things that just aren't practical and deciding the best way to compromise." RN 506

Practice Guideline

Nurses and health care assistants also identified the need for a practice guideline, so that clear instructions were available to refer to. This was despite the fact that several nurses had highlighted that written guidelines tended not to be referred to in practice (as referred to above, under 'Lack of information'). It was considered important that any such recommendations were practical so that they could be easily implemented on the ward. Several respondents suggested that guidance should be displayed on the door of each isolation room so that it was easily accessible. The desire for practice to become consistent was also considered important. Indeed, one health care assistant considered this to be a higher priority than the need for the instructions themselves to be correct. Table 22 presents some examples of these issues.

Table 22: Examples of Interview Findings Relating to the Perceived Need for a Practice Guideline	
Need for a tailor-made guideline	"I mean where does the infection control information come from. Who decides that we should do this. Do you see what I mean? Maybe we should have a look at what procedures we've got on the ward and what procedures we ought to do. Because I mean maybe what they're saying is not really practical to what we've got and what we're doing on the ward. Do you see what I mean? Maybe we could have a protocol of our own to suit us." HCA 03
Need to display guideline for easy reference	"I would like clear instructions really. Because we've got the three cubicles. If we could just print out one and then just photocopy it and just put it on the door, that the patient's being barrier nursed, this is what you should do." RN 503
The need for practice to be consistent	"Well even if we were all doing the same thing and it was a sort of black and white written procedure, whether it was right or wrong, it wouldn't really matter, if we were all doing the same." HCA 02

Support with Practical Implementation

It was evident that some kind of support was considered necessary to ensure that Contact Precautions could be implemented successfully. Although the form this should take was not articulated in detail, several respondents suggested that there was a need for some sort of practical supervision so that help would be available should queries arise. Table 23 presents some examples of the comments made about this.

Table 23: Examples of the Perceived Need For Support with Practical Implementation of Contact Precautions

The need for assistance from an infection control specialist in person	"We need somebody who can come and help us if we need anything. Somebody who knows all about these sorts of things to tell us that its fine for you to do this, you can take this in, but as long as you don't leave it in too long or as long as you wipe it clean. Something so that we know everybody is doing the same thing really." RN503 "I think we should have a meeting with everybody and discuss what we can do and what we can't do. Different people get different stories about what's supposed to be done. If it came from the horse's mouth, we can then ask questions, why this and why not that." RN 302 "I think people need to have clarification of what the actual procedures should be. More detailed instructions and why those precautions should be taken and explain it more to people. I think someone needs to come up to the ward and tell us what we should be doing." HCA 05

Summary

In summary, the findings of the ranking exercise and semi-structured interviews revealed that respondents were concerned primarily about infection control practice in relation to Contact Precautions. Indeed, the priority given to this issue was abundantly clear, even from the findings relating to other areas of infection control practice, since respondents frequently identified that greater importance was placed on infection control practices relating to the care of patients nursed in isolation as compared with other patients. In view of this, it was selected as the focus of practice development on the study ward.

Detailed analysis of the interview findings relating to Contact Precautions revealed a range of issues that informed the design of the intervention employed during Phase II of the study. In particular, there were large gaps in the knowledge base of nurses and health care assistants. The lack of understanding of basic microbiology and infection control principles resulted in misconceptions about the modes of spread of micro-organisms, particularly in relation to MRSA. This has huge potential implications for practice, since not knowing how

micro-organisms are transmitted means there could be little appreciation of the infection control measures required to prevent this. As a result, confusion, conflict and inconsistencies can occur in practice in relation to the implementation of Contact Precautions for patients with CDAD and MRSA. This may be compounded by a lack of information at ward level, doubts about the effectiveness of measures such as the use of protective clothing and concerns about the risks to staff from occupational exposure to these infectious conditions.

The qualified nurses' lack of knowledge in relation to Contact Precautions identified in this study is particularly concerning, since health care assistants, student nurses and health care staff from other disciplines relied upon them to take the lead and advise them about correct procedures. The inconsistency with which this was done resulted in frustration amongst health care assistants, who were frequently given differing instructions. In addition, although most respondents reported problems with non-adherence to Contact Precautions by other health care professionals, and in particular, medical staff, many felt uneasy about tackling this in view of the limitations to their own knowledge base. Qualified nurses were also unable to reassure more junior colleagues about the risks to staff from CDAD and MRSA and as a result, there was heightened anxiety about this.

These findings indicate that respondents experienced a lack of control in relation to Contact Precautions, since they did not understand what they were doing and were doubtful about the effectiveness of the measures they employed to prevent the spread of infection. They expose a real need for educational input. In particular, respondents themselves identified the need for written guidance and some form of practical instruction. This was addressed during Phase II of the study. However, prior to this, it was important to investigate the extent to which the problems identified by nurses in relation to Contact Precautions were evident in practice. The findings of the analysis of the structured observations of practice are described in Chapter 7.

CHAPTER 7

FINDINGS (2): THE STRUCTURED OBSERVATIONS OF PRACTICE

Introduction

In this chapter, the results of the analysis of the structured observations of nursing practice undertaken during Phase I, the pre-implementation phase of the study, are presented. As described in Chapter 5, these observations were conducted to confirm the prevalence and understand the context of the issues and problems described in relation to Contact Precautions during the initial interviews. A structured observation tool was developed to enable the Contact Precautions undertaken by nurses and health care assistants to be observed and recorded systematically. The following account presents an overview of the data and then focuses on a more detailed analysis of the findings relating to each specific aspect of Contact Precautions.

Characteristics of the Sample of Nurses and Health Care Assistants Observed

The sample consisted of all registered nurses (RNs) and health care assistants (HCAs) who were permanently employed on the study ward, apart from three health care assistants who worked only on night duty. These three staff were not included in the sample because the observations took place between the hours of 08.00am and 10.00am, when they were not on duty. All other nurses and health care assistants were observed nursing patients in isolation due to *Clostridium difficile* associated diarrhoea (CDAD) or methicillin resistant *Staphylococcus aureus* (MRSA) on at least one occasion (ranging between one and ten occasions), since none of the individuals approached were unwilling to participate.

Number of Observations

In all, sixty hours of observation were conducted, ten of which involved a second observer to assess the inter-observer reliability of the observation schedule. Table 24 shows the number of staff observed according to their status. It also shows the total number of occasions that nurses and health care assistants were observed and the proportion of these that related to patients with CDAD and MRSA. It can be seen that the total number of occasions that nurses and health care assistants were observed was similar. Likewise, the total number of occasions involving patients with CDAD and MRSA was similar.

Table 24: Structured Observations of Practice: Number of Nurses and Health Care Assistants Observed				
	Number of individuals observed	Number of occasions observed		
		CDAD	MRSA	Total
Registered Nurses	10	17	17	34
Health Care Assistants	7	11	18	29
Total	17	28	35	

Overview of the Data

Length of Patient Care Interactions and Number of Activities Undertaken

Although as Table 24 shows, the total number of occasions observed was comparable between nurses and health care assistants, and also between CDAD and MRSA, the length of the patient care interactions was not. Patient interactions varied in length according to the number of activities undertaken. For example, a short interaction took place when a participant took something into the room for a patient, such as their breakfast or medication. Much longer interactions took place when a patient required assistance with their hygiene needs, since many different activities tended to be undertaken by the participant while they were in the room, such as assisting the patient to move, wash and dress, making the bed and disposing of the used linen. Table 25 presents the observations of nurses and health care assistants according to the number of activities undertaken per patient interaction.

Table 25: Structured Observations of Practice: Number of Activities per Patient Interaction					
Number of activities	RNs		HCAs		Total
	CDAD	MRSA	CDAD	MRSA	
1-2	14	15	4	4	37
3-9	2	0	4	5	11
10-21	1	2	3	9	15
Total	17	17	11	18	63

The table clearly shows that nurses were most frequently observed during short interactions with patients, involving between one and two activities. By comparison, health care assistants were more frequently observed during longer interactions, a higher proportion of which involved patients with MRSA. This difference reflected the way duties on the study ward were allocated during early shifts, as health care assistants were required to undertake much of the personal hygiene care of patients, whilst nurses administered medications,

undertook specific clinical procedures and were involved in patient and ward management activities (e.g. liasing with other health care professionals).

Table 26 presents a summary of the number of patient care activities undertaken by nurses and health care assistants according to the extent of physical contact with patients and their environment.

Table 26: Structured Observations of Practice: Number of Activities According To the Extent of Physical Contact with the Patient or Their Environment

Type of contact with patient or their environment:	RNs		HCAs		Total
	CDAD	MRSA	CDAD	MRSA	
No / minimal physical contact (e.g. talking, taking temperature/pulse, serving food, administering oral medication)	17	22	15	24	78
Extensive physical contact (e.g. washing, dressing, assisting to move, bed making, handling used bedpan)	25	25	49	118	217
Total	42	47	64	142	295

As the table shows, health care assistants performed more than three times the number of activities involving extensive physical contact with patients and their environment than nurses. These activities are known to result in higher levels of bacterial contamination of hands than activities involving minimal physical contact (Pittet et al,1999) and are therefore more likely to result in the cross-transmission of bacteria between patients when hand hygiene measures are inadequate (Pittet et al, 1999). Since health care assistants frequently worked without being directly supervised by trained staff, they were clearly an important group of staff to target as part of the study's education and support programme.

Appropriateness of the Contact Precautions Undertaken

As described in Chapter 5, the process of observing practice involved monitoring the infection control measures taken immediately before, during and after contact with a patient or their environment. The patient care activities undertaken within an interaction were therefore recorded in sequence along with the infection control measures employed so that the appropriateness of these could be assessed in accordance with the local infection control policy and research-based evidence. Table 27 presents a summary of the findings according to the appropriateness of the Contact Precautions undertaken by nurses and health care assistants.

Table 27: Structured Observations of Practice: Appropriateness of the Contact Precautions Practices Undertaken

Contact Precautions observed:	RNs				HCAs				Total
	Correct practice		Incorrect practice		Correct practice		Incorrect practice		
	n	(%)	n	(%)	n	(%)	n	(%)	
Hand hygiene									
Hands washed when indicated	21	(87.5)	3	(12.5%)	30	(54%)	26	(46%)	80
Glove use									
Gloves worn when indicated	46	(100%)	0	(0%)	151	(99%)	1	(1%)	198
Gloves not worn when not indicated	18	(42%)	25	(58%)	14	(26%)	40	(74%)	97
Gloves changed / removed when soiled	1	(25%)	3	(75%)	3	(16%)	16	(84%)	23
Apron use									
Apron worn when indicated	58	(100%)	0	(0%)	178	(99%)	1	(1%)	237
Apron not worn when not indicated	17	(55%)	14	(45%)	14	(52%)	13	(48%)	58
Linen / clinical waste disposal									
Linen/waste segregated into correct bag / sharps container	4	(100%)	0	(0%)	13	(100%)	0	(0%)	17
Linen/waste removed from room as for non-infectious patients	0	(0%)	8	(100%)	0	(0%)	25	(100%)	33
Total	**165**	**(76%)**	**53**	**(24%)**	**403**	**(77%)**	**122**	**(23%)**	**743**

As the table shows, overall, the proportion of Contact Precautions carried out correctly by nurses and health care assistants was comparable (76% and 77% respectively). This figure was surprisingly high given the extent of the problems identified during the pre-implementation interviews. It was largely a result of gloves and aprons being worn when indicated on virtually all occasions (RNs 100%, HCAs 99%), since it was customary on the study ward to apply them routinely before entering an isolation room. However, this also meant they were being used unnecessarily, as they were worn on more than half (92/155) of the occasions on which they were not actually needed (RNs 58% gloves, 45% aprons; HCAs 74% gloves, 48% aprons).

There was a clear difference between nurses and health care assistants regarding hand hygiene practice, since nurses almost always washed their hands when appropriate (87.5% occasions), whereas health care assistants only did this half of the time (54%). As regards the changing or removal of soiled gloves, inappropriate technique was used on 16/19 (84%) of the occasions when health care assistants were observed and on 3/4 (75%) of those involving nurses. Observations relating to the disposal of linen and clinical waste by nurses and health

care assistants revealed that this was always segregated correctly (17/17 occasions), but was never removed from the room appropriately in the same way as for 'non-infectious patients' (33/33 occasions). The following account describes all of these findings in detail according to each aspect of Contact Precautions.

Hand Hygiene

The hand hygiene practices observed involved either the use of soap and water at a handwash basin (usually the one in the patient's room), the use of an alcohol-based handrub (located immediately outside the patient's room) or a combination of the two. No assessment was made of the thoroughness of the hand hygiene techniques of participants. Instead, it was simply recorded that a handwash had taken place with soap and water and / or alcohol-based handrub at a given point during an interaction with a patient.

The findings relating to the observations of hand hygiene practice were assessed for appropriateness in accordance with the local infection control policy and also the evidence base for hand hygiene (as described in Chapter 1). The local infection control policy did not include a specific guideline on hand hygiene. Instead, the *Clostridium difficile* and MRSA policies mentioned the need to wash hands after physical contact with the patient or their environment. In addition, the *Clostridium difficile* policy also stipulated the need to wash hands immediately after contact with faeces. No recommendations were made in either policy about the indications for hand hygiene during patient care. Also, no mention was made about the use of a skin disinfectant such as alcohol-based handrub, even though this was available for use on the study ward.

This guidance was rather limited compared to information available within the literature and in particular, within published guidance on hand hygiene and Contact Precautions (ICNA, 1998; Garner et al, 1996; Larson, 1995), which supports the need for hands to be decontaminated before contact with any susceptible patient or site on a patient as well as after patient contact. Table 28 presents a summary of the recommendations on hand hygiene from the local infection control policy and from the literature that were used to assess the appropriateness of hand hygiene practice. Given the disparity in the level of detailed guidance on hand hygiene between the local infection control policy and published guidance, a distinction is made between the two during the following account of the findings.

Table 28: Recommendations on Hand Hygiene Used to Assess the Appropriateness of Hand Hygiene Practice
Local Infection Control Policy Hands should be washed: • after physical contact with the patient or their environment • after contact with faeces
Published Guidelines on Hand Hygiene and Contact Precautions (ICNA, 1998; Garner et al, 1996; Larson, 1995) Hands should be washed: • before invasive procedures • after patient contact • after contact with a source of micro-organisms (body fluids and substances, mucous membranes, non-intact skin, inanimate objects that are likely to be contaminated) • after visible soiling • after removing gloves

Table 29 presents the findings of the observations of nurses' and health care assistants' hand hygiene practice.

Table 29: Structured Observations of Hand Hygiene Practice When Indicated During and After the Care of Patients With CDAD and MRSA

	RNs				HCAs				
	Correct Practice		Incorrect Practice		Correct Practice		Incorrect Practice		
	CDAD	MRSA	CDAD	MRSA	CDAD	MRSA	CDAD	MRSA	**Total**
During patient care (after contact with a source of micro-organisms; after visible soiling)	0	0	2	1	0	0	5	11	**19**
Subtotal (%)	0 (0%)		3 (100%)		0 (0%)		16 (100%)		
After patient care or on leaving the patient's room (following physical contact with the patient or their environment)	12	9	0	0	9	21	4	6	**51**
Subtotal (%)	21 (100%)		0 (0%)		30 (75%)		10 (25%)		
Total	21 (87.5%)		3 (12.5%)		30 (54%)		26 (46%)		
	24				**56**				**80**

As the table shows, hands were decontaminated on 51/80 (64%) of the occasions when this was indicated. There was a clear difference between nurses and health care assistants in

relation to hand hygiene practice, since nurses washed their hands when indicated on 21/24 (87.5%) occasions, whereas health care assistants did on only 30/56 (54%) occasions. There were no apparent differences in hand hygiene practice between nursing patients with CDAD and those with MRSA.

Looking firstly at hand hygiene practice after physical contact with the patient or their environment, as specifically recommended in the local infection control policy, this was necessary not only at the end of patient care, but also when leaving the room to remove or collect items of equipment associated with the patient's care. There was a high level of adherence to this requirement, particularly amongst nurses, who always washed their hands (21/21 occasions). Health care assistants washed their hands on 30/40 (75%) occasions. They most often omitted to remove their gloves and wash their hands when leaving the room to collect equipment, which accounted for seven of the ten omissions in all. Participants almost always washed their hands following removal of gloves (49/51 occasions), there being only two occasions when health care assistants did not do this. These findings demonstrated awareness amongst nurses and health care assistants of the need to wash their hands after physical patient contact and after removing gloves.

In contrast to the above findings, hands were not washed by either nurses or health care assistants on any of the nineteen occasions when this was indicated during patient care (RNs 3; HCAs 16). On all of these occasions, gloved hands had become visibly soiled following contact with a source of micro-organisms, but despite this, the gloves continued to be worn for all subsequent patient care activities. On seven occasions (RNs 1; HCAs 6) gloves had come into direct contact with the patient's faeces, but instead of being removed immediately afterwards, they continued to be worn for between two and seven subsequent activities, including on one occasion, pouring the patient a drink. On the other twelve occasions (RNs 2; HCAs 10), gloved hands were used to wash a patient's buttocks and genitalia and apply barrier cream to broken areas of skin on the buttocks. However, instead of being removed after this (given the extent of soiling with barrier cream and micro-organisms), they continued to be used for between two and ten subsequent activities including assisting the patient with oral hygiene, administering oral medication and on one occasion, applying a wound dressing.

This finding demonstrated a staggering lack of attention to basic hand hygiene principles by nurses and health care assistants alike, which clearly needed to be addressed during the

implementation phase of the study. Indeed, it appeared as though nurses and health care assistants were using gloves as a means to protect themselves from infection without also considering the need to reduce risks to the patient by removing or changing them and washing their hands between 'dirty' and 'clean' procedures.

In addition to observing the times when hand hygiene took place, a record was also made of the products used to do this. Table 30 presents the findings relating to the products used by nurses and health care assistants to wash their hands. It shows that soap and water alone was used most frequently (71% occasions). Alcohol gel was rarely used on its own (4%), but instead tended to be used following a handwash with soap and water (25%). There were no apparent differences between nurses and health care assistants regarding the products used. Neither was there a difference in the use of products following contact with patients with CDAD and those with MRSA.

Table 30: Hand Hygiene Products Used Following Care of Patients with CDAD and MRSA

	RNs		HCAs		
	CDAD	MRSA	CDAD	MRSA	Total (%)
Soap and water	9	5	7	15	36 (71%)
Alcohol-based handrub	0	1	0	1	2 (4%)
Soap and water followed by alcohol-based handrub	3	3	2	5	13 (25%)
Total	12	9	9	21	51

No assessment was made of the appropriateness of the products used for hand hygiene as part of the overall findings, since the local infection control policy gave no guidance about this and the use of either product was considered preferable to no handwash at all (Hoffman and Wilson, 1995; Ayliffe et al, 1988). Nonetheless, as discussed in Chapter 1, alcohol-based handrubs are generally considered to be superior to soap and water for the destruction of transient bacteria such as MRSA on hands providing they are physically clean (Ojajarvi, 1980). However, this was used on only one third (33%) of occasions after the care of patients with MRSA, indicating the need to promote its use during the implementation phase of the study. Alcohol-based handrubs are not considered to be effective against *Clostridium difficile* spores on hands (Cooke et al, 1994) and in view of this, the use of soap and water has been recommended following the care of patients with CDAD (Cooke et al, 1994), which occurred on all twenty-one occasions.

Use of Gloves and Aprons

As with hand hygiene, the findings relating to the observations of glove and apron use were assessed for appropriateness in accordance with the local infection control policy and also the evidence base for protective clothing (as described in Chapters 1 and 2). The local infection control policy stipulated that for patients with MRSA, gloves and an apron were required for all physical contact with the patient and their environment. For patients with CDAD, they were required for contact with the patient's faeces and with equipment contaminated by it. In addition to this, gloves were required as a 'Universal Precaution' for anticipated contact with blood and other body fluids. No specific recommendation was made in the policy about the need to remove or change gloves between 'dirty' and 'clean' procedures on a patient.

This guidance was comparable with published national guidance on Contact Precautions for patients with MRSA (Ayliffe et al, 1998) and CDAD (Cooke et al, 1994). Indeed, whereas the national guidance on MRSA required the use of protective clothing for virtually all physical contact with the patient or their environment, the national guidance on CDAD was more selective (see Table 31). Whilst the routine use of protective clothing for all contact with the patient and their environment has been advocated as part of Contact Precautions (Garner et al, 1996), there is a lack of scientific evidence to support this recommendation. In view of this, the more selective approach to glove and apron use for CDAD recommended both in the local and national guidance was used as the basis on which to assess observed practice in relation to CDAD. As with the local guidance, neither the national guidance on MRSA or CDAD referred to the importance of removing or changing gloves between 'dirty' and 'clean' procedures on a patient. However, this recommendation has been made elsewhere (ICNA, 1998). Table 31 presents a summary of the recommendations from the local infection control policy and from the literature that were used to assess the appropriateness of glove and apron use.

Table 31: Recommendations on Protective Clothing Used To Assess the Appropriateness of Glove and Apron Use

Local Infection Control Policy

Gloves and a disposable plastic apron should be worn:

- for all patients, when contact with blood and other body fluids is anticipated
- for MRSA, when in physical contact with the patient or their environment
- for CDAD, when in contact with faeces or equipment contaminated by it

Table 31 (continued)

Published Literature and National Guidance

- for MRSA, gloves and a plastic apron should be worn when handling the patient or their environment and for anticipated contact with body fluids, lesions and contaminated items (Ayliffe et al, 1998)
- for CDAD, gloves and a plastic apron should be worn for anticipated contact with body fluids, excretions and contaminated items (Cooke et al, 1994)
- for all patients, gloves should be worn to minimise microbial contamination of hands in situations when this is likely to be heavy (Kjolen and Andersen, 1992)
- for all patients, a plastic apron should be worn to minimise microbial contamination of clothing in situations when this is likely to be heavy (Babb et al, 1983)
- for all patients, gloves should be removed or changed and wash hands between 'dirty' and 'clean' procedures (ICNA, 1998)

Table 32 presents the findings of the observations of nurses' and health care assistants' practice in relation to glove and apron use.

Table 32: Structured Observations of Practice in Relation to Glove and Apron Use while Nursing Patients With CDAD and MRSA

	RNs				HCAs				Total
	Correct Practice n (%)		Incorrect Practice n (%)		Correct Practice n (%)		Incorrect Practice n (%)		
	CDAD	MRSA	CDAD	MRSA	CDAD	MRSA	CDAD	MRSA	
Glove use									
Gloves worn when indicated	16	30	0	0	32	119	0	1	198
Subtotal (%)	46 (100%)		0 (0%)		151 (99%)		1 (1%)		
Gloves not worn when not indicated	8	10	18	7	3	11	32	8	97
Subtotal (%)	18 (42%)		25 (58%)		14 (26%)		40 (74%)		
Gloves changed / removed when soiled	0	1	2	1	0	3	5	11	23
Subtotal (%)	1 (25%)		3 (75%)		3 (16%)		16 (84%)		
Apron Use									
Apron worn when indicated	27	31	0	0	54	124	0	1	237
Subtotal (%)	58 (100%)		0 (0%)		178 (99%)		1 (1%)		
Apron not worn when not indicated	8	9	7	7	3	11	7	6	58
Subtotal (%)	17 (55%)		14 (45%)		14 (54%)		12 (46%)		
Total	**140 (77%)**		**42 (23%)**		**360 (84%)**		**71 (16%)**		**613**

As the table shows, gloves were indicated for one hundred and ninety-eight patient care activities and aprons for two hundred and thirty-seven. This included times when they were indicated both before and after an activity that did not actually require them, as there was little point in removing them on such occasions unless they needed to be changed. There was

optimal adherence to both glove and apron use by nurses (100%) and health care assistants (99%), as they were worn when indicated on all but one occasion.

However, gloves and aprons were also worn unnecessarily on over half (92/155) of the occasions when they were not required. Indeed, gloves were worn unnecessarily for 65/97 (67%) patient care activities (58% by RNs and 74% by HCAs). Likewise, aprons were worn unnecessarily for 27/58 (47%) patient care activities (45% by RNs and 48% by HCAs). This overuse of protective clothing reflected the fact that when used, gloves and aprons were donned just before entering the patient's room and were then worn continuously up until leaving the room, irrespective of the type of patient care activities being undertaken. Table 33 shows the occasions on which gloves and aprons were worn unnecessarily according to the extent of physical contact with the patient or their environment.

Table 33: Unnecessary Use of Gloves and Aprons According to the Extent of Physical Contact with the Patient or their Environment

		RNs			HCAs			Total (%)
		CDAD	MRSA	Subtotal (%)	CDAD	MRSA	Subtotal (%)	
No / minimal physical contact with patient / environment								
Gloves	not worn when not needed	8	10	18 (53%)	3	11	14 (42%)	32 (48%)
	worn unnecessarily	9	7	16 (47%)	11	8	19 (58%)	35 (52%)
Apron	not worn when not needed	8	9	17 (55%)	3	11	14 (52%)	31 (53%)
	used unnecessarily	7	7	14 (45%)	7	6	13 (48%)	27 (47%)
Extensive physical contact with patient / environment								
Gloves	not worn when not needed	0	0	0 (0%)	0	0	0 (0%)	0 (0%)
	worn unnecessarily	9	0	9 (100%)	31	0	31 (100%)	40 (100%)
Apron	not worn when not needed	0	0	0	0	0	0	0
	used unnecessarily	0	0	0	0	0	0	0

As the table shows, gloves and aprons were worn unnecessarily during activities involving little or no physical contact with the patient or their environment on approximately half of these occasions (52% and 47% occasions respectively). This included activities such as

delivering medication or a meal, talking to the patient without also engaging in other activities and taking their temperature. The data was comparable between nurses and health care assistants and also between CDAD and MRSA.

Conversely, for activities involving more extensive physical contact with the patient or their environment, such as bed making, dressing the patient and assisting them to move, there was a marked difference between the findings relating to glove use for CDAD and MRSA. As described above, the recommendations on glove use differed between the two conditions. For MRSA, both gloves and aprons were required for all activities involving extensive physical contact and in view of this, they were never worn unnecessarily. Likewise, for CDAD, aprons were required for all such activities and were therefore never worn unnecessarily. However, although for CDAD there was no specific indication to use gloves for extensive physical contact when no contact with body fluids or excretions was anticipated, they were used by nurses and health care assistants on all forty of these occasions. As such, it appeared as though nurses were not distinguishing between CDAD and MRSA with regard to their decision to use gloves.

The non-task-specific approach to glove and apron use fulfilled the wearer's need to protect themselves from exposure to the patient's microorganisms. However, it did not allow for a reduction of risks to the patient by ensuring the removal or changing of gloves and washing of hands between 'dirty' and 'clean' procedures. This was evident as gloves were neither removed nor changed when soiled during patient care on nineteen separate occasions and continued to be worn for between one and ten subsequent activities (as already described above under 'Hand Hygiene'). On the four occasions when gloves were changed, this occurred just before leaving the patient's room to take a bedpan to the sluice, thus leaving the room provided the cue.

Disposal of Linen and Clinical Waste

The findings relating to the observations of linen and clinical waste disposal were assessed for appropriateness in accordance with the local infection control policy. No specific evidence was identified from published literature regarding the risks associated with these procedures other than that which is referred to below. The local infection control policy made no specific recommendations about the disposal of clinical waste from patients with CDAD and MRSA, stating that the procedure should be no different from normal. This included the removal of bedpans and urine bottles from the room, which were to be taken to

the sluice in the normal way. The procedure for the disposal of linen required the use of a hot water soluble-bag, which was then placed into a colour-coded laundry bag (red) for transportation to the laundry. This system was also required for the disposal of heavily soiled linen from all patients to eliminate the need for laundry staff to handle the linen before it was washed.

There was no mention of the need for a 'double-bag' technique for either linen or clinical waste. This technique has been described elsewhere in relation to linen disposal as historically forming part of isolation precautions (Weinstein et al, 1989). It involves the nurse in the patient's room placing the soiled linen into a bag and then closing it. This nurse then places the first bag into a second bag being held by a "clean nurse" outside of the patient's room. Since microbiological evidence does not support the use of this technique (Weinstein et al, 1989; Maki et al, 1986) and it is not stipulated as a requirement of Contact Precautions (Garner et al, 1996), it was considered unnecessary for the purpose of assessing the appropriateness of practice. Table 34 presents a summary of the recommendations on the disposal of linen and clinical waste from the local infection control policy that were used to assess the appropriateness of practice. No additional recommendations were identified from the literature.

Table 34: Recommendations From the Local Infection Control Policy on the Disposal of Linen and Clinical Waste from Patients with CDAD and MRSA

- Clinical waste (other than sharp instruments) should be disposed of as normal into a single yellow plastic bag (marked with a biohazard sign for incineration only)
- Used disposable sharp instruments should be discarded into a sharps container as normal
- Used bedpans and urine bottles should be placed into the bedpan washer as normal
- Used/soiled linen should be disposed of into a hot water-soluble bag and then into a red laundry bag

Table 35 presents the findings of the observations of nurses' and health care assistants' practice in relation to the disposal of linen and clinical waste. As the table shows, linen and clinical waste was always segregated into the correct colour bag or into a sharps container, both by nurses and health care assistants. However, procedures concerning the removal of linen, clinical waste bags and bedpans / urine bottles from the patient's room were found to be unnecessarily elaborate (ritualistic). This was because a 'double-bag' technique was used by all of the nurses and health care assistants observed for the removal of linen and clinical waste bags even though there was no requirement to do this. On thirteen of the seventeen

occasions when this was done, a second person was called upon to stand outside the room, hold the outer bag open and then tie it up and take it away. On the other four occasions, nobody was available to help, but the participant still applied the outer bag at the door threshold and then left it there until she was ready to leave the room and take it to the disposal area. Interestingly, when cleaners were observed removing clinical waste bags from the isolation rooms, they never double-bagged them. The removal of bedpans and urine bottles involved placing these items into a clinical waste bag rather than using one of the paper covers available for this purpose. On five occasions, they were double-bagged by a colleague at the door threshold in much the same way as for linen and clinical waste bags.

Table 35: Structured Observations of Practice in Relation to the Disposal of Linen and Clinical Waste

Linen and clinical waste disposal:	RNs				HCAs				Total
	Correct Practice n (%)		Incorrect Practice n (%)		Correct Practice n (%)		Incorrect Practice n (%)		
	CDAD	MRSA	CDAD	MRSA	CDAD	MRSA	CDAD	MRSA	
segregated into correct waste bag / sharps container	2	2	0	0	5	8	0	0	17
Subtotal (%)	4 (100%)		0 (0%)		13 (100%)		0 (0%)		
linen / clinical waste removed from room as normal	0	0	2	2	0	0	5	8	17
Subtotal (%)	0 (0%)		4 (100%)		0 (0%)		13 (100%)		
bedpans / urine bottles removed from room as normal	0	0	3	1	0	0	6	6	16
Subtotal	0 (0%)		4 (100%)		0 (0%)		12 (100%)		
Total	4 (33%)		8 (67%)		13 (34%)		25 (66%)		50

The adoption of these ritualistic practices was consistent with findings of the pre-implementation interviews, since nurses and health care assistants expressed concern about the potential for the spread of infection to other patients when taking items such as bedpans and linen bags from an isolation room through the ward to the sluice room. The use of a 'double-bag' technique provided participants with a means to reassure themselves that they were minimising the risk of spreading infection, even though their beliefs about the efficacy of this practice were misplaced.

Additional Observations Relating to Contact Precautions

Several other observations were made during the course of conducting the structured observations of practice that provided validation of issues identified during the initial interviews with study participants. It was evident that between the hours of 08:00am and 10:00am when the observation sessions took place, the activities of nurses and health care assistants were focused mainly on meeting patients' physical needs. Indeed, of the sixty-three patient care interactions observed, only four appeared to be initiated for the specific purpose of talking to the patient, without also undertaking other activities. Whilst it is not known whether this was also the case at other times of the day, this finding concurred with data from the pre-implementation interviews, which highlighted participants' concerns about the lack of social contact received by patients in isolation.

No observations were made of the procedures in place for cleaning of the equipment used for patients with CDAD and MRSA before its use by other patients. This was because no equipment other than crockery / cutlery and bedpans / urine bottles was removed from the room during the periods of observation. Equipment may have been left in the room because participants did not know how to clean it, but this was not possible to record. Nonetheless, this issue required investigation during the implementation stage of the study, since participants raised it as a concern during their pre-implementation interviews.

Another of the participants' concerns that was apparent from the interview data was the potential for spread of infection by the airborne route. However, in spite of this, findings of the observations of practice revealed that the doors to isolation rooms were usually left open unless there was a need for privacy. This was in stark contrast to the elaborate way in which linen and clinical waste were removed from the room in an attempt to 'contain' infection. Whilst there is little evidence to support the need to keep the door of an isolation room closed for conditions such as CDAD and MRSA that are spread principally by the contact route unless a specific risk of dispersal of microorganisms has been identified (see Chapter 2), it was interesting to note that the concerns and misconceptions expressed at interview about airborne spread of infection did not result in attempts to keep the doors to the isolation rooms closed.

During the course of conducting the structured observations no attempt was made to identify participants' concerns in relation to the practices observed. Nonetheless, the confusion and uncertainty amongst those observed was apparent. Individuals often commented

spontaneously that they were not sure if they were doing things correctly. Some even asked the researcher to clarify practice issues at the time the observations were taking place. Whilst the researcher did not engage in discussion, suggesting instead that individuals did what they would normally do, the need for on-hand advice on infection control issues to be made available to participants was clear.

Summary

In summary, the findings of the structured observations of participants' practice in relation to Contact Precautions confirm that there is a clear need for educational input, as previously identified from the pre-implementation interviews. Although overall, the proportion of infection control practices carried out correctly by nurses and health care assistants was fairly high (76% and 77% respectively), this finding obscures the presence of serious deficiencies in practice as well as some unnecessarily elaborate procedures. The findings relating to hand hygiene and glove use are particularly concerning. Health care assistants, who undertook the majority of activities involving extensive physical contact with patients and their environment washed their hands less often than nurses, that is, on only half (54%) of the occasions when this was indicated. Neither nurses nor health care assistants washed their hands on any of the nineteen occasions when this was required during patient care. Instead, they wore gloves throughout the duration of patient care without removing or changing them when they became soiled. This approach to glove use placed patients at increased risk of self- (or 'endogenous') infection, that is, infection caused by a person's own microbial flora (Ayliffe et al, 2000: 1) given the potential to transfer micro-organisms from a 'contaminated' body site to a 'clean' one by the continued use of soiled gloves. It suggested that participants were using gloves for their own protection without considering the risks to the patient. This concurs with findings of the pre-implementation interviews in relation to participants' anxieties about the risks to themselves from exposure to CDAD and MRSA.

The routine donning of gloves and aprons on entry to isolation rooms resulted in gloves and aprons being used unnecessarily, both by nurses and health care assistants, on more than half of the occasions when they were not actually needed. Unnecessary procedures were also in use for the disposal of linen and clinical waste, which reflected findings of the pre-implementation interviews, in which participants revealed their lack of understanding of the modes of transmission of CDAD and MRSA and expressed their concerns about the potential for the spread of infection from linen and waste. Indeed, the unnecessary use of a 'double-bag' technique for the removal of linen and waste from isolation rooms provided

participants with a means to reassure themselves that they were minimising the risk of spreading infection, even though their beliefs about the efficacy of this practice were misplaced.

These findings, along with those of the pre-implementation interviews informed the development of the practice guideline that was used during Phase II of the study. The process of observing practice also exposed the need for on-hand advice on infection control issues to be made available to participants, as individuals often vocalised that they were unsure about what they were doing and a few even sought clarification from the researcher. The availability of this form of support was therefore incorporated into the design of the supportive intervention used during Phase II of the study. The following chapter describes the findings of Phase II of the study.

CHAPTER 8

FINDINGS (3): THE PROCESS RECORD AND PARTICIPANT OBSERVATIONS OF PRACTICE

Introduction

In this chapter, the results of the analysis of the data collected during Phase II, the implementation phase of the study, are presented. As described in Chapter 5, a process record was maintained of all the questions, comments and concerns raised by study participants during implementation of the guideline on Contact Precautions and in particular, during the sessions of one-to-one instruction and support. In addition, the researcher's observations of individual participants' infection control practices were recorded. The following account presents an overview of the data and then focuses on a more detailed description of the findings according to the six topic areas that emerged during data analysis.

Characteristics of the Sample of Nurses and Health Care Assistants Involved in Phase II of the Study

The sample consisted of nurses and health care assistants who were permanently employed on the study ward on either day or night duty during part or all of the six-month implementation phase of the study. This included all individuals who met the sampling criteria, since none of those approached were unwilling or unable to participate. Each participant was given one-to-one support and instruction on implementation of the guideline on Contact Precautions during at least one of their shifts of duty (ranging between one and three separate shifts). Table 36 shows the number of participants included in Phase II of the study according to their status and grade.

Table 36: Number of Participants Involved in Phase II of the Study

Status / Grade of Nurse	Number of individuals	Total number of occasions worked with
Ward Manager ('G' grade)	1	2
Senior Staff Nurse ('F' Grade)	1	1
Registered Nurse ('E' grade)	2	2
Registered Nurse ('D' grade)	9	19
Health Care Assistant ('A/B' grade)	5	6
Total	**18**	**30**

As the table shows, a total of eighteen individuals were involved in Phase II of the study. Of these, thirteen were nurses and five were health care assistants. During the six-month implementation period, the researcher worked a total of thirty shifts on the study ward. During each of these, she worked alongside the member of staff who was allocated to provide care for patients in isolation with CDAD or MRSA. This enabled the provision of one-to-one support and instruction.

Overview of the Data

A total of three hundred and forty-nine separate entries were made in the process record regarding the questions, comments and concerns raised by participants in relation to implementing the guideline on Contact Precautions. Table 37 presents a summary of this data according to specific aspects of isolation precautions practice.

Table 37: Number of Entries in the Process Record about Implementing the Contact Precautions Guideline

	Questions		Comments / concerns		Sub-total		TOTAL (%)
Topic areas:	RN	HCA	RN	HCA	RN	HCA	
Hand Hygiene	5	1	32	9	37	10	**47 (13%)**
Use of gloves and aprons	19	14	77	33	96	47	**143 (41%)**
Use / disposal of linen / waste	26	14	6	2	32	16	**48 (14%)**
Use and cleaning of equipment	19	5	19	5	38	10	**48 (14%)**
Issues about patients / visitors	13	5	11	4	24	9	**33 (9%)**
General issues	14	4	11	1	25	5	**30 (9%)**
Sub-total	96	43	156	54	252	97	**349**
TOTAL	**139**		**210**		**349**		

As the table shows, a total of one hundred and thirty-nine questions were asked, approximately two-thirds (96/139) of which by nurses and one third (43/139) by health care assistants. In addition, two hundred and ten comments and concerns were expressed, three-quarters (156/210) of which by nurses and one quarter (54/210) by health care assistants. By far the highest proportion of entries (41%) concerned the use of gloves and aprons.

The researcher's own observations of individual nurses' and health care assistants' practice were also recorded systematically at the end of each nursing shift. Table 38 presents a summary of this data.

Table 38: Researcher's Observations of Nurses' and Health Care Assistants' Practice in Relation to Contact Precautions

Contact Precautions as per practice guideline:	RNs		HCAs		**Total**	
	Yes	No	Yes	No	**Yes**	**No**
Always washed hands during patient care when indicated	12 (71%)	5 (29%)	2 (67%)	1 (33%)	**14 (70%)**	**6 (30%)**
Always washed hands at the end of patient care	17 (71%)	7 (29%)	4 (67%)	2 (33%)	**21 (70%)**	**9 (30%)**
Gloves and aprons always worn when indicated	24 (100%)	0 (0%)	6 (100%)	0 (0%)	**30 (100%)**	**0 (0%)**
Used gloves and aprons selectively for patient care activities	12 (50%)	12 (50%)	2 (33%)	4 67%)	**14 (47%)**	**16 (53%)**
Always changed gloves during care when soiled	14 (82%)	3 (18%)	1 (33%)	2 (67%)	**15 (75%)**	**5 (25%)**
Sub-total 1	79 (75%)	27 (25%)	15 (63%)	9 (37%)	**94 (72%)**	**36 (28%)**
Used single bag system for disposal of linen	14 (100%)	0 (0%)	5 (100%)	0 (0%)	**19 (100%)**	**0 (0%)**
Used single bag system for disposal of clinical waste	7 (100%)	0 (0%)	4 (100%)	0 (0%)	**11 (100%)**	**0 (0%)**
Did not wrap bedpan/urine bottle in clinical waste bag	15 (94%)	1 (6%)	5 (83%)	1 (17%)	**20 (91%)**	**2 (9%)**
Equipment always cleaned correctly after use	7 (78%)	2 (12%)	3 (100%)	0 (0%)	**10 (83%)**	**2 (17%)**
Sub-total 2	43 (93%)	3 (7%)	17 (94%)	1 (6%)	**60 (94%)**	**4 (6%)**
TOTAL	**122 (80%)**	**30 (20%)**	**31 (74%)**	**11 (26%)**	**154 (79%)**	**40 (21%)**

As the table shows, nurses' and health care assistants' practice was in accordance with the guideline on 80% and 74% occasions respectively. This included occasions when individuals sought clarification from the researcher about what to do immediately prior to implementing the new approach. For example, ten participants asked the researcher about the correct procedure for the disposal of linen at the point when they implemented the new approach for the first time.

Overall, the proportion of infection control practices carried out correctly by nurses and health care assistants was similar to that observed during the structured observations of practice in Phase I of the study, since this was 76% and 77% respectively. However, within this there were some clear differences in practice. For example, whereas in Phase I, the findings of the structured observations revealed that nurses and health care assistants never

washed their hands during patient care, this occurred during Phase II of the study on 71% and 67% of occasions respectively, representing a major change in practice. Likewise, whereas during Phase I, nurses and health care assistants never changed their gloves when soiled during patient care, this occurred during Phase II on 82% and 33% of occasions respectively. Nonetheless, as sub-total 1 indicates, changes concerning hand hygiene and the use of gloves and aprons were generally more complex than those concerning the disposal of linen and clinical waste and the cleaning of equipment and less (72%) of these practices were implemented correctly.

In contrast, as sub-total 2 of Table 38 shows, almost all (94%) of the practices concerned with the disposal of linen and clinical waste and the cleaning of equipment were implemented correctly. This reflected the straightforward nature of these changes, which involved the simple adoption of a new rule. For example, the new approach to the disposal of linen and clinical waste involved the use of a single-bag system rather than the 'double-bag' technique that was used unnecessarily by nurses and health care assistants during Phase I of the study. This new approach was adopted universally both by nurses and health care assistants on all of the occasions observed during Phase II. Likewise, bedpans and urine bottles were no longer wrapped in clinical waste bags on most (91%) of the occasions when their removal from an isolation room was observed during Phase II, whereas they were always used during the Phase I structured observations of practice.

Interestingly, there was a difference between study participants regarding the extent to which they engaged in Phase II of the study. Two-thirds (12/18) of the individuals involved exhibited what the researcher considered to be a high degree of engagement. This included eight nurses and four health care assistants, all of whom took the opportunity to exploit the support offered to them. These individuals seemed at ease when working with the researcher and tended to discuss aspects of their practice spontaneously. In general, they responded positively to the researcher's feedback, reflecting openly on the changes they were making to their practice. Seven of them worked with the researcher on more than one occasion, either because they specifically requested to do this or because they spontaneously volunteered on the days when the researcher worked on the ward.

Conversely, the other six study participants (five nurses and one health care assistant) were considered by the researcher to have engaged in Phase II of the study to a lesser extent and

only one of them worked with the researcher on more than one occasion. Although none of these individuals actually declined to work with the researcher, they all seemed uncomfortable about it. They also appeared reticent about discussing their practice and made few spontaneous comments, often only commenting in response to feedback from the researcher during the reflective feedback session.

There were no apparent differences between these two groups of participants with regard to attributes such as their age and qualifications. Nonetheless, those individuals who were considered by the researcher to be more highly engaged were generally more likely to exhibit good practice with regard to Contact Precautions. However, this observation must clearly be viewed with a degree of caution, since it was based only on the researcher's perceptions of how individuals responded to the supportive intervention and was therefore not amenable to external validation.

The following account describes the above findings in more detail according to the topic areas listed in Table 37. The data were analysed to ascertain differences between nurses and health care assistants. Where relevant, distinctions are made between CDAD and MRSA, although differences in the data in relation to the two organisms were in fact few in number.

Hand Hygiene

The findings relating to hand hygiene practice revealed that this topic generated 47/349 (13%) of the entries in the process record. As Table 39 shows, only six questions were asked, four relating to the effectiveness of skin disinfectants such as alcohol hand rub and two about correct handwashing technique. This was the fewest number of questions of any of the topic areas, possibly reflecting a perception amongst participants that there is not much to know about such a simple procedure.

Table 39: Questions about Hand Hygiene

Subject	Number of questions		Example
	RNs	HCAs	
Effectiveness of skin disinfectants	3	1	*How long does alcohol gel take to work?*
Handwashing technique	2	0	*How long should a proper handwash take?*
TOTAL	**5**	**1**	

The comments and concerns about hand hygiene could be categorised into four themes as presented in Table 40.

Table 40: Comments and Concerns about Hand Hygiene		
	RNs	**HCAs**
Opinions about hand hygiene products and their indications for use	13	5
Perceptions about the importance / effectiveness of hand hygiene	7	2
Importance of hand hygiene after contact with isolated patients	6	0
Lack of hand hygiene and reasons for this	6	2
Total	**32**	**9**

Opinions expressed about hand hygiene products and their indications for use accounted for almost half (18/41) of the comments/concerns about hand hygiene practice. They were made by nurses and health care assistants, there being no apparent distinctions between the two regarding the nature of the comments made. Almost all comments were to do with the use of alcohol handrub. The main concern was the detrimental effect of alcohol handrub on skin. In particular, this product was perceived to cause skin to become dry/sore and was also disliked for making hands feel sticky. Interestingly, studies to investigate the effect on skin of using alcohol-based handrubs have demonstrated that they cause less drying and skin irritation than soap and water (Boyce et al, 2000). However, only three participants made positive comments about alcohol handrub, considering it to be less drying and more convenient to use than soap and water. One of these individuals also commented about the benefit of using a moisturising cream that was available on the ward for use by staff to help minimise skin dryness. Concern amongst health care workers about the development of dry/sore skin due to handwashing has been highlighted in the literature as a deterrent to optimal hand hygiene practice (Zimakoff et al, 1992; Larson and Killien, 1982). Clearly, in order to promote optimal hand hygiene behaviour it is critically important to consider the provision of hand hygiene products that have minimal adverse skin reactions and that are well-tolerated by users (Larson et al, 1997).

As regards indications for the use of hand hygiene products, these comments also related to the use of alcohol handrub, which was used after physical contact with isolated patients, but not after contact with other patients. This was because the use of a skin disinfectant was perceived to be more important after contact with isolated patients than with other patients. In addition, alcohol handrub was more easily accessible outside of the isolation rooms than on the main ward. Perceptions of the increased importance of skin disinfection after contact

with isolated patients as compared with other patients reflected a concern amongst participants about the need for enhanced infection control measures when nursing isolated patients. This issue of the perceived need for enhanced infection control measures when nursing isolated patients emerged repeatedly from the process record data and also concurred with findings of the pre and post-implementation interviews. It is considered in detail in Chapter 10. With regard to the accessibility of alcohol handrub for more widespread use, this is clearly an important factor in the promotion of optimal hand hygiene practice that had not been addressed on the study ward, despite the ease with which it could have been resolved. This reflected the relatively low priority given to hand hygiene practice in general (other than for patients in isolation) by nurses and health care assistants on the study ward, as identified from the interviews during Phase I of the study.

The only other comment made in relation to indications for the use of hand hygiene products was by one nurse who explained that she always used alcohol handrub before going home at the end of the shift to minimise the risk of taking infection home to her family. Similar concerns about the risks to staff and their families from infection were also raised as a general issue and in relation to glove and apron use (see below). This concurred with findings of the pre and post-implementation interviews and is discussed in detail in Chapter 10.

All of the comments and concerns regarding the effectiveness of hand hygiene were made by seven individuals (five nurses and two health care assistants), all of whom expressed their awareness of the importance of hand hygiene as an infection control measure. However, two of these participants, both of whom were nurses, also raised a concern about the effectiveness of hand hygiene alone in situations when gloves were not required. One nurse said that she was not always confident that handwashing with soap and water alone was effective enough to decontaminate her hands, but that the use of alcohol handrub as an additional measure overcame this problem, as she was convinced of its effectiveness. Indeed, this view is supported in the literature, since alcohol-based handrubs are generally considered to be superior to soap and water for the destruction of transient bacteria (Ojajarvi, 1980). The other nurse was not convinced that either soap and water or alcohol handrub would remove MRSA from her hands and in view of this, she was inclined to wear gloves more often for patients with MRSA than for any other patients. Despite the provision of information by the researcher on the effectiveness of handwashing and alcohol-based handrubs, this nurse

remained concerned about her hands as a means of transmitting MRSA to other patients, not to mention herself.

This heightened concern about MRSA was evident in a more general sense by comments made about the importance of hand hygiene after contact with patients in isolation as compared with those on the main ward. As already mentioned, the use of a skin disinfectant was considered to be more important after contact with isolated patients than with other patients. In addition to this, six comments were made by nurses who highlighted a tendency to wash their hands more frequently following contact with patients nursed in isolation than those on the main ward, even though they were aware that in theory at least, their approach to hand hygiene should be consistent between all patients. This revealed that although these nurses were knowledgeable about the importance of hand hygiene between all patients, they tended to direct their efforts more towards those with recognised infectious conditions. The implications of this are discussed in Chapter 10.

Both nurses and health care assistants commented about the problem of non-adherence to hand hygiene recommendations. Two nurses highlighted a concern that nurses and other health care practitioners affiliated with the study ward (such as medical staff) did not always wash their hands when indicated. However, they offered no explanation for this. The other six comments were made by individuals in response to feedback by the researcher about omissions in hand hygiene practice observed when working alongside them. Five of these attributed their lack of hand hygiene to forgetfulness and the sixth to a misunderstanding that the use of gloves obviated the need for hand hygiene. Both of these reasons have been identified in other studies as explanations for sub-optimal hand hygiene practice (Pittet, 2001).

The researcher's observations of hand hygiene practice revealed that hands were not always washed when indicated during and after patient care. Nonetheless, there was a substantial improvement in hand hygiene frequency during patient care as compared with the findings of the structured observations of practice during Phase I of the study. Table 41 presents these findings. As the table shows, during seventy percent of the sessions of one-to-one support and instruction, participants always washed their hands when indicated during patient care. This contrasted starkly with the structured observations of practice in Phase I of the study, which revealed that nurses and health care assistants never washed their hands during patient

care. However, the finding that hands were not always washed during or after patient care in thirty percent of the sessions, either by nurses or health care assistants, revealed that sub-optimal hand hygiene practice remained a problem in both of these groups.

Table 41: Researcher's Observations of Nurses' and Health Care Assistants' Hand Hygiene Practice in Relation to Contact Precautions

	RNs (13)		HCAs (5)		Total	
Contact Precautions as per guideline:	Yes	No	Yes	No	Yes	No
Always washed hands during patient care when indicated	12 (71%)	5 (29%)	2 (67%)	1 (33%)	14 (70%)	6 (30%)
Always washed hands at the end of patient care	17 (71%)	7 (29%)	4 (67%)	2 (33%)	21 (70%)	9 (30%)
Total	29 (71%)	12 (29%)	6 (67%)	3 (33%)	35 (70%)	15 (30%)

The lack of hand hygiene despite the fact that participants were working alongside the researcher and were nursing patients they regarded as a priority with regard to the importance of infection control procedures suggested that there was a lack of awareness of the need to wash hands on these occasions rather than a deliberate omission. As mentioned above, the researcher fed back these findings to individuals either at the time or at the end of the shift. Most participants expressed surprise about not having washed their hands when appropriate, although only six offered an explanation for this, the other nine accepting the feedback without further comment. This highlights the difficulty inherent in promoting hand hygiene practice when health care workers do not always appreciate when this is required.

Use of Gloves and Aprons

The findings relating to the use of gloves and aprons revealed that this topic generated the highest proportion of entries in the process record (143/349 or 41%). In all, thirty-three questions were asked and one hundred and ten comments and concerns were made. This was because the new guideline recommended the use of gloves and aprons for specific activities according to the likelihood and extent of microbial contamination, rather than their use indiscriminately for virtually all contact with patients in isolation as previously practised on the study ward. As a result, participants were keen to clarify the activities that required the use of gloves and aprons and those that did not. Indeed, most (32/33) of the questions asked were in relation to this. Table 42 presents a summary of the questions asked by nurses and health care assistants and some examples of these.

Table 42: Questions Asked about the Use of Gloves and Aprons			
	Number of questions		
Subject	RNs	HCAs	**Example**
Activities involving minimal physical contact	3	4	*Is it alright not to wear gloves if only talking to the patient?*
Bed making	6	3	*Are gloves needed for bed making?*
Assisting patient to move	3	4	*Are gloves as well as an apron needed when sitting a patient up in bed?*
Assisting with patient hygiene	3	1	*Are gloves needed for washing the patient's face when they have MRSA?*
Cleaning equipment	1	1	*Are gloves needed when cleaning the patient's washbowl?*
Indiscriminate use of gloves and aprons	2	1	*Should gloves and an apron be worn all the time in an isolation room?*
Other	1	0	*Is it important to change apron before attending to another patient?*
TOTAL	**19**	**14**	

As the table shows, questions were asked both by nurses and health care assistants about specific indications for glove and apron use. This need to clarify rationales for the use of protective clothing indicated that this was an area of practice participants felt very uncertain about. Indeed, the previous approach of routinely donning protective clothing on entry to an isolation room negated the need to think about the rationales for practice in this situation. By implication, this finding suggests that participants were not confident to make decisions about glove and apron use based on their usual practice when nursing patients other than those in isolation, possibly because they were guided more by personal preferences rather than by scientific rationales. This issue is elaborated upon in Chapter 10.

The comments and concerns made in relation to glove and apron use were mostly to do with the routine (non-selective) or selective use of gloves and aprons and the changing of gloves during patient care. In addition, comments were made about the rationales for glove and apron use in general for patients other than those nursed in isolation. Table 43 presents a summary of these comments and concerns.

As the table shows, comments and concerns were made both by nurses and health care assistants about each of the four topic areas. The comments made about the routine use of gloves and aprons revealed the reasons why some participants adopted this approach. The main reason identified on a total of twenty occasions by twelve of the participants (eight nurses and four health care assistants) was habit or thinking that gloves and aprons were necessary routinely. Sixteen of these comments arose during the first time of working with

these participants, the other four occurring on subsequent occasions by individuals who remained uncertain about changing their practice in this respect. In addition to this, six participants (five nurses and one health care assistant) said that although they recognised that gloves and aprons were not always needed, they still preferred to wear them routinely so that they were at least on when they were needed. This indicated that these individuals did not want to think in detail about the rationales for glove and apron use during their day-to-day work, which has serious implications for improving health care workers' infection control practice, since it cannot be assumed that all health care workers are able or willing to consider the principles that underpin it. Indeed, all of these individuals only considered changing their approach to the use of gloves and aprons in relation to no longer wearing them for activities involving minimal physical contact with isolated patients, expressing their intention to continue wearing them at all other times.

Table 43: Comments and Concerns about Glove and Apron Use

	RNs	HCAs
Routine (non-selective) use of gloves and aprons • Habit / thought gloves and aprons were necessary • Worn routinely so that they are already on when needed • Only confident about no longer wearing gloves and aprons for activities involving minimal contact with isolated patients • Protecting self/family from infection • Feels safe wearing gloves • Gloves worn more for patients in isolation than for other patients • Not convinced that hand hygiene alone is effective enough for MRSA	27	10
Selective use of gloves and aprons • Makes more sense as more like 'normal' nursing practice • Makes you think carefully about rationales for glove and apron use • Less concerned about wearing gloves and aprons routinely to be 'seen' as setting a 'good' example • Feels 'strange' / 'exposed' no longer wearing gloves and aprons routinely • Takes time to adjust to wearing gloves and aprons more selectively • Difficult to know which activities require gloves	30	10
Changing gloves during patient care • Gloves not changed previously because thinking only about protecting self • Now able to appreciate the importance of changing soiled gloves • Giving greater consideration to doing 'clean' activities before 'dirty' ones • Having gloves available inside the room makes it easier to change them	12	6
Rationales for glove and apron use in general • Gloves used routinely for all patients out of personal preference or as a 'Universal Precaution' when in contact with blood and body fluids • Gloves used to protect skin which is sore / broken • Not convinced about the value of aprons as an infection control measure	8	7
Total	**77**	**33**

Another reason identified by nurses and health care assistants for wearing gloves and aprons routinely was concern about the need to protect themselves and their families from infection

with CDAD or MRSA. Eight comments were made to this effect, five by nurses and three by health care assistants. As part of the implementation process, the researcher discussed the risks associated with CDAD and MRSA with participants when working with them and explained why patients are generally more vulnerable to infection with these organisms than staff members. It was also explained that protective clothing is primarily required as an isolation precaution to prevent cross-infection between patients. However, whilst some participants appeared to accept this, others required considerable reassurance and were not necessarily convinced of the need to change their practice. This indicated that self-preservation served as a powerful motivating factor that greatly influenced the infection control practices of some individuals, a finding that also emerged from the process record data as a general issue (see below under 'General Issues'), as well as from the findings of the pre and post-implementation interviews. This issue is discussed in detail in Chapter 10.

Related to this were comments about the sense of security that was associated with wearing gloves in particular and the raised awareness of their need when nursing isolated patients. These were made by two nurses, both of whom said that they felt safer with gloves on and were more likely to wear them when attending to patients being nursed in isolation compared with those on the main ward as they perceived it to be more important in this situation. In addition, one other nurse commented to this effect, explaining that she was particularly concerned about the effectiveness of hand hygiene when nursing patients with MRSA (see above under 'Hand Hygiene'), explaining that although she could understand the logic of not needing to wear gloves routinely, she was nonetheless more inclined to wear them for patients with MRSA due to concern about transmitting this organism to other patients.

In general, those participants (eight nurses and four health care assistants) who appeared more receptive to using gloves and aprons more selectively considered that this was a more rational approach, since it was more consistent with 'normal' nursing practice for patients without diagnosed infectious conditions and as such was a more 'universal' approach. They tended to regard the routine use of gloves and aprons as being 'over-the-top' and appreciated being able to practice in a way that they felt made better sense. Several said they were less concerned about having to be 'seen' to be wearing protective clothing in isolation rooms in order to set a good example to others. Many of these more receptive participants said that as a result of working with the researcher, they had a better understanding of the rationales for glove and apron use and were thinking more carefully about this in their day-to-day work.

Indeed, several explained how they were previously unaccustomed to thinking about this, since they generally tended to concentrate on aspects of their work other than infection control.

Nonetheless, some of these individuals said that it would take time for them to become accustomed to the new approach. Comments were made about it feeling 'strange' and even 'exposed' being in an isolation room without gloves and an apron on. There was also concern about the difficulty with not knowing which patient care activities were more likely to result in heavy microbial contamination of hands and therefore require the use of gloves. This concern was expressed mainly in relation to MRSA, as it was considered harder to conceptualise how this organism spreads in comparison with CDAD, the effects of which are more 'visible'.

The comments made in relation to changing gloves during patient care were again made by those participants who appeared more receptive to using gloves and aprons more selectively. They revealed that one of the main reasons for not changing gloves prior to Phase II of the study was that participants were thinking principally about protecting themselves from infection rather than practicing hygienically. Several participants explained that they had not previously considered the need to change gloves between 'dirty' and 'clean' procedures, as there was a sense in which having the gloves on made them feel safe whatever they were doing. Ten participants (six nurses and four health care assistants) acknowledged that as a result of working with the researcher, they were able to appreciate the importance of removing or changing soiled gloves during the care of isolated patients. A few also said that they were giving greater consideration to the order with which they carried out nursing activities, starting with 'clean' tasks before doing 'dirty' ones. This demonstrated a change in the way infection control principles were being applied by these individuals, since they were no longer concerned solely about their own protection, but also about minimising the risks to the patient by the correct sequencing of gloved tasks. Having gloves available inside the isolation rooms was considered to make the changing of gloves during patient care much easier to do.

Comments relating to the rationales for glove and apron use in general when nursing patients not considered to be 'infectious' were made both by nurses and health care assistants. Two of these reflected an awareness of the need for protective clothing as part of 'Universal

Precautions' when in contact with blood and other body fluids. However, in general, the use of protective clothing appeared to be guided more by personal preference than by scientific rationales. Interestingly, no comments were made about the use of gloves as a routine measure to minimise the risk of spreading infection between patients, which possibly reflected participants' lack of knowledge about this. Two health care assistants commented on the use of aprons, stating that they were not convinced of their value as an infection control measure. They explained that they rarely used them on the main ward and only wore them when nursing patients in isolation to comply with others' expectations of them. One participant who suffered from eczema explained that she wore gloves for most patient care activities on the main ward as well as those involving patients in isolation to protect her skin, as this was often broken.

Table 44 presents the findings of the researcher's observations in relation to glove and apron use.

Table 44: Researcher's Observations of Nurses' and Health Care Assistants' Practice in Relation to the Use of Gloves and Aprons as part of Contact Precautions

	RNs (13)		HCAs (5)		Total	
Contact Precautions as per guideline:	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
Used gloves and aprons selectively for activities involving physical contact	11 (46%)	13 (54%)	2 (33%)	4 (67%)	13 (43%)	17 (57%)
Always changed gloves during care when soiled	13 (76%)	4 (24%)	2 (67%)	1 (33%)	15 (75%)	5 (25%)
Total	24 (59%)	17 (41%)	4 (44%)	5 (56%)	28 (56%)	22 (44%)

As the table shows, gloves and aprons were used selectively during less than half (43%) of the sessions of one-to-one support and instruction, more so by nurses than health care assistants (46% and 33% respectively). This reflected the complex nature of this change in practice, which as described above, required participants not only to think about the rationales for their practice, but also to overcome their anxieties in relation to the perceived need for personal protection from exposure to CDAD and MRSA. Observations relating to the changing of soiled gloves during patient care revealed that this occurred spontaneously on 15/20 (75%) of the occasions when indicated. On the remaining five occasions, the researcher provided instruction about the need to change gloves either at the time or at the end of the shift. This represented a substantial improvement as compared with the structured

observations undertaken during Phase I of the study, which revealed that gloves were neither removed nor changed when soiled on 19/23 (83%) of the occasions when this was required.

Use and Disposal of Linen and Clinical Waste

The findings relating to the use and disposal of linen and clinical waste revealed that this topic generated 48/349 (14%) of the entries in the process record. Most (40/48) of these were questions, as presented in Table 45. As the table shows, the highest proportion (35/40) of questions concerned the correct procedures for bagging up and removing linen, clinical waste and bedpans from isolation rooms. This was because the new guideline recommended that there was no need for a 'double-bag' technique when disposing of linen and clinical waste or the use of clinical waste bags to cover bedpans when removing them from isolation rooms, as previously practised on the study ward. As a result, both nurses and health care assistants were keen to clarify the correct procedures in relation to this. Only five other questions were asked, all of which by nurses, about the use and disposal of linen and clinical waste. This included one question about the risk of spreading infection to other patients when carrying a used bedpan through the ward and another about the risk of microbial contamination of the environment associated with bedmaking. In addition, three questions were asked about how often to change isolated patients' bed linen.

Table 45: Questions about the Use and Disposal of Linen and Clinical Waste

Subject	Number of questions		Example
	RNs	HCAs	
Removal of linen/clinical waste/bedpans from isolation rooms	21	14	*Does linen/clinical waste need to be double-bagged?*
Risk of spreading infection via contaminated linen and waste	2	0	*What is the risk of spreading infection from a bedpan?*
Other	3	0	*How often does an isolated patient's bed linen need to be changed?*
TOTAL	**26**	**14**	

Given the number of questions about the disposal of linen and clinical waste, surprisingly few comments were made in relation to this (see Table 46). Half (4/8) of those made concerned the risk of infection associated with removing a used bedpan from an isolation room. Two nurses expressed concern that the use of a paper cover (as recommended in the new guideline) was insufficient to prevent the spread of infection to other patients. In addition, one nurse and one health care assistant commented about this in response to feedback by the researcher when they were observed using a clinical waste bag for this

purpose. Both of these participants were unaware of the new guidance about the disposal of bedpans. Concern about the spread of infection from bedpans indicated a lack of knowledge about the modes of spread of CDAD and MRSA. This concurred with findings of the pre-implementation interviews with nurses, which elucidated their lack of knowledge and misconceptions about infection control in relation to Contact Precautions.

Table 46: Comments about the Use and Disposal of Linen and Clinical Waste		
	RNs	**HCAs**
Risk of infection associated with disposal of bedpans	3	1
Bagging procedure for linen and clinical waste	1	1
Inadequate size of clinical waste bins in isolation rooms	2	0
Total	**6**	**2**

The other four comments were varied. One nurse explained how she considered that the new procedure for disposing of linen and waste was an improvement as it simplified practice and lessened the ritualistic approach to isolation nursing. A health care assistant explained that she was pleased to have clarified the issue of double-bagging, since there was still a lot of confusion about this on other wards in the hospital. Lastly, two nurses commented on the inadequate size of the clinical waste bins inside the isolation rooms.

The researcher's observations of practice in relation to linen and clinical waste disposal revealed that almost all participants carried out these procedures in accordance with the new guideline. Table 47 presents a summary of these findings.

Table 47: Researcher's Observations of Nurses' and Health Care Assistants' Infection Control Practice in Relation to Linen and Clinical Waste Disposal						
	RNs (13)		**HCAs (6)**		**Total**	
Contact Precautions as per guideline:	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
Used single bag system for disposal of linen	14 (100%)	0 (0%)	5 (100%)	0 (0%)	19 (100%)	0 (0%)
Used single bag system for disposal of clinical waste	7 (100%)	0 (0%)	4 (100%)	0 (0%)	11 (100%)	0 (0%)
Did not wrap bedpan/urine bottle in clinical waste bag	15 (94%)	1 (6%)	5 (83%)	1 (17%)	20 (91%)	2 (9%)
Total	**36 (97%)**	**1 (3%)**	**14 (93%)**	**1 (7%)**	**50 (96%)**	**2 (4%)**

As the table shows, the bagging of linen and waste was carried out correctly on all of the occasions observed and the removal of bedpans from isolation rooms was carried out correctly on all except two occasions. This almost universal change in practice was adopted largely without question (other than the above-mentioned concern about bedpans raised by two nurses). Indeed, all that most participants required was clarification from the researcher about the correct procedures (hence the large number of questions about this). The straight-forward nature of this change contrasted with the more complex processes concerning hand hygiene and the use of gloves and aprons, probably because it involved little more than a simple change of rule. Nonetheless, its wide acceptance amongst participants was a little surprising given the misconceptions about airborne spread of infection that were elicited during the pre-implementation interviews. Interestingly, during the post-implementation interviews, a few participants did in fact express a desire to return to their previous practice, as described in Chapter 9.

Use and Cleaning of Equipment

The findings relating to the use and cleaning of equipment revealed that this topic generated 48/349 (14%) of the entries in the process record. In all twenty-four questions were asked and twenty-four comments were made. Table 48 presents a summary of the questions asked by nurses and health care assistants and some examples of these.

Table 48: Questions about the Use and Cleaning of Equipment

Subject	Number of questions		Example
	RNs	HCAs	
How to clean equipment	11	4	*How do you clean a specialised pressure-relieving mattress?*
Taking equipment into isolation rooms	4	0	*Is it alright to take a dressing trolley into an isolation room?*
What to do with unused disposable items of equipment	4	1	*Can unused sterile supplies in an isolation room be used for other patients?*
TOTAL	**19**	**5**	

As the table shows, the majority (15/24) of questions were concerned with establishing the most appropriate method of cleaning various items of equipment. These questions tended to arise at the times when there was a need to clean an item of equipment, illustrating a lack of working knowledge about cleaning procedures amongst participants on the study ward. Indeed, participants rarely cleaned equipment without first checking with the researcher about the most appropriate method to use. In addition to this, four questions were asked

about whether or not specific items of equipment (e.g. a dressing trolley) could be taken into an isolation room and five were asked about whether or not unused disposable items of equipment that had been inside an isolation room could be used for other patients.

Table 49 presents a summary of the comments and concerns raised in relation to the use and cleaning of equipment. Five participants highlighted that certain items of equipment were difficult to clean. For example, sphygmomanometer cuffs were considered problematic as they were covered in a fabric sleeve, which although removable, was not easily washed given that there was no washing machine available to use for this purpose. Coupled with this, concerns were expressed by six participants about the lack of equipment on the ward, since it was not always possible to designate specific items of equipment for single patient use, as recommended in the new guideline, to eliminate the need to decontaminate it after each use (unless visibly soiled).

Table 49: Comments about the Use and Cleaning of Equipment

	RNs	HCAs
Items of equipment that are difficult to clean	3	2
Lack of equipment	4	2
Lack of knowledge about correct cleaning procedures	5	0
Usefulness of detergent wipes	2	1
Keeping room tidy / only using necessary equipment	3	0
Taking dressing trolley into an isolation room	2	0
Total	**19**	**5**

The problem of nurses' and health care assistants' lack of knowledge of cleaning procedures was highlighted by three nurses, who explained how they often came across items of equipment left within isolation rooms because nobody knew how to decontaminate them. This problem had also been identified during the pre-implementation interviews. In addition, two nurses were observed carrying out incorrect cleaning procedures and when questioned about this, indicated their lack of awareness of the correct approach. Three comments were made about the usefulness of the detergent wipes that had been introduced on the ward as a convenient alternative to using detergent and water. A further three comments were made about the importance of ensuring that isolation rooms were kept as uncluttered as possible to facilitate cleaning and minimise microbial contamination of the environment.

Lastly, two nurses expressed concern about taking a dressing trolley into an isolation room as they considered this practice to be inappropriate given that the trolley would be used to carry out 'aseptic' procedures on other patients. It was interesting that despite the researcher reassuring these nurses about the effectiveness of the cleaning procedure for dressing trolleys, both remained unconvinced about the acceptability of using them inside isolation rooms. This demonstrated that sometimes even when provided with information by a 'credible' source, nurses still prefer to be guided by their own alternative belief system, no matter how irrational this may be. This issue is elaborated upon in Chapter 10.

The researcher's observations of the cleaning of equipment by participants revealed that the correct procedure was followed on 10/12 (83%) of the occasions observed (see Table 50). This was because on all ten occasions, participants clarified the correct procedure with the researcher immediately beforehand. On the two occasions when nurses' practice was incorrect, they were unaware of this until the researcher highlighted it.

Table 50: Researcher's Observations of Nurses' and Health Care Assistants' Practice in Relation to the Cleaning of Equipment as part of Contact Precautions

	RNs (13)		HCAs (6)		Total	
Contact Precautions as per guideline:	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
Equipment always cleaned correctly after use	7 (78%)	2 (22%)	3 (100%)	0 (0%)	**10 (83%)**	**2 (17%)**

Although limited in number, these findings illustrated the absence of a working knowledge of cleaning techniques amongst participants on the study ward, which was a cause for concern given the frequency with which equipment is re-used on a hospital ward and its potential to serve as a source of cross-infection between patients (Talon, 1999).

Issues about Isolated Patients and their Visitors

The findings relating to isolated patients and their visitors revealed that this topic generated 33/349 (9%) of the entries in the process record. In all, eighteen questions were asked and fifteen comments were made. Table 51 presents a summary of the questions asked by nurses and health care assistants and some examples of these. As the table shows, ten questions concerned the management or treatment of patients with CDAD or MRSA, nine of which were asked by nurses. This indicated an apparent lack of working knowledge of patient management issues amongst some nurses despite the frequency with which patients with

CDAD and MRSA were encountered on the study ward. A further four related to the risks associated with patients leaving their rooms to enable them to mobilise as part of their physiotherapy. Four questions were asked about visitors, three concerning the infection control measures they needed to take and one about the information available to them in relation to Contact Precautions.

Table 51: Questions Asked about Isolated Patients and their Visitors

Subject	Number of questions		Example
	RNs	HCAs	
Management / treatment of patients with MRSA	7	1	*What treatment is needed for a patient with MRSA?*
Management / treatment of patients with CDAD	2	0	*When can isolation be discontinued for a patient with CDAD?*
Isolated patients leaving their room	2	2	*Is it alright for an isolated patient to leave their room for physiotherapy?*
Precautions for visitors	1	2	*What infection control precautions to visitors need to take?*
Information for visitors	1	0	*What information is available for visitors about isolation precautions?*
TOTAL	**13**	**5**	

The comments about patients and their visitors were to do with the benefits associated with no longer wearing gloves and aprons for social contact and the instructions given to visitors about this. Table 52 presents a summary of these findings.

Table 52: Comments about Patients and their Visitors

	RNs	HCAs
Benefits for patients and visitors	6	3
Instructions given to visitors	5	1
Total	**11**	**4**

As the table shows, the majority (9/15) of comments concerned the benefits of no longer wearing gloves and aprons for social contact with isolated patients, as this was considered to be more reassuring and less stigmatising for them and also their visitors. Four nurses described how patients were benefiting from more social contact with staff, who were much more inclined to go into their room for a chat. The other six comments were made by participants who described the instructions they were giving to visitors. Four of these were by nurses whose advice was in accordance with the new practice guideline, whereas the other two (by one nurse and one health care assistant) required correction by the researcher, since the individuals concerned were not aware of the recommendation that gloves and aprons

were not routinely required for visitors. There were only a few instances when participants were actually observed giving instructions to visitors. Therefore, the extent to which practice changed in this respect was assessed only during the post-implementation interviews.

General Issues

In addition to the entries in the process record about specific aspects of the guideline on Contact Precautions, there were some more general questions, comments and concerns about Contact Precautions. These amounted to 30/349 (9%) of the entries recorded and included eighteen questions and twelve comments/concerns. Table 53 presents a summary of the questions asked by nurses and health care assistants, which could be grouped under three headings.

Table 53: Questions about General Issues

Subject	Number of questions		Example
	RNs	HCAs	
Risk to self / family	3	3	*What is the risk of taking infection home to my family?*
Mode of spread of CDAD / MRSA	8	0	*How is MRSA spread?*
Efficacy of Contact Precautions	3	1	*If basic infection control measures are the same for all patients, why do CDAD and MRSA patients need to be isolated?*
TOTAL	**14**	**4**	

Six of the questions related to the risk of infection to staff and their families associated with nursing patients isolated due to CDAD and MRSA. This issue was an apparent source of anxiety amongst participants on the study ward, some of whom required considerable reassurance about it. Eight questions were about the mode of spread of infection, four in relation to CDAD and four about MRSA. These were all asked by nurses, illustrating the extent of their lack of knowledge about Contact Precautions. This had huge implications for practice, since without knowing how these organisms are transmitted, there could be little, if any appreciation of the infection control measures that prevent their spread. This finding concurs with findings of the pre-implementation interviews, which revealed the lack of knowledge of basic microbiology and infection control principles amongst nurses and health care assistants, many of whom had misconceptions about airborne spread of infection, particularly in relation to MRSA.

Interestingly, four participants (three nurses and one health care assistant) asked about the effectiveness of Contact Precautions for patients with CDAD and MRSA given that the infection control measures promoted in the guideline were the same as those required for all patients. This demonstrated that these participants recognised the inconsistency inherent in recommending that the infection control measures applicable to all patients are safe and effective to prevent contact transmission of infection, whilst at the same time requiring that all patients with CDAD and MRSA are nursed in isolation. It highlights a critical issue that is central to this research study and has been the subject of great debate in the literature since Lynch et al (1987) first drew attention to it. This issue is discussed in detail in Chapter 10.

Table 54 presents the general comments about Contact Precautions that were made by nurses and health care assistants.

Table 54: Comments about General Issues

	RNs	HCAs
Risk to self / family	4	0
Raised awareness of infection control measures for isolated patients	6	1
Importance of infection control measures for all patients	1	0
Total	**11**	**1**

As the table shows, almost all (11/12) of these were made by nurses and were grouped under three headings. Four general comments concerned the risks associated with staff taking infection home to family members following contact with isolated patients. This was in addition to the more specific comments relating to glove and apron use described above. As already mentioned, such comments illustrated the anxiety amongst participants about this issue, which is discussed in detail in Chapter 10. A further seven comments were in relation to their being a raised awareness amongst nurses of the importance of infection control measures for isolated patients as compared with other patients. Again, these comments were in addition to those already described in relation to hand hygiene and the use of gloves and aprons. They illustrated how there were two levels of infection control practice in operation on the study ward, one for isolated patients and one for all other patients, a finding which was also identified from the pre-implementation interviews and is discussed in detail in Chapter 10. Notwithstanding, one nurse did express the view that infection control measures should be applied consistently to all patients irrespective of whether or not they have CDAD

or MRSA, which demonstrated her agreement with the infection control principles promoted during Phase II of the study.

Summary

In summary, the findings of Phase II of the study provide an understanding of participants' infection control practice in relation to Contact Precautions in the context of a supportive intervention designed to improve practice. They also confirm a number of the issues identified during Phase I of the research. In particular, they reveal how participants found it difficult to understand infection control principles and apply them practice, as evidenced by the questions and comments raised whilst working alongside the researcher. In some instances, individual participants were reluctant to adopt recommended procedures if these conflicted with their own beliefs about the spread of infection. Participants' anxiety about the risk to themselves from exposure to infection also concurred with findings of the pre-implementation interviews and influenced some individuals' willingness to change their practice. The increased importance placed upon the need for infection control measures when nursing isolated patients as compared with other patients, as identified in the pre-implementation interviews, was also confirmed during Phase II.

The findings also reveal the differing degrees to which participants appear receptive to changing their infection control practice. Changes in some aspects of practice, such as the disposal of linen and clinical waste, were relatively straightforward and as a result of this, were adopted almost universally. However, other changes, in particular, those relating to the use of gloves and aprons were more complex and were not adopted to the same extent by all participants. The recommendation to use gloves and aprons on a selective rather than a routine basis proved to be especially complex and individual participants differed in the degree to which they adopted it according to their willingness to consider the rationales for glove and apron use and their level of anxiety about the risk to their own health from exposure to CDAD and MRSA. Some participants required considerable reassurance about this issue before they were willing to change their practice. Nonetheless, there appeared to be marked improvements in practice as compared with the findings of the structured observations of practice during the Phase I of the study, although as the observations of practice during Phase II were unstructured, they provide an indication rather than a more precise measure of the extent to which participants' practice changed. In addition, there were

perceived benefits to patients from improvements in practice. For example, participants considered that the more selective approach to glove and apron use meant that patients felt potentially less stigmatised and appeared to receive more in the way of social contact from nurses and health care assistants.

The findings that emerged during this phase of the research provide important information about the factors that influence participants' infection control practice and form the basis of the discussion in Chapter 10. In the next chapter, the findings of the interviews undertaken during Phase III, the post-implementation phase of the study are described.

CHAPTER 9

FINDINGS (4): THE POST-IMPLEMENTATION SEMI-STRUCTURED INTERVIEWS

Introduction

In this chapter, the results of the analysis of the semi-structured interviews with nurses and health care assistants undertaken during Phase III, the post-implementation phase of the study, are presented. As detailed in Chapter 5, these interviews were conducted with all of the nurses and health care assistants who took part in Phase II of the study to ascertain their perceptions of its impact on their practice. In particular, respondents were asked which, if any aspects of their practice they had changed and which aspects of the supportive intervention facilitated this. The following account presents a brief overview of the data on respondents' self-reported changes in practice and then focuses on a more detailed analysis of these findings according to each aspect of infection control practice that formed part of the guideline on Contact Precautions. Following this, the findings relating to respondents' evaluation of the supportive intervention are described.

Characteristics of the Sample of Nurses and Health Care Assistants Interviewed

The sample consisted of all nurses and health care assistants who participated in Phase II of the study, as detailed in Chapter 8. This included all eighteen participants who met the sampling criteria, as none of the individuals approached were unwilling or unable to participate in an interview. The interviews were tape recorded and lasted on average thirty minutes, ranging between twenty to forty-five minutes. Table 55 shows the number of respondents according to their status and grade.

Table 55: Number of Interviews (Post-Implementation)	
Status / Grade of Nurse	**Number of Interviews**
Ward Manager ('G' grade)	n=1
Senior Staff Nurse ('F' grade)	n=1
Registered Nurse ('E' grade)	n=2
Registered Nurse ('D' grade)	n=9
Health Care Assistant ('A / B' grade)	n=5
Total	**n=18**

Overview of the Data

Table 56 presents a summary of the interview findings relating to the self-reported changes in practice that took place as a result of the supportive intervention.

Table 56: Self-Reported Changes In Practice as a Result of the Supportive Intervention

	RNs (13)		HCAs (5)		Total	
	Yes	No	Yes	No	Yes	No
Washing hands more	8	5	3	2	11	7
No gloves or apron for minimal physical patient contact	13	0	5	0	18	0
Selective use of gloves and aprons for physical patient contact	7	6	2	3	9	9
Changing gloves during care when soiled	8	5	4	1	12	6
Instructing visitors about correct precautions	11	2	4	1	15	3
Using single bag system for linen and waste disposal	12	1	5	0	17	1
Not wrapping bedpans and urine bottles in yellow bags	7	6	4	1	11	7
Cleaning equipment correctly	10	3	5	0	15	3
Total	**76 (73%)**	**28 (27%)**	**32 (80%)**	**8 (20%)**	**108 (75%)**	**36 (25%)**

As the table shows, in all, the proportion of practices that were reported to have changed as a result of the supportive intervention was 108/144 (75%). Health care assistants reported a slightly higher proportion of changes overall (80%) as compared with nurses (73%). There were variations in the number of respondents who reported changing their practice according to each practice area. For example, all eighteen respondents reported no longer using gloves and aprons for minimal physical contact with patients as a result of the study, whereas only half (9/18) reported using them selectively in all other situations. The findings are similar to those of the participant observations of practice undertaken during Phase II of the study which revealed that overall, 154/194 (79%) of the practices observed were carried out correctly whilst participants worked alongside the researcher. In particular, the findings relating to the selective use of gloves and aprons and use of a single-bag system for linen and waste disposal were very similar. Indeed, in Phase II, selective glove and apron use was observed on forty-seven percent of occasions and was reported as a change in practice by fifty percent of respondents in Phase III. Likewise, almost all (94%) respondents reported using a single bag system for linen and clinical waste disposal in Phase III, which was observed on one hundred percent of occasions in Phase II. The following account describes the interview findings relating to self-reported changes in practice in more detail.

Hand Hygiene

The interview findings relating to hand hygiene revealed that eleven of the eighteen (61%) respondents reported washing their hands more frequently as a result of the supportive intervention. Specific changes included washing hands after removing gloves, washing hands during patient care when changing gloves, using alcohol gel more often and washing hands more between patients on the main ward. Interestingly, eight respondents (six nurses and two health care assistants) specifically stated that they had a better appreciation of the importance of hand hygiene as an infection control measure, as the following excerpts illustrate:

> "I think from all the discussions we've had and things I've read and I think from what you've been saying about handwashing, it just seemed a significant factor. And I was particularly keen on looking at methods that may prevent infection universally and just between any patients. And the fact that we don't know a patient's got an infection until we get a positive result, I think its quite a simple and obvious thing to do."
>
> RN 702

> "I think before, it was very much you only washed your hands if you really thought yuck, I've got something on my hands, I'll go and wash them. I'm sure I did wash my hands, but it would only be if they were obviously soiled. So yes, from the point of view of just thinking about transferring germs from one patient to another, I wash my hands after each patient no matter what I've done, whereas I wasn't doing that before."
>
> RN 306

Prior to Phase II of the study, participants were generally much more concerned about the potential for airborne spread of infection. It was therefore essential to address this misconception in order to promote improvements in hand hygiene practice. However, five of the eight respondents who said they had gained a better appreciation of the importance of hand hygiene in routine practice also said that they were still more conscious of the need for hand hygiene when attending to patients being nursed in isolation compared with those on the main ward. Indeed, they all acknowledged that hands were not always washed when they should be between patients on the main ward. One nurse considered that it was more difficult to tackle colleagues about poor hand hygiene practice when patients were not being nursed in isolation as the risks were not as obvious. The following excerpts demonstrate these points:

> "People are more conscious when they're in there [isolation room] that they're hands must be washed properly, but I feel when you're on the main ward, obviously you've still got to have clean hands, but I find, I even do it myself sometimes, you're in a rush, somebody else is calling you and hands don't always get washed."
>
> RN 305

> "I know in theory you should do the same for everybody, but I just think its human nature, when you clean up someone with CDT, after you've taken you're gloves off to really really scrub your hands. Yes, you should do it for everybody but it just doesn't happen."
>
> RN 409

> "I do still find it difficult when I see other people aren't [washing their hands] to pull them up on that..... I think you can tackle them when you're looking at patients in isolation with a known infection. When you're talking generally about patients' care and hygiene I think its difficult.... Its the proof factor which is difficult and also I think there's a bit of embarrassment that you're in a way suggesting that the nurse either isn't hygienic or isn't caring. With patients in isolation you've got something known and concrete you're dealing with and that risk is known and documented. Its a standard that we all need to follow."
>
> RN 702

This illustrates one of the difficulties inherent in promoting good hand hygiene practice between all patients, as it appeared that unless patients were being nursed in isolation, hand hygiene was unlikely to occur as frequently as it should. One nurse also said that by making the approach to Contact Precautions more like normal practice, she found it more difficult to remember to wash her hands after attending to patients nursed in isolation:

> "Its much more normal, much more normal. I think at times though, because its more normal, its harder to remember to wash your hands when you leave the room. So I often find myself thinking oh, I haven't washed my hands and going to the sink outside of the room to wash my hands before I go to another patient. So it makes it more normal, but its easier to make those mistakes."
>
> RN 408

This clearly has important implications for practice, since potentially, rather than promoting improved hand hygiene practice for all patients, a more generic approach to infection control may result in less frequent handwashing. Whilst there is an abundance of observational studies in the literature that report the problem of non-adherence to hand hygiene recommendations by health care workers (see Chapter 3), none have compared routine practice with practice in relation to Contact Precautions. This is an important issue that requires further research in order to inform the debate about the relative merits of the traditional isolation precautions system versus a more generic approach to infection control practice, as discussed in Chapter 10.

There was a mixed response to the promotion of an alcohol-based handrub as part of hand hygiene practice during Phase II of the study, as the following excerpts reveal. Whereas some participants reported that they liked the product, others disliked it, mainly owing to concerns about it drying their skin. This concurred with findings of Phase II, during which most of the comments made in relation to hand hygiene were to do with participants' concerns about the detrimental effect of alcohol handrub on their skin. As mentioned in Chapter 8, this finding illustrates the importance of providing hand hygiene products that are well-tolerated by health care workers, since even though alcohol-based handrubs have been

found to cause less drying and skin irritation than soap and water (Boyce et al, 2000), participants were not necessarily convinced about this.

> "I hadn't used the alcohol gel before we started the project. I like it because it's got moisturiser in it, which saves your skin drying out. I use it every time I leave the room, even if I've just been in there to talk to them and I've touched something while I was in there."
>
> N304

> "I quite like the gel, I use it. I know a lot of people don't like it and I'm not sure how much they use it."
>
> N503

> "I hate it [alcohol gel]. And it dries my hands. My hands are very dry anyway and if I don't put cream on them, all cracks come out on my hands. So I only use the gel when I come out of the isolation rooms or on the ward if I've done a dressing."
>
> N302

> "I'm pretty bad at using alcohol gel. I just don't like it. It's supposed to be non-sticky, but it still makes my fingers stick. I think washing my hands should be enough."
>
> N507

The seven respondents (five nurses and two health care assistants) who reported no change to their hand hygiene practice considered that they had always washed their hands appropriately anyway. However, as described in the following section, six of these respondents did not report changing their gloves when soiled during care (at which point a handwash would usually be indicated too) revealing their lack of appreciation about what constitutes appropriate hand hygiene practice. The remaining nurse explained that she had always appreciated the value of hand hygiene, as it had been reinforced during her nurse training. However, she also expressed concern that other colleagues on the ward did not appear to appreciate the importance of hand hygiene:

> "I still think people don't see it [hand hygiene] as the most important thing. I think people think its almost too basic and they just don't think about it."
>
> RN 601

Use of Gloves and Aprons

The interview findings relating to the use of gloves and aprons revealed that all eighteen respondents reported changing their practice with regard to no longer wearing gloves and aprons routinely on entering an isolation room for activities involving minimal physical contact with the patient or their environment (e.g. talking to the patient, delivering their meal or medication, recording their oral temperature). All respondents appeared to accept the rationale for this change and indeed many said they welcomed it because it was less time consuming and avoided wasting resources. In addition, two respondents (one nurse and one health care assistant) said they felt more reassured about the risks to themselves as a result of

no longer being required to wear gloves and aprons routinely. The following excerpts are examples of these points:

> " If you're just taking in food or putting a cup of tea down, I mean I always thought it [wearing gloves and apron] was a bit ridiculous anyway to be honest."
>
> HCA 04

> "You save money on gloves and aprons and there's less time wasting gowning up and whatever."
>
> RN 302

> "I suppose it gave me more confidence that I could go in there without all this gowning and gloving and goodness knows what else. I felt more comfortable going in. Whereas before I would be thinking Oh my God, have I got something on my uniform? Am I going to take this home?"
>
> RN 306

> "Its not so worrying because you've got that reassurance. Because we really don't know what its [infection] going to do to us. We don't know how its going to affect us over a long time. You don't know do you? So to have somebody say no, its OK, you don't need to wear it for that, it lessens that fear of what that.... Because you don't know. Its like anything else, you might think oh what am I going to get later on? I'd better put all this gear on. But if you get the reassurance that that's fine, as long as you've got that go ahead, you feel quite confident."
>
> HCA 10

Benefits for the patient were that it was less stigmatising and that they were gaining more from social contact with staff, who were more inclined to go into the room for a chat. Most (15/18) respondents were also correctly advising visitors that they did not need to wear protective clothing for social contact with the patient and this too was considered to have a less stigmatising and more reassuring effect both for patients and visitors.

> "I think it's nicer for the patient when you go in there that you haven't always got to go in with gloves and aprons on. Because I think it makes them feel a bit... oh you know, I'm infectious, they want to keep away from me. This way, you can go in and talk to them just like you would anybody on the ward."
>
> N304

Whilst all respondents reported wearing gloves and aprons less as a result of the supportive intervention, half (9/9) reported still wearing them more than necessary. All of the respondents who reported having fully adopted the selective approach to glove and apron use, as recommended in the practice guideline, stated that they were thinking more carefully about the rationales for this practice as a result of the study. They described the ways in which they made judgements about when gloves and aprons were needed. Indeed, they reported using them for specific activities or procedures involving contact with moist body sites, bodily fluids or infective material and wearing only an apron for activities such as

assisting the patient to move and bedmaking. This was in accordance with recommendations in the new guideline.

> "After working with you I was able to use my common sense a bit and know that I could rely on handwashing when I had just been doing ordinary things with a patient like going in and moving things around in their room, taking their pulse, or even helping them to move in the bed. I felt happy not to be wearing gloves, but aware I needed to do the handwashing thing."
>
> RN 408

> "I'm actually thinking now before I do anything. Before I would automatically put gloves and an apron on and walk in regardless of anything, but I would probably think now and say well is it necessary for me to do this?"
>
> HCA 11

The other nine respondents (six nurses and three health care assistants) continued to wear gloves and aprons for most patient care activities regardless of whether or not they were recommended for use.

> "I basically wear gloves and aprons for pretty much everything, unless I'm going in say if someone's got MRSA or CDT and I'm going in to stick a thermometer in their mouth, stand there for two minutes, look at it and walk out again, I'll wear gloves and aprons for basically anything else."
>
> RN 409

All of these respondents reported wearing gloves and aprons more for patients in isolation than for those on the main ward. The main reasons given for this were the perceived need for personal protection and ensuring that gloves were worn when they were needed:

> "Because I've got a young child at home, I tend to be really paranoid about taking anything home with me and giving it to her."
>
> RN 409

> "For MRSA patients I still put gloves on, because I don't want to pick up a bug. I do the same thing for CDT. Whereas on the main ward, unless they're incontinent, then no [I don't wear gloves]."
>
> HCA 04

> "I still wear gloves and apron if I'm going to do anything for the patient because you never know what you're going to find. You can guarantee that if you go into the room, they'll want you to do something for them, so I still always do it as a precaution."
>
> HCA 05

One respondent suggested that the routine use of gloves and aprons when nursing patients in isolation, although unnecessary, would at least ensure that this practice was adhered to given that not all health care staff necessarily think much about infection control. This is a valid point, although as the findings of the structured observations conducted in Phase I of the study revealed, routine glove and apron use resulted in serious deficiencies in hand hygiene

practice during patient care. Nonetheless, the issue of how best to express rules about infection control is a highly pertinent one, as discussed in detail in Chapter 10.

> "I mean it might be easier to go for like any time you go into a sideroom, you put gloves and aprons on, because at least you know its going to get done. I mean alright, it's a bit over-the-top and unnecessary and wasteful in terms of resources, but at least infection is minimised. I think you need to try and make it apply to the lowest common denominator. Think stupid. Aim it at that level and you'll probably be alright."
>
> RN 409

Interestingly, one nurse who reported wearing gloves more than necessary did report being selective about glove use for patients with CDAD, but not for those with MRSA. This was because she was not convinced that hand hygiene practice alone was sufficient to prevent the spread of MRSA to other patients:

> "I think with MRSA its just this feeling that this thing just seems to get a hold. You know, you get this concept, you read everything in the paper, even though you know it isn't like that, you just think who am I going to pass it on to. Are they going to be somebody that is so susceptible that they're not going to be able to clear it whereas with CDT it doesn't seem to be such.... I mean its important, but it doesn't seem so important as MRSA. I feel I can wash my hands and be clear of it, whereas with MRSA I always air more on the side of caution."
>
> RN 306

This illustrates how health care workers' own beliefs about infection control are an important influence on their practice, an issue which is discussed in detail in Chapter 10.

Those respondents who reported using gloves and aprons selectively recognised that not all of their colleagues were doing the same. One nurse considered that this was because they were less motivated to think about their practice and preferred instead to be told what to do:

> "I think people should be questioning why they're doing what they're doing. And if you have to stop and think every time before you go into a side room then that's good. Some people do, whereas I think other people don't. Some people just want to be told this is what you do and I don't think we're going to change that. And they're probably the people who are going to wear gloves and aprons for everything."
>
> RN 601

This again highlights the point that health care workers may differ in the extent to which they are willing or able to think in detail about infection control aspects of their practice, which has implications for the way in which rules about infection control are presented. Whilst this did not appear to cause concern amongst most of the respondents, one health care assistant did experience problems, as she was being instructed by some of the qualified nurses to wear gloves more than she understood was necessary:

"At the moment, we seem to be going in with gloves and aprons on to hoist the patient and if I turn around and say well we don't need gloves for this, we always get one member of staff that will say yes you do. I walked in one day and they said out there and put your gloves on..... But then who am I to argue? Because I am at the bottom of the rung. Its very frustrating."

HCA 11

The interview findings relating to the changing of gloves during patient care revealed that twelve respondents (eight nurses and four health care assistants) became aware about the importance of doing this as a result of the supportive intervention. In addition, one nurse reported that she had always done this anyway. During their interviews, many respondents acknowledged that the reason they had not previously changed gloves during the care of patients in isolation was that they were thinking mainly about protecting themselves from infection. The following excerpts illustrate these points.

"I think because you're thinking more generally about what you're doing, you're then aware that rather than thinking all the time that this is a protection for you, that I mean if you're getting these organisms on your gloves, you then don't want to spread them to another part of the patient. So if you've done their catheter care, you would then change them before going on to do something else. I think before, I would just tend to be gloved and aproned and think that was it really, that that gave you protection rather than the patient. And because things weren't getting directly onto your skin, you weren't really thinking. I mean I don't think you were encouraged to think what have I just done, what am I about to do next in terms of infection control. You thought the infection control aspect was tackled by the fact you had gloves and an apron on, so then you could just purely concentrate on doing things for patients."

RN 702

"Having the gloves inside the room definitely changed peoples' practice. I think it freed you up to being able to go into the room without gloves on, knowing they were there if you needed them. And not doing everything with gloves on, from catheter care to washing someone's face, knowing that you had the option, as you have the option of washing your hands or putting gloves on when you're looking after somebody who isn't in isolation. Then you have the option as well to change your gloves and so that was a change I noticed in not just me."

RN 408

"Now, when you're doing a dirty job on a patient, you're not going to carry on using those same gloves and wash their face or any other care on them. Once you've done it, the gloves go and you get a clean pair. So you're not only caring for yourself, but you're caring for the patient, because you're not transferring those germs from that area to another area."

HCA 10

The other five respondents (four nurses and one health care assistant) reported no change in their practice with regard to changing gloves, nor did they demonstrate an awareness of the importance of doing this.

"I only change them if they split. I noticed when I did a PEG one day with you, you said that I should really have changed the gloves. But other than that, there's no need unless they're ripped or manky. There's no need for it, because if you're doing total patient care, you start from the top and go to the bottom anyway."

N302

Interestingly, all of these respondents were among those who reported that they were still wearing gloves and aprons non-selectively, suggesting that in general, they were giving less thought to this aspect of their practice than some of their colleagues. This concurred with findings of Phase II of the study, which revealed differences between participants with regard to the extent to which they were prepared to consider aspects of infection control practice such as the rationales for glove use.

Disposal of Linen and Clinical Waste

The interview findings relating to the disposal of linen and clinical waste revealed that most respondents reported changing their practice in accordance with the new guideline. Indeed, as regards the change from double-bagging to single-bagging of linen and waste, all but one of the respondents reported that they had adopted the new approach. This almost universal change in practice seemed to take place without much difficulty once participants had clarified what the new system involved.

> "Yes, the double-bagging and needing somebody on the other side of the door has changed. What we're doing now feels like the right routine. It feels like the right way to be going and people settled into that quite quickly once they had the information. I think people worried that there was a risk to other patients and once they realised that there wasn't then that was it. It was quite a black and white issue. You either do it right or you don't. I think that's why it was easy because it was yes or no really."
>
> RN 601

> "I think the majority of people are just bagging it once now. And they're more relaxed about it, so there's no more of this you've got to stand outside and I'll pass it out. That's definitely happening and its made it much easier because there's not all this problem of needing a second person."
>
> N406

However, despite changing their practice, two respondents (one nurse and one health care assistant) did express concern about the effectiveness of using only one bag, indicating that they would prefer to revert to the old system:

> "I couldn't quite see the logical reason as to why you didn't double-bag it. I felt it was still more logical to have two bags. And maybe if someone else was tying it. You've got one bag in the room and it would have been easier to bag everything up and then maybe just sort of at the doorway have a clean bag. Because you're carrying it actually through the ward. And you could be passing germs. I don't quite know how, but its just the thought that you are walking through the ward with this bag covered in germs."
>
> RN 306

> "I suppose thinking about it the fault lies on the outside of that bag. Because that still goes outside doesn't it. It doesn't go into another bag. We used to put the dirty linen in the white bag first and then into the red bag. And the red bag was outside so the red bag was held open and the white bag thrown in and tied up. So the red bag didn't actually enter the room, so that was fine. It's a good practice. I think its good because it keeps infection down a bit doesn't it? Definitely."
>
> HCA 10

The respondent (a nurse) who had not changed his practice seemed completely unaware of the new system and was unable to describe the recommendation within the guideline. This reflected this individual's limited participation in Phase II of the study rather than a reluctance to accept the rationale for the new approach.

As regards the change from using yellow bags for the removal of bedpans and urine bottles to using paper covers, eleven respondents (seven nurses and four health care assistants) reported changing their practice and a further three nurses stated that they had always used paper covers anyway.

> "I never knew what to do with bedpans and stuff until I started working with you. I probably did something different every time. I know that one thing that used to happen was to put it into a yellow bag. I don't know what happened to the gloves and apron on the way down to the sluice. I know that the yellow bag was involved and it was a big palaver. So that has simplified definitely."
>
> RN 408

> "I think I'm more confident about doing that [taking bedpans to the sluice]. I think it was always done, but in a kind of furtive way sometimes, you know, I hope nobody sees me because... I think ignorance breeds fear and you felt you were bringing something very lethal out of this room and putting people at risk. But knowing that there wasn't an alternative for getting it from A to B... I mean everybody had to do it, but I don't think it was a thing people felt comfortable with. But now, I think people are more understanding and you know that providing you don't stop and place it on somebody's chair or something on the way to the sluice, its OK."
>
> RN 701

The remaining four respondents reported that they were continuing to use yellow bags. This included three nurses who seemed unaware of the change of system and one health care assistant who was aware of the new approach, but chose not to adopt it out of concern about her own protection:

> "We always used to cover them [bedpans and urine bottles] in yellow bags. I still do. I mean I know you say that you can't get infected outside, but I prefer to do it. Because it's not very nice to take a urine bottle or a bedpan up the ward anyway. And I just use it for my own protection in case it spills on me. Because if its in one of those paper things, its not much good if it spills on you. Whereas if its in a yellow bag, you can put it right inside the bag so its better for me."
>
> HCA 04

Interestingly, this respondent did use paper covers when removing bedpans and urine bottles from 'un-infected' patients on the main ward, presumably because she perceived that there was less of a risk to herself. Another health care assistant also expressed concern about the effectiveness of the new approach even though she had changed her practice:

> "We used to put them [bedpans and urine bottles] in yellow bags. Those yellow bags didn't actually go into the room and so the infection was contained into that bag really. I thought that was a good idea."
>
> HCA 10

This illustrated the difficulty associated with attempting to alter participants' beliefs about infection control, since despite an intensive individual education and support during Phase II of the study, the lack of understanding of the ways in which bacteria may spread from items such as bedpans and urine bottles remained apparent amongst some individuals. The following excerpt is a good example of this:

> "I mean if patients are sat there and you walk by with a steaming bedpan, you could have stuff jumping off it, you could have bacteria being spread."
>
> RN 409

The implications of this irrational response to new information about infection control are discussed in Chapter 10.

Cleaning of Equipment

As with the disposal of linen and waste, interview findings relating to the cleaning of equipment revealed that most (15/18) respondents reported changing their practice. Indeed, all those who said that their practice had changed were able to describe the correct methods of cleaning items of patient care equipment. Many also explained how they were more confident about knowing what to do.

> "We're not afraid of bringing things out of the room now. Before, you would take something in and that would sit in there and collect dust for God knows how long, whereas now if its clogging up the room and there's no need for it, we can just clean it and bring it out."
>
> RN 503

> "I think its good that we do know how to clean the equipment now. I think before, some of the equipment would have been in the room with the patient who had that infection, then even if three weeks later they hadn't actually used it, it would still be there because people wouldn't know what to do. They would take things in the room, but they wouldn't know how to clean it to make it safe to come out. So the room would get very full of things. And if other patients were in need of that equipment, we would have to go and borrow from other wards."
>
> RN 702

Only three respondents, all of whom were nurses, stated that they had not changed their practice with respect to cleaning equipment. All described incorrect methods of cleaning, indicating that they had not adopted the new approach. This possibly reflected their limited

participation in Phase II of the study, since these respondents were among those who appeared to engage in the supportive intervention to a lesser extent than others.

General Issues

An issue that emerged repeatedly from the interview data was the sense of confidence that individuals considered they had gained as a result of the supportive intervention. Indeed, the majority of nurses and health care assistants said that they felt more confident about what they were doing. Several also commented that as a result of this increased confidence, they were better able to correct the practices of colleagues and in particular, doctors.

> "I think having the confidence to go into a barrier nursing room without gloves on was a big change. Before, I just put gloves and an apron on straight away before entering a room, whereas when I worked with you, I was able to ask what I needed gloves for and that definitely changed my practice."
>
> RN 408

> "Nurses feel a lot better about telling doctors what they should be doing, because we feel we have the knowledge to do it and people will pull people up and say no you mustn't do that or have you cleaned your stethoscope or whatever. Whereas I think before, people would never have said anything. They might have moaned about it amongst themselves, but they wouldn't have said anything to the person involved."
>
> RN 601

Being able to instruct other health care professionals about Contact Precautions was an important issue, particularly for qualified nurses, as other health care professionals tended to rely on them for guidance on what to do. Indeed, this issue was highlighted during the pre-implementation interviews, as nurses had felt under-confident about their ability to instruct colleagues given their own lack of knowledge. As one nurse said:

> "I think that if nurses feel more confident and are understanding what they are doing, it increases their worth in a way, that they are able to make judgements and be selective and talk to the relatives about the infection, rather than they're just playing a part in something that they're equally mystified with. You know, that increases their standing if they can educate people and that they're only doing what's necessary and that they've thought about it."
>
> N702

Several nurses commented that they considered health care assistants to be more confident about isolation nursing, requiring less supervision from the trained staff than before. Some of the health care assistants themselves confirmed that they were more confident and one in particular felt able to correct others' practice.

> "I think the nursing assistants are more competent to go and look after somebody in isolation. They know what to do and they don't have to keep coming and asking you. And they don't feel the need for a trained member of staff to be with them. Whereas before, the care assistants were less confident and maybe a bit scared to go and do it by themselves. They were a bit worried about whether they were going to do it right and about their own protection."
>
> N507

> "I'm a lot more confident about saying things to people, whereas I wouldn't have done before, because I wasn't sure whether I was right or not."
>
> HCA 205

One nurse highlighted the benefits to patients from participants' newly found confidence, indicating that prior to the supportive intervention, fear about the risk of exposure to infection may have given rise to an avoidance of patients with infections:

> "I think before, there would be a tendency to put gloves and aprons on for everything, which had a detrimental effect on patients, or an avoidance of patients with infections, which was equally bad. But now, the patient's having an infection isn't actually a barrier to them getting the care they need, whereas previously I suspect it was. People didn't want to look after the patient who had the infection. I think it was like a fear that they would get it or take it home to some member of their family."
>
> N702

Indeed, this concern amongst participants about the risks to themselves from exposure to infection is an important theme that emerged from the findings of all three phases of the study, as discussed in Chapter 10.

> "I think particularly for those of us with children there were concerns and for those of us who were pregnant there were concerns about how it affected us. But I think a lot of that was because people didn't really understand how the infections were transmitted really. So it's a steep learning curve."
>
> N601

Whilst the majority of respondents appeared to comprehend the main points of the guideline and described their sense of confidence in this respect, a few remained unclear about the rationales for various aspects of Contact Precautions. These respondents appeared less able to converse about the new approach to practice in any detail and were at times unfamiliar with the new recommendations. Other respondents recognised that not all of their colleagues had changed their practice to the same extent. Indeed, one respondent in particular suggested that the difference in individuals' ability to comprehend infection control principles was a potential disadvantage of the new approach to Contact Precautions promoted during Phase II of the study, since it required participants to exercise a degree of clinical judgement.

> "I suppose the disadvantage of the new approach is that you presume everybody's got the same understanding and decision-making ability as everybody else. I think there's always people who will surprise you. When ninety-nine percent of people say oh surely you must wear gloves for that, there'd be one person who might have a different view. So I think there is scope for error, but there again, the old method of a blanket approach wasn't any more safe, because the ignorance would have meant people were being put at risk anyway. Especially when using gloves and not being selective in what they've done and moving from a dirty area to a clean area. So I think you have to go with the risk of someone having a different view or maybe making a different decision and look to spot that really. I think a more rational approach is better and that's the way things are going in other areas."
>
> N701

Notwithstanding, this respondent still considered that the new, more rational approach was preferable to having hard and fast rules. As mentioned earlier in the chapter, the issue of how best to express rules about infection control is an important one, which is discussed in detail in Chapter 10.

Nurses' and Health Care Assistants' Perceptions of the Impact of the Supportive Intervention

The interview schedule included questions about the impact of the supportive intervention in order to evaluate respondents' perceptions of this. Firstly, respondents were asked how they had learned about isolation nursing before participating in the study. Responses to this question revealed that generally, nurses relied on what they had been taught during their training, no matter how long ago this was. Other than this, they described how they had acquired information somewhat haphazardly, mainly from more experienced colleagues. None of the health care assistants had received formal training on the subject and learned mainly by emulating qualified nurses. This haphazard approach to learning clearly contributed to the widespread confusion about Contact Precautions that was evident amongst study participants prior to their involvement in Phase II of the study.

Subsequently, respondents were asked which if any aspects of the supportive intervention helped to change their practice. These were the one-to-one support and instruction that was offered by the researcher when working alongside individual study participants, the practice guideline on Contact Precautions (full version), the summarised version of the practice guideline (quick reference guide) that was displayed within each isolation room and the availability of recently published research articles on aspects of Contact Precautions. Table 57 presents a summary of the responses to this question.

Table 57: Interventions that Facilitated Changes in Practice						
	RNs (13)		HCAs (5)		Total (%)	
Intervention:	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
One-to-one support and instruction	10	3	5	0	**15 (83%)**	**3 (17%)**
Practice guideline (full version)	1	12	1	4	**2 (11%)**	**16 (89%)**
Quick reference guide	9	4	2	3	**11 (61%)**	**7 (39%)**
Provision of research literature	2	11	0	5	**2 (11%)**	**16 (89%)**

As the table shows, one-to-one support and instruction was considered by all but three nurses to have influenced their practice. Over half (11/18) of the respondents also found that the summarised version of the guideline had helped them. Conversely, only two respondents (one nurse and one health care assistant) thought that the full version of the guideline had been useful and only two nurses thought that the provision of research articles had helped. The following account describes these findings in more detail.

One-to-One Support and Instruction

The interview findings relating to the provision of one-to-one support and instruction revealed that 15/18 (83%) of the respondents considered that it had influenced their practice. However, there were differences between individuals in relation to their perceptions of the experience according to the extent to which they engaged in Phase II of the study. As described in Chapter 8, two-thirds (12/18) of the participants exhibited what the researcher considered to be a high degree of engagement. This included eight nurses and four health care assistants, all of whom took the opportunity to fully exploit the support offered to them. These individuals identified that that the key benefit of this approach was its applicability to practice, since being able to ask questions that arose while working allowed them to learn in a very practical, "hands-on" way:

> "Working with you was excellent, because it was those stupid little things that came up only when you were doing a working day that you needed to ask. And although they were often silly little things, they were still questions that mattered. So that worked really well."
>
> RN 408

> "It made me think. It made me more aware of what I was doing. I didn't mind you being there at all. I had no problem with that, because you were able to answer our questions and that's what we wanted, answers, which we knew we would get if we asked you."
>
> N503

"Working with you, because we worked together and we worked through it. I think its always good to work with people, because I'm better at practice anyway than the theory, so once I've done something through, it goes more into my head."

HCA 10

The researcher's practical input was also valued as it enabled guidance to be given in the context of every day work, taking account of the practical difficulties that were encountered. This seemed to give added credibility to the advice and information imparted by the researcher and was valued as an approach to the change process, as it took account of practitioners' perspectives.

"You were there and you were doing it with us. And we didn't feel as though we were being watched over to see if we were doing it right or not. We could ask you questions and you knew yourself what we were up against. You were seeing it yourself rather than us coming off the ward and telling you. And if you don't see it for yourself then its hard to imagine the problems that we were coming up against. I mean its all very well for somebody outside to sit and ask you questions and things like that, but then you were there, you were working, you were seeing problems that we were coming up against. Whereas if you try and explain it to somebody outside without them seeing the problem, they don't understand. Which you did when you were working with us. So you could see it first-hand rather than us sort of thinking what the hell's she talking about."

HCA 05

"It was really getting down to the nitty gritty and the day to day reality, which is what nurses often get upset about when you're thinking of changing practice, they think there's a divide and there's someone with a job title who's doing research, who's looking at an aspect but they don't understand our dilemmas of trying to everything for all these patients. And so it was like you were stepping over and saying well look, I can see what you have to do and the difficulties. So I think that was the main benefit."

N702

Several respondents considered that it would be useful if in general, infection control nurses could spend more time working in clinical areas to enable their expertise to be more accessible.

"I think if you've got the time and the resources, you should have infection control nurses doing a stint on every ward with every member of staff. I mean maybe have, like you have resus updates on the ward, like a simulated cardiac arrest, have an infection control nurse come up to the ward and go through it with the staff and make sure everybody has been updated on it. Make it a mandatory thing."

RN 409

"Its always useful to have an infection control nurse somewhere around to be able to ask questions. That was the beauty of you working with us, was that you were there when all the silly little questions came up."

RN 408

Three of the respondents (two nurses and one health care assistant) who reported that working with the researcher had influenced their practice were among those whom the researcher considered to have engaged in Phase II of the study to a lesser extent. They

seemed to have viewed the experience of working with the researcher in a less than positive way. This appeared to be because they felt especially conscious of being observed as they were working. As one nurse said:

> "It was a bit daunting to be quite honest. People felt, oh no, she's watching me today. Its like anything. If you're a skilled practitioner like we all are, if someone's coming to watch you, you're always thinking well why is she watching me, what is she actually looking for. No one likes having people watch them, because we are all skilled practitioners and we all know what we're doing. If you're skilled at your job, you don't really like having someone watching you."
>
> RN 301

The remaining three nurses who said they had not found it helpful to work with the researcher offered no further comments about their experience in this respect. Interestingly however, several respondents recognised that some of their colleagues had not enjoyed this part of the intervention and some offered explanations for this:

> "I think it [one-to-one instruction] was probably one of their least favourite parts for the people who didn't enjoy it. Other people thought it was the best bit ever, that they gained so much from the shifts that they worked with you. I think the culture that we have all trained in, especially those of us who trained a very long time ago is very different. You know, we were all used to working with clinical tutors. Most people aren't now. And I think part of it is peoples' own insecurity. That they didn't want their practice under scrutiny, that they couldn't see that in a non-threatening way. You know, they felt like it was a pass or fail test thing, but it wasn't at all. And others just wanted to do the right thing and would do whatever it takes to achieve that. But I think it's a lot to do with personalities rather than anything else."
>
> RN601"

> "I do remember a couple of people who were uneasy about it.B because you might be questioning the knowledge that they've already got and making them feel stupid. Whereas I didn't have a problem with that."
>
> RN 406

> "I think working with you scared some people, but at the same time, once they'd worked with you, it did have an impact. It's just the fear of somebody who knows more than you watching what you're doing. So I mean that is a drawback, but at the same time, it did have a massive impact I think."
>
> RN 408

> "I think in some ways it might have been the most challenging for you, but I also think it was for them. The rest [the guideline, journal articles etc] you could have around and how people got involved in it was very much down to them. And the nature of some people they wouldn't and others would. The one-to-one, there was no escape, you know. They had to think. They were put in a position where they had to consider infection control and what they do."
>
> N702

The process of providing one-to-one support and instruction required that the researcher made every effort to interact with participants in as non-threatening a way as possible. This was because individuals were being placed in a potentially vulnerable position, as their

knowledge and practice in relation to infection control was exposed. However, in addition to this, it was also important for the researcher to remain aware that practitioners may have felt that their overall approach to patient care was also on view. As one nurse highlighted:

> "I don't think you could have made it any less threatening for people. But I think its also because of the personal care and one to one interaction with the patient, that nurses probably felt they were being observed on other aspects other than infection control. And it was about them as a nurse and how they dealt with the patient. Even though your remit was to look at care in relation to infection control, it was everything that was being observed. And I think that a lot of nurses aren't really used to that any more. The workload is such that anybody they're working with is just involved and the emphasis has been very much on academic work, things like communication..... I mean its written about but its not assessed in practice and as you're a nurse and a human being, you must have sometimes thought that's a more professional way of dealing with it than that is. I mean you're only human, so you must have made judgements about people, you know, how they dealt with things other than infection control. And I think that's probably why people felt on view."
>
> RN 702

In addition, the importance of the researcher's trustworthiness with regard to the information gained about individual participants' practice was paramount:

> "I think it was good that we didn't actually hear any bad feedback about somebody from somebody else. Because the only person who could have done it might have been you. But it didn't happen. So everybody felt that even though we might have been doing bad practices, you're going to tell us and that's how far its going to go. And that was important. Its just trust really, which we had."
>
> N503

These comments illustrate the sensitive nature of the researcher's role on the study ward, particularly during Phase II of the study, since it placed participants and the researcher in a potentially vulnerable position.

Use of the Practice Guideline

The interview findings relating to the use of the practice guideline revealed that only 2/18 (11%) of the respondents (one nurse and one health care assistant) considered that it had helped them in practice. Both of these individuals considered that it was important to have the guideline to refer to:

> "I think it is always important to have the guideline there for people to refer to, but that is how it's used - its to refer to at peoples' leisure more than within a working day."
>
> RN 408

> "Having the guidelines has been good, because at least you've got it in writing as to how its supposed to be done, rather than people disputing how it should be done and having different opinions of how it should be done."
>
> HCA 05

The other sixteen respondents did not consider that the guideline had influenced their practice. Many did say that they had read it once, but that they had not referred to it after that. The main reason given for this was lack of time, particularly as there were so many policies and guidelines that nurses were expected to implement.

> "I think you'll find not everybody has read it from start to finish. And I think like any guideline it is hard to remember everything that's in there. I think people don't read guidelines and I think we get so many policies. I mean we've got two huge policy folders and most people could tell you what there are policies for, but very few could tell you the content of each policy. That's human nature."
>
> RN 601

Many respondents said that in general they tended to ask colleagues for advice in their day-to-day work rather than referring to written guidance. Indeed, seven nurses said that they had acquired information about implementing the Contact Precautions guideline in this way.

> "I looked at the [main] guideline when it first came out, but I haven't gone back to it again since I first looked at it. I think its just busy and if you're doing something, you don't want to stop what you're doing and go into the office and look at the guideline. Sometimes if you're stuck on something, you'd rather ask someone than going to look at a guideline. If the sister is on, or someone who you think might know, you ask them first. And then if you don't get an answer, maybe you would look at the guidelines. I think that applies with all the guidelines."
>
> RN 507

The fact that the guideline required interpretation in practice was another reason why it was not considered to be useful. As one nurse said:

> "I mean with guidelines, sometimes you can interpret them in so many different ways. And sometimes you still have to say to other people look what does this actually mean? Is it when you do this or when you do that? If I'm working along side somebody and I'm listening and watching, that's certainly the way I learn. And it's more likely to impress upon me than reading something."
>
> RN 306

Although the main guideline had little impact on practice, the summarised version (quick reference guide) was considered to be more useful. Indeed 11/18 (61%) of the respondents said that it had helped them to change their practice. The reason for this was that it was readily accessible (as it was on display in each of the isolation rooms and in the ward office) and acted as an 'aide-memoire':

> "The quick guide, because it was just there wasn't it, with the pictures which I liked and you could just go oh yes, I remember now. That I think was the best. The big guideline I don't think anyone really read thoroughly. Its just too big."
>
> RN 407

"The quick guide in the room was definitely good. Because if I couldn't remember what I was supposed to be doing then I could always read that when I was in the room. I didn't have to come out and go wherever to read something else."

HCA 05

Provision of Research Literature

The provision of recent research articles about aspects of Contact Precautions was not generally considered to have influenced practice. Indeed, only two nurses said that it had helped them:

"Getting a lot of recent research. I was able to read it because it was there. Like the one on not needing to double-bag clinical waste and obviously that has changed, because we don't do it anymore."

RN 301

"I probably wouldn't get the time to go to the library and look this up myself, but because it was already there, all I had to do is sit for my coffee break and read it through."

RN 503

This highlighted an important point about the utilisation of research-based information in nursing practice, as it was clear that in general, nurses were not making use of such information in an independent way to guide their individual practice. As with the written guideline, the main reasons given for the limited impact of research articles were lack of time and the need to interpret them before they can be applied in practice.

"When you were there working alongside me, it was nice because I could ask questions. And so that was the only thing that really made a difference. I think all the rest, when you're on a busy ward, you just don't have time to stop and think and look at paperwork. From the moment you come in, its full on all the time to the moment you leave and I mean they have all these paperwork folders and nobody ever has opportunities to read them. Sometimes the students do. But I think for me personally, if I'm with someone who's showing me, I learn far better. If I read an article, I'd still have to go and apply it before I knew what to do. And so I suppose literature isn't really enough, because it is only working alongside somebody which can really pass the right information onto you and give you the confidence that what you're doing is right."

RN 306

Summary

In summary, the findings of the post-implementation interviews illuminate respondents' perceptions of the impact of the supportive intervention on their practice. They also confirm a number of the issues identified during Phase II of the research. In particular, they reveal how the majority of respondents reported a range of improvements in their practice, which were attributed to a better appreciation of the underlying rationales. However, as found in Phase II, not all respondents reported having changed their practice to the same extent. There

were various reasons for this, all of which are highly pertinent to the issue of how best to promote improvements in infection control practice.

Firstly, the findings confirm the differing degrees to which participants appear receptive to changing their practice. Indeed, not all respondents seemed willing or able to comprehend the rationales for infection control practice. This was apparent particularly in relation to the recommendation to use gloves and aprons on a selective basis, which required a degree of clinical judgement. Whilst most respondents appeared to have welcomed this approach, a few reported continuing to use gloves and aprons routinely, thus avoiding the need to consider when they were actually required. These respondents also expressed ongoing concerns about the risk to themselves from exposure to CDAD and MRSA, despite having been offered reassurance. This concurs with similar findings in Phases I and II of the study, indicating that self-preservation served as a powerful motivator in relation to Contact Precautions.

The findings also reveal how participants were guided by their own beliefs about the spread of infection and did not necessarily respond rationally to the information presented to them. For example, even though the changes in relation to the disposal of linen and clinical waste were well adopted, doubts about the rationale for new approach persisted amongst a few respondents who expressed a desire to return to their previous practice. In addition, most respondents expressed an inclination to direct their infection control efforts more towards patients nursed in isolation than other patients, as found in Phases I and II of the study.

With regard to the impact of the supportive intervention, there was a clear preference for verbal over written information about the recommended changes in Contact Precautions. In general, the provision of one-to-one support and instruction was considered to be highly beneficial, particularly by those respondents who took the opportunity to fully exploit it, since it was directly applicable to practice. However, not all respondents appeared to favour this approach, possibly due to a reluctance to engage in scrutinizing their practice.

In the next chapter, the findings of all three phases of the study are discussed in relation to a range of possible theoretical explanations. The implications of the findings, both for clinical practice and future research are also considered.

CHAPTER 10

DISCUSSION

Introduction

The findings of this study strongly suggest that the current approach to the promotion of infection control in health care practice is simply not working. In the case study of practice scrutinised, nurses' and health care assistants' infection control practice was deeply flawed and participants experienced great difficulty in relation to infection control behaviour in a number of areas. They found infection control a particularly difficult subject to understand and did not always respond rationally to the information and guidance offered to them. Moreover, their understanding of the need for infection control practice was focused principally on those patients with recognised infectious conditions rather than all patients and they were motivated primarily by a perceived need to protect themselves from exposure to infection. The majority of participants were motivated to improve and change their practice, although a significant minority were unwilling to engage with the supportive intervention employed during the study.

Throughout the chapter, a number of possible practical and theoretical explanations for the findings are explored and resonances with the previous relevant research literature are examined. The implications for clinical practice, education and training and future research are also considered. The discussion centres around two key areas, one concerning how best to develop health care workers' knowledge and skills in relation to infection control and the other concerning how best to promote improvements in infection control practice.

Developing Health Care Workers' Knowledge and Skills in relation to Infection Control

Given the substantial body of evidence to support the value of infection control practice and in particular, hand hygiene in preventing the spread of infection in health care settings (see Chapters 1 and 2), the need to ensure health care workers have appropriate knowledge and skills in relation to infection control is evident. In the present study, nurses and health care assistants experienced great difficulty when attempting to make sense of their infection control practice. The possible reasons for this are considered below in order to shed light on what is required to develop health care workers' knowledge and skills in this area.

Deficiencies in Knowledge of Basic Microbiology and Infection Control Principles

The difficulties experienced by participants with regard to understanding their infection control practice could be explained at least in part by their lack of knowledge of basic microbiology and infection control principles. Indeed, findings of the initial interviews revealed that both nurses and health care assistants had misconceptions about the modes of transmission of micro-organisms and their potential to cause disease. For example, the majority of respondents thought that infection and in particular, Methicillin resistant *Staphylococcus aureus* (MRSA) is spread mainly by the airborne route rather than by contact. This resulted in a lack of appreciation of the infection control measures required to prevent the spread of infection. In particular, there was misplaced emphasis on infection control measures of no proven value, such as the 'double-bagging' of bedpans, which were directed towards 'containing' infection within the rooms used to isolate patients with either *Clostridium difficile* associated diarrhoea (CDAD) or MRSA. This was coupled with a lack of confidence in measures directed towards preventing contact transmission of infection, such as hand hygiene and the use of gloves and aprons. For qualified nurses especially, their lack of understanding of basic microbiology and infection control principles presented a major difficulty, as they were unable to provide clear instructions to more junior nursing staff, colleagues from other disciplines and patients and their visitors about the correct procedures to follow, despite being looked upon to do so.

These findings are consistent with those of Courtenay (1998), who also found that nurses and health care assistants had misconceptions about microbiological principles regarding the motility, spread and survival of micro-organisms, which resulted in ritualistic and inconsistent practice. The same may also be true of other health care professionals, although there has been a lack of similar research to investigate whether or not this is the case. Indeed, as discussed in Chapter 3, most of what is known about health care workers' knowledge in relation to infection control has been derived from questionnaire studies, which have been limited by the extent to which respondents' own beliefs and understanding about the spread of infection have been explored. As Courtenay described, only four of the seventeen nurses and health care assistants interviewed in her study were found to possess an accurate understanding of how infection is spread. Among the other thirteen, there were misconceptions of this concept, including beliefs that micro-organisms could move of their own accord, at will, to cause infection in patients.

As in Courtenay's research, nurses and health care assistants in the present study often described their concerns about the risk of transmission of infection in vague and inaccurate ways, such as the idea that infection could "whoosh" out of an isolation room when the door is opened or that infection could somehow "jump" off linen bags and bedpans removed from isolation rooms as they are carried through the ward and cause infection in patients. Thus, participants were inadequately prepared to apply infection control principles in practice, as they did not understand that micro-organisms such as *Clostridium difficile* and MRSA are spread mainly by the contact route and that the principal means by which to interrupt transmission is by good routine infection control practice and in particular, hand hygiene.

This lack of understanding of basic microbiology and infection control principles suggests that the education and training participants received prior to the study was entirely unsatisfactory in this respect. Although this was not actually assessed as part of the study, during their post-implementation interviews, participants were asked about the ways in which they had gained information about infection control prior to the study. The majority of registered nurses explained that they had relied mainly upon the knowledge gained during their nurse training to inform their infection control practice, no matter how long ago this had been. In contrast, health care assistants learned most of their practice from registered nurses in the clinical setting. This has serious implications for the infection control content of nurse education programmes, since registered nurses relied upon this even though their knowledge base was clearly deficient. It also implies that there were serious limitations both in post-basic education and in the dissemination of information about infection control in clinical practice, which although not formally assessed, appeared to have had little, if any impact. Further consideration is given to this issue later in the chapter in relation to the use of practice guidelines.

The finding that registered nurses were inadequately prepared to apply infection control principles in practice also has serious implications for the perpetuation of a cycle of ignorance, especially since experienced nurses frequently provided instruction on infection control practice to junior nurses, health care assistants and other health professionals. This point has previously been made by Horton (1992), who investigated registered nurses' perceptions of the effectiveness of their preparation in infection control for subsequent practice. As in the present study, Horton (1992) found that registered nurses relied almost exclusively on their basic education to guide their infection control practice, even though the majority ranked their knowledge of applied microbiology as only fair or poor. In view of

this, Horton (1992) called for a reappraisal of the importance given to the subject of microbiology and its relation to infection control in nurse education programmes, a view which is supported by the findings of the present study. Elliott (1996) has also highlighted the need to review the place of hand hygiene within the curriculum for nurse education having identified a lack of priority given to this subject in a survey of twenty colleges of nursing and midwifery, as well as a failure to consult experienced infection control staff on the content of education training services. This need also applies to the training and education of all other health care workers.

The above-mentioned study by Courtenay (1998) included an exploration of the infection control content of nurse education programmes. This revealed that the information about microbiology and infection control principles that was taught on these programmes was minimal, inconsistent and lacked application to clinical practice. Courtenay (1998) suggested that knowledge of microbiology, involving the motility, spread and survival of micro-organisms should be included in nurse education and training, a view which is supported by the findings of the present study. Courtenay (1998) also argued that teaching needs to be explicitly linked to the infection control procedures followed in the clinical environment and that this may be more effective in a clinical rather than a classroom setting. She suggested that nurse educators need to become more aware of learners' own understanding of microbiology and infection control principles, to allow any misconceptions to be challenged, arguing that the use of teaching methods based on appropriate learning theories such as constructivism and situated cognition may provide the means to do this. Indeed, whilst it is not clear to what extent current approaches to infection control education and training incorporate means to ascertain health care workers' own beliefs about the subject, the need to identify and challenge any misconceptions and to ensure that teaching is linked as closely as possible to clinical practice is evident.

For this reason, the approach to teaching that was used during the present study was based on principles of situated learning theory (Lave and Wenger, 1991) in so far as it allowed infection control principles to be considered within their situational context. As such it differed from previous research in this area. The researcher gained an understanding of individual participants' own beliefs about infection control and used this as the basis on which to provide them with the support and instruction they required to address their practical concerns. It also presented opportunities for the researcher to challenge any misconceptions in order to promote the rationales underpinning infection control practice.

The effectiveness of this approach was determined to a great extent by individuals' willingness to fully exploit the support offered to them. As discussed later in the chapter, participants varied in the degree to which they engaged in the supportive intervention and found it beneficial. Nonetheless, the approach was deemed to be highly beneficial by the majority of study participants and those who changed their practice to the greatest extent suggested that the researcher's input as an expert role model was the only intervention that instilled them with the confidence to do this. The potential of the infection control nurse to influence health care workers' infection control practice in this way is considered more fully later in the chapter.

Notwithstanding the apparent beneficial impact of the approach, the findings of the present study do cast some doubt on the potential of a situated learning theory such as that devised by Lave and Wenger (1991) for the development of infection control practice, since this would depend upon the learner being in a "field of mature practice" (Lave and Wenger, 1991). However, at the outset of the study, experienced nurses were not necessarily more competent than junior nurses and other health care professionals with regard to implementing Contact Precautions. This was in spite of the fact that they regularly provided care to patients in isolation due to CDAD and MRSA and were frequently relied upon to provide instruction about this. As a result of Phase II of the study, many participants reported feeling more confident about their practice in relation to Contact Precautions and were conversant with the key changes in practice that had been promoted. In addition, several nurses commented that they were more willing to correct colleagues' and other health care professionals' inappropriate practice. However, as discussed during this chapter, there were several other factors that appeared to limit individual participants' ability to improve their practice and thereby function successfully as role models.

The Difficulty Associated with Conceptualising Infection Control Principles

The approach adopted to practice development provided valuable insights into the difficulties encountered by nurses and health care assistants when attempting to apply infection control principles in practice. One such difficulty related to the invisibility of micro-organisms. More specifically, several participants highlighted that infection control is a difficult subject to conceptualise owing to the invisibility of micro-organisms. Indeed, their apparent difficulty deciding on the appropriate infection control measures to employ in practice was partly because they were unable to 'see' the effect of their actions. Interestingly, the infection control measures required for *Clostridium difficile* were generally considered to

be easier to make sense of than those required for MRSA, due to the visible symptom of diarrhoea. Since MRSA more frequently colonises patients than causes infection (Ayliffe et al, 1998), patients rarely had any visible symptoms of infection and participants found this especially difficult to make sense of. For example, when attending to patients with MRSA, participants frequently had difficulty determining the patient care activities that were more likely to result in heavy microbial contamination of their hands (and thus require the use of gloves in addition to hand hygiene) from those for which hand hygiene alone would suffice. Coincidently, this also revealed their uncertainties about the rationales for glove use in routine practice, since those studied had differing approaches to this, based more on their own personal preferences than on scientific rationales.

In their consideration of the issues related to applying infection control evidence in practice, Jenner et al (1999) highlighted the problem of not being able to visualize the real processes of transmission and infection. They commented that:

> "The invisibility of germs can result in a lack of a good mental model of what is happening at the microscopic level."
>
> (Jenner et al, 1999: 95)

These authors also draw attention to the problem of not being able to demonstrate cause and effect in infection control, owing to the time delay between omitting a practice such as handwashing and a patient subsequently developing an infection, particularly since many other events are likely to intervene and confound the picture. In the present study, several nurses and health care assistants made comments to this effect during their initial interviews, since the inability to link poor practice to the spread of infection was considered to be a negative influence on adherence to infection control procedures. These problems may counteract attempts to reinforce learning in practical disciplines such as nursing, medicine and other health professions. Indeed, practitioners are accustomed to monitoring their patients' signs and symptoms of disease and the effect of their actions and treatments on this, all of which contributes to their experiential learning. In view of this, there is a clear need to develop new ways to promote the principles of infection control, since conceptually, they appear to be difficult to grasp.

The Difficulty of Promoting a High Standard of Infection Control Practice For All Patients

Another of the difficulties encountered by nurses and health care assistants in the present study in relation to applying infection control principles in practice concerned their

misunderstanding of the need for infection control practice to be focused principally on those patients with recognised infectious conditions rather than all patients. As discussed below, this has serious implications for the promotion of a safe and effective approach to infection control in routine practice.

The priority given by participants to Contact Precautions over the routine use of infection control measures for all patients was evident from the data collected during each phase of the present study. Findings of Phases II and III confirmed those of the initial interviews during Phase I, since they revealed that nurses and health care assistants placed greater importance on the need for infection control precautions such as hand hygiene, the use of protective clothing and the safe handling of used equipment when attending to patients with infectious conditions who were being nursed in isolation as compared with 'non-infectious' patients nursed on the open ward. Even those who, as a result of the intervention, recognised that their practice ought to be more consistent between all patients admitted that they were still more likely to adhere to infection control measures such as hand hygiene following contact with isolated patients than with other patients, owing to a heightened awareness about infection risks. This also had implications for monitoring the adherence of colleagues, since one participant explained that it was more difficult to tackle colleagues about poor hand hygiene practice relating to patients other than those nursed in isolation, as the risks were not as obvious. This suggests that decisions about infection control practice were being driven partly by differences in risk perception, which is consistent with risk-taking theory (Sulzbach-Hoke, 1996).

Sulzbach-Hoke (1996) has discussed risk taking by health care workers in relation to Universal Precautions and suggests that the definition of risk varies depending on one's perception of risk and what the stakes are. In addition, she suggests that a person's sense of control or lack thereof appears to be a major determinant of perceived risk and of affective reactions to risky situations. In the present study, it was evident that the system of Contact Precautions in place on the study ward encouraged the increased use of infection control precautions for patients with recognised infectious conditions and in so doing, unwittingly undermined their importance during the care of patients considered to be 'non-infectious'. In addition, there was considerable evidence to suggest that participants experienced a lack of control in relation to the risks associated with the transmission of infection, since they found them difficult to comprehend and frequently doubted that their actions to minimise them were effective. Their inaccurate perceptions about the risks to themselves from exposure to

infection contributed to the confusion. Also, during their initial interviews, many respondents expressed frustration about not always having enough single rooms to accommodate patients in need of isolation, which they felt made a mockery of the system of Contact Precautions. All of these factors undoubtedly influenced participants' perceptions of risk with regard to Contact Precautions and may account at least in part for it being identified as the main priority for practice development.

The problems associated with the traditional system of isolation precautions, which results in a two-tiered application of infection control principles, were recognised by Lynch and colleagues (Lynch et al, 1987) as long as two decades ago. Indeed, their dissatisfaction with this system prompted them to devise an alternative approach called Body Substance Isolation (BSI). This approach minimised to the greatest extent the requirement for patients with infectious conditions, other than those spread by the airborne route, to be nursed in single room isolation, promoting instead the consistent use of infection control measures for all patients. They noted that:

> "Routine infection control practices often fail to prevent nosocomial transmission of infectious agents because the colonized patient (or sometimes even the infected but not isolated patient) is not considered a reservoir for infectious agents by health care workers."
>
> (Lynch et al, 1987: 244)

However, even though the BSI system has since been implemented with some success in various centres (Lynch et al, 1990; Hartley-Troya et al, 1991; Duncan and Batchelor, 1993), its effectiveness as compared with the traditional system of isolation precautions and in particular, Contact Precautions, has not yet been established by definitive rigorous research. In addition, there has been limited exploration of health care workers' own perceptions and concerns about the process of changing from the traditional system of isolation precautions to BSI. As described in Chapter 3, Hartley-Troya et al (1991) conducted a survey to evaluate the knowledge, attitudes and self-reported practices of nurses following implementation of BSI. They found that nurses reported the increased use of barrier precautions for patients with MRSA even though this was no longer necessary. The authors commented that this finding revealed the difficulty in overcoming long-standing traditions associated with doing more for patients with diagnosed infectious conditions such as MRSA. However, as discussed in Chapter 3, it was not clear whether respondents perceived a need for additional precautions for their own or their patients' protection.

Findings that health care workers tend to target their infection control efforts towards patients with recognised infectious conditions are strongly supported by the current study and appear to be consistent with risk-taking theory. This has huge implications for the promotion of routine infection control measures such as hand hygiene and the use of protective clothing that are required irrespective of whether or not the patient has a recognised infectious condition. In spite of this, other than Lynch and colleagues' pioneering work on BSI (Lynch et al, 1990), the potential impact of the system of isolation precautions on adherence to routine infection control measures does not appear to have been investigated or addressed as part of intervention studies designed to improve practice. Thus, it is conceivable that the limited success of such studies may be due in part to a misconception amongst health care workers that optimal infection control practice is only necessary when in contact with patients who are considered infectious.

Certainly, the findings of the present study revealed that such misconceptions were prevalent amongst nurses and health care assistants during each phase of the research and were difficult to overcome despite intensive one-to-one practical instruction. As structured observations were only undertaken of the infection control practices employed when attending to isolated patients, it was not possible to confirm nurses' self-reported practice in relation their limited use of infection control measures for patients other than those nursed in isolation. However, the repeated emergence of this theme during each phase of the research does lend increased weight to its validity. As discussed in Chapter 3, none of the observational studies of isolation precautions practice have compared the infection control measures employed with those used routinely for all patients. Research on this issue is urgently required to establish the extent to which health care workers' adherence to infection control practices such as hand hygiene, the use of protective clothing and the safe handling of patient care equipment differs according to whether or not a patient is identified as being infectious.

The findings of such research would be of crucial relevance to the ongoing controversy surrounding the relative merits of Contact Precautions versus a more generic approach such as BSI, since much of the debate has centred on the issue of health care workers' non-adherence to infection control practice. Indeed, Jackson and Lynch (1996) have argued that the recommended use of Contact Precautions may have more to do with concern about the lack of adherence to routine infection control precautions than their effectiveness per se. With this in mind, the problem of non-adherence needs to be resolved before a definitive trial

to compare Contact Precautions and BSI can be undertaken, since ultimately, the effectiveness of either system lies in its ability to realize maximum impact on health care workers' adherence to infection control practice.

In view of this, there is a clear need to investigate health care workers' perceptions of risk in relation to Contact Precautions and routine infection control practice and to establish the effect of these perceptions on infection control behaviour. Findings of the present study revealed that there were differences in nurses' and health care assistants' self-reported behaviour in relation to Contact Precautions as compared with routine infection control practice that were driven partly by differences in risk perception. Indeed, participants placed greater importance on the need for infection control precautions when attending to isolated patients as compared with other patients owing to a heightened awareness about infection risks, both to themselves and patients. However, as mentioned above, these findings were not confirmed by direct observations of practice. In addition, as a case study of nursing practice on only one hospital ward, it is not known to what extent these findings are representative of nurses and other health care workers in other health care settings. Further research of this kind is therefore necessary to establish both the validity and generalisability of these findings. This in turn may inform the development of interventions to address the problem of non-adherence to infection control practice. For example, it may be that attempts to improve adherence to practices such as hand hygiene will continue to be limited until health care workers become more convinced of their value in routine practice as well as in the context of isolation precautions.

Interestingly, during the Phase II of the present study, some participants did begin to question the rationale for placing patients with conditions such as CDAD and MRSA in single room isolation, given that the infection control precautions promoted for these patients were virtually the same as those required for all other patients. Such remarks contrasted starkly with the frustration expressed by many participants during their initial interviews about not always having enough single rooms to accommodate patients in need of isolation. Lynch et al (1990) reported a similar finding and drew attention to the inconsistency inherent in promoting a standardised approach as effective and safe and then adding additional special precautions based on the patient's diagnosis. To this end, it would have been of interest to fully develop the approach to infection control on the study ward along the lines of the BSI system, to establish whether or not this resolved the issue in participants' minds and ultimately enhanced the perceived value of routinely applying infection control measures for

all patients. Unfortunately however, this was not possible, since it would have been out of step with infection control recommendations in the rest of the hospital at the time of the study. In addition, owing to the limited approach to surveillance of infection at the study hospital, there would have been no means by which to accurately monitor the effect of this approach on colonisation and infection rates on the study ward.

As already highlighted, there is clear need for further research on this issue to identify health care workers' perceptions of risk as well as other factors that influence their infection control behaviour when practicing within a system of traditional isolation precautions or BSI. For example, in relation to the BSI system, it is not clear whether or not health care workers continue to identify some patients as being a greater infection risk than others and adapt their behaviour accordingly, even though the infection control procedures are designed to be applied consistently to all patients. In view of this, it is critically important that a better understanding is gained of the ways in which health care workers make sense of these systems of infection control, since this may provide the key to determining which of the two offers the greatest potential in terms of optimising infection control practice and ultimately, minimising the risks of transmitting infection. In the meantime, given the ambivalent evidence base, infection control professionals are faced with a fundamental problem regarding the value of Contact Precautions over BSI, since it is difficult to determine which of the two approaches is most advantageous.

In summary, the findings of the present study have implications for future approaches to developing the skills and knowledge of health care workers in relation to infection control practice. Although based on a small sample, it would seem that there is a clear need to review the content of education programmes offered to health professionals to ensure that microbiology and infection control forms a core component. The way in which this material is delivered may also be of critical importance, given that conceptually, the principles of infection control appear to be difficult to grasp. In particular, it is important that educators establish health care workers' own beliefs about the subject and incorporate these into teaching strategies in order to ensure that any misconceptions are addressed. As Courtenay (1998) has argued, the clinical environment may be the most appropriate setting for this, in order to address health care workers' learning needs in their situational context. At the very least, it is of crucial importance that health care workers are taught to appreciate the importance of applying infection control principles routinely to all patients rather than just

those with recognised infectious conditions, since failure to recognise this may lead to serious deficiencies in infection control practice.

Promoting Improvements in Health Care Workers' Infection Control Practice

There has been a substantial amount of previous research to investigate ways to promote improvements in health care workers' infection control practice, as discussed in Chapter 4. However, the reasons for the success or failure of intervention programmes are frequently unknown, owing to a lack of focus on the process of change. In the present study, the process of changing nurses' and health care assistants' infection control practice was studied in detail and revealed differences in the extent to which individual participants were prepared to change their practice. The possible reasons for this are considered below in order to shed light on what is required in order change health care workers' infection control practice.

The Issue of Self-Preservation

In the present study, participants' anxiety about the risk to their own health and that of their families from exposure to *Clostridium difficile* and MRSA frequently appeared to be the main motivator to adhere to Contact Precautions. Findings of the initial interviews with nurses revealed a lack of understanding of the risks to health care workers from *Clostridium difficile* and MRSA. This was confirmed by data from Phase II of the study, since many of the participants required a great deal of reassurance about this issue before they were willing to contemplate changing their practice. Indeed, even though the risks to health care workers from *Clostridium difficile* and MRSA are considered to be negligible (Ayliffe et al, 1998; Cooke et al, 1994), a few participants remained entirely unconvinced about this by the end of the study, as revealed during the post-implementation interviews.

These misplaced concerns greatly influenced nurses' and health care assistants' perceptions of the rationales for Contact Precautions and in particular, the purpose of protective clothing. Indeed, it was assumed that the main reason for wearing gloves and an apron was to protect the health care worker from acquiring *Clostridium difficile* or MRSA infection, rather than to minimise the risk of transferring these organisms to vulnerable patients. In Phase I of the study, this resulted in serious deficiencies in hand hygiene practice, as revealed by the structured observations of practice, since hands were never washed nor gloves changed during patient care between 'dirty' and 'clean' procedures. These deficiencies were addressed during Phase II of the study. Participants subsequently changed their practice to

differing degrees according to the extent to which they appreciated and accepted the rationales for practice that were promoted as part of the intervention. This implies that self-preservation has a huge impact on infection control practice and anxiety about the perceived health threat associated with nursing isolated patients needs to be overcome before a more rational approach to infection control can be successfully promoted.

The influence of self-preservation on adherence to infection control practice has been recognised in the literature particularly in relation to Universal Precautions. Indeed, as discussed in Chapter 3, health care workers frequently report the increased use of universal precautions when a patient is known to be infected with a blood-borne pathogen (e.g. Preston et al, 2002; Naing et al, 2001, McCarthy et al, 1999). Much less is known about this issue in relation to other aspects of infection control practice, although the available evidence suggests that self-preservation is a factor that motivates adherence to hand hygiene (Zimakoff et al, 1992; Larson and Killien, 1982). The present study therefore provides valuable new evidence on the importance of self-preservation as a factor that motivates adherence to infection control practice in relation to Contact Precautions, even though participants' perceived risks regarding *Clostridium difficile* and MRSA were unfounded.

O'Boyle Williams et al (1994) postulated that the Health Belief Model (HBM) is of relevance to the issue of self-preservation in relation to adherence to Universal Precautions. As the authors discussed, the HBM, proposed by Rosenstock (Rosenstock, 1974 in O'Boyle Williams et al, 1994) was used to describe the variables that influenced patient decisions related to health behaviour. These variables include a person's perceived susceptibility to a disease, perceived seriousness of the disease and a personal evaluation of the impediments and benefits to the prevention or treatment strategies. O'Boyle Williams and colleagues conducted a questionnaire study amongst health care workers in a hospital emergency department to identify the variables described in the HBM that influenced adherence to Universal Precautions. They found that the perception that a patient was not a risk or infected with HIV or Hepatitis B virus was an obstacle to adherence to Universal Precautions, which is consistent with the HBM. They suggested that the difficulty in complying with Universal Precautions, which requires that all patients are treated as though they are infected with a blood-borne pathogen, is related to the perceived susceptibility to disease, which also refers to the likelihood that one will acquire the disease. Thus, contrary to the principle of Universal Precautions, health care workers distinguish between patients on the basis of perceived risk of infection and alter their infection control practice accordingly. O'Boyle

Williams et al (1994) also found that health care workers who identified three or more obstacles to adherence to Universal Precautions were significantly less likely to report using gloves for anticipated contact with blood, which is consistent with the HBM.

As discussed above, in the present study, participants frequently reported that they were more inclined to adhere to infection control measures when attending to isolated patients than to others. In addition, they were clearly motivated by anxiety about the risk to themselves from exposure to infection. The HBM partially explains these findings in terms of infection control efforts being directed towards recognised infection risks and being motivated by concern for one's own health. However, since the HBM was originally developed to explain preventative health behaviours (Rosenstock, 1974 in O'Boyle Williams et al, 1994), its relevance to the field of infection control is possibly limited to measures such as Universal Precautions that are performed by health care workers primarily to protect themselves from occupational exposure to infection. Conversely, infection control practices such as hand hygiene and Contact Precautions are frequently altruistic in nature, being required to minimise the risk of cross-infection between patients. In this respect the applicability of the HBM is dubious.

Notwithstanding, Kretzer and Larson (1998) considered the HBM in addition to several other behavioural theories (the Theory of Reasoned Action, the Theory of Planned Behaviour, self-efficacy and the Transtheoretic Model) to be of relevance to infection control and in particular, to hand hygiene practice. They considered that these theories had been tested sufficiently enough to inform the design of intervention studies to improve adherence to infection control practice. Representative studies were discussed in relation to each theory, which were concerned with promoting behaviour change related to the subjects' own health (e.g. smoking cessation, exercise to maintain cardiovascular fitness, seat belt use). On this basis, the authors proposed a hypothetical framework to improve hand hygiene practice. However, as already mentioned, the relevance of these theories to hand hygiene practice is uncertain, given that they have been field tested mainly in relation to health promotion behaviour.

In spite of this potential limitation, the Theory of Planned Behaviour (TPB) has been used as the basis of explanatory models of adherence to hand hygiene practice in order to identify ways to improve practice (Jenner et al, 2002; O'Boyle et al, 2001). As described in Chapter 3, Jenner et al (2002) conducted a questionnaire study of hospital-based health care workers

to identify psychological constructs predictive of hand hygiene behaviour based on a model developed using the TPB. The findings revealed that attitudes and personal responsibility were significant predictors of intention to wash hands, whilst perceived behavioural control and intention were significant predictors of self-reported hand hygiene behaviour.

Similarly, O'Boyle et al (2001) conducted a questionnaire study of registered nurses employed in critical care and post-critical care units based on an explanatory model incorporating TPB variables. They also found that TPB variables predicted intention to wash hands and that intention was related to self-reported hand hygiene behaviour. However, in addition to this, they investigated whether the TPB variables predicted observed adherence to hand hygiene recommendations and found that none of these were associated with observed adherence. Instead, they found that intensity of activity in the nursing unit at the time of observation was significantly negatively associated with observed adherence (i.e. adherence was lower when the nursing unit was busier). In view of this, the authors concluded that motivations were largely unrelated to observed hand hygiene practices and that future research is required to identify and quantify the situational and contextual variables that influence clinical practice.

This demonstrates the difficulty applying a theoretical model in an area that is incompletely understood. Indeed, in the present study, investigating nurses and health care assistants' perspectives of infection control in their situational context revealed important influences that may have a bearing on efforts to improve health care workers' infection control practice. Not least, the finding that participants needed to be satisfied they were not placing themselves at risk of infection before they were willing to consider adopting changes to their practice provides valuable new evidence on the importance of self-preservation as a factor that motivates adherence to infection control practice in relation to Contact Precautions. In this respect, the Health Belief Model appears to be particularly relevant to the issue of self-preservation. Indeed, it may provide the most useful theoretical framework on which to further explore this issue in relation to infection control practice even though its relevance in the wider context of promoting infection control practices that are altruistic in nature is questionable.

The Issue of Irrationality

Whilst the majority of intervention studies designed to improve infection control practice have incorporated some form of education programme to enhance knowledge levels, there is

a general consensus that improved knowledge alone does not result in improved practice (Larson and Kretzer, 1995). As a result, intervention studies have increasingly employed multiple strategies aimed at both individual and organisational levels in order to support and reinforce changes in practice. However, whilst the importance of this approach is clear, such strategies generally assume that health care workers will respond rationally to new information. Indeed, the Theory of Planned Behaviour has been used as the basis of explanatory models for adherence to hand hygiene practice in order to identify ways to improve practice (Jenner et al, 2002; O'Boyle et al, 2001) and one of its underlying assumptions is that human beings are rational and make systematic use of available information (Ajzen and Fishbein, 1980 in Kretzer and Larson, 1998).

However, Curtis (2001) has argued that with regard to people's hygiene behaviour, individuals have predispositions to behaviours and do not act purely on rationality. Macqueen (1995) has also highlighted the irrational infection control behaviours exhibited by health care workers in a paediatric intensive care unit. These observations resonate with findings of the present study, since participants' approach to infection control practice was not always rational. Moreover, it may be that infection control practices relating to isolation precautions are particularly likely to invoke irrational responses by health care workers. Indeed, Meers et al (1997) remarked that the human race usually overreacts to dangers it does not comprehend and suggested that the application of isolation to the control of infection is a good example of this. Likewise, Lynch and Jackson (1986) described the ritualistic infection control practices adopted by health care workers in relation to isolation precautions. They noted that:

> "Historically, the rooms of persons with diagnosed infections and everything in that environment was considered "contaminated". Thus, things inside the room were "dirty" and things outside the room were "clean". To operationalize this belief required doing such things as the double-bagging technique with one person garbed in isolation attire inside the room placing the contaminated trash or linen inside a clean bag held by a second person outside the room. Also, supplies needed to practice isolation techniques were placed on shelves or carts outside the room where they were considered "clean". The door to the room was kept closed to keep "dirty" things and the "contaminated air" inside the room."
>
> (Lynch and Jackson, 1986: 4)

This description strongly resembles findings of the present study, in which there were similar examples of ritualistic practice in an attempt to 'contain' infection. Although nurses and health care assistants were keen to establish clear guidelines for their infection control

practice in relation to Contact Precautions, they did not always respond rationally to the information presented to them. For example, during Phase II of the study, two qualified nurses stated that they did not think it was appropriate to use a dressing trolley when performing 'aseptic' procedures on patients nursed in isolation. This was because they considered it wrong to take a piece of equipment associated with 'aseptic' procedures into the room of a patient with an infectious condition, although they were unable to further articulate what is was that concerned them about doing this. This resembles the above description by Lynch and Jackson (1986), in which there were distinctions between "clean" and "dirty" things. Despite being given information about the correct way to effectively decontaminate a dressing trolley after use, neither nurse was willing to alter their opinion.

Similarly, with regard to the disposal of linen and waste, findings of the post-implementation interviews revealed that several nurses and health care assistants wished to return to their previous practice of double-bagging, even though the new, more straight-forward approach had been widely adopted on the study ward. This was because they believed that double-bagging was safer, as it provided a better means to contain infection, thereby preventing it from spreading "down the ward". Again, this resembles the above description by Lynch and Jackson (1986). Although irrational, this ritual appeared to offer participants a way to deal with their anxiety about spreading infection from items such as bedpans and linen bags. These observations, along with others such as the overuse of protective clothing, illustrate participants' inclination to overreact to dangers they did not comprehend, as highlighted by Meers et al (1997).

Strange (2001) considered the persistence of ritual in nursing practice and suggested that among its other functions, ritual may help nurses to deal with uncertainty and the emotions generated by nursing patients. This is pertinent to the present study, since although in general, nurses and health care assistants considered that their knowledge and practice with regard to Contact Precautions had improved as a result of Phase II of the study, it was evident that some remained uncertain about particular aspects of practice such as the risks associated with linen and waste disposal, equipment and the selective approach to glove use. In addition, as discussed later in the chapter, some remained particularly anxious about the risks to their own health when nursing patients with infectious conditions even though they were offered reassurance to the contrary. By implication, it would seem that even with intensive individualised education and support, the extent to which it is possible to influence nurses' and health care assistants' infection control practice in relation to Contact

Precautions is limited when they have strongly held irrational beliefs about the subject. Potentially, this may also be true of other health professionals, although there has been a lack of research on this issue.

Sulzbach-Hoke (1996) made a similar observation in relation to health care workers' perceptions about Universal Precautions, arguing that health care workers may not always respond rationally to messages about risk. Likewise, Parsons et al (1995) found that nurses and hospital domestic workers had limited trust of the information they had been given about infection control in relation to HIV/AIDS. Sulzbach-Hoke (1996) cited Denscombe's work on risk-taking theory (Denscombe 1993, in Sulzbach-Hoke, 1996) as offering two explanations for this. The first concerned people's built-in resistance to unwelcome information and the second related to cognitive limitations, such that people may be unable to fully comprehend the significance of the information they are given. Indeed, there is considerable resonance between these explanations and the findings of the present study, since participants were not always receptive to the information and guidance offered by the researcher and frequently experienced difficulties when attempting to make sense of their infection control practice.

For example, during Phase II of the study, an attempt to reduce the over-use of gloves was only partially successful because not all participants were willing to accept that gloves are not always necessary to prevent the spread of infection providing that hands are thoroughly decontaminated. One nurse in particular explained that she was not convinced that handwashing with either soap and water or alcohol handrub would remove MRSA from her hands and in view of this, she preferred to use gloves more often for patients with MRSA than for other patients. Others expressed concerns about the need to protect themselves from exposure to MRSA and *Clostridium difficile*, despite being offered considerable reassurance about the negligible risks to health care workers associated with these pathogens.

In relation to Universal Precautions, Sulzbach-Hoke (1996) has highlighted the need to understand what factors people consider when deciding whether to act on the basis of the risk information received and to determine whether they act in a rational manner in the face of health risk information. Findings of the present study suggest that a similar approach is warranted in relation to Contact Precautions and possibly infection control more generally, since it cannot be assumed that health care workers will respond rationally to information which conflicts with their own belief system. Likewise, this may be a valid issue to

investigate in relation to health care practice in general. Indeed, it may be that health care workers respond irrationally to the evidence base in other areas of health care practice, thus impeding efforts to promote evidence-based practice.

The Issue of Determining Rationales for Infection Control Practice

As the above account illustrates, the way in which health care workers respond to the evidence base on infection control and indeed, other areas of health care practice is critically important when considering the rationales for practice. In addition to this, when developing guidance, it is important to consider the degree to which practitioners will be expected to exercise clinical judgement. Brennan and Abrutyn (1995) recalled that whereas the term 'policy' suggests a binding document that eliminates clinical judgement, the term 'practice guideline' implies that practitioners may exercise clinical judgement to determine the appropriate health care for specific clinical circumstances. They stated their own preference for the term 'practice guideline' in relation to the development of guidance on infection control in hospitals, owing to the "undesirable overtones" associated with the term 'policy'. However, Jenner et al (1999) argued that there is a need to decide whether rules about infection control should be expressed in black and white terms or as part of a spectrum. Using the example of handwashing, they questioned whether it is better to produce overkill by writing hard and fast rules which stipulate the need for handwashing before and after every patient contact or to have a mass of individual rules which stipulate that 'hands must be washed before and after the following procedures'.

One of the key factors in this debate centres around practitioners' ability and willingness to comprehend the rules presented to them. As discussed earlier in the chapter, participants in the present study struggled to make sense of infection control practice as a result of their limited understanding of basic microbiology. This in itself limited their ability to exercise clinical judgement. However, little use was made of the practice guideline that was developed specifically to assist nurses and health care assistants to overcome their confusion about the rationales for practice in relation to Contact Precautions. In addition, individuals engaged in the supportive intervention to differing degrees. Indeed, whereas some individuals entered into detailed discussions with the researcher in order to gain a better appreciation of the principles underlying infection control practice, others were much less inclined so to do.

Both Brennan and Abrutyn (1995) and Jenner et al (1999) have asserted that the writing of clear, credible guidelines, which can and will be followed is of key importance to infection control practice. Indeed, guidelines are one of the main methods used by health care organisations to disseminate information about best practice. However, the validity of these assertions is cast in doubt by the findings of the present study. Whilst participants expressed the need for a tailor-made guideline owing to their frustration about the perceived lack of clear information and inconsistencies in practice, only one nurse and one health care assistant reported that the written document had influenced their practice. Likewise, only two nurses reported making use of the research literature that was made available on the study ward to accompany the guideline. Most participants explained that there was insufficient time to refer to written guidance during the course of their work. The large volume of other guidance documents that nurses in particular were also expected to utilise was frequently stressed as the reason why in general, guidelines were considered to be ineffective. Better use was made of the summarised version of the guideline, which was displayed as an A4-sized poster in strategic places on the study ward. This was because it was more readily accessible and more succinct than the main document. However, as it did not include statements about the rationales for the recommendations made, it served more as an aide-memoire than an educational tool.

The majority of participants considered the on-hand guidance and support provided by the researcher to be a far more effective, albeit labour-intensive approach to promoting improvements in practice. This supports Jenner's view that personal explanation and accompanying persuasion of rules are key factors in their adoption (Jenner et al, 1999). However, even this strategy was not entirely successful, since participants differed in the extent to which they made use of the support offered to them. Indeed, whereas two-thirds of the study participants exhibited what the researcher considered to be a high degree of engagement in this element of the study, the remaining third engaged to a lesser extent. This appeared to have more to do with participants' level of interest in the study and in particular, their willingness to expose deficits in their knowledge and practice and to learn from the researcher than characteristics such as status, age and gender. Indeed, whereas the majority of nurses and health care assistants were willing to acknowledge limitations in their knowledge and practice and to learn from the researcher's expertise, those who engaged to a lesser extent seemed much less inclined so to do and evaluated this form of support somewhat negatively. This finding is purely speculative, since it was based only on the researcher's perceptions of how individuals responded to the supportive intervention.

Nonetheless, study findings revealed that participants differed with regard to the extent to which they changed their practice and some individuals were more conversant with the rationales for the new approach than others.

The differing degrees to which nurses and health care assistants adopted changes in their infection control practice is illustrated by their approach to the use of gloves. As mentioned earlier in the chapter, during Phase I of the study, participants' misplaced concerns about the risks to themselves from exposure to infection resulted in indiscriminate glove use and serious deficiencies in hand hygiene practice, since hands were never washed nor gloves changed between 'dirty' and 'clean' procedures. Whereas some participants responded to this problem during Phase II by adopting the recommendation to use gloves more selectively and to change them when soiled, others didn't. Many of those who did adopt this change acknowledged that this was particularly challenging, since it required them to think about the rationales for glove use in order to minimise risks to the patient as well as themselves, an issue they had not previously considered.

The remaining participants continued to use gloves for all patient care activities other than those involving only minimal physical contact with the patient. Reasons given for this were habit, ensuring that gloves were always worn when they were needed and an ongoing concern about the risk of occupational exposure to infection. The routine use of gloves avoided the need to think in detail about the rationales for their use. However, as the findings of the post-implementation interviews confirmed, this also resulted in a continued lack of appreciation of the need to change gloves when soiled during patient care. One of the nurses who persisted with this approach suggested the need for infection control recommendations to be as simple as possible in order to accommodate those health care workers who are least likely to consider the rationales for practice. This may indeed be what is required in order to achieve uniformity. However, as Jenner et al (1999) pointed out, this may lead to adoption of the lowest common denominator, that is, everyone must do everything, even though much of it is unnecessary. It may also demoralise those health care workers who are keen to understand the rationales for their practice. In addition, as the findings of the present study demonstrate, if health professionals do not understand the rationales for practice, they may overlook important aspects of infection control such as the need to change soiled gloves. One of the difficulties with requiring health care workers to consider the rationales for infection control practice during the course of their work is that they are frequently engaged in complex activities that require them to concentrate on other aspects of patient care.

Indeed, health care workers often cite "being too busy" as a reason for non-adherence to infection control practices such as hand hygiene and Universal Precautions (Madan et al, 2002; Ganguly et al, 1999; Zimakoff et al, 1992; Larson and Killien, 1982). This implies that infection control is not necessarily seen as an essential component of patient care and that health care workers may not think about this aspect of their practice as they are working.

Treloar et al (1996) considered the effect of 'mindlessness' on health care workers' behaviour in relation to Universal Precautions practice. During in-depth interviews and focus group discussions with health care workers, they identified that:

> "....some health personnel spoke about working as if they were 'on automatic pilot': while engaged in one task they were 'thinking two miles ahead' and reported it was often difficult to concentrate while doing routine procedures when many other activities were going on around them."
>
> (Treloar et al, 1996: 457)

The authors equated the phenomenon of 'automatic pilot' with that of 'mindlessness', as defined in psychological literature (Treloar et al, 1996). They described how mindlessness develops from a reliance on past behaviours, habits and established cognitive schema as a strategy to conserve cognitive capacity. Using a model of mindless behaviour (the Cognitive Conservation Model of Mindlessness), they developed and implemented an education programme to decrease accidental exposure to blood-borne pathogens among health care workers in the intensive care and emergency units of a hospital in New South Wales, Australia. Four key messages were delivered during an 'academic detailing' visit, which involved a one-to-one educational session for individual health care workers to raise their awareness of the hazard of mindless functioning when performing high risk procedures. This included the promotion of a checklist to produce a 'mindful approach' to routine procedures by directing the health care worker's attention to the environment in which the procedure is performed. Mindlessness was measured using a questionnaire before and after the intervention and structured observations of adherence to Universal Precautions practice were also conducted. Findings revealed a significant increase in adherence to Universal Precautions following the intervention. Conversely, there was a non-significant trend towards more frequent experience of mindlessness in the post-intervention period. However, as the authors pointed out, this may have reflected participants' increased comprehension of the concept of mindlessness rather than an actual increase in its occurrence.

Whilst acknowledging that further research is needed to determine the effectiveness of their intervention and generalizability of the findings in other settings, Treloar et al (1996) suggested that the effects of mindlessness on health behaviour may be far-reaching and should be considered in studies of repeated behaviours and organizational policy or functioning. This phenomenon was not specifically explored as part of the present study, although the findings did reveal that participants were frequently guided by their past behaviours, habits and misconceptions about the spread of infection as well as the risk to themselves from exposure to infection. In this respect, the importance of indoctrinating health care workers with good infection control habits at an early stage of their training is clear. However, whilst past behaviours and habits may have enabled participants to function in a mindless manner, the Cognitive Conservation Model of Mindlessness used by Treloar et al (1996) did not adequately represent the circumstances of the present study. In particular, the model assumes that a skill is learned and then performed with some degree of mastery before the practitioner fosters mindless behaviour. However, in the present study, participants recalled how prior to the study, they had learned about Contact Precautions in a haphazard manner, typically by emulating more experienced nursing colleagues, whose own practice was not necessarily correct. This resulted in ongoing confusion and conflict about what the correct procedures were.

Moreover, the supportive intervention used in the present study was designed to encourage nurses and health care assistants to think in detail about their infection control practice and yet individual participants differed in the extent to which they were willing or able to do this. Indeed, as mentioned above, whereas some participants were keen to gain a better appreciation of the principles underlying infection control practice to minimise risks to patients as well as themselves, others were much less inclined so to do, limiting their decision-making to the consideration of measures that protected themselves from infection. This may also have reflected an inclination by some participants to resist the process of change, since as mentioned above, participants' level of interest in the study and in particular, their willingness to expose deficits in their knowledge and practice and to learn from the researcher did appear to vary. However, it is not known to what extent this accounted for the findings.

Nonetheless, it appears that quite apart from the possibility that work pressures may give rise to mindless functioning, in the present study, participants seemed to differ with regard to their inclination to engage in decision making about infection control beyond that which

concerned their own protection. This possibly reflected some participants' apparent lack of willingness to scrutinise and reflect on their own practice. Potentially, this has serious implications for practice development, since it is not clear how best to instil in health care workers a sense of personal responsibility with regard to preventing the spread of infection between patients. Clearly the findings of this study are purely speculative. However, the overwhelming evidence on non-adherence to infection control practice suggests that this problem may be widespread throughout the health care industry.

In view of this, there is a clear need to consider the way in which rules about infection control are formulated, communicated and ultimately interpreted by health care workers. The formulation and communication of rules is likely to be a complex issue, given the need to appeal to health care workers with differing ability to comprehend the rules, as well as differing degrees of willingness to exercise clinical judgement. On one hand, as Larson et al (1997) concluded, it may be that rules need to be presented in the form of a mandatory policy in which non-compliant health care workers are liable to disciplinary action. Indeed, as discussed in Chapter 4, there has been some reported success using this approach (Larson et al, 2000; Sahdev et al, 1994; Kelen et al, 1991). Alternatively, there may be a need to focus greater attention on the ways in which health care workers interpret the rules before determining how best to present them. Indeed, as described in Chapter 3, there is a growing body of evidence, particularly in relation to Universal Precautions, which suggests that among other factors, health care workers interpret infection control rules according to their perceptions of risk from occupational exposure to infection. It is not clear to what extent they also consider the risks to patients. However, as discussed earlier in this chapter, findings of the present study revealed that nurses and health care assistants placed greater importance on the need for infection control precautions when attending to isolated patients as compared with other patients, owing to a heightened awareness about infection risks to themselves and to patients.

Parsons et al (1995) surmised that the way in which health care workers adapt their infection control behaviour according to their perceptions of risk seems critical to understanding the issue of adherence to infection control practice. Indeed, there is a clear need to gain a better understanding of the psychological processes and in particular, the perceptions of risk that influence health care workers' moment-to-moment decision-making in relation to infection control practice. In the present study, such insights were gained using participant observation as a means to ascertain the reasons for nurses' and health care assistants' infection control

behaviour in the context of everyday work situations. However, as a case study of nursing practice on only one hospital ward, it is not clear to what extent the findings are of relevance to nurses and other health care workers in other settings. To date, the majority of evidence on health care workers' perceptions of risk in relation to infection control practice has been derived from questionnaire studies, which by necessity are based on pre-determined criteria and relate to intended rather than actual behaviour. In view of this, there is a need for further research to investigate the ways in which health care workers interpret infection control recommendations in practice and in particular, the ways in which they assess risk, since this may hold the key to determining how best to develop practice.

The Role of the Infection Control Nurse in Changing Practice

In the present study, the researcher's role as an infection control nurse (ICN) formed a central component of the supportive intervention used to develop practice. Thus, it is of particular relevance to consider the potential impact of this role in relation to changing practice. As described earlier in the chapter, owing to the invisibility of micro-organisms, there was a lack of obvious ways to demonstrate the effectiveness of infection control procedures in practice. In view of this, the researcher relied mainly upon her expertise as an infection control specialist and role modelling to influence participants' practice. This was supported by the provision of a tailor-made, evidence-based guideline along with accompanying literature, although as already discussed, these were not well utilised. However, the majority of participants were highly receptive to the guidance and support offered by the researcher while working alongside them. During their post-implementation interviews, many identified that the key benefit of this approach was its applicability to practice, since being able to ask questions as they arose in practice allowed learning to take place in its situational context. In addition, the researcher's practical input gave credibility to the advice and information she imparted, as this was perceived to be directly relevant to practice. Most participants considered that the experience had positively influenced their practice, albeit to varying degrees. These self-reports concurred with the findings of the participant observations of practice conducted during Phase II of the study, which revealed that in general, infection control practice in relation to Contact Precautions was more hygienic and less ritualistic than in Phase I of the study. Given that the majority of the Phase III interviews were conducted between six and nine months after completion of Phase II, the self-reported changes in individual participants' practice appeared to be relatively long lasting. However, it is not known whether or not these changes persisted over a longer time

frame or whether new staff members who joined the study ward after completion of the study were encouraged to adopt them.

Clearly, any claims of improved practice must be viewed with caution, since the observations of practice during the Phase II of the study were unstructured, providing an indication rather than a more precise measure of the extent to which participants' practice changed. In addition, during Phase III, participants' self-reported practice was not confirmed by structured observations of practice. Whilst the inclusion of structured observations as part of the evaluation was appealing in order to compare participants' infection control practice before and after Phase II, the purpose of the study was to gain detailed insights into the processes of infection control practice rather than to evaluate the effect of an intervention using a pre-test/post-test design. Moreover, the use of structured observation as a means to evaluate improvements in practice would itself have been limited owing to the small sample size and the problem of staff turnover. In addition, during the structured observations that were conducted during Phase I, not all participants were observed undertaking the same activities. Whilst this was sufficient to enable identification of the infection control practices in need of improvement, it would not have been possible to demonstrate whether or not individual participants had changed their practice as a result of the supportive intervention.

The researcher's ability to influence infection control practice by means of her expertise concurs with the findings of a study reported by Raven and Hayley (1982). The study, known as the Study on the Efficacy of Nosocomial Infection Control (SENIC), explored among other issues, the inter-relationship between the ICN and staff nurses. This formed part of a much larger investigation of the effectiveness of infection control programmes in a representative sample of hospitals in the United States (433 in all). To examine the characteristics of successful infection control programmes, an interview survey was conducted with four hundred and thirty-three ICNs or nurses with responsibility for infection control and a self-administered questionnaire was given to a representative sample of staff nurses at each hospital (7188 in all). Findings relating to the inter-relationship between the ICN and staff nurses revealed that staff nurses reported being especially likely to attribute their compliance with infection control practice to the expertise of the ICN, as defined by their superior knowledge or ability in relation to infection control. Interestingly, ICNs did not rate expert power very highly and reported relying instead upon informational power, as defined by the persuasiveness of the information communicated by them.

In the present study, participants identified the need for clear information about isolation precautions to assist them in overcoming the confusion and inconsistencies in practice that were the source of considerable frustration at the outset of the study. However, they made little, if any use of the written guideline and accompanying literature provided. Instead, the majority of participants relied heavily upon the researcher's function as an expert role model, since this allowed them the opportunity to observe the way in which the researcher implemented Contact Precautions and to clarify infection control issues as they arose in practice. However, this also had a downside, since the researcher's expert knowledge was apparently off-putting to a few individuals who were reluctant to expose deficits in their knowledge and practice. Nonetheless, the almost exclusive reliance upon the researcher as the means by which to update practice has clear implications for the role of the ICN in promoting best practice, particularly given the lack of impact of written material.

In order to shed further light on the ICN's potential to influence nurses' infection control practice, Seto et al (1990) conducted an interview survey of eight hundred and eighty-one nurses in twenty hospitals in Hong Kong to evaluate the effectiveness of twenty-three influencing tactics. These authors highlighted the limitations of the social influence variables previously identified by Raven et al (1982), pointing out their mainly theoretical basis and their inability to describe the actual influencing tactics (rather than bases of power) that a power-holder can exploit to effect influence on the target. Instead, they examined potential influencing tactics based on those identified by Kipnis et al (Kipnis et al, 1980, in Seto et al, 1990) in a study of managers from various types of organizations. Their findings revealed that nurses most favoured 'professional-resources' tactics, followed by 'professional-respect' tactics.

The 'professional-resources' category incorporated tactics in which the infection control team is able to exploit their expertise, including providing information or explaining the hospital's reasons for the policy and also the formulation of guidelines and the offering of needed resources. Interestingly, in the present study, nurses perceived the need for a practice guideline to address the inconsistencies in their infection control practice and yet the written material developed in consultation with them was not well utilised. However, the researcher's interpretation of the guideline in the context of practical situations was generally considered to be highly beneficial, reflecting the importance of effective communication and application of this information rather than its perceived validity per se.

The second most valued category in Seto's study was that of 'professional-respect'. This incorporated tactics which treat nurses as fellow professionals, such as making requests politely and requesting the opinions or assistance of nurses as well as those that esteem the ideals of the profession, such as adopting good practice for the patient's good. Again, this was an important element of the researcher's approach in the present study, since it was essential to recognise nurses' own opinions and concerns in relation to implementing the practice guideline and to acknowledge and learn from their experience as practising nurses. By comparison, the factors yielding the lowest response rate in Seto's study were those termed 'non-communicative', in which nurses' own views were disregarded and 'hierarchical', in which the ICN assumes the position of a superior. Indeed, in the present study, such approaches would undoubtedly have undermined efforts to engage study participants.

Clearly, the findings of the studies by Seto et al (1990) and Raven et al (1982) are limited by the fact that they relate to nurses' behavioural intent rather than their actual behaviour. Also, the extent to which they are of relevance to the UK setting is unclear. Nonetheless, the findings do support the data from this study, suggesting that among other factors, the ICN's status as an expert places them in a good position to influence practice. This view was reinforced in the present study, particularly in light of the difficulties encountered by participants when attempting to make sense of contact transmission and Contact Precautions. Indeed, participants' misconceptions and erroneous beliefs about the transmission of infection needed to be identified and challenged in order to promote a more accurate understanding of infection control principles. This may therefore be best achieved by working alongside them. However, it is clearly not practical to replicate the labour-intensive approach to practice development used in the present study on a hospital-wide scale, particularly as ICNs would typically be too few in number to facilitate this. Even in small health care establishments, the problem of staff turnover and the need to include other health care workers in addition to nurses would likely render this approach unworkable.

Nonetheless, as Courtenay (1998) has highlighted, it is important to offer health care workers opportunities to discuss their infection control practice, preferably within the clinical environment, in ways that enable educators to identify and challenge any misconceptions. In the UK, an approach that has been advocated as a means to complement the efforts of the infection control team is to set up "link nurse networks" (Teare and Peacock, 1996). Such networks are facilitated by the infection control team and typically comprise nurse

representatives from wards or units who are responsible for promoting a high standard of infection control practice amongst their colleagues. This system clearly depends upon link nurses possessing both an accurate understanding of infection control principles and the ability to influence their peers. However, as mentioned earlier in the chapter, findings of the present study cast some doubt on nurses' ability to function as role models, at least in relation to contact transmission and Contact Precautions. This implies that the form of preparation and support offered to nurses who take on this role is of critical importance in order for them to function effectively, as is their response to the information presented to them. Other potential limitations include the limited time available for nurses to devote to their role as link nurses given the likelihood of there being many other demands on their time. In addition, since it is generally nurses who are recruited to this role, it is unclear whether it has any influence on other health care professionals. Nonetheless, Teare and Peacock (1996) have reported anecdotally the benefits of a link nurse network, although there has been no formal evaluation of such systems in the UK.

In Hong Kong, Ching et al (1990) reported the findings of a controlled trial to test the effectiveness of involving "infection control liaison nurses" (ICLNs) in the implementation of a new guideline for the control of catheter-associated urinary tract infection. They found that the proportion of incorrect practices amongst 'test' nurses who were exposed to ward-based demonstration tutorials by ICLNs in addition to an in-service lecture by the ICN was significantly lower than in the 'control' group, who received only the in-service lecture. This lends support to the potential value of ward-based practical instruction by ICLNs, although no assessment was made of the long-term impact of the programme. However, given that infection control practice relating to urinary catheter care is arguably a more straight-forward and tangible subject for nurses to comprehend than subjects such as contact transmission and Contact Precautions, it is not clear whether Ching's findings are applicable to infection control practice more generally. Nonetheless, it is clear from the above discussion that strategies incorporating a more "hands on" practical approach to infection control training and education may offer an important means by which to influence health care workers' infection control practice, not least because they enable learning to take place in its situational context and provide important opportunities for educators to challenge health care workers' misconceptions about infection control. As such, they warrant further attention, including evaluation of their feasibility, cost-effectiveness and long-term impact on practice.

In summary, the findings of the present study have implications for future approaches to changing health care workers' infection control practice. Although based on a small sample, it would seem that health care workers' personal belief systems may impede efforts to promote evidence-based practice. In particular, self-preservation instincts and irrational beliefs appear to have a powerful influence on the degree to which individuals adhere to infection control practice. Moreover, it cannot be assumed that all individuals will be motivated to learn and update their practice to the same extent. With this in mind, it is important to consider the way in which rules about infection control are presented and good practice is promoted. More specifically, there is a need to determine whether or not a blanket approach to implementing infection control procedures is advantageous on the basis that not all health care workers may respond rationally to the evidence presented. In addition, given that not all health care workers may possess a sense of personal responsibility with regard to preventing the spread of infection nor respond positively to efforts to promote improvements in practice, this approach may require some form of administrative mandate. Alternatively, it may be that more effort should be focused on finding new ways to enhance learning and to engage those practitioners who do not appear to feel personally responsible for preventing the spread of infection. In either case, the infection control nurse has a key role to play in determining which direction to pursue and how best to utilise his/her own expertise in order to optimise the development of infection control practice.

Conclusion

The challenge of promoting optimal adherence to infection control in health care practice is a hugely complex one. The difficulties experienced by participants in the present study shed light on some of the possible reasons for this. Whilst the findings are limited, particularly in view of their lack of generalisability, the issues raised are nonetheless compelling, since they suggest that there are powerful processes relating to health care workers' personal belief systems, which may impede efforts to promote evidence-based practice. In particular, the study findings revealed that nurses' and health care assistants' capacity to understand infection control practice was severely hampered, not only by a lack of knowledge, but also by irrational beliefs, inaccurate perceptions of risk, both in relation to themselves and patients and a lack of ability or willingness to exercise clinical judgement.

The finding that there were marked deficiencies in knowledge of basic microbiology and infection control principles amongst study participants has serious implications for the content of the education and training programmes offered to health care workers. Indeed,

there is a clear need to ensure that this subject forms a core component of these programmes. Moreover, the way in which this material is taught may be of crucial importance, since conceptually, the principles of infection control appeared difficult to grasp by participants in the present study. At one level, it could be argued that the approach to teaching used during the study was effective, given that the majority of participants embraced the opportunity to develop their practice. Indeed, uncovering participants' own beliefs about infection control allowed misconceptions to be challenged. In addition, encouraging individuals to scrutinise and reflect on their practice while they were working enabled learning to take place in its situational context. However, at another level the approach was not entirely effective, since not all participants fully engaged in the supportive intervention. Moreover, some individuals' irrational beliefs and inaccurate perceptions of risk, both in relation to themselves and patients, persisted despite intensive education and support.

In view of this, there is an urgent need to determine whether the findings of the present study are of relevance more generally to nurses and other health care workers. Indeed, if this is found to be the case, it may necessitate a radical re-think about the ways in which health care workers are educated and supported in practice. At the very least, it would be crucial to ensure that health care workers are taught to appreciate the importance of applying infection control measures routinely to all patients rather than just those with recognised infectious conditions, since failure to recognise this may lead to serious deficiencies in infection control practice. In addition, it may be necessary to find ways to tackle individuals' irrational beliefs and self-preservation instincts if these appear to be overriding the evidence base and impeding practice development. Finding ways to engage those practitioners who appear to lack a sense of personal responsibility with regard to preventing the spread of infection may also prove imperative.

In any case, there is a clear need for further research to elucidate the factors that have a bearing on health care workers' moment-to-moment decision-making in relation to infection control practice and in particular, their perceptions of risk both to themselves and to patients. This in turn will inform further theory development. In particular the application of risk taking theory to infection control warrants further scrutiny, since this may offer new explanations for health care workers' infection control behaviour in the light of their perceptions of risk. Risk taking theory also appears to take account of peoples' inclination to resist unwelcome information and their inability to fully comprehend its significance

(Denscombe 1993, in Sulzbach-Hoke, 1996), both of which were especially pertinent to the present study.

As regards infection control policy development, there is an urgent need to resolve the ongoing controversy surrounding the use of Contact Precautions versus Body Substance Isolation (BSI). Indeed given the ambivalent evidence base in relation to this, infection control professionals currently face a fundamental problem regarding the potential merits of either system, since it is difficult to determine which direction to pursue. Findings of the seminal work on Body Substance Isolation (BSI) undertaken by Lynch et al (1987) are strongly supported by the present study with regard to the apparent difficulty inherent in promoting the routine use of infection control precautions when a traditional system of isolation precautions is in operation. However, whilst the BSI system offers an approach that is arguably more rational than Contact Precautions, it is not clear what sense health care workers make of this system in practice. Indeed, as the findings of the present study reveal, it cannot be assumed that health care workers do act purely on rationality. Research on health care workers' perceptions of risk in relation to infection control may shed further light on this issue. Notwithstanding, there is clearly a need to establish whether or not Contact Precautions offers any advantage over a more generic approach to infection control, since until there is a definitive answer to this question, messages about infection control are likely to generate confusion amongst health care workers. A definitive trial to compare the two systems is therefore urgently required.

Appendix 1

Analysis of Intervention Studies Designed to Improve Adherence to Infection Control Practice

Researchers	Year	Topic and Subjects	Intervention	Findings
Preston et al	1981	Hand hygiene by HCWs in an ICU	Major structural changes including increased number of handwash basins	No significant change in hand hygiene behaviour or rate of colonisation/infection
Mayer et al	1986	Hand hygiene by nurses in an ICU	Changing to emollient soap and performance feedback	No significant change in hand hygiene behaviour due to emollient soap. Significant short-term improvement in hand hygiene frequency
Donowitz	1987	Hand hygiene by HCWs in a paediatric ICU	Use of an overgown	No significant change in hand hygiene behaviour
LeClair et al	1987	Glove and gown isolation precautions by health care workers in a paediatric medical ward	Involvement of head nurse in the promotion and monitoring of glove and gown use for patients with respiratory syncytial virus (RSV)	Significant increase in glove and gown use during intervention and significant reduction in rate of RSV infection
Williams et al	1988	Hand hygiene by HCWs in a hospital	Educational and motivational programme	Significant increase in estimated hand higiene frequency which returned to baseline by 6 months
Conly et al	1989	Hand hygiene by health care workers in an ICU	Two separate education programmes: one involving performance feedback and the other involving feedback plus active encouragement by senior ICU personnel	Significant increase in hand hygiene frequency immediately after intervention and significant reduction in infection rates
Seto et al	1989	Needle re-capping by nurses in 36 hospital wards	Three methods of awareness-raising: simple announcement, posters/pamphlets and in-service lecture	Significant self-reported reductions in needle re-capping according to respondents' intention to comply with guideline and the awareness-raising method used
Bowman	1990	Use of gloves as a Universal Precaution by nurses in a rural medical centre	In-service education and performance feedback	Increase in glove use after intervention (no statistics, time scale unclear)
Dubbert et al	1990	Hand hygiene by nurses in an ICU	In-service education and performance feedback	Significant increase in hand hygiene frequency up to 4 weeks after intervention

Researchers	Year	Topic and Subjects	Intervention	Findings
Graham	1990	Hand hygiene /disinfection by HCWs in an ICU	Introduction of alcohol-based hand rub	Significant increase in hand hygiene frequency 1 week after intervention
Hammond et al	1990	Universal Precautions by surgical residents involved in trauma resuscitations	Improved availability of equipment and promotion of Universal Precautions by trauma nurse	Significant increase in use of Universal Precautions during intervention
Lynch et al	1990	Body substance isolation (BSI) by HCWs in a hospital	Consultation with staff, structural changes, revision of policies and in-service education	Significant increase in glove use up to 18 months after intervention
Ribner et al	1990	Needle re-capping by HCWs in a hospital	Two programmes: one involving memo, in-service education and improved availability of sharps containers; the other involving memo, performance feedback, discussion with individuals/small groups and inspection of contents of sharps containers	Significant reduction in re-capped needles found in sharps containers after first programme and further significant reduction after second programme that was sustained 15 months after second intervention
Simmons et al	1990	Hand hygiene by nurses in two ICUs	In-service education, button campaign and performance feedback	No significant change in hand hygiene behaviour
Talan et al	1990	Universal Precautions by nurses in an emergency department	In-service education	Significant increase in use of gloves and protective eyewear immediately after intervention
Courington et al	1991	Universal Precautions by HCWs in a surgical unit	Formal lecture / in-service education	No significant change in use of Universal Precautions
DeVries et al	1991	Glove wearing as a Universal Precaution by nurses in an emergency department	Individual performance feedback	Increase in glove use during intervention (no statistics)
Larson et al	1991	Hand hygiene by HCWs in post-anaesthesia recovery room and neonatal ICU	Automated sink	Significantly improved quality of hand hygiene, but significantly decreased frequency
Lohr et al	1991	Hand hygiene by physicians in an out-patient department	Promotional campaign including signs, performance feedback and promotion of hand hygiene by head nurse	No significant change in hand hygiene behaviour

Researchers	Year	Topic and Subjects	Intervention	Findings
Kelen et al	1991	Universal Precautions by health care workers in an emergency department	Institutional policy mandating compliance with Universal Precautions	Significant increase in the use of universal precautions 7 months after intervention
Raju et al	1991	Hand hygiene by HCWs in a newborn nursery and neonatal ICU	In-service education, posters and performance feedback	Significant increase in hand hygiene up to 7 months after intervention
Stevens et al	1991	Universal Precautions by health care workers in an anaesthesia department	In-service education	Significant increase in self-reported glove use immediately after intervention. No increase in any other precautions.
Babcock et al	1992	Use of gloves as a Universal Precaution by nursing assistants in a head injury treatment unit	Individual performance feedback	Increased glove use by some nursing assistants during intervention (no statistics)
Freeman et al	1992	Hand hygiene and glove wearing as universal precautions by HCWs in an out-patient department	Didactic in-service education	No significant change in hand hygiene or gloving behaviour
Friedland et al	1992	Glove wearing as a Universal Precaution during vascular access procedures by RNs in a paediatric emergency department	In-service education plus written materials and posters	Significant increase in glove use up to 5 months after the intervention
Schwartz et al	1992	Universal Precautions by HCWs in helicopter emergency medical service	Mandatory in-service education	Significant increase in glove use but not goggles up to 2 months after intervention
Sahdev et al	1994	Universal Precautions by trauma team members involved in resuscitations	In-service education, improved access to equipment and administrative mandate	Significant increase in the use of Universal Precautions up to 6 months after intervention
van de Mortel et al	1995	Hand hygiene by health care workers in an ICU	Overt observation and performance feedback	Significant increase in hand hygiene frequency only amongst physiotherapists and visiting medical officers for up to 6 months after intervention
Dorsey et al	1996	Hand hygiene by health care workers in an emergency department	Use of brightly coloured signs listing hand hygiene recommendations	No significant increase in hand hygiene frequency
Tibballs	1996	Hand hygiene by medical staff in a paediatric ICU	Performance feedback	Significant short-term increase in hand hygiene frequency 7 weeks after intervention

Researchers	Year	Topic and Subjects	Intervention	Findings
Treloar et al	1996	Universal Precautions by nursing and medical staff in an ICU and emergency department	Academic detailing education programme	Significant increase in use of Universal Precautions up to 6 weeks after intervention
Gould et al	1997	Hand hygiene, glove use and sharps handling practice of nurses in two surgical wards	Ward-based education programme	No significant increase in hand hygiene, gloving and sharps handling practices
Larson et al	1997	Hand hygiene by health care workers in an ICU	Focus group sessions, installation of an automated sink and performance feedback	No significant change in hand hygiene behaviour
White et al	1997	Reducing risk of blood exposures by health care workers in three operating departments	User-led development of unit-specific interventions based on initial report of observed practice	Significant reduction in self-reported blood exposures in second study period
Wright et al	1997	Universal Precautions by nurses	Computer-assisted learning programme	Significant increase in use of Universal Precautions 3 weeks after intervention
Avila-Aguero et al	1998	Hand hygiene by health care workers in a paediatric hospital	Videos, brochures, posters, observation and performance feedback	Significant short-term increase in hand hygiene frequency, which returned to baseline levels by 4-7 weeks
Coignard et al	1998	Hand hygiene by health care workers in a hospital-wide study	In-service education, individual technique demonstrations, posters, newsletter articles and observation by 'hygiene referees'	Significant increase in quality of hand hygiene immediately after intervention
Messmer et al	1998	Universal Precautions and respiratory isolation precautions by nurses in two specialised units receiving HIV/AIDS patients	In-service education plus posters and pamphlets	Significant increase in use of Universal Precautions and respiratory isolation precautions 1 week after intervention
Brooks et al	1999	Universal Precautions by trauma team members in an emergency department	In-service education including video evaluation and performance feedback	Significant increase in use of Universal Precautions 1 month after intervention
Khatib et al	1999	Hand hygiene and glove use by respiratory care practitioners in an ICU	In-service education and application of reminder labels to mechanical ventilators	Significant increase in hand hygiene frequency and glove use up to 4 weeks after intervention
Kidd et al	1999	Use of correct isolation signs by health care workers in a hospital	In-service education plus written self-learning pack	Improvement in use of correct isolation signs (no statistics)

Researchers	Year	Topic and Subjects	Intervention	Findings
McGuckin et al	1999	Hand hygiene by health care workers in four community hospitals	Patients instructed to remind health care workers to wash their hands	Significant increase in soap usage during intervention period
Bischoff et al	2000	Hand hygiene by health care workers in two ICUs and a medical ward	In-service education, performance feedback, patient awareness programme and introduction of alcohol-based hand rub	No significant change in hand hygiene frequency after education and feedback, but significant increase up to 12 weeks after introduction of alcohol-based hand rub
Larson et al	2000	Hand hygiene by health care workers in two ICUs	Administrative intervention to change organizational culture	Significant increase in estimated hand hygiene frequency 6 months after intervention
Maury et al	2000	Hand hygiene by health care workers in an ICU	Introduction of an alcohol-based hand rub	Significant increase in hand hygiene frequency up to 4 months after intervention
Moongtui et al	2000	Hand hygiene and glove use by nurses and nursing assistants	Overt observation and feedback by peers	Significant increase in hand hygiene frequency and glove use which returned to baseline levels by one month
Muto et al	2000	Hand hygiene by health care workers in a medical ICU and ward	In-service education and introduction of an alcohol-based hand rub	No significant change in hand hygiene behaviour
Mukti et al	2000	Universal Precautions by health care workers in an emergency department	Academic detailing education programme	Significant increase in Universal Precautions practice 6 months after intervention
Pittet et al	2000	Hand hygiene by health care workers in a hospital-wide study	In-service education, introduction of an alcohol-based hand rub, poster campaign and performance feedback	Significant increase in hand hygiene frequency during intervention associated with a reduction in infection rates over 3 years
Conrad	2001	Hand hygiene by health care workers in a hospital	In-service education	Increase in consumption rates of alcohol-based hand rub over 8 years
Earl et al	2001	Hand hygiene by health care workers in two ICUs	Introduction of an alcohol-based hand rub	Significant increase in hand hygiene frequency up to 14 weeks after intervention
Girard et al	2001	Hand hygiene by health care workers in four hospital units	Introduction of an alcohol-based hand rub	No overall significant increase in hand hygiene frequency, but significant short-term improvement in hand hygiene technique
Girou et al	2001	Hand hygiene by health care workers on two ICUs and two medical wards	In-service education, introduction of an alcohol-based hand rub and performance feedback	Significant increase in hand hygiene frequency 6 months after intervention

Researchers	Year	Topic and Subjects	Intervention	Findings
Kim et al	2001	Universal Precautions by operating department staff	Didactic in-service education, posters and performance feedback	Significant increase in use of eye protection and rates of double-gloving up to 2 years after intervention
Bittner et al	2002	Hand hygiene by health care workers in an ICU	Sustained performance feedback	No significant change in hand hygiene behaviour
Columbo et al	2002	Hand hygiene by nurses on two medical wards, three surgical wards and six ICUs	In-service education and provision of additional alcohol-based hand rub dispensers	Increased ratio between measured and calculated need for alcohol-based hand rub
Harbarth et al	2002	Hand hygiene by health care workers in three paediatric ICUs	Quality improvement initiative incorporating in-service education, introduction of an alcohol-based hand rub, encouragement by opinion leaders and performance feedback	Significant increase in hand hygiene frequency up to 3 months after intervention
Sharek et al	2002	Hand hygiene by health care workers in a neonatal ICU	In-service education, reminder stickers and posters, performance feedback and individual 'open book test' on content of new policy	Significant increase in hand hygiene frequency up to 6 months after intervention

Appendix 2

Semi-Structured Interview Schedule (Pre-Implementation)

1. Introductory Comments

(i) Thank respondent for taking part

(ii) Outline purpose of interview

(iii) Explain about anonymity

(iv) Ask for consent to use tape recorder

2. Background Information

Registered Nurses:

(i) Can I first ask you how long you have been qualified for?

(ii) Where did you do your training?

(iii) How long have you worked on this ward?

Health Care Assistants:

(i) Can I first ask how long have you been working as a Nursing Assistant?

(ii) Have you worked anywhere other than this ward?

(iii) How long have you worked on this ward?

3. Rank Order Exercise

(i) Take respondents through the following 'cue' cards:

Aseptic technique	Isolation precautions
Cleaning of equipment	Linen handling and disposal
Clinical waste and sharps disposal	Universal precautions
Hand hygiene	Urinary catheter care
Intravascular therapy care	Use of gloves and aprons

(ii) Ask them to look at the cards and think about them in relation to their everyday work.

(iii) Ask if any of the practices need to be clarified and define if necessary.

(iv) Ask respondent to arrange the cards in order according to the extent to which there are difficulties with achieving 'good' practice on the ward, starting with the one that is most problematic.

4. **Main Interview**

For each practice (starting with most problematic):

(i) Ask respondent to define what they regard the practice to entail and give further clarification if necessary.

(ii) Can you tell me about the problems you have found with this practice on the ward? (Probe until topic exhausted)

(iii) How do others feel about it? (e.g. nurses, medics, PAMs etc)

(iv) What do you think is needed to improve practice?

5. **Opportunity to Amend Rank Order**

(i) Ask respondent if they wish to change the rank order.

6. **Preferred Project Focus**

(i) Which practice would you most like to develop as a project on the ward

(ii) Why?

(iii) What do you think we would need to do?

(iv) What problems do you think we might have?

7. **Closing Comments**

(i) Ask respondent if there is anything else they would like to mention about infection control on the ward that has not been covered in the interview.

(ii) Thank respondent for participating.

(iii) Explain what will happen to tape recording and transcript.

(iv) Explain what the next part of the project will involve.

Appendix 3

Observation Schedule for Structured Observations of Practice

Date:	IC PRACTICE:	Gloves on	Gloves off	Apron on	Apron off	Hands washed	Alcohol gel applied	ACTIVITY:	Applying cream	Bed making	Brushing hair	Charting	Cleaning equipment	Collecting items	Delivering items	Disposing items	Dressing patient	Feeding patient	Injection	IV care	Mouth care	Moving patient	Pouring drink	Removing items	Talking to patient	Taking medication	Temp/pulse/BP	Toileting	Washing patient	Wound care	TOUCHING:	Blood/body substances	Clean equipment	Non-intact skin	Used equipment		Yes	Helped
Observer:																																				Linen bags: correct colour		■
Condition:																																				Linen: 2nd bag at door		
Sequence:																																				Waste bag: correct colour		■
Staff																																				Waste: 2nd bag at door		
Code																																				Bedpan: put in yellow bag		■
Time																																				Bedpan: 2nd bag at door		
Notes:																																						

Appendix 4

Coding Schedule for Structured Observations of Practice

INFECTIOUS CONDITION					
1	CDAD	2	MRSA	3	Both

STAFF DESIGNATION			
1	Registered Nurse	2	Health Care Assistant

CONTACT PRECAUTION					
1	Gloves	6	Gloves changed (hands washed inbetween)	11	Apron removed (gloves left on)
2	Apron	7	Gloves changed (hands not washed)	12	Gloves/apron removed, hands washed (sw)
3	Gloves and apron	8	No infection control measures taken	13	Gloves/apron removed, alcohol handrub (ah)
4	Hands washed (soap and water)	9	Gloves/apron removed	14	Gloves/apron removed, hands washed (sw+ah)
5	Alcohol handrub applied	10	Gloves removed (apron left on)	15	Hands washed/wiped with gloves on

ACTIVITY					
1	Applying cream	10	Feeding patient	19	Temp/pulse/BP
2	Bedmaking	11	Injection	20	Toileting
3	Brushing hair	12	Intravascular care	21	Touching blood/body substances
4	Charting	13	Mouth care	22	Touching clean equipment
5	Cleaning equipment	14	Moving patient	23	Touching non-intact skin
6	Collecting item	15	Pouring drink	24	Touching used equipment
7	Delivering item	16	Removing item	25	Washing patient
8	Disposing items	17	Talking to patient	26	Wound care
9	Dressing patient	18	Taking medication		

Coding Schedule (continued)

CLASSIFICATION OF ACTIVITIES ACCORDING TO EXTENT OF CONTACT WITH PATIENT/ENVIRONMENT								
1	**No physical contact**	**2**	**Minimal physical contact**	**3**	**Substantial physical contact**		**4**	**Direct contact with excretions/secretions**
	Charting		Removing (used) item (e.g. crockery)		Applying cream	Intravascular care		Touching blood/body substances
	Collecting item		Pouring drink		Bedmaking	Mouth care		Touching non-intact skin
	Delivering item		Taking medication		Brushing hair	Moving patient		
	Talking to patient		Temp/pulse/BP		Cleaning equipment	Removing (soiled) item (e.g. bedpan)		
			Touching clean equipment		Disposing items	Toileting		
					Dressing patient	Touching used equipment		
					Feeding patient	Washing patient		
					Injection	Wound care		

APPROPRIATENESS OF OBSERVED PRACTICE					
1	Handwash indicated	6	Gloves indicated as a universal precaution	11	Gloves/apron indicated immediately before and after activity
2	Gloves and apron indicated as an isolation precaution	7	Gloves indicated as a hygiene precaution	12	Continued using soiled gloves when no longer necessary
3	Gloves and apron indicated as a universal precaution	8	Apron indicated as an isolation precaution	13	Continued using soiled gloves when clean gloves needed
4	Gloves and apron indicated as a hygiene precaution	9	Apron indicated as a universal precaution	14	No measures necessary
5	Gloves indicated as an isolation precaution	10	Apron indicated as a hygiene precaution		

Appendix 5

Recommendations used to Assess the Appropriateness of Observed Practice

Recommendations on Hand Hygiene
Local Infection Control Policy Hands should be washed: • after physical contact with the patient or their environment • after contact with faeces
Published Guidelines on Hand Hygiene (ICNA, 1998; Larson, 1995) Hands should be washed: • before invasive procedures • after patient contact • after contact with a source of micro-organisms (body fluids and substances, mucous membranes, non-intact skin, inanimate objects that are likely to be contaminated) • after visible soiling • after removing gloves

Recommendations on Protective Clothing
Local Infection Control Policy Gloves and a disposable plastic apron should be worn: • for all patients, when contact with blood and other body fluids is anticipated • for MRSA, when in physical contact with the patient or their environment • for CDAD, when in contact with faeces or equipment contaminated by it
Published Literature and National Guidance • for MRSA, gloves and a plastic apron should be worn when handling the patient or their environment and for anticipated contact with body fluids, lesions and contaminated items (Ayliffe et al, 1998) • for CDAD, gloves and a plastic apron should be worn for anticipated contact with body fluids, excretions and contaminated items (Cooke et al, 1994) • for all patients, gloves should be worn to minimise microbial contamination of hands in situations when this is likely to be heavy (Kjolen et al, 1992) • for all patients, a plastic apron should be worn to minimise microbial contamination of clothing in situations when this is likely to be heavy (Babb et al, 1983) • for all patients, gloves should be removed or changed and wash hands between 'dirty' and 'clean' procedures (ICNA, 1998)

Recommendations (continued)

Recommendations on the Disposal of Linen and Clinical Waste
Local Infection Control Policy • clinical waste (other than sharp instruments) should be disposed of as normal into a single yellow plastic bag (marked with a biohazard sign for incineration only) • used disposable sharp instruments should be discarded into a sharps container as normal • used bedpans and urine bottles should be placed into the bedpan washer as normal • used/soiled linen should be disposed of into a hot water-soluble bag and then into a red laundry bag

Appendix 6

An Illustration of the Results Generated from Analysis of Structured Observation Data Using a Pivot Table									
			RN			HCA			Grand Total
'CP'	'OK'	'Why'	CDAD	MRSA	Total	CDAD	MRSA	Total	
Gloves and apron	No	HW needed	0	1	1	6	6	12	**13**
Gloves and apron	No	HW + glove change needed	2	0	2	2	8	10	**12**
Hands washed	Yes	HW needed	0	0	0	0	2	2	**2**
Alcohol gel used	Yes	HW needed	1	0	1	0	0	0	**1**
Gloves changed + hands washed	Yes	HW + glove change needed	0	0	0	0	1	1	**1**
Gloves changed + hands washed	Yes	HW + glove change needed	0	1	1	0	3	3	**4**
No infection control measures	No	HW needed	0	0	0	0	2	2	**2**
Gloves and apron removed	No	HW needed	0	0	0	1	1	2	**2**
Gloves and apron removed + hands washed	Yes	HW needed	7	6	13	7	9	16	**29**
Gloves and apron removed + alcohol gel used	Yes	HW needed	0	0	0	0	1	1	**1**
Gloves and apron removed + hands washed and alcohol gel used	Yes	HW needed	4	2	6	2	5	7	**13**
Grand Total			**14**	**10**	**24**	**18**	**38**	**56**	**80**

Appendix 7

Guideline on Contact Precautions for *Clostridium difficile* associated diarrhoea (CDAD) and Methicillin resistant *Staphylococcus aureus* (MRSA)

This guideline has been developed as part of an ongoing research project to explore factors which influence the implementation of Contact Precautions for patients with CDAD and MRSA. It is designed to be used on the study ward to accompany the Trust-wide policies on management of CDAD and MRSA.

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Key facts about *Clostridium difficile*

What is Clostridium difficile?
Clostridium difficile is an important cause of infectious diarrhoea in hospitalised patients[1]. It is a bacterium which is found in the gut of about 3% of healthy people, but may be present in the faecal flora of as many as 13-40% of hospital patients[1].

What kinds of illness does it cause?
Clostridium difficile can colonise the gut harmlessly, but sometimes causes disease which can range from mild to severe diarrhoea[1]. Occasionally, it can cause life-threatening complications such as pseudomembranous colitis (inflammation of the colon, leading to severe diarrhoea, dehydration and toxaemia)[1].

Which patients are at risk of infection?
The most important risk factor for infection is recent antibiotic treatment, as it disrupts the bacteria which normally colonise the colon, enabling *Clostridium difficile* to establish[1]. In addition, the elderly and those who are debilitated due to an underlying illness (e.g. surgical, oncology and renal patients) are especially vulnerable to infection[1].

How is it spread?
Clostridium difficile is spread mainly by contact (touch), via the hands of staff who pick it up through contact with faeces or items soiled by it (including the patient's skin) [1]. It may also be spread via contaminated equipment (e.g. commodes) and surfaces. In theory, direct spread between patients by the faecal-oral route is possible, although evidence to support that this occurs is limited[1]. Spread is most likely to occur while the patient is symptomatic[1].

What are the key measures to prevent spread?
The most important way to prevent spread of *Clostridium difficile* is by scrupulous attention to handwashing between patient contacts[1]. Use of gloves and plastic aprons for direct contact with faeces or items soiled by it is also important[1]. Thorough cleaning of equipment and surfaces will reduce contamination of the environment with *Clostridium difficile*, which can survive as spores for months[1]. In hospital, patients with suspected or confirmed *Clostridium difficile* diarrhoea are usually nursed in isolation rooms with their own toilet / commode, until they have formed stools. This is because infected patients are much more likely to heavily contaminate the environment when they have diarrhoea than when their stools are formed[1].

How is it treated?
The effects of infection with *Clostridium difficile* often subside on their own with no actual treatment other than stopping the patient's antibiotics[1]. If diarrhoea persists, the patient can be treated with a course of oral metronidazole[1]. Vancomycin is sometimes used as an alternative, if treatment with metronidazole has been unsuccessful[1].

What are the risks to staff members and their families?
Clostridium difficile rarely causes infection in healthy people such as health care staff and their families[1]. This is because additional risk factors such as antibiotic treatment, age and debility are usually necessary to give rise to illness[1].

What are the risks to members of the public?
As with staff, members of the public who are healthy are unlikely to become infected with *Clostridium difficile*. Clearly some visitors may themselves be elderly or debilitated, which is why it is important to instruct them to wash their hands after visiting a patient who has *Clostridium difficile*.

Key facts about MRSA

What is MRSA?

MRSA stands for Methicillin Resistant *Staphylococcus aureus*[2]. It is a form of the bacterium *Staphylococcus aureus* (*S. aureus*), which is resistant to the antibiotics normally used to treat infection. *S. aureus* lives harmlessly in the nose or on the skin of many people. It can cause superficial skin infections such as boils, abscesses and impetigo and is responsible for about a third of hospital-acquired wound infections. It can also cause more serious infections, including septicaemia, endocarditis, osteomyelitis and pneumonia.

Why is MRSA so important?

Most patients who acquire MRSA suffer no ill-effects, because like *S. aureus*, it can live harmlessly in the nose and on the skin[2]. However, it can cause the same kinds of infection as *S. aureus* and because it is resistant to many antibiotics, these infections are more difficult to treat. Patients with MRSA infections may require treatment with intravenous antibiotics such as vancomycin, which can have serious side-effects and are expensive[2].

How is it spread?

MRSA is spread mainly by direct contact (touch), via the hands of staff who pick it up through contact with a patient's infected or colonised body sites[2]. It may also be spread via heavily contaminated uniforms, equipment or surfaces. Spread via the air is much less common, but may occur when a patient who is a heavy disperser of MRSA is in close proximity to other patients[2]. Heavy dispersers are often infected patients with large burns or widespread eczema, but may also be asymptomatic carriers and patients with upper respiratory tract infections[2].

What are the key measures to prevent spread?

The most important way to prevent spread of MRSA is by scrupulous attention to handwashing[2]. Use of gloves and plastic aprons also helps to prevent spread in situations where heavy contamination of hands and clothing is likely[5,7,8]. Thorough cleaning of equipment and surfaces will help to reduce contamination of the environment with MRSA[2]. In hospital, patients with MRSA are usually nursed in single room isolation to minimise contact with other susceptible patients, minimise environmental contamination and to alert staff to the need for careful attention to infection control measures.

How is it treated?

In hospital, patients are usually treated with topical skin preparations (e.g. 'Hibiscrub', 'Sterzac' powder and 'Bactroban' nasal ointment) to reduce or eliminate skin carriage. The exact treatment depends on the patient and the type of MRSA they have. Patients who have an infection caused by MRSA may need antibiotic treatment.

What are the risks to staff members and their families?

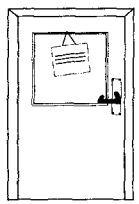
MRSA rarely causes infection in healthy people such as healthcare staff and their families[2]. Staff members caring for patients with MRSA may occasionally become colonised, although in most cases carriage is only temporary[2]. Because of this, staff are not screened routinely, although it may become necessary where there is evidence of persistent spread of the organism in a particular ward or unit.

Why does management of patients in hospital differ from those in the community?

Patients with MRSA do not normally require special treatment after discharge from hospital. This is because MRSA poses little risk to members of the public, including residents of nursing or residential homes, unless they have open wounds or invasive devices such as urinary catheters[2]. Staff from nursing or residential homes with vulnerable residents should seek advice from the consultant in communicable disease control (CCDC) who liases with the hospital infection control team.

Contact Precautions for Patients with *Clostridium difficile* associated diarrhoea or Methicilllin Resistant *Staphylococcus aureus* (MRSA)

Use of a single room



- In this hospital, patients with MRSA or diarrhoea due to *Clostridium difficile* are usually nursed in single room isolation to minimise contact with other susceptible patients, minimise environmental contamination and to alert all staff to the need for careful attention to infection control measures.
- In some circumstances, it may not be possible to nurse the patient in isolation (e.g. due to patient safety or lack of availability of a single room), in which case, advice should be sought from the infection control team on the most appropriate measures to take.
- Remove all non-essential equipment from the room before the patient is isolated to avoid it becoming contaminated unnecessarily.
- Ensure essential equipment is available inside the room (e.g. designated commode, disposable gloves, liquid soap, paper towels, clinical waste bag).
- Display the isolation precautions sign at the entrance to the room.
- Ensure the following equipment is available outside the room: plastic aprons, alcohol gel, detergent wipes, alcohol wipes.

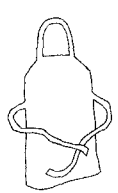
Needs of the patient

- Explain the reason for isolation to the patient and close relatives, to help them understand the measures being taken and to gain their cooperation.
- Ensure they receive a patient information leaflet and are aware of how to obtain further information if needed. Contact the infection control nurses if you require additional information or support.
- Some patients may find it distressing to be in isolation[3]. It is therefore especially important to consider their psychological needs during this time, to help minimise feelings of stress and anxiety.
- To avoid an unnecessarily prolonged period of isolation, ensure that isolation precautions are discontinued as soon as they are no longer necessary.

Hand Hygiene

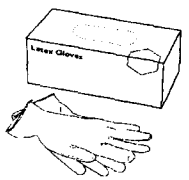
- Hand hygiene is the single most important means of preventing the spread of infection[4]. This is because bacteria are easily picked up on hands and can be transferred in large numbers. Careful hand hygiene **after** any physical contact with the patient or their environment is therefore essential[1,2].
- Hands should also be washed **during** patient care whenever they have become soiled, whenever gloves are removed or changed (see below) and before clean or aseptic procedures.
- Wash hands using the liquid soap provided in the room as a means of physically removing bacteria from the skin[4].
- Use alcohol gel as an additional measure to disinfect the skin before aseptic procedures and when leaving the patient's room[4].

Apron



- Wear an apron when entering the room if you anticipate that your clothing will have substantial physical contact with the patient, environmental surfaces or items in the patient's room (e.g. assisting with hygiene needs, assisting to move, bed making, room cleaning and handling bedpans)[5,6].
- An apron need not be worn for activities involving minimal physical contact with the patient or their environment (e.g. talking, pouring a drink, taking temperature, bringing items into the room), as clothing is unlikely to become heavily contaminated in these situations[5,6].
- To minimise the risk of cross-infection, remove the apron and wash hands before attending to another patient. This is usually done before leaving the room, but at times, it may be more practical to remove it at the end of the activity (e.g. after taking a bedpan to the sluice). Aprons should also be changed inside the room between dirty and clean procedures.

Gloves

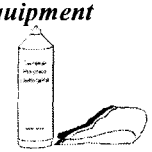


- Wear gloves when contact with the patient's blood / body fluids, mucous membranes or potentially infectious material (e.g. faeces, sputum, infected wound site) is anticipated and when cleaning the room. This will protect hands and prevent them from becoming **heavily** contaminated with micro-organisms[5].
- Gloves are not necessary for other activities involving contact with the patient and their environment (e.g. bedmaking, assisting to move, taking temperature and pulse, bringing items into the room). This is because hands are less likely to become **heavily** contaminated during these activities and the bacteria they do pick up can be easily removed by thorough hand hygiene[4,8].
- Gloves must be changed between procedures which require them, to ensure that bacteria from an infected or colonised site on the patient are not transferred to a susceptible site such as a wound or urinary catheter[5].
- Remove gloves promptly after use, to avoid contaminating clean surfaces / equipment and other patients.
- Always wash your hands after removing gloves, because hands can be contaminated through leaks in gloves or when gloves are removed[9].

Removing items from room

- Items such as bedpans and urine bottles can be taken out of an isolation room wearing gloves and a plastic apron and emptied directly into the bedpan washer. They do not need to be placed in a plastic bag before removal from the room, as there is no risk of cross-infection if the nurse has no physical contact with other patients until gloves and apron are removed and hands washed[5].
- Other re-usable items of equipment will need to be decontaminated before being used by another patient (see under cleaning of equipment).

Cleaning equipment

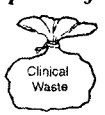


- When possible, dedicate the use of patient care equipment to the patient while they are being nursed in isolation.
- When use of shared items is unavoidable, ensure they are decontaminated effectively before being used by another patient. In most cases, thorough cleaning with detergent and water is sufficient (see Cleaning and Disinfection Policy).

Crockery

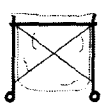
- Disposable crockery and cutlery is not necessary for infectious patients. This is because crockery and cutlery are unlikely to become heavily contaminated during use and bacteria will not be able to survive and multiply on them once they are clean and dry[5].
- After use, they should be washed using hot water and detergent (preferably in a dishwasher) and allowed to dry before storage and re-use.

Disposal of waste



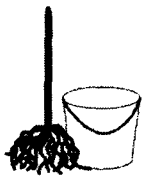
- Discard used or soiled items into the yellow clinical waste bag within the room to ensure incineration. When full, the bag should be tied securely, then removed from the room in the usual way. Double-bagging is unnecessary, as the outer surface of waste bags do not become significantly contaminated during use[10].
- Dispose of sharps into a sharps container in the usual way. These will be disposed of by incineration and do not need to be marked as infectious.

Disposal of linen



- Dispose of all linen into an alginate bag, then a red bag. The red bag indicates to the laundry staff that the contents are potentially infectious and need to be washed as appropriate for fouled / infected linen. The alginate bag is placed directly into a washing machine (where it splits open during the wash cycle). In this way, the laundry staff can avoid handling the linen until it has been decontaminated by washing.

Cleaning the room



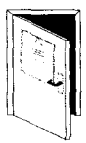
Daily room cleaning:

- Equipment and surfaces should be kept clean and dry to prevent the accumulation of micro-organisms.
- Inform the domestic supervisor that the patient is being isolated, so that a mop, bucket and cleaning cloths can be provided for the room.
- Ask the domestic to wear gloves and an apron to clean the room and to discard them and wash his/her hands before leaving.

Room cleaning following patient discharge:

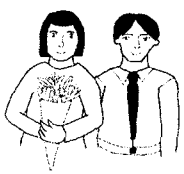
- All furniture and horizontal surfaces, including the mattress and bed frame should be cleaned thoroughly with detergent and water. There is no need for walls to be washed unless they are visibly soiled, as they are unlikely to be contaminated and as such, do not represent a significant source of infection.
- Once clean and dry, the room may be re-used straight away.
- It is not necessary to discard unused packets of disposable equipment, providing the outer packaging has remained intact and is clean and dry[5].

Closing the door



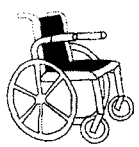
- It is preferable, although not essential to keep the door of an isolation room closed to minimise contamination of adjacent areas[2]. If this is likely to compromise patient care, for instance in the elderly confused patient, a risk assessment should be made as to whether the door may be kept open. It is important to close the door during procedures that may heavily contaminate the environment, such as bedmaking, wound dressing (MRSA) and chest physiotherapy (MRSA).

Visitors



- Visitors who only have social contact with the patient, such as hugging and holding hands do not need to wear protective clothing. This is because they are unlikely to have contact with infectious material such as faeces or an infected wound and unlike staff, they will not usually be able to transmit infection through contact with other patients on the ward.
- Visitors should be advised to wash their hands before leaving the room. This is the only necessary measure, as the risk to visitors from infection with *Clostridium difficile* and MRSA is minimal[1,2].
- Visitors who assist with the patient's bodily care may need to wear gloves and an apron for this.

Leaving the room for treatment

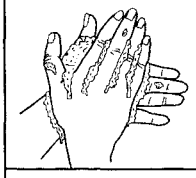


- During their time in isolation, the patient may need to leave the room for investigations or treatment. In this situation, the department should be notified in advance to enable them to take the appropriate precautions.
- Porters do not need to wear protective clothing, but should be instructed to wash their hands on completion of the journey.
- Patients needing to leave the room as part of their rehabilitation programme can usually do so, following discussion with the infection control nurses to ensure all reasonable precautions are being taken.

In case of death

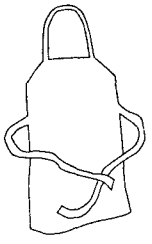
- Follow the usual last offices procedure, as no additional measures are required for patients with MRSA or *Clostridium difficile* associated diarrhoea, unless they continue to leak blood / body fluid (see mortuary policy).

Quick Guide to Contact Precautions



***Wash hands thoroughly*:**
- **before** clean or aseptic procedures
- **during** patient care when soiled
- **after** any physical contact with the patient / environment and after removing gloves

Apply alcohol gel before aseptic procedures and after handwashing on leaving the room



Wear an apron:
- for substantial physical contact with the patient or their environment (e.g. assisting with hygiene needs, assisting to move, bed making, room cleaning, handling bedpans)

An apron is not needed:
- for activities involving minimal physical contact (e.g. talking, taking temperature)

Change apron:
- between dirty and clean procedures

Remove apron and wash hands thoroughly before attending to another patient

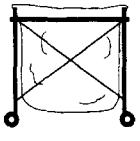
***Wear gloves*:**
- when contact with blood / body fluids, mucous membranes or potentially infectious material (e.g. faeces, sputum, infected wound site) is anticipated and for room cleaning

***Change gloves*:**
- between procedures which require them to ensure that bacteria from an infected or colonised site on the patient are not transferred to a susceptible site such as a wound or urinary catheter

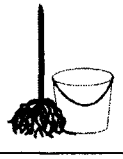
Remove gloves:
- promptly after use and wash hands to avoid contaminating clean surfaces / equipment

Equipment
- Ensure only essential items of equipment are stored inside the room
- Remove items such as bedpans and urine bottles from the room wearing gloves and a plastic apron and empty directly into the bedpan washer
- Decontaminate other re-usable items of equipment before use by another patient (use of general purpose detergent is usually sufficient - see Cleaning and Disinfection Policy for more details)

Waste
- Discard used or soiled items into the yellow clinical waste bag within the room
- When full, tie the bag securely, then remove from the room in the usual way
- Dispose of sharps into a sharps container in the usual way. The container does not need to be marked as infectious, as it is disposed of by incineration

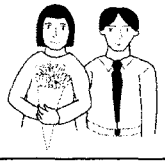


Linen
- Dispose of all linen into a red bag within the room. When full, the bag should be tied securely, then removed from the room in the usual way. Double-bagging is not necessary



Daily room cleaning
- Equipment and surfaces should be kept clean and dry
- Inform the domestic supervisor that the patient is being isolated, so that an isolation room cleaning schedule can be arranged and a mop, bucket and cleaning cloths can be provided for the room

Keeping the door closed
- It is preferable to keep the door of an isolation room closed during times when heavy contamination / disturbance of the environment may occur (e.g. during bed making, wound dressing, chest physiotherapy, room cleaning). At other times, the door may be opened at the patient's request



Visitors
- Visitors do not need to wear protective clothing, but should be advised to wash their hands and apply alcohol gel before leaving the room
- Visitors who assist with the patient's bodily care may need to wear an apron and gloves for this

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Appendix 8

Approach to Sampling of Infection Control Nurses (ICNs) for Peer Review of Practice Guideline on Isolation Precautions

Pilot Survey

- Sent to four ICNs.

Main Survey

Inclusion Criteria:

- Full member of Infection Control Nurses' Association (ICNA) in 1998 membership directory.

Exclusion Criteria:

- Community-based ICNs and Public Health Nurses, as guideline concerned with hospital infection control practice.
- ICNA member not employed as an ICN.
- ICNs sampled in pilot survey
- Myself and a colleague at the study hospital

Approach to Sampling:

- Selected 100 of the 442 ICNs who fulfilled the inclusion criteria.
- Sample determined on a proportional basis according to each of 11 regional groups within the United Kingdom, as detailed below.
- Arranged ICNs in alphabetical order within each regional group and selected 5 ICNs out of every 22 (i.e. 4^{th}, 9^{th}, 13^{th}, 18^{th}, 22^{nd}).

Regional group	**ICNA full members**	**ICNA members excluded from sample**		**ICNs who fulfilled inclusion criteria**	**Total ICNs selected**
		Community-based ICNs, Public Health Nurses and others not employed as ICNs	ICNs in pilot survey, myself and colleague		
Ireland	40	0	0	40	7
London	154	26	6	122	29
Midlands	58	15	0	42	10
North East	30	1	0	29	7
North West	54	12	0	41	9
Scotland	53	12	0	40	10
South West	28	4	0	24	5
Trent	44	5	0	38	9
Wales	23	5	0	18	4
Wessex	30	5	0	24	5
Yorkshire	31	7	0	24	5
TOTAL	**545**	**92**	**6**	**442**	**100**

Appendix 9

Template Used to Record the Researcher's Observations of Participants' Infection Control Practice		
Infection control practice as per practice guideline:	Yes	No
Always washed hands during patient care when needed		
Always washed hands at the end of patient care		
Used gloves and aprons selectively for activities involving patient contact		
Always changed gloves during care when soiled		
Used single bag system for disposal of clinical waste		
Used single bag system for disposal of linen		
Did not wrap bedpan/urine bottle in clinical waste bag		
Always cleaned equipment correctly after use		

Appendix 10

Semi-Structured Interview Schedule (Post-Implementation)

1. **Introductory Comments**

   (i) Thank respondent for taking part

   (ii) Outline purpose of interview

   (iii) Explain about anonymity

   (iv) Ask for consent to use tape recorder

2. **Background Information**

   (i) Before you got involved in the project on the ward, where did you gain most of your information about infection control and in particular, 'barrier nursing'?

   (ii) How adequately prepared did you feel to put 'barrier nursing' into practice?

3. **Main Interview**

   (i) Has your practice changed as a result of the project?

   If yes, in what way?

   Probes – what about:
   - handwashing (soap / alcohol gel)
   - gloves / aprons (using / changing / instructions for visitors)
   - disposal of linen / waste
   - removing items from room
   - cleaning of equipment

   If no, why do you think this is?

   (ii) Do you think other peoples' practice has changed (as in other nurses who were involved in the implementation stage)?

   If yes, in what way? (Use above probes)

   If no, why do you think this is?

(iii) One of the points raised at the beginning of the project was the problem of people not adhering to 'barrier nursing' methods properly. How do you feel about this now on the ward?

(iv) Before the project, people tended to wear gloves and aprons every time they entered an isolation room. As part of the project, we changed this.
- What are the advantages of the new approach?
- What are the disadvantages?
- What things are still a problem as far as barrier nursing is concerned?

(v) As part of the project, there were several initiatives, including a new guideline, the quick reference guide, use of the notice board to display relevant research articles and working with me.
- Which of these, if any do you think has made a difference to your practice?
- Which do you think has made a difference to others' practice?
- What else helped to change practice on the ward?
- What else could have been done?

(vi) Now that the project has finished, what do you think needs to happen on the ward as regards isolation precautions?

4. Closing Comments

(i) Ask respondent if there is anything else they would like to mention about the project that has not been covered in the interview.

(ii) Thank respondent for participating.

(iii) Explain what will happen to tape recording and transcript.

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