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USING ORGANISATIONAL LEARNING THEORY AS A MEANS OF MOBILISING KNOWLEDGE RESOURCES IN THE CONTROL OF INFECTION

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USING ORGANISATIONAL LEARNING THEORY AS A MEANS OF MOBILISING KNOWLEDGE RESOURCES IN THE CONTROL OF INFECTION

By

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ABSTRACT

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USING ORGANISATIONAL LEARNING THEORY AS A MEANS OF MOBILISING KNOWLEDGE RESOURCES IN THE CONTROL OF INFECTION

This research investigates learning and infection control knowledge within hospitals in the United Kingdom (UK). Fundamental infection control practices are not always carried out by clinical staff caring for patients, as a result infections are transmitted (Pittet et al 2000). Failure to carry out infection control practices may reflect a division between the espoused and actual practice of clinicians (Huzzard and Ostergren 2002). This division may be contributed to by infection control teams and educationalists relying on classroom based, pedagogic teaching and failing to investigate the value of other learning theories (Courtney 1998).

This study is based upon an investigation of the utility of situated learning within clinical infection control practice. The situated learning is based upon a combination of underpinning learning theories including community of practice and knowledge creation theory. The investigation consists of a discussion of the background of infection control in UK hospitals followed by a review of the literature concerning individual and organisational learning theory and learning in clinical practice. This review results in the production of a research model which combines learning theories, providing a guide for subsequent empirical research phases.

A mixed methods, pluralist research methodology is produced employing qualitative and quantitative research methods. The first empiric phase of the research reveals evidence of a division between espoused and actual infection control practice, of tacit learning in practice, and of existing knowledge structures and relationships that could be further developed to

facilitate and guide situated learning in practice. This evidence is used in conjunction with individual and organisational learning theory in the second empiric phase of the research in which an educational intervention employing situated learning in practice takes place. Results of this intervention study reveal improvements in infection control knowledge and practice amongst research participants indicating that situated learning, when harnessed and guided in clinical practice is able to offer a resilient means of contributing to the creation and application of knowledge within challenging learning environments.

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AUTHOR'S DECLARATION

At no time during the registration for the degree of Doctor of Philosophy has the author been registered for any other University award without prior agreement of the Graduate Committee.

Relevant conferences and study days have been attended at which work was presented and peer reviewed; external agencies and institutions were approached for consultation purposes and papers for publication are being prepared.

Signed
Date 8/12/06

Chapter 1

Introduction and Background

Introduction

Every day people are born, die and may even be conceived in hospitals; and while all this is happening, patients, staff and visitors to the hospital carry on with all the usual activities of daily living that most people take for granted. Hospitals are communities in their own right; they may contain several hundred patients at any one time plus all the attending staff and visitors to care for them. They are rich with their own history, characters, traditions and myths. They have their own hierarchies, conflicts, alliances, rumour and gossip, all of which contribute to the culture and character of the hospital. Against this background the infection control team (ICT) must work to try to control, and prevent the spread of infection. This chapter provides an introduction to the recent history of infection control in hospitals, the size, cost and character of the problems caused by infection and an outline of the various organisational, professional and societal influences which may affect it. Educational interventions aimed at improving infection control practice will also be discussed.

A brief history of infection control in the United Kingdom

Typically an ICT might consist of two nurses that have completed some specialist training in microbiology and infection control, and one microbiologist who may only be employed in infection control part time. The ICT is responsible for training staff, designing, implementing and policing policy, and acting as a local expert and source of advice in infection control (PHLS 1995). Arguably, there is nothing new or revolutionary in contemporary infection

control. Much of its knowledge base stems from the work of nineteenth century scientists, in particular Semmelweiss (Carter 1983) whose demonstration that handwashing can drastically reduce the transmission of infection remains the most fundamental infection control precaution.

ICT's have been in existence within hospitals for many years. The template for most contemporary ICT's was provided by the publication of *Hospital Infection Control: Guidance on the control of infection in hospitals* (PHLS 1995) which is commonly referred to as the Cooke report after one of its authors.

In 1995 the Cooke report (PHLS 1995) estimated that roughly ten percent of patients within hospital acquire an infection. Increased use of invasive procedures (e.g. procedures that break the skin or involve entering sterile areas of the body) have increased the risk of infection, also, the frequent use of antibiotics has contributed to the development of resistant organisms (PHLS 1995). The Cooke report (PHLS 1995) found that infections were costly in terms of financial costs, extending patients stay in hospital, and were a significant cause of mortality. The report estimated that 1% of all deaths in the United Kingdom might be attributable to healthcare associated infection (HCAI) while in another 3% of deaths HCAI's may have been a contributing factor. In 1995 the financial costs of HCAI's had not been realistically estimated, however the Cooke report (PHLS 1995) argued that they were likely to be very high. This was supported by Plowman et al (1999) who, in their study of patients on general wards of a district general hospital, found that infected hospital patients incurred costs 2.9 times greater than non-infected patients. They estimated that HCAI costs the National Health Service (NHS) in England £986.36 million annually. What these estimates do not take account of is the increased risk of litigation against hospitals, and adverse publicity caused by

incidents or outbreaks of infectious disease which could lead to the hospital losing the confidence of both the public and purchasers of hospital services (PHLS 1995).

The Cooke report (PHLS 1995) stressed that not all HCAI's could be prevented, but argued that realistically around a third of HCAI's could be prevented by better application of infection control knowledge (PHLS 1995). To aid this the report suggested certain changes and interventions to help reduce the incidence of HCAI's. It was suggested that each infection control nurse (ICN) should aim to cover 250 acute beds but acknowledged that in reality most ICN's in the United Kingdom (UK) covered an average of 400-500 acute beds. Surveillance systems to allow early detection and control of outbreaks and long term monitoring of infection rates were to be introduced, the results were to be fed back to clinicians with the intention of changing attitudes and improving practice in infection control. The development of link nurse networks were encouraged as were programmes of education for all members of staff (PHLS 1995). The Cooke report (PHLS 1995) emphasised the impact of HCAI's and argued that attempts to prevent them should be a matter of routine for all hospital staff. It also pointed out that consultants of infected patients have a duty of care under common law for the health and safety of staff, visitors and patients in the hospital. It went on to state that some clinical departments find it useful to have a lead consultant for infection control issues within that department (PHLS 1995). Bearing this in mind it is curious that the report suggested the formation of link nurse networks and education programmes for all members of staff without specifically focusing on the members of staff that take the lead in providing care for their patients i.e. senior medical staff.

The recommendations of the Cooke report (PHLS 1995) appear to be a missed opportunity to increase the involvement of medical staff in the control and prevention of infection in their

patients and to some extent they support the notion that the day to day practicalities of control of infection are a nursing issue and not a major concern for medical staff. There is evidence in the literature to support this notion. Larson and Kretzer (1995) observed only 16% adherence with infection control precautions amongst medical staff working in a trauma department over a two-month period. Reasons given for the lack of compliance included lack of time, forgetting that precautions were required or lack of knowledge of the precautions required. In a study of intravenous cannulation, Yentis (1993) found that doctors rarely carried out correct infection control precautions when inserting cannulae. In their hand hygiene promotion campaign within hospitals Pittet et al (2000) found poor doctor compliance with handwashing guidance an unexplained and difficult issue. This apparent lack of knowledge of the day to day practicalities of infection control is also reflected by Desai et al (2000) who found that compliance with infection control procedures could in some circumstances be as low as 30%, and suggest that greater infection control education for medical staff should be initiated at the earliest opportunity.

It is interesting to note the similarity of the content of the Cooke report (PHLS 1995) with that of more recent government guidance on infectious disease (D.O.H 2002; D.O.H 2003). Similar descriptions, estimates, causes and suggested interventions to reduce HCAI's are given in these publications. Once again the guidance stresses the importance of a commitment to infection control from all healthcare workers and to a need for improved management, leadership and education (D.O.H 2002; D.O.H 2003). This repetition of much of the information and advice given in 1995 shows just how little progress had been made in infection control. It is not to say that effort has not been made, much has, particularly in the area of staff education. However, evidence of increasing incidence and prevalence of

infection suggests that much of this effort has failed to produce consistent long term improvements in practice (Larson and Kretzer 1995; D.O.H 2002; D.O.H 2003).

Educational interventions by ICT's

Presently, ICT's are the local source of infection control advice and education for staff within hospitals. However, it can be argued that the demands made upon an ICT prevent it providing a consistent and continuous level of education and follow up for healthcare workers which in turn leads to an erosion of their knowledge and a decline in these workers' infection control practice. This point is well supported by the literature. In their study of handwashing practices in an intensive care unit, Dubbert et al (1990) found that practice improved immediately following the implementation of an educational programme, but within a month handwashing practice had declined to its previous levels. In their review of compliance with handwashing and barrier precautions Larson and Kretzer (1995) found that educational inputs were successful in the short term in improving practice but these improvements could not be sustained and were swiftly followed by a decline back to practices demonstrated prior to the educational inputs. Jarvis (1994) argues that efforts to improve compliance, for example, through in-service training have produced at best only temporary improvements in practice. This is echoed by Kretzer and Larson (1998) who find that no single educational intervention carried out by ICT's has been able to produce a sustained improvement in infection control practices carried out by healthcare workers.

Long-term educational interventions might be more successful in producing a sustained improvement in practice. However, it is difficult to imagine how a typical hospital ICT could commit sufficient time and resources (Kretzer and Larson 1995). As an alternative, non-ICT

staff could be used to provide infection control advice and monitor practice. Leclair et al (1987) in their study of compliance with infection control advice found that behavioural changes and improvement in compliance amongst staff could be sustained when senior members of both medical and nursing staff demonstrated a commitment to the advice. In other words changes in practice were not seen as being imposed from the outside, but were adopted and endorsed by the staff themselves. This evidence indicates that any educational intervention aiming to achieve some sustained improvement in infection control practice amongst staff should aim to facilitate ways in which the staff may themselves adopt, reinforce and maintain the intervention.

In response to the suggestion that problems with infection control education may stem from a lack of ICT staff and resources, many ICTs have looked to mobilise alternative staff and resources to enable a longer term and continuous programme of education which might replicate the improvement in practice found by Leclair et al (1987). In many areas this has been attempted by the setting up of infection control link nurse networks (Teare 1998) as suggested in the Cooke report (PHLS 1995). These networks consist of nurses with an interest in infection control being based on each ward or department within a hospital and being a source of advice on infection control and a link between the ward/department staff and the ICT. These networks have to some extent been successful but they may often rely on the link nurse being on duty and available to help and advise. There may also be some doubt as to whether link nurses will always be in a sufficiently senior and powerful position, as suggested by Leclair et al (1987), in which to influence and change practice. Once again, the reliance upon link nurse networks reinforces the assumption that infection control is a nursing responsibility.

It is reasonable to question how and why this assumption has come to exist. Could it be related to the historical development of nursing and nurse education and its relationship with medicine and their different roles and professional training in caring for patients?

The influence of professional training

In her discussion of the historical development of nurse education, Rafferty (1996) argues that education is at the centre of occupational culture and politics in nursing, and is a primary means of socialising new members into the professional culture of nursing. Rafferty (1996) continues to argue that as a predominantly female occupation, nursing has been characterised more by moral and virtue, than by intellectual prowess. This could conjure up thoughts and images of the hardworking, diligent nurse, and the angel stereotype who spends her long working day cleaning, dressing, washing, lifting and bathing patients. Many of these activities are linked to and associated with hygiene, one of the basic cornerstones of infection control.

As a result of nurse education historically not focusing on the development of academic strength, it could be argued that an innovative, confident and intellectual culture within nursing has been stunted and slow to develop. Consequently, nursing has not always effectively challenged the assumptions made about it or challenged the roles assigned to it. Indeed, instead of asserting itself as a profession in its own right, Rafferty (1996) argues that nursing provides a support to medicine in its professional dominance of healthcare. However, in contrast to the argument of Rafferty (1996), some evidence is found in the literature to suggest that following the changes to nurse education in the 1990's, nurses may feel more comfortable with the notion of challenging medical knowledge and practice (Allen et al 2001; Jones 2005).

Much of Rafferty's historically based argument appears to be supported by Jowett et al (1994) in their examination of the changes in nurse education in the 1990's during which nurse education changed from its previous apprenticeship, hospital based model to a more academic training, with students based within higher education. Jowett et al (1994) argue that the reform of nurse education in the 1990's took place in response to extensive criticism of the apprentice based training and was to a great extent fuelled by concerns over educational standards and service delivery within nursing. As a result of the reforms, student nurses were to be part of an academic community and not, as was previously the case, rapidly placed on hospital wards to provide pairs of hands to do the nursing work, often to the detriment of their learning opportunities (Jowett et al 1994; Witz 1994).

In becoming part of the academic community, nurse education joined with and allied itself to the social sciences (Rafferty 1996; Jowett et al 1994) in contrast to the alleged leanings of medicine towards the natural sciences and positivist paradigms (Rafferty 1996). In order to maintain recruitment into nursing the entry gate into training was widened. Applicants could enter training with a handful of GCSE's or via an entrance test; this resulted in many students struggling in areas of scientific knowledge and understanding. The increased academic bias in the new training produced nurses with greater academic skills sometimes at the cost of hands on clinical nursing skills (Jowett et al 1994). This meant that many newly qualified nurses were left to learn their clinical skills under the informal training of nurses that had been trained under the previous apprenticeship based model.

The historical development of nursing and the recent changes within nurse education described above has created a hybrid of an occupation in which many of its members were trained and gained most of their working experience under the old non-academic,

apprenticeship based method of training while an increasingly large minority come from a more academic, less hands on clinically based background. Those that undertook the apprentice based training could trace the heritage and roots of the curricula they followed back to the founders of Victorian and Edwardian nursing (Witz 1994), when nursing explicitly aimed to control and cleanse the environment, where dirt and grime were states requiring nursing intervention (Rafferty 1996). These historical roots and nursing heritage have themselves become part of the culture of nursing. The history, traditions and myths found in hospitals are often made up of the stories of mature and experienced nurses reminiscing about their time in training. These stories tell of times when nurses were required to clean and sterilise equipment in preparation for use, of times that could be said to have more in common with domestic service than with a healthcare profession. This heritage and cultural influence has helped to develop the sentiment that infection control is a nursing responsibility, which is to some extent perpetuated today by the continuing development of specific link *nurse* networks (Teare 1998). By their very nature these networks suggest an exclusion of non-nursing staff. The continuing willingness of some nurses to accept that infection control is primarily a nursing responsibility and not a responsibility to be shared amongst all healthcare workers, as is suggested in the literature reinforces the belief that infection control is a primarily nursing role (PHLS 1995; D.O.H 2002).

Infection control is arguably a victim of the traditional care and cure demarcation between nursing and medicine; nurses provide care by preventing infection, while doctors provide a cure by prescribing treatments to those that are infected (Witz 1994). This view is supported by O'Malley et al (2005) who find that the handwashing behaviour of doctors remains as poor as it was twenty years ago, and by Gamester et al (2006) who found that medical students' infection control training was inadequately applied in practice. Further support for this notion

is provided by Feather et al (2000) and Stone (2001) who claim there has been a lack of emphasis on infection control during medical training, although discussion with staff responsible for the infection control education of undergraduate medical students suggests that this lack of emphasis and culture may be changing. However, the evidence of O'Malley et al (2005) and Gamester et al (2006) appears to support Feather et al (2000) in their claim that when medical staff fail to carry out basic infection control practices they expose their lack of belief in or value of these practices.

Culture

Schein (1989 p9) defines culture as "a pattern of basic assumptions - invented, discovered or developed by a given group as it learns to cope with its problems of external adaptation and internal integration - that has worked well enough to be considered valid and therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems". Smith (1998), while finding much to agree with in Scheins (1989) definition, suggests that culture is based in an organisations visible practices. However, observed behavioural regularities, norms, values, philosophy, rules and climate within an organisation reflect rather than define its culture (Schein 1989). Schein (1989) goes on to argue that an organisations true culture can be found at a deeper level of fundamental notions and sub-conscious beliefs shared by members of the organisation. These beliefs are learnt responses to a group or organisations method of adapting to its environment or circumstances. In other words groups or organisations may evolve in response to environmental changes and challenges and this evolution and the tools used to achieve the evolution may contribute to its culture.

Schein (1989) finds that multiple groups e. g doctors, nurses, or cleaners may each have their own culture within a larger inclusive organisation and argues that cultural development is greatly influenced by leadership and cultural learning. It is this process of cultural learning which may have significant influence within healthcare and the control of infection. Schein (1989) describes cultural learning as a reflection of someone's values e.g. how things should or should not be done. A leader within a group or organisation may propagate such values which are in turn culturally learnt by other members of the group. Schein (1989 p16) argues that if these culturally learnt values are seen as being successful then the group or organisation develops a process of "cognitive transformation". In this process culturally learnt values become beliefs and go on to become sub-conscious assumptions within the group or organisation that the values originally propagated are correct. If this argument was applied to the control of infection then it is possible to see how such cognitive learning may contribute to the transmission of infections and also its control.

The work of Semmelweiss (Carter 1983), and countless others since, has established that many patients acquire their infections from the hands of those that are caring for them. However, because of the very nature of the transmission, i.e. the infective organisms are invisible to the naked eye and may not produce appreciable symptoms within a patient for hours, days or even months; the person transmitting the infection is not recognised to be doing so. This suggests that those caring for patients may carry out various procedures using less than optimum precautions, and may unwittingly transmit infectious organisms to the patient. If these procedures and less than optimum precautions are seen to be successful then following the argument of Schein (1989) it is possible that the procedure and its associated precautions may become culturally learnt. Imagine a situation where a consultant is teaching a junior how to insert a central line into a patient. If the junior sees the consultant successfully place the

central line; even if less than optimum infection control precautions are used during its insertion, the junior may well culturally learn to use a similar technique in the future. Even if the imaginary central line did become infected at its insertion site or the patient subsequently became septicaemic there would be little or no evidence to suggest that the infection was acquired during insertion as a result of poor technique. A central line is just another part of, or attachment to, a patient, consequently it may be handled and manipulated by many various healthcare workers during any given day, and on any of these occasions infectious organisms could have been transmitted. Thus the culturally learnt values described by Schein (1989) may not be based on them being seen as successful but rather that they have not been seen to be unsuccessful. As a result of this, Schein's (1989 p16) process of "cognitive transformation" in which the culturally learnt values become beliefs and go on to become sub-conscious assumptions within the group or organisation may be based upon misplaced beliefs and assumptions and culturally learnt values that are invalid.

The example given above relates mainly to situations where clinical staff such as doctors, nurses or physiotherapists are teaching and learning. However, there are many other grades of staff working within hospitals that may not have any clinical training or experience at all e.g. porters or cleaners, but may still be employed in situations that put them at risk of acquiring or spreading infections. They too may develop their own culture within the organisation and they too may culturally learn about infection control from examples within their own cultural group with the same risk of developing beliefs and practices based upon invalid values and assumptions. Therefore the organisational culture in which the ICT works may to some extent be based upon mistaken beliefs on what, when, where and indeed if any infection control precautions are needed in any given circumstances, with the consequent increased risk of further spread of infection.

Schein's (1989) work on culture fits well with endogenous factors, similar to the examples given above, that may guide development of organisational culture within the health service. However, Schein's (1989) work may not fully take account of the many exogenous factors that may also influence the organisational culture of the health service. For example the external influences of wider societal factors such as politics, power, prejudice and finance must all have some influence on the culture and behaviour of the health service and its employees with subsequent implications for the control of infection.

Beds, staff and the public

According to Harrison et al (1997), there has been a widespread perception that the health service has been the victim of severe financial pressure. Debate over what constitutes adequate resources and funding of the health service is likely to continue for the foreseeable future and will itself be influenced by economic, political and ideological pressures. However, health service spending is often characterised as a bottomless pit which is able to swallow huge amounts of funding and yet still supply a healthcare system that is unable to provide a comprehensive service for all. Demand for health services will always exceed supply (Harrison et al 1997).

It has been stated that the popular view amongst the public is of an NHS lacking basic resources such as adequate beds in which to place patients and insufficient numbers of staff to care for them (Hutchinson et al 2001). Combine this with hospitals that may in future be built and operated through private finance initiatives with high productivity expectations (Gaffney 1990) and a picture starts to emerge of a service in which infection control practices may fail to thrive.

A hospital in which basic resources such as beds and staff are insufficient may create a situation in which staff are hurried and are unable to carry out adequate infection control precautions due to time constraints (Coia et al 2006). Pressure and demand upon scarce beds could also contribute to situations where, because of a lack of isolation rooms, potentially infectious patients that should be nursed in isolation are found in the company of other patients on main wards. Worse still, scarcity and the demand for beds could result in infectious patients being moved around a hospital with the consequent risk of spreading infection to other wards or areas of the hospital (D.O.H 2003).

There is evidence to suggest that this popular view amongst the public, of under resourced, under financed and understaffed hospitals (Hutchinson et al 2001) has been picked up and further popularised in the press and media. This has resulted in lurid headline stories of patients' unhappy experiences at the hands of the NHS. To these stories the press has arguably added another ingredient of relevance to infection control - the superbug story.

Recent government guidance on infectious disease (D.O.H 2002) is replete with copies of headlines published in the popular press over recent years. These headlines tell of "superbugs", and hospital infections that kill thousands of patients each year. Sardar (1996) writing in the New Statesman stated that hospitals were hazardous places where patients could be infected by "superbugs" which are so resistant that they cannot be treated with antibiotics.

Many of these stories are factually and microbiologically incorrect and may provide those working within microbiology and infection control equal measures of frustration and amusement, but it could be suggested that the continuing presence of these stories within the media resonates and creates an impression amongst the public. This impression could be

described as one of ill informed concern based upon misinformation derived from inaccurate press stories, but this could in itself be a misrepresentation of the true picture.

Evidence within the literature shows that infections are responsible for the deaths of 70,000 people each year; 150,000 people are admitted to hospital each year because of infections and increasingly resistant organisms are becoming more difficult to successfully treat (D.O.H 2002). To some extent therefore, Sardar (1996) was right in saying that hospitals are hazardous places for patients.

It would be wrong to suggest that all patients derive their knowledge on infectious disease from the popular press and many patients have become far more knowledgeable, questioning and challenging of medicine and healthcare (Kelleher et al 1994). Patients or the families of patients that have had adverse experiences within hospitals have been increasingly willing to take legal advice and resort to litigation (Kelleher et al 1994; Senior 2001). It is this increased risk of expensive and potentially damaging litigation against hospitals as a result of patients acquiring infections while in hospital (PHLS 1995) that may help ICT's in their attempts to improve infection control practice. Litigation and damages payments as a result of claims made by patients infected in hospitals are all likely to be costly to hospital trusts in terms of both finance and reputation (PHLS 1995). The risk of this litigation could arguably be reduced by hospitals doing more to support and adopt, and being seen to adopt basic, fundamental, and not necessarily expensive infection control policies and practices. Such basics as correct handwashing and sustained educational programmes for healthcare staff (Carter 1983; Leclair et al 1987) may reduce the risks associated with HCAI and their subsequent cost implications.

Power in the NHS and medicalisation of society

Foucault (1980) argued that medical power has increased with scientific developments from the nineteenth century. As a result of these developments in medical science Foucault (1980) argues that medicine has become the common denominator in health, housing, hygiene, food, criminality and sanity. As a result, much of modern society has been medicalized. Cities have been medicalized in as much as they require medical opinions on the siting of drains or the disposal of waste. Foucault (1980) states that the family is a prime target for medicalization. The family comes to rely on medical advice from doctors who are supported by the state, as a result of this, people are raised from infancy to recognise and respect medical power. In addition to families and cities relying on medical power Foucault (1980) states that national governments are obliged to respect medical power, arguing that the health of the population is an essential objective of political power, therefore politicians are dependent on the ability of medicine to maintain a healthy population. As a consequence of this medicalization of society Foucault (1980) sees doctors as the great advisor and expert. Kelleher et al (1994 p xii) appear to agree with Foucault; they argue that doctors have increasingly adopted the role of "secular priests" whose role includes advising on health, lifestyle and behaviour. As a result of this process of medicalization, medicine has become the dominant profession within healthcare and hospitals have become the seat of that domination.

Parkin's (1988) discussion of Webers work on power and domination argues that domination may be obtained through legitimate authority, and domination can be divided into three types; traditional, charismatic and legal-rational. Doctors can claim possession of all three types of domination. Medicine has a long tradition, some doctors may be charismatic and individualist in their approach, and they also have legal and rational support from their own professional

bodies and government. Parkin (1988) states that where there is dominance there is harmony with the dominating force using its power or the threat of it to achieve dominance, and when dominance is absent disharmony may exist.

When medicine has achieved domination all other professions working with medicine have to be subordinate (Friedson 1970) and to achieve this subordination medicine limits these professions power and autonomy and excludes them from areas of influence (Turner 1987). Medicine has achieved dominance through its professional body i.e. the British Medical Association (B.M.A.) in being able to negotiate and establish working practices, the division of labour and control of the labour market, therefore creating a monopoly (Friedson 1977; Kelleher et al 1994). As a result of this monopoly, Friedson (1977) argues that medicine is able to stop or hinder processes of rationalization by management, and although Friedson (1977) recognises an element of interdependence between, for example doctors and managers or pharmacists, he argues that this does not reduce medical dominance. Friedson (1977) also finds it unlikely that any other profession will be able to obtain power from the dominant medical profession, although he concedes that while other healthcare professions may achieve their own monopoly of their labour market, they would not be able to remove complete dominance of the division of labour in healthcare from the medical profession.

Elston (1991) argues that as a last resort some doctors might rely on their monopolistic situation in diagnosing and prescribing of treatment. If doctors were not to co-operate with managers because they argued that their freedom to diagnose and prescribe was threatened, then there could be a situation in which managers would have to concede to the doctors' wishes (Elston 1991).

Gabe et al (1991) suggest that there has been an increase in the questioning of medical autonomy and expertise in recent years. With this there is increasing questioning by government of medical policy, gradual de-skilling of doctors and more challenges to medical power from a variety of areas such as informed patients, management, nursing, alternative medicine, lawyers, journalists and the women's movement (Gabe et al 1991; Kelleher et al 1994). It is debatable whether sections of the government and the population have lost faith in medicine and that this may cause a severe loss of power and influence by the medical profession (Lukes 1974). With regard to de-skilling of doctors, Friedson (1977) rejects the idea that this would reduce medical power but does not mention what or whether other professional groups may gain more power by taking on skills shed by doctors. Elston (1991) finds that as a result of the increasing power of management, tension and conflict has been created between management and medicine with the increasing possibility or reality that medical dominance is threatened. This reflects and supports the previously stated argument of Parkin (1988) that where there is dominance there is harmony and when dominance is absent disharmony exists.

This is not to say that medicine has lost its grip on power or its position as the dominant profession within healthcare, only that it is subject to increasing challenge and question. Doctors, if they wished to do so, are capable of using their monopolistic power over diagnosis and treatment to see off challenges to their occupational position within the health service (Kelleher et al 1994).

The recruitment of powerful and influential members of the dominant professional group within healthcare in support of the ICT could have a major impact on education and practice. Senior members of staff that demonstrate a commitment to good infection control advice and

practice can have a positive and sustained influence on the compliance with infection control precautions demonstrated by other members of staff (Leclair et al 1987).

Evidence in the literature supports the idea that medical staff remain a powerful and influential professional group within the health service and are well able to change and influence practice at an organisational level (Foucault 1980). Consequently the support of medical staff and their endorsement of infection control practice as opinion leaders, could make them a powerful and effective ally of the ICT. There are assumptions made here, that medical staff will be prepared to adopt the role of opinion leader or become a beacon of excellence in infection control, or that they will be capable of doing so.

Gender and race

The success or otherwise of the use of individuals as opinion leaders as described above is likely to depend upon their willingness and ability to fulfil the role. It is also possible that issues related to race and gender may have implications for both staff and patients and interfere with the ability of individual members of staff to fulfil the role of opinion leader.

Warren and Rasmussen (1977) find that there may be a cultural view of women as being more exploitable than men. They also argue that in organisations, gender remains a significant factor especially when it is linked with the possession and use of power within an organisation. Warren and Rasmussen (1977) also point out that many organisations and professions remain male dominated with women assigned to supporting roles. They discuss the "traditional female" role characterised by lower status and dependence upon a more powerful male.

Many of the findings and arguments of Warren and Rasmussen (1977) dating from the mid to late nineteen seventies have been echoed more recently. In regard to gender issues within healthcare, Doyal (1994) finds that institutional and professional power in medicine has served to maintain male dominance in the NHS. Doyal (1994) goes on to argue that the recognition of women's lack of power in formal healthcare systems is at the core of feminist criticism of medicine. This consequently disadvantages those women who work within the health service. Doyal (1994) found that approximately only 15% of consultants were women and that these are often employed in particular specialities such as paediatrics; just over 3% of female consultants were surgeons. Not only are women under represented as consultants in clinical practice, very few are involved in professional and educational decision making within organisations such as the British Medical Association, the General Medical Council or the Royal Colleges (Doyal 1994). In conclusion, Doyal (1994) finds that the ideology and practice of medicine remains profoundly male, often to the detriment of women's organisational power and authority.

A similar situation appears to exist in relation to racial issues within the health service. Bhopal (2001) compares the situation in the NHS with the definition of institutionalised racism found in the McPherson report on racism within the police service. In doing so Bhopal (2001) draws upon his own experiences of racism as a doctor working within the NHS and on the experiences of members of his family that as patients have fallen victim to what he argues are examples of institutionalised racism. Evidence exists of racism in medicine and healthcare, where students, doctors, patients and other healthcare workers have been discriminated against and disadvantaged on the grounds of their race and ethnicity (Bhopal 2001).

The above paints a picture of female and ethnic minority staff within the NHS facing a climate of discrimination and disadvantage with a consequent impact upon their possession and ability to use organisational power. If opinion leaders or similar, regardless of their race or gender, were to be recruited in support of the ICT they would need to have the power, influence and ability to change and sustain an improvement in infection control practice amongst the staff with whom they work. Bhopal (2001) argues that more than legislation is needed in this situation, he finds that a campaign within healthcare to win over the hearts and minds of all needs to be mounted with the aim of removing discrimination from the health service and providing equity of opportunity for all. Clearly, such a campaign, whilst desirable, is well beyond the scope of this research.

In terms of manpower and resources within the health service, issues other than discrimination, such as levels of staffing and education amongst medical, nursing and other grades of staff may also have an influence on the control of infection in hospitals.

Staff and Education

If sustained educational interventions are the way to improve infection control practice then some form of curricula, however loose and brief, should be applied to the interventions to ensure that a desirable educational pathway is followed. Similarly, if members of staff that are currently employed in a clinical role e.g. medical consultants, are to be tasked with providing extra educational interventions then that educational role and its curricula should not be burdensome but instead be developed within the clinical role. An example of this might be one to one teaching on a ward round or in a clinic.

In defining curricula Applebee (1996) argues that curricula provide realms for discussion and dialogue, thereby providing the primary means of teaching and learning. In other words, a curriculum is a form of conversation between the teacher and the student which offers both the student and the teacher the opportunity to learn and teach through reflection upon the content of the conversation. Such conversations are built upon a dialogue between individuals based, for example, on their own previous knowledge, experience, attitudes, prejudices and their own points of view and culture; that is their own philosophy based on their own construction of reality which may or may not change as a result of the learning experience offered by the conversation/curriculum. Applebee (1996 p2) describes this process of reconstruction of information and reality as "knowledge in action". If this argument is accepted, that this knowledge in action is to some extent based on what has gone before and the culture in which prior learning took place then it might also be concluded that curricula are "culturally constructed tools" (Applebee 1996 p2). This point supports Schein's (1989) argument in regard to cultural learning and should serve as a caution to ensure that any content within a culturally constructed curriculum is based upon valid beliefs, knowledge and practice.

It can be suggested that any curriculum should be based on a particular model or combination of curriculum models. For example, two curriculum models may be particularly suited to the development of curricula for the in service training of staff. The product or objectives model focuses on behavioural targets of learning while the process model centres on how learning is achieved (Armitage1999). The product model is closely associated with fundamental points that must be addressed by any curriculum i.e. the aims and objectives of the curriculum, learning experiences aimed to meet these aims and objectives, organising learning experiences into a curriculum programme and the evaluation of the programme (Armitage1999).

Of course development of a successful curriculum is dependant on more than the selection of a model or a philosophy upon which to base it, other factors must come into play. Applebee (1996) argues that any curriculum is likely to be influenced by the individuals teaching or being taught and their own individual philosophy and its interaction with the philosophy of the curriculum or the training establishment. This argument is supported by Carr (1995) who suggests that those engaged in teaching must be guided and base their practices upon a theory and philosophy which makes their practices intelligible. Carr (1995) argues that teachers reveal this theory in their choice of teaching method or curriculum content and that educational philosophy is held within the ideas, values and beliefs underlying their everyday practice. This goes straight back to Applebee's (1996) point that curricula are culturally constructed tools, constructed upon the ideas, values and beliefs of those involved in the educational process.

There is no great need for these sustained educational interventions to become formal lectures or similar. The secret of their success may be in their informality and in their persistence, the continuous drip feed of knowledge and information. The culturally constructed tools of Applebee (1996) and the cultural learning of Schein (1989) may already be in place in many hospitals and wards throughout the country. Unfortunately, it is possible that from an infection control point of view the wrong curricula and the wrong lessons are being learnt. That is not to say that these culturally constructed tools and cultural learning cannot be embraced and developed by ICT's to make sure that the right messages are heard and the correct lessons are learnt at individual, group and organisational level.

Ideology and politics

Recent UK health policy produced by both Labour and Conservative governments has been influenced by the ideology of the new right. The new right has in turn been greatly influenced by the work of economic theorists who argued in favour of economies based on free markets and laissez faire liberalism in which the state has reduced input into the economy (Bullock and Woodings 1990).

Bosanquet (1983) argues that the ideology of the new right is largely based in economics and on concepts related to commercial markets and individualism. When dealing with social issues the new right leans heavily on stereotypes e.g. consumers, freedoms and choices and is not able to deal with incompatibilities e.g. imposing market forces onto healthcare provision (Bosanquet 1983).

As part of new right economic theory it is argued that public expenditure by the state intrudes upon the forces of the market place and should be kept to a minimum, this restriction of public expenditure includes spending on welfare (King 1987). To allow for this restriction of public spending King (1987) has argued that privatization is ideologically required as this will reduce state influences and allow the free expansion of market forces. Examples of such privatization are arguably found in the case of private finance initiatives.

In the case of a hospital built as a result of a private finance initiative, a private company or companies will become both constructors and operators of the hospital through which, cost effective and improved services could be provided (Eglin 1995). However, Gaffney (1999) in his examination of the economics of private finance initiatives finds that they will

considerably expand the cost of hospital building, and that these increased costs are likely to be paid for by cuts in clinical budgets whilst at the same time exceptional and demanding targets in increased healthcare productivity will be set.

In terms of infection control, recent guidance from the Department of Health (D.O.H 2002; 2003) gives some clues as to what the clinical impacts may be of private finance initiatives or other policy that results in increasing demands upon productivity in healthcare. The D.O.H (2002; 2003) list many factors that have led to the resurgence of HCAI. In this list they include poor hand hygiene practices by clinicians, mixing of patient populations and pressure on beds which in turn leads to increased amounts of patient movements within hospitals, poor standards of cleanliness and hygiene and a lack of attention paid to infection control by management. All of these factors contribute to the transmission of infection and all could be exacerbated by private finance initiatives or any other form of health policy which sets exceptional and demanding targets in increased healthcare productivity.

To reduce the risk of transmission of infection, all grades of staff must be allowed the time to decontaminate their hands effectively before moving on to the next patient and not be rushed into cutting corners. Patients that are potentially infectious to others must be carefully managed in isolation as needed and not moved around the hospital presenting the risk of infection to all they come into contact with. Domestic staff must be given the time and training required to ensure that adequate levels of hygiene and cleanliness are maintained. Management must pay sufficient attention to the risks of HCAI (D.O.H 2002; D.O.H 2003; Coia et al 2006). Without these provisions the behaviour and the organisational culture within the NHS will continue to be influenced by the need to rush, cut corners and costs, and increase productivity, all at the expense of the control of infection (D.O.H 2003).

Summary

In this chapter some description has been given of the various organisational, professional and societal influences that may shape the control of infection in hospitals. It has given the reader an introduction to the recent history of the control of infection in UK hospitals. It is a history largely based on attempts to apply the scientific knowledge established in the nineteenth century by the likes of Lister and Semmelweiss. It has been suggested that this body of knowledge and its application to practice is often ignored or not complied with, frequently as a result of organisational issues or because of individuals' lack of knowledge or insight. As a result infections are readily transmitted.

Increased incidence of HCAI and the development of organisms resistant to antibiotics have caused heightened levels of concern amongst the government and the public. These increased numbers of infections also have cost implications for the health service and society at large. This in turn has created a demand for an improvement in infection control practice within hospitals.

Evidence suggests that educational interventions may improve the infection control practice of staff involved in patient care. However, to prevent a decline in practice when interventions have ceased, it has been argued that educational interventions should be sustained over the long term and include all occupational groups that may be involved in patient care throughout the hospital organisation. Such potentially demanding, long-term educational interventions may well be beyond the resources of many ICT's, consequently, the use of new resources in the development and implementation of educational interventions should be investigated.

This research intends to investigate means by which new resources may be mobilised in the creation and employment of infection control knowledge in practice. In carrying out this investigation the research will present a discussion of individual and organisational learning theories and how they might be applied in the control of infection. Knowledge gained from this discussion will then be used to inform the development of a research model which will suggest means by which infection control learning, knowledge and practice may be better understood. This research model will underpin the first empiric phase of this research which will aim to further investigate infection control practice and the utility of learning theory as a means of improving practice. Evidence gained from the first empiric phase of this research will be used in combination with knowledge derived from the literature, to guide an intervention study which will draw upon individual and organisational learning theory in order to create a clinical environment in which participants, recruited from various healthcare professions, may contribute to the continuing development and sharing of good infection control knowledge in practice. Finally, conclusions on this research, recommendations for future research and contributions to theory will be discussed.

However, before proceeding with the research as described above, some discussion of the role of the researcher is required. Caelli et al (2003 p9), discuss "theoretical positioning" finding that researchers' "motives, presuppositions and personal history" may influence the choice and means of their enquiry. Consequently, in the case of this research it should be recognised that the researcher is a former infection control nurse, with a previous history of working within the kind of sites used for the empiric phases of this research and was employed within higher education at the time of carrying out the research. Therefore the possibility that the researcher's personal history may have influenced choices, assumptions and deductions made in carrying out this research should be recognised. A further influence may, for example, be

the researcher's belief that it is possible to control infection using good clinical practice and that this in its turn may be influenced by education and learning.

Chapter 2

Learning and the control of infection.

Introduction

The literature devoted to the concept of learning is vast, and its discussion could easily engulf any thesis. This chapter recognises that any discussion it provides on learning theories must inevitably be limited. Consequently, the intention is to provide a brief outline of learning theories that may be applicable to the learning of individuals, to review the main literature and discuss organisational learning theories that might lend themselves to describing and analysing the learning environment and processes found in clinical practice. These theories have been chosen as they share features e.g. development of tacit knowledge or learning in practice that may be easily recognised by healthcare staff and adapted for use within clinical practice and so construct an analytical framework upon which to base the proposed research.

Some definitions of learning

A simple dictionary definition of learning finds that learning is knowledge acquired by study (Concise Oxford Dictionary 1991 p673). However, this definition does not appear to take account of learning or outcomes of learning that individuals might achieve without studying, but by participation in daily occurrences for example at home, school or work. This form of learning may more closely fit with the definition offered by Kolb (1984 p36) who succinctly suggests that learning "is the process whereby knowledge is created by the transformation of experience". This definition is developed by Bigge and Shermis (1999 p162) who acknowledge the role of individual experience in learning but also appreciate the importance

of perceiving the experience and behaviour of others, they see learning as "the process of one's construing internal representations of behaviour through informative feedback resulting from ones own direct behaviour, and ones observation of examples of behaviour in other people and the consequences of both". These definitions indicate that learning involves change, for example through acquisition, interpretation or transformation of knowledge, experience or information. However, they do not appear to offer any specific view on how or whether learning might be manifested by behavioural change.

Kim (1993) offers an opinion on this, arguing that learning is the acquisition of knowledge or skills, pointing out that this form of learning includes not only know-how but also *know-why*. This suggests not only the acquisition of some practical or mental skill but also the ability to demonstrate a conceptual understanding of learning and experience. Learning is seen to have taken place when new knowledge is acquired which enhances the ability to take effective action, and is demonstrated through a replicable change in behaviour (Kim 1993). This definition could be seen as pertinent to any investigation into infection control knowledge, how this is learnt, and its application in practice. However, it does not provide any insight into the processes underpinning learning and the acquisition of know-how and know-why.

Behavioural learning

Hill (1997) discusses the history of behaviourism, arguing that it is derived from the study of animal behaviour. For behavioural learning theorists, the study of behaviour was seen as objective, practical and informative, in contrast to the subjective study of consciousness (Hill 1997). Behaviourism argues that we are born with a variety of reflexes that respond to stimuli e.g. the irritation of nasal passages initiates sneezing. Behaviourism claims that we can build

upon and acquire new responses to stimuli which results in new forms of behaviour and learning (Gross 1996; Hill 1997; Marton and Booth 1997). This new behaviour, learning and knowledge is acquired through the serial combination of reflexes, and the provision of appropriate responses when encountering particular stimuli (Hill 1997). Hill (1997) goes on to argue that in the view of behaviourism all that we think, feel, say or do to some extent involves the entire body and its reflexes and that this is essential to behaviourist learning theory. Hill (1997) discusses the roles of frequency and recency in behaviourism, arguing that if a response to a stimuli is made frequently then it is more likely to be repeated, similarly if a response to a stimuli is made recently it too is more likely to be repeated (Hill 1997). This might be considered as a mechanistic process but its manifestation may be applicable in infection control when clinical staff are seen to fail to wash their hands frequently and repeatedly in clinical practice (Larson and Kretzer 1995; Pittet et al 2000). Such behaviour may be explained by the law of effect (Hill 1997). This suggests that the response to a stimulus depends upon the effects following a response. If the response is followed by a reward then the stimulus response is strengthened, if it is followed by a punishment the stimulus response is weakened (Hill 1997; Marton and Booth 1997; Lovell 1980). Social acceptance within clinical practice could be seen as a form of reward. For example, if an individual sees other clinical staff failing to wash their hands in response to a particular stimulus e.g. contamination of hands, then by adopting a similar response the individual may gain some satisfaction by demonstrating behaviour congruent with that of colleagues. This notion is supported by Marton and Booth (1997) who find that behaviour is contingent upon its consequences.

Criticism may be made of behaviourism, for example that it does not fully account for cognitive behaviour e.g. attitudes and goals (Hill 1997). Stimuli may be seen to guide and

elicit responses but the aim to achieve goals drives behaviour, this purposive behaviourism may be accounted for by individuals' cognitions – their perceptions and beliefs in regard to the world, these cognitions from previous experiences can be combined to enable individuals to respond to new circumstances and guide and inform their behaviour (Hill1997).

Cognitive learning

Cognitive theory rejects much of the behaviourist argument, finding the role of consciousness in learning of primary concern (Hill 1997). Cognitive theory argues that stimuli from the environment are acquired and transformed into internalised mental symbols which are then linked with perceptual processes (Wislock 1993; Marton and Booth 1997). These mental symbols make up the raw data that is processed by the brain and is essential to the learning process (Wislock 1993). Lovell (1980) goes on to describe how this process contributes to the development of insightful learning – the flash of inspiration that leads to the solution of a problem, this allows the learner to move on and use this knowledge to inform attempts to solve subsequent problems. This process has been described as Gestalt learning, where an entity that we perceive is "more than the sum of its parts"; the emphasis in this process is seen to be on understanding rather than on behaviour (Hill 1997 p90).

Cognitive/Gestalt theory rejects the stimulus – response bonds of behaviourism, arguing that memories are organised entities or gestalts, consequently continuing learning is achieved through accommodating, changing, integrating and reorganising these gestalts in response to experience, time or thought (Lovell 1980; Hill 1997). Lovell (1980) argues that gestalt learning is based upon prior experience, finding that new material is only accommodated when

the learner has some related knowledge into which the new material can be included; this accommodation is described as a schema (Lovell 1980; Hill 1997).

Schemata are described as perceptions, thoughts and understandings of the world (Lovell 1980; Hill 1997). They represent frameworks upon which mental activity can be constructed and supported (Hill 1997). These schemata can change, e.g. when experience is not consistent with an existing schema the individual will change their schema to accommodate the new insight gained from the experience, this process it is argued leads to our learning and understanding of the world (Hill 1997).

Wislock (1993) describes how modalities e.g. publications, discussions, visual and tactile experiences might influence cognitive learning and subsequent development of schemata. Modalities such as those listed by Wislock (1993) may all be found within clinical practice and may all be suggested as potential influences upon infection control knowledge and learning. Similarly it might also be suggested that the social environment in which these influences are found and the actors within the social environment may too influence knowledge and learning. Social groups have structures of power and status; they also have expectations in regard to the behaviour of group members (Lovell 1980).

Social learning theory

Social learning theory (SLT) combines elements of behavioural and cognitive learning theory, finding that both perceptions and consequences of past behaviour act to determine future behaviour (Lovell 1980; Bigge 1982; Bigge and Shermis 1999). SLT is based upon cognitive interaction i.e. the interaction between an individual, his or her behaviour and the

physical/social environment. Individuals are interactive, participatory and reciprocal; they act on their needs and motives (Bandura 1969; Sims and Lorenzi 1992; Bigge and Shermis 1999). SLT also involves the use of symbolic interaction (Bandura 1969; Bigge 1982) such as the use of symbolic thought rather than action in problem solving. By the use of symbolic representation of behaviour and its outcomes, individuals are able to convert foreseeable consequences into motivators for the modification of current or future behaviour (Bandura 1969; Bigge 1982; Hill 1997). Bigge (1982) stresses the value of cognitive reinforcement and finds that it is central to SLT, arguing that by perceiving the consequences of actions individuals decide how to respond to particular circumstances and behave accordingly. This reinforcement may be obtained directly through individuals own experience or vicariously where the consequences of the behaviour of others is observed (Bandura 1969; Bigge 1982; Sims and Lorenzi 1992). This vicarious learning through the observation of others contributes to another significant component of SLT – modelling (Bandura 1969; Bandura 1977; Bigge 1982; Sims and Lorenzi 1992; Hill 1997).

Social behaviour is greatly influenced by modelling; the actions and attitudes of individuals and groups may be modified by altering the behaviour of those that have a significant role as behaviour models (Bandura 1969; Bandura 1977). Lovell (1980) agrees with this argument, finding that powerful group members exert leadership regarding the ideas, communication, behaviour and learning within the group, this leads to the formation of group rules regarding the expected behaviour of individuals within the group. In achieving this, these powerful group members may demonstrate their belief in their own self efficacy, their ability to change their circumstances and environment by taking and leading action for others to observe, model and learn (Hill 1997).

In the process of modelling, individuals observe and reflect upon the behaviour of others and use information derived from this observation and reflection to guide their own behaviour, thus modelling enables individuals to learn from the example of others (Bandura 1969; Bigge 1982). For this process to be successful four further elements are required i.e. – attention to behaviour, retention of knowledge, production of behaviour and motivation e.g. rewards that will stimulate the demonstration of behaviour (Sims and Lorenzi 1992; Hill 1997). In regard to motivation, individuals' learning and adoption of modelled behaviour is less likely to occur when it is subsequently seen to be punished, and more likely to occur when learners see the modelled behaviour rewarded e.g. by social acceptance (Bandura 1969; Bandura 1977; Bigge 1982).

In her discussion of SLT, Hill (1997) finds that learning based on modelling may lead to the learnt inhibition of responses e.g. if a learner observes a model not carrying out a particular form of behaviour, such as washing contaminated hands, then the learner may well adopt the inhibited response demonstrated by the model. Hill (1997) also finds that responses may be influenced by disinhibition where the desire to carry out an activity is active but requires some indication that it may or should be carried out. This indication is referred to as elicitation, whereupon the observation of a model carrying out a particular behaviour creates a "positive desire" amongst learners to imitate and perform the modelled behaviour (Hill 1997 p153). However, Bigge and Shermis (1999) caution that such responses may become routine and carried out without thought with the attendant risk of this contributing to traditional and ritualised behaviour.

It has been concluded that through the process of social learning identities may be constructed i.e. an individual models his or her behaviour on the behaviour of other individuals or

members of a social group (Bandura 1977; Lovell 1980). Moreover, learners may not simply learn from models, they may also learn to be like the models that they have a high regard for and value (Bleakley 2002). In the course of modelling and social learning, individuals may experience their socialisation into a particular group or profession (Bleakley 2002).

Experiential learning

Experiential learning (EL) involves interpreting the relationships between the internal characteristics of individuals and their external circumstances, and between their personal and social knowledge (Kolb 1984). Learning is seen as a social process, consequently an individuals' learning may be influenced by the circumstances, culture, and social knowledge to which they are exposed (Kolb 1984). EL differs from cognitive theories that emphasise the role of acquisition, manipulation and recollection of information. It also differs from behavioural theories that do not account for consciousness or the role of personal experience in learning. Instead, EL looks to combine and integrate behaviour and cognition whilst generating knowledge through the transformation of experience (Kolb 1984).

In the case of EL, learning may result via a four stage cycle based upon, firstly – personal experience and practice of individuals or groups, secondly - observation, review, and reflection, thirdly - analysis and planning and finally modification of action, experience and intervention in practice (Kolb 1984; Burnard 1989; Coates 1995). It is this integrated cycle of experience, conceptualisation, reflection and action which results in learning (Kolb 1984). In EL it is recognized that knowledge and ideas are continuously and dynamically evolving, and being tested in the light of further experience and reflection (Kolb 1984; Burnard 1989; Schon 1987). An implication of this is that for EL to be effective, learners must possess the skills

and opportunities to enable them to change their role and perspectives e.g. from actor to observer, from physical involvement to detached objectivity (Kolb 1984). It may be reasonable to question whether learners will always have these abilities and opportunities, for example a learner within a busy area of clinical practice may find that their workload precludes them from adopting and learning from a position of analytical detachment. On the other hand, a working environment that is in some way able to facilitate learners, without making additional burdensome demands upon them, in changing their perspectives from active involvement to analytic, reflective detachment, could provide a valuable learning opportunity within practice.

In regard to the site at which experiential learning may take place Kolb (1984) argues that the workplace is a learning environment that can facilitate the generation and sharing of knowledge. However, Kolb (1984) cautions that experiential learning can only take place in circumstances where individual, group and organisational values are mutually supportive and based upon shared commitment. This notion of experiential learning, with shared commitment and knowledge demonstrates similarities to the learning model proposed by Kim (1993).

The model of Kim (1993) is based upon a four-stage cycle of observation, assessment, design and implementation. Through this cycle individuals experience and observe events, they assess and reflect upon their experience and then design and construct their own response to the experience and implement that response, this is then mediated through shared mental models. Mental models are the deeply held beliefs, views and notions that individuals or groups may share; these mental models may strongly influence how individuals and groups learn and apply their knowledge (Kim 1993; Gorelick et al 2004; Starkey et al 2004).

Learners may not necessarily replicate the mental models of their colleagues. The mental models shared by individuals do not need to be indistinguishable from each other but rather they should aim to be consistent, mutually compatible and accommodate the mental models of other individuals and the learning aims of the wider social group. Through this accommodation of some degree of variation, individuals may be allowed the freedom to experiment with new experiences and adapt to their social and physical environment through their thoughts, perceptions and behaviour, potentially leading to further experiential learning (Kolb 1984). This form of independent and self directed learning through experience may be seen as a theoretical basis from which the learning theory of andragogy has emerged (Coates 1995). Andragogical and pedagogical educational theory have been described as being located at opposite ends of the educational spectrum (Knowles 1980); this chapter will now discuss these two learning theories.

Pedagogy

Pedagogy may be described as the art and science of teaching; it is based on the premise that knowledge can be transferred from teachers to learners (Knowles 1980). Ironside (2001) sees pedagogy as the production, negotiation, transformation and realisation of knowledge through the interactive relationship of the learner and teacher. However, it is also argued that the pedagogical learner is dependent, with the teacher actively aiming to bring about some change in those being taught and consciously deciding when and how content is learnt and assessed (Knowles 1984; Marton and Booth 1997; Bedi 2004). As such it is based upon a methodology of transmission e.g. lectures or instruction and assumes that students are prepared to receive and learn from this transmission (Knowles 1984). This pedagogical teaching is subject centred and involves learners acquiring knowledge that is prescribed by others, and is

motivated by external pressures (Knowles 1984). Learning that is acquired through a pedagogical approach may be delayed or postponed in its application in practice (Knowles 1980).

Pedagogy provides a problem solving and outcome based educational method that focuses on the transmission and accrual of information, which in the face of limited resources has been widely used in healthcare education (Ironside 2001; Bedi 2004). However, Ironside (2001) goes on to discuss how nurse educators are becoming aware of the limitations of conventional pedagogy and how this is reflected by an increasing demand for pedagogies that are culturally relevant and provide learners with an understanding of cultural meanings and issues. These culturally relevant pedagogies may for example be derived from feminist or post modern philosophies (Ironside 2001).

Feminist pedagogies draw attention to the dependent nature of the pedagogical student and the development of unbalanced power relationships which may in turn have implications for learning and its application (Ironside 2001; Bedi 2004). In his discussion of pedagogy in public health, Bedi (2004) warns that a didactic, pedagogical relationship between learner and teacher may be transferred into clinical practice and may engender dependency in patients thus inhibiting their ability to challenge the practice of healthcare workers.

Further criticism of the application of pedagogically derived knowledge is made by Guile and Griffiths (2001) who find that conventional, subject centred pedagogy produces the study of topics in isolation which in turn leads to problems in relating these topics in context. To counter this, Guile and Griffiths (2001) offer a model that takes greater account of the role of context and situated learning. In this teachers are encouraged to develop "pedagogical spaces"

and learners are enabled to gain knowledge and understanding through reflection upon their own experience (Guile and Griffiths 2001 p125). Pedagogical spaces may for example be found or created in the workplace amongst communities of practice (Wenger 2000; Guile and Griffiths 2001). It is in these spaces that Guile and Griffiths (2001) urge learners to use their pedagogically derived, formal knowledge in experiencing and investigating working practices which in turn may lead to the development and integration of new knowledge. This form of learning through some degree of self direction and investigation may be seen to have some similarities to the form of learning discussed within andragogical learning theory.

Andragogy

The essential goal of andragogy is the enablement of learners to take control and responsibility for their own learning through a combination of study, personal experience, analysis and reflection (Knowles 1980; Knowles 1984; Coates 1995). In pursuit of this goal andragogy is underpinned by a set of assumptions about the learner and his/her circumstances (Knowles 1980; Howard 1993; Coates 1995). Firstly, it is assumed that the learner is increasingly independent and capable of self direction. Secondly, that personal experience is crucial to learning. Thirdly, that individuals will learn in response to their own real life needs and circumstances. Finally, that learners become problem and performance centred rather than subject centred (Knowles 1980; Howard 1993; Coates 1995). These assumptions indicate that an andragogical learning approach supports and enables learners to become increasingly self-directed, to be informed by their own previous experience and use experiential learning methods in their learning (Knowles 1980; Knowles 1984; Howard 1993; Coates 1995).

This approach also places much emphasis on learners being able to identify their learning needs and any divergence between their existing knowledge and capability and that required by their situation (Coates 1995). It is the recognition of this divergence that motivates the learners to gain new knowledge to enable them to successfully manage their situation (Coates 1995). This could be identified as a potential criticism in andragogical learning. For example, if learners fail to recognise a learning need e.g. the need to carry out correct handwashing to prevent transmission of infection then they may not be motivated to learn how and when to carry out this behaviour. In response to this potential criticism, some form of facilitation may be effective in helping learners identify significant learning needs (Coates 1995). This facilitation might take the form of exposition e.g. presentation of some educational material, direction e.g. leading or organising educational processes, or discovery through the solution of questions or problems (Nottingham Andragogy Group 1981).

This facilitative role need not be fulfilled by an identified teacher, instead in andragogical learning, learners are seen to have two simultaneous roles as both teacher/facilitator and learner (Nottingham Andragogy Group 1981). However, the success of this facilitation may be dependent upon the opportunities and abilities of learners to reflect upon and evaluate their experience and gain a "conceptual grasp" of their situation (Knowles 1980; Coates 1995 p44).

Andragogy may not be an appropriate learning theory to employ in circumstances where adult learners may be resistant to learning environments and methods that are inconsistent with the expression of their own individual autonomy (Coates 1995). Similarly, an andragogical approach may not be appropriate for use by learners that may possess personality traits such as shyness or lack of assertiveness, learners such as these may have difficulty in focussing and independently acting upon their learning needs (Coates 1995). Dependent learners may

benefit from the learning opportunities offered by a pedagogical teaching and learning approach.

This thesis will now further consider the learning experience of individuals within the wider workplace and organisational context. Examination and consideration of organisational learning theories in combination with individual learning theories such as those described above, may assist in the development of a theoretical framework upon which the proposed research may be based.

Knowledge Creation

Concepts and theories on the subject of organisational learning are ubiquitous; however there appears to be little agreement on what organisational learning actually is and how it is achieved (Dodgson 1993). Where there does seem to be some agreement within the literature is in regard to the importance of organisational learning in enabling organisations to succeed in and adapt to turbulent, changing and threatening environments (Dodgson 1993). In response to these changing and dynamic environments it has been argued that learning is a dynamic process and that the implementation of learning theory must itself adapt and emphasize the changing character of organisations (Dodgson 1993). This ability to adapt to changing and threatening environments is arguably relevant to infection control which itself has to adapt to rapidly changing clinical situations, fast and frequent patient transfers within hospitals and with new and emerging organisms and diseases.

An organisational learning theory that emphasizes the importance of dynamism, change, adaptation and the generation and re-generation of knowledge within organisations is that of knowledge creation.

Organisations, particularly those in the west, have often seen themselves simply as information processors (Dodgson 1993). Following this model the organisation receives and processes information and through this process it is able to adapt, solve problems and achieve its goals. Nonaka et al (2000) argue that this model views organisations as inert and passive and fails to recognize the dynamic character of knowledge creation. Nonaka et al (2000) find that organisations do not simply respond to problems, they create and respond to problems of their own making; they develop their own knowledge to solve these problems from which in turn new knowledge is generated. In this way the organisation is not simply an information processing machine, it is instead an organic, creative and developing body, which is able to interact with its environment and develop new knowledge through that interaction.

In describing knowledge Nonaka et al (2000) find that it is dynamic, context specific and is generated through the relationships between individuals and organisations. Knowledge may be described as a commitment or a belief that is based within a person's own individual values. It is through an individual's, or an organisation's interpretation of information that this information becomes knowledge. As such knowledge could be described as socially constructed, it is dependent upon both individual and shared beliefs, values and understanding (Nonaka et al 2000).

In further discussion of the nature of knowledge Nonaka and Takeuchi (1998) suggest that knowledge can be further described as explicit or tacit. They argue that within western

organisations knowledge has been predominantly viewed as explicit, it is formalized, based within hard and easily transmissible data. Transmission of explicit knowledge in these circumstances is likely to take place in formal teaching, training or educational sessions held within formal educational environments. This description of knowledge transmission fits well with the type of pedagogic educational interventions discussed previously in relation to healthcare education (Ironside 2001; Bedi 2004). These educational interventions assume the transmission of explicit knowledge e.g. microbiological facts and figures. Such interventions are likely to be dependant upon the transmission of scholarly knowledge from experts to learners in formal classroom or training situations, situated within the confines of a large western organisation e.g. an NHS hospital. In contrast Japanese organisations have viewed knowledge as being largely tacit (Nonaka and Takeuchi 1989). Tacit knowledge can be characterized as subjective, intuitive and difficult to transmit. It is expressed in the skills and know-how of a craftsman or it can be found in the taken for granted beliefs, models and perceptions of individuals, groups or organisations. Tacit knowledge is dynamic and internalized within its holders; it is embedded within actions, values, ideals and commitments (Nonaka et al 2000).

Tacit knowledge can be developed through socialization and the sharing of experiences such as working experiences, for example in the way an apprentice might learn and internalize skills from a craftsman through the use of hands on learning (Nonaka et al 2000). Similarly, junior doctors or nurses may learn new tacit knowledge while working with skilled and experienced practitioners. This is not to say that explicit knowledge should be less valued or left undeveloped. Tacit knowledge can be developed and processed into explicit knowledge e.g. training manuals or databases that allow for easier transmission of knowledge throughout

an organisation. The implementation of this explicit knowledge in turn allows the opportunity for more tacit knowledge to be created.

Nonaka et al (2000 p10) argue that the creation of knowledge within an organisation is dependent upon internalization i.e. the "embodying of explicit knowledge into tacit knowledge". Learning in practice, or hands on learning carries out much of this process, and through this process knowledge is shared within organisations (Nonaka et al 2000). This is a continuous process that is able to transcend hierarchical and departmental boundaries; it creates a situation in which knowledge created within an organisation is continuously reassessed and renewed (Nonaka et al 2000).

Knowledge creation is bound by context. Societal and historical contexts form a basis upon which individuals interpret information and create knowledge (Nonaka et al 2000). Evidence within the literature suggests that knowledge developed and learnt in context e.g. within a working environment, is retained and implemented more effectively than that which is learnt in a formal classroom environment (Albanese 2000). Learning in context arguably situates the learning experience, for example the workplace is able to become the site where information is transformed into knowledge (Nonaka et al 2000). This learning in context is not dependent upon the transmission of explicit knowledge through the input of a teacher but could in fact take place through the interactions between a learner and a skilled practitioner. These types of learning experience, where learners or novices learn through hands on practice enables the learners to develop skills and tacit knowledge (Nonaka et al 2000). Clearly, there is much in favour of this process but its success is dependent upon the skilled practitioner passing on to the learner knowledge and skills that are valid and comply with the aims and goals of the employing organisation.

Knowledge may be described as a commitment or a belief that is based within individuals own values. Should a skilled practitioner not value or believe in a certain aspect of their work e.g. the use of safety equipment in a manufacturing process, then it is possible that similar values and beliefs may be shared and internalised by learners working with that skilled practitioner. Situations such as this could have obvious implications for the wider organisation. This in turn suggests that learning in context should be carried out with some level of support and leadership from those with a knowledge of good practice, share organisational goals and have the power to influence the implementation of these goals and good practice.

This concept of situated learning has similarities with the concepts of problem based learning in which groups of learners are presented with practical and theoretical problems to solve in context (Frost 1996) and with communities of practice (Lave and Wenger 1991) in which members of the community participate, learn and develop tacit knowledge through practice. In discussing this concept of a place in which tacit knowledge is learnt and shared Nonaka et al (2000) use the Japanese term *ba* which describes a space e.g. work, mental or virtual, and time (not necessarily a fixed time) where tacit knowledge is shared between participants within a community. Interestingly, Nonaka et al (2000) appear to support the argument that assistance and leadership for the participants within the community should be available from capable individuals; they find that having access to the right individuals with specific knowledge and ability is vital to knowledge creation.

In regard to leadership of the knowledge creation process, it has been argued that managers should aim to lead organisations in actively creating circumstances where the process can thrive. Leaders should provide a "knowledge vision, develop and promote sharing of

knowledge assets" and "enable and promote the continuous spiral of knowledge creation" (Nonaka et al 2000 p23).

Much of the argument of Nonaka and his colleagues is supported by Lam (2000). Lam (2000) argues that knowledge is increasingly seen as a vital resource within organisations and that there is a growing acknowledgement of the importance of tacit knowledge in improving performance, stimulating innovation and enabling organisational learning.

In her description of organisational forms and models of organisational learning Lam (2000) discusses what she describes as J-form organisations, so called because of their similarities to Japanese knowledge creating organisations (Nonaka 2000; Nonaka and Takeuchi 1998). Lam (2000) argues that J-form organisations have a great capacity for gathering and generating tacit knowledge, and that key to the success of these organisations are cross functional teams which bridge gaps between professional groups and areas of expertise while creating and diffusing knowledge widely throughout the organisation. This diffusion is often assisted by the rotation of staff in temporary placements within the cross functional team moving on to other areas and so spreading knowledge and good practice (Lam 2000). This model of J-form organisation with its emphasis on diffusion of tacit knowledge throughout the organisation might arguably be of interest to infection control teams (ICT). The cross functional team described by Lam (2000) could be roughly paralleled by the multidisciplinary community commonly found working on hospital wards. Similarly, the rotation of staff through the cross functional team described by Lam (2000) is comparable with the routine rotation of placements within ward communities experienced by junior doctors and student nurses. The mobilising and accumulation of tacit knowledge in infection control practice within these communities could be of significant assistance to understaffed ICT's that may be unable to

provide long term educational interventions. This use of tacit learning within work based communities' supports Nonaka et al (2000) in their argument that situated learning, learning in context and the concept of *ba* have similarities to the concept of communities of practice. This chapter will now discuss these similarities and the wider theory underpinning the concept of communities of practice.

Communities of Practice

Much of the argument of Dodgson (1993) in regard to the importance of developing knowledge to enable organisations, in particular business organisations, to succeed in and adapt to turbulent, changing and threatening environments is supported by Wenger (2000). However, Wenger (2000) takes this argument further and proposes that the development of knowledge is crucial to the success of any organisation not just commercial businesses. Wenger (2000) also supports much of the argument of Nonaka et al (2000). He too suggests that while much knowledge can be readily expressed and transmitted i.e. explicit knowledge; a great deal remains tacit. However, this tacit knowledge must be owned and valued by its users to allow it to be effective in practice (Wenger 2000). It has also been argued that the communities in which it is used and practised animate and give life to this tacit knowledge. These communities of practice generate, share, apply, and modify this knowledge (Wenger 2000). As such this tacit knowledge is dynamic; it evolves and changes with its environment, its users and in time (Nonaka et al 2000; Wenger 2000).

These communities of practice may not be formal and discrete units within an organisation; indeed their informality and ubiquity within day to day working life may prevent them from being noticed and disguise their familiarity (Wenger 1997). Wenger (2000 p207) argues that

communities of practice constitute an organisation's store of knowledge, they are the organisation's "most versatile and dynamic knowledge resource and form the basis of an organisation's ability to know and learn". In defining communities of practice Wenger (2000 p208) argues that they consist of three core elements; a commitment to "joint enterprise" which binds members of the community, "mutual engagement" through which members learn with and from each other and a "shared repertoire of communal resources". These resources may include a combination of explicit and tacit knowledge sources such as policies, standards, attitudes and beliefs. It is this repertoire that provides the community with the basis and resources for creating new knowledge in response to new challenges and situations (Wenger 2000).

Communities of practice are formed around the recognised knowledge needs within an organisation. They are able to spread and disseminate knowledge widely throughout an organisation, in so doing they can become the "social fabric" around which an organisations knowledge needs are structured (Wenger 2000 p213). In other words if members of an organisation recognise a need for knowledge, value it and make a commitment to its use, communities of practice can form throughout the organisation through which new knowledge and good practice can be spread.

Communities of practice have similarities with the cross functional teams as described by Lam (2000), that are able to bridge gaps between professional groups and areas of expertise. Wenger (2000 p210) finds that communities of practice are able to "span institutional structures and hierarchies". However, this does not necessarily mean that issues of power are irrelevant within communities of practice. Power within a community of practice may be accrued through knowledge and expert status rather than through organisational hierarchy and

bureaucracy (Wenger 2000) although it follows that the accruement of knowledge and expert status may well be associated with lengthy professional experience and a senior position within an organisation. Again in similarity with cross functional teams, the members of communities of practice may also belong to other organisational structures (Wenger 2000). For example, engineers working on different projects for DaimlerChrysler maintained a cross project community of practice in which standards, knowledge and lessons learnt could be shared (Wenger 2000). Similarly, on a typical hospital ward there will be teams of nurses, doctors, cleaners etc that are all part of their own particular professional group or department, and simultaneously all part of the overall ward team or community of workers practising on the ward.

In discussion of the developing nature of communities of practice and their creation of knowledge, it is clear that some formative outline of learning needs or curriculum development is involved. Communities of practice progress through various stages of development, they may begin as loose associations and networks built upon opportunities, challenges or tasks within an organisation. Over time the community builds upon the relationships and shared interests of its members and as it matures a "learning agenda" or curriculum emerges (Wenger 2000 p217). It is the activity of the community of practice that develops this broad and flexible curriculum, it is not fixed or necessarily based upon instructions for best practice provided by an authority outside of the community of practice (Lave and Wenger 1991). Interestingly, Lave and Wenger (1991) emphasise the importance of differentiating between a learning curriculum i.e. learning and knowledge assets used, viewed and valued daily by learners, as opposed to a teaching curriculum designed to provide instruction to learners. Arguably, this issue of curriculum development is relevant to the pedagogic educational interventions previously discussed in relation to healthcare (Ironside

2001; Bedi 2004). Educational interventions such as these are based upon a teaching curriculum, i.e. a framework which enables teachers to teach, albeit within the limitations of resources and workload. A learning curriculum that is flexible, responsive, persistent and is intended to support the learning and knowledge creation within a community or group of learners may well be more effective in creating and distributing knowledge within that community. In doing so this continual form of knowledge creation might contribute to a sustained improvement in infection control practice.

In response to this argument, the kind of learning curriculum described above could risk becoming un-focused and lacking in direction. However, this does not allow for the internal leadership found within communities of practice (Wenger 2000). This leadership does not necessarily need to come from a recognised expert; however recognised experts give legitimacy to the community and have the ability to maintain a focus and direction for the learning agenda or curriculum practised within the community (Wenger 2000). Kofman and Senge (1993) agree that leadership within a community of practice is not necessarily dependent upon position or hierarchy; instead they discuss the concept of servant leaders, people who lead because they choose to serve. These servant leaders are demonstrating something very similar to the kind of commitment depicted by Kofman and Senge (1993), in which leaders and participants develop communities of commitment and leadership communities that are able to go beyond personal loyalties and instead commit to achieving change within an organisation.

These opinions on the role of leadership within communities of practice have failed to pay enough attention to the influence of organisational power and politics within communities of practice. That political processes and defensive behaviour from individuals or groups within

organisations exists is well recognised within the literature (Easterby-Smith et al 1998). This characteristically negative behaviour may in turn have a de-moralising effect upon the organisation and communities within it. Consequently it has been questioned whether learning through communities of practice could ever effectively infuse an organisation with knowledge without the organisation itself being committed to entrusting real power to the leadership of the communities (Easterby-Smith et al 1998). Without this type of commitment leaders may lack the recognized organisational power needed to influence the strategy of the organisation as a whole. Furthermore, without the support and direction of genuinely empowered and legitimated leaders, the achievement of learning through communities of practice might not be possible (Easterby-Smith et al 1998).

Of course where there are leaders within a community it follows that there will be followers or in the case of communities of practice, participants. Each of these participants will have their own views, aims, objectives and needs. So too will they have their own level of participation and involvement within the community which may change and develop over time (Wenger 2000). Lave and Wenger (1991 p29) argue that this type of work based, situated learning is characterised by "legitimate peripheral participation". In this process learners develop a mastery of knowledge and skills to allow them to become full, integral members of a community of practice. The situated learning associated with legitimate peripheral participation arguably has similarities with the tacit knowledge creation described by Nonaka et al (2000). Participation is based upon the situated and continuous negotiation of meanings. The implication of this is that understanding and experience are continually interacting; consequently divisions between intellectual and physical action, thought and involvement are discarded (Lave and Wenger 1991). Through this process, which Lave and Wenger (1991 p55) describe as "a conceptual bridge", individuals and groups are involved in knowing and

learning both explicitly and tacitly. They progress from learners to skilled members of a community of practice.

At this point it may well be worth sounding a note of caution. Lave and Wenger (1991) recognise the role of history in learning and the transformation of individuals from learner to expert. It is worth remembering the findings of Schein (1989) in regard to the risk of cultural learning reinforcing and regenerating bad practice when it is based upon a history of culturally learnt values and beliefs that are misplaced, invalid and not grounded within accepted good practice. Such a situation only re-emphasises the importance of recognised experts and their ability to provide legitimacy and maintain a focus for the curriculum practised within the community (Wenger 2000).

Those that have previous experience of apprenticeship training may find the concept of legitimate peripheral participation familiar. Lave and Wenger (1991) link legitimate peripheral participation with apprenticeship and find that apprenticeship is synonymous with situated learning. Arguably the significance of apprenticeship has been overlooked in its use in developing skilled practitioners with an emphasis on craft skills and tacit learning (Lave and Wenger 1991). Lave and Wenger (1991) find that in studies of apprenticeship little observable teaching takes place yet learning still occurs. This learning may be based upon the learners' exposure to working with a skilled practitioner in which intellectual and physical activity, deliberation and participation are combined. It might also be suggested that the learning associated with apprenticeship is also linked with the construction of identities (Lave and Wenger 1991). As discussed earlier, identities may be constructed on the basis of modelling i.e. an individual model his or her behaviour on the behaviour of others (Bandura

1977). In other words apprentices may not simply learn from experts, they may also learn to be like the experts they value and respect (Bleakley 2002).

In Bleakley's (2002 p9) discussion of pre-registration training of junior doctors, he describes the pre-registration year spent in clinical practice as a "formal apprenticeship into the profession of medicine". In this pre registration year, doctors work in rotation during which they are attached to medical teams from various specialities and are taught by the senior medical staff within these teams. Bleakley (2002 p9) argues that the process by which doctors are socialised into the culture of medicine represents an "extended or hidden curriculum". This type of curriculum and process of learning through socialisation which is guided by legitimate experts such as consultant physicians or surgeons is analogous with the type of tacit learning described by Nonaka et al (2000) and the learning agenda or curriculum described by Wenger (2000).

The pre-registration year sees junior doctors passing through and being socialised by various communities of practice. During this process the junior doctors begin to develop their own professional identities (Lave and Wenger 1991; Bleakley 2002). Bleakley (2002) goes on to describe the varying nature of ward based communities of practice, arguing that communities with an enthusiasm for innovation in practice that are able to utilise a variety of learning resources including the patients themselves will generate a positive climate for learning. Through these communities of practice the junior doctors learning is not limited to explicit and structured knowledge, instead it allows them to learn tacitly and through the use of legitimate peripheral participation it provides them with a route of transition from novice to expert (Bleakley 2002; Lave and Wenger 1991).

Bleakley (2002 p14) concludes that there is scope for the development of ward-based communities of practice into a wider "community of learning". These wider communities could for example draw upon the multi-disciplinary team typically found on wards and which has similarities to the cross-functional teams described by Lam (2000). The development of these wider communities of learning would enable the broad distribution and generation of knowledge within the communities themselves and the use of staff such as junior doctors or student nurses on temporary rotation through the communities would enable this knowledge to be disseminated widely throughout the organisation. Through the use of communities such as these improvements in practice and organisational performance as described by Wenger and Snyder (2000) might be achieved.

This theme of developing communities is pursued elsewhere in the literature. Kofman and Senge (1993) talk of developing communities of commitment and leadership communities which exceed individual loyalties and instead express a commitment to achieving societal change through the efforts of learning organisations. Kofman and Senge (1993) argue that without the genuine commitment of those involved in communities, real progress will not be made.

In their discussion of non-canonical practice Brown and Duguid (1991) describe how service technicians working for a large corporation developed their own communities of practice in response to failing and inadequate canonical, formalised and explicit knowledge contained within service manuals and procedures etc. If the technicians had not rejected the canonical approach of the employing corporation and not developed their own understanding and abilities to improvise within their own community of practice, the corporation's ability to perform would have been significantly damaged. Brown and Duguid (1991) argue that to

encourage learning and innovation organisations should promote and reconceive themselves as communities of communities.

This demonstrates the function of communities of practice in their ability to innovate, to generate and situate learning within the workplace. This concept of situated learning is discussed by Kofman and Senge (1993) and could be linked to the theory of problem based learning which is increasingly used within healthcare. Kofman and Senge (1993) liken learning in organisations to that found within sports or performing arts; it may be situated in either the practice field or room (classroom) or in the performance venue (workplace). They argue that learning and working spaces must be integrated to create a continuing process of action, experimentation and reflection. By the use of problem based learning theory this seamless movement between classroom and workplace may possibly be aided.

Frost (1996) in her evaluation of the usefulness of problem based learning (PBL) in nursing describes the principal of PBL as being a method in which scenarios are presented to small groups of students with the aim of instigating them to acquire the knowledge and skills needed to deal with the given scenarios. In presenting these scenarios and in discussing their solution the conventional role of teacher is replaced by that of a leader who guides the group. Albanese (2000) supports Frost's description and argues that the basic premise often used to support the use of PBL is the idea of contextual learning, in other words when something is learnt in the context in which it is likely to be used, this promotes learning and the ability to recall, adapt and apply skills and knowledge in practice.

Frost (1996) argues that curricula based on PBL are not based on independent academic disciplines, but instead they are based on professional issues which can in turn develop the

students own problem solving skills and ability to innovate in practice. Frost (1996) also argues that PBL in nurse education is a suitable method for bridging the gap between theory and practice. She argues that by learning in context e.g. by experiencing real life situations in clinical practice or in classroom simulations of them, the student will be able to reflect upon and integrate theory and practice.

When studying in a PBL environment, students work as teams in small groups. The use of these small groups, working within a PBL environment that aims to produce contextual learning would assist in providing the seamless movement of learning from classroom to workplace as proposed by (Kofman and Senge 1993). Similarities may be seen between the communities of study groups used in PBL with the aim of generating contextual learning in the classroom (or the practice room as described by Kofman and Senge) and the communities of practice found in the workplace. This notion appears to be supported to some extent by Baldwin and Ford (1988) who find that where elements in the training and practice environments are similar, or ideally identical, then knowledge learnt in training will be more readily transferred into practice. The importance of a supportive environment and the role of managers and leaders in accommodating a learning climate within the organisation is stressed by Baldwin and Ford (1988). This argument in regard to the environment is developed by Raelin (1999) and by Poell et al (2000) who find that training and learning is increasingly taking place in the workplace through the implementation of work-based learning theory (WBL), this deserves further discussion.

Work-based learning

A useful definition of WBL is provided by Raelin (1999 p14) and is worth quoting at length. WBL:

> "can be defined as a process of individual and organisational learning characterised by three elements.
>
> 1. It views learning as acquired in the midst of action and dedicated to the task at hand.
> 2. It sees knowledge creation and utilization as a collective activity wherein learning becomes everyone's job.
> 3. Its users demonstrate a learning-to-learn aptitude that frees them to question underlying assumptions of practice".

Elements within this definition can be linked to themes found in both communities of practice and knowledge creation theory. For example learning "in the midst of action" (Raelin 1999 p14) can be roughly paralleled with the situated learning described in the literature on communities of practice. Similarly, the collective and social activity of learning in WBL is comparable to the processes described by Nonaka et al (2000) when discussing knowledge creation. The element of WBL that is made explicit in the definition of WBL provided by Raelin (1999 p14) and which is not made overt within other literatures is the importance in WBL of users demonstrating a "learning-to-learn aptitude that frees them to question underlying assumptions of practice". It is this element that could have implications in working environments in which practices have ossified. For example in areas where practices and procedures have been carried out in the same way for years because "they have always

been done this way", or in situations where cultural learning (Schein 1989) has reinforced bad practice based upon invalid knowledge, poor information and misplaced beliefs.

Raelin (1999) argues that only through hands on practice and experience can participants learn and know that they are able to change their working practices and behaviour. On the other hand however, it is wise to remember the role of theory based, explicit knowledge in developing tacit knowledge and hands on practice (Nonaka et al 2000). This is supported by Raelin (1999) who finds that WBL must merge theory and practice, but also argues that practice must be enhanced by the use of reflective learning similar to that described by Kolb (1984) and Schon (1987).

One of the arguments in favour of WBL is that it recognizes the workplace as a central venue for learning while using various instruments or agencies to implement the learning process such as teams, training and mentorship (Raelin 1999). Whatever instruments or agencies are used to effect learning, WBL produces sustained learning, in which participants are required to make judgements, carry out procedures based upon their knowledge and be able to defend their decisions and actions in practice (Raelin 1999).

This development and sustaining of knowledge in practice could have a positive influence upon the problem of transfer of training described by Baldwin and Ford (1988). Baldwin and Ford (1988) estimate that while American industries spend approximately $100 billion a year on training, only 10% of this training is actually implemented in the workplace. To improve this situation it is suggested that a supportive framework within the workplace is needed to enable learning and the sustained use of newly acquired knowledge. This framework could typically consist of motivational, supervisory and peer support and organisational leadership

that will create a favourable and supportive environment for learning to take place (Baldwin and Ford 1988).

In discussing the transfer of training, Baldwin and Ford (1988 p96) describe the use of different types of "learning curves" and "maintenance curves" which indicate how knowledge and skill developed in training is applied in practice. Of some significance and in support of the argument of Raelin (1999) is the learning curve which portrays a sustained increase of training applied to practice in circumstances where for example one member of a working group has learnt a new skill which is valued, emulated, learnt and implemented by other members of the working group. In other words learning has taken place and may continue to take place within the workplace. This contention is endorsed by Poell et al (2000). In their discussion of learning network theory, they find that learning within the workplace reduces problems associated with transfer of training while at the same time enhancing innovation in practice.

The fundamental aspect of WBL programmes is the action project. These projects characteristically involve the construction of a team of participants tasked with dealing with current problems within practice. Much of the practical experience of these teams in responding to the problems is under the guidance of a "coach whose role is to help the professional learn the technical skills as well as the norms of behaviour of professional practice" (Raelin 1999 p16). This echoes the contentions of others in regard to the importance of legitimated experts, leadership and the process of socialisation into professional groups (Bleakley 2002; Lave and Wenger 1991; Nonaka et al 2000).

The area chosen for attention by the action project should have some strategic value and meaning to an organisation, for example in reducing faults and stoppages in a factory's production lines or in reducing avoidable infections in hospital patients (Raelin 1999). Projects such as these may well be experimental in nature; e.g. they involve the use of some new procedure or technology. However, through this process real change and improvement in practice can be disseminated throughout an organisation. Raelin (1999) concludes that through the use of action projects that stretch and cross organisational boundaries the organisation at a broader level is able to re-examine itself, its practices and learn.

Criticisms of action teams can be suggested. For example, Raelin (1999) suggests that action teams may carry out much of their project work away from their usual workplace. If this is the case then this contradicts much of the evidence in favour of situated learning. In reply to this it can be suggested that working in a different environment can encourage original ways of thinking about known problems (Raelin 1999). Another criticism could be made over the timing and duration of action projects. Raelin (1999) argues that the duration of these projects might be decided by the ability of the employer to continue to attach participants to the action team. If the action team was made up of participants of an already extant team, for example the multidisciplinary team found on a hospital ward, then potential problems associated with duration and location of the action team could be reduced. In conclusion, much of Raelin's (1999) argument reveals a possible route through which organisations as a whole may learn.

Organisational learning

The multitude and variety of definitions and conceptions of organisational learning within the literature might surprise newcomers to the field of organisational learning (Dodgson 1993; Nicolini and Meznar 1995). In contrast to this diversity however there are arguments that recur and appear common to many of the conceptions and theories on organisational learning. The merit of organisational learning is clear; it may increase productivity, allow organisations to adapt and respond to change and also enable them to become more competitive within a turbulent and changing environment (Dodgson 1993). Many of these merits may superficially look as if they apply solely to commercial and private organisations. However, public sector organisations such as health or postal services have found themselves under pressure from changing environments, demands for improved productivity and threats from the private sector (Finger and Burgin Brand 1999). Consequently, the need for organisational learning within the public sector may be every bit as important as it is within the private sector.

In his overview of organisational learning theory Dodgson (1993) broadly defines organisational learning as a method by which organisations construct, enhance and systematise knowledge and activity within their own cultures, whilst developing their organisational capability and improving the implementation of skills within the workforce. Shrivastava (1983 p13) similarly finds that organisational learning requires the development of a knowledge base within the workforce, that is communicable within the workforce, has "consensual validity", and is integrated into the practices of the workforce. These definitions rely on assumptions such as learning leading to overall positive outcomes even if organisations are sometimes obliged to learn from their mistakes. Also, it may be assumed that learning occurs at all levels within an organisation, and that with individuals as the

principal learning agency within an organisation, it is through the activity of individuals that the organisation learns as a whole (Dodgson 1993). These assumptions may be debatable but it could be argued that individuals are of prime importance in enabling organisations to learn, and that individuals learn from personal experiences such as mistakes (Bandura 1977).

The experience of Brown and Duguid (1991) in regard to non-canonical practice amongst service technicians and management failing to learn that canonical, formalised and explicit knowledge was inadequate to allow their technicians to perform, highlights that learning may not take place at all levels within an organisation.

Learning translates from individuals into organisations via organisational culture, the shared values and beliefs learnt as a result of group experience within an organisation (Schein 1989; Dodgson 1993). In enabling organisations to learn, the knowledge of the individual is shared and integrated within the organisation. This knowledge is then used and implemented within the organisation through the use of routines such as rules, procedures and codes. These routines become independent of the individuals that develop and use them, they become a part of the organisational structure and culture, as such they are able to survive through time and turnover in staff (Dodgson 1993). Individuals are socialised into the organisational culture. They are taught the socially acceptable way to think, behave and act within the culture, in this way learning within the organisation is socially constructed (Dodgson 1993; Schein 1989; Nonaka et al 2000).

At this point it is worth sounding a note of caution in regard to the influence of cultural learning and the risk of it reinforcing bad practice, and possibly preventing new knowledge being developed and used. There is the contention that organisations often fail to learn

because of the influence of "inhibitory loops" (Dodgson 1993 p389). Inhibitory loops are defined as "a self reinforcing cycle in which errors in action provoke individuals to behaviours which reinforce those errors" or "group and inter group dynamics which enforce conditions for error (vagueness, ambiguity, etc)". The resultant effect of these inhibitory loops may be that organisations create learning systems that are unable to address and question the organisations beliefs, customs, practices and objectives (Dodgson 1993). Inhibitory loops may also cause members of organisations to focus on local problems rather than problems that face the organisation as a whole; this in turn may create defensiveness within the workforce. The overall result of the effect of inhibitory loops may be a discernable gap between what workers say they do and what in reality takes place (Dodgson 1993).

Returning to the theme of individuals within organisational learning, Shrivastava (1983) in his discussion of organisational learning systems also finds that individual learning is a prime medium for learning within the broader organisation. Shrivastava (1983) agrees that individual learning is rooted in practice and that individuals know about their work through the development of implicit, tacit knowledge (Nonaka et al 2000). Shrivastava (1983) and Nicolini and Meznar (1995) discuss the influence of individual cognition and the sharing of assumptions by individuals within the organisation. This cognition and assumption sharing may be manifested in organisational learning by adaptation. It is argued that organisations are able to demonstrate adaptive behaviour (Shrivastava 1983). For example, organisations may continuously adapt their policies, or aims on the basis of previous experience. This organisational experience will have been learnt and mediated within the organisation by its members. This individual learning comprises a knowledge base which the organisation is able to draw upon to make decisions and adaptations in response to environmental changes and threats (Shrivastava 1983). Environmental changes, threats or errors are perceived and

adapted to by individuals within the organisation. This process develops and maintains a set of shared theories in use based on shared assumptions and cognitive maps within the organisations members (Shrivastava 1983).

This continuous process of sharing, adapting, renewing assumptions and socially constructing realities within the organisation leads to organisational learning (Nicolini and Meznar 1995). An important point made by Shrivastava (1983) is that the effectiveness of the organisation is influenced by the quality of the knowledge base it relies upon when making crucial decisions. In other words, if the organisational knowledge base is underpinned by invalid or incorrect information and knowledge then the organisation as a whole may be at risk of making wrong decisions or may even fail to realise that decisions and changes need to be made. This point highlights the need for legitimated and expert leaders in driving and focussing the knowledge creation process (Wenger 2000). Shrivastava (1983) also recognizes the importance of leadership, arguing that key organisational leaders and decision makers are vital to the effectiveness of knowledge sharing within the organisation.

In response to such a situation where an organisations knowledge base is derived from invalid knowledge, it could be suggested that it is just as important for the organisation to have the ability to unlearn and cast aside invalid knowledge as it is to have the ability to learn new knowledge. The process of unlearning may be hindered by organisational members being reluctant or unable to change their theories in use, shared assumptions and cognitive maps (Nicolini and Meznar 1995). Unlearning may also be hampered by the influence of inhibitory loops (Dodgson 1993). In addition, unlearning may be interfered with by organisational and political pressure, disjointed structures, communication problems or simple self interest and deception on the part of individuals. Nicolini and Meznar (1995) conclude that rather than

focussing solely on being able to unlearn, organisations should instead focus on being able to learn from failure.

Much of the argument of Shrivastava (1983) and Nicolini and Meznar (1995) is supported by Daft and Weick (1984). In their model of organisational learning as interpretive systems they too discuss the role of individuals in organisational learning. Daft and Weick (1984) find that individuals interpret what they have learnt and what they have done; these interpretations are in turn processed as information within the organisation which then bases its actions upon the information. Additionally, organisations develop cognitive systems of their own. Individuals may pass through the organisation but the organisation itself preserves and develops knowledge, beliefs and values. This is consequently shared amongst incoming or existing members of the organisation. The merging and sharing of understanding and knowledge amongst members of the organisation enables the organisation to act as an interpretive system (Daft and Weick 1984).

In regard to leadership of this process Daft and Weick (1984) argue that senior level managers within the organisational hierarchy formulate and guide the organisations interpretation of information and knowledge gathered. Also, Daft and Weick (1984) argue that although many individuals may be involved in the process of information gathering, it is at higher management level that information converges, is interpreted and decisions are made in response to it. This argument could be compared with that of (Wenger 2000) who contends that leadership does not necessarily need to come from a recognised expert, or from the higher levels of an organisational hierarchy. Similarly the argument of Daft and Weick (1984) could be favourably compared with the possibly more pragmatic view of Easterby-Smith et al (1998)

who doubt whether organisational learning could be successfully achieved without the support of powerful leadership.

Through interpretation, organisations know their environment and are able to change, adapt and learn in response to the environment. Interpretation is the process by which organisations understand events, develop meanings and produce conceptual and cognitive schemes amongst members of the organisation (Daft and Weick 1984). It could be argued then that the organisational interpretation described by Daft and Weick (1984) is similar to the cognitive learning and sharing of assumptions within an organisation as described by Shrivastava (1983) and Nicolini and Meznar (1995). In the interpretational model of Daft and Weick (1984) interpretations are initially given meaning through individual cognition, these meanings are then shared and cognitive maps and assumptions are made. Interpretation at an organisational level occurs when senior members and leaders within the organisation share, conceptualise and arguably validate these shared assumptions and cognitive maps. Finally, learning is demonstrated when the organisation changes or takes action in response to the interpretation.

Daft and Weick (1984 p293) conclude that virtually all organisational activity is reliant upon interpretation and that the outcomes of this interpretation are dependent upon the views and opinions of "key decision makers". Once again the recurring theme as to the importance of individuals that are able to influence and support learning within organisations is made plain.

The notion of organisational learning as being a social construction dependent upon data processed into cognitive maps, shared assumptions and interpretive networks is further supported by Klimecki and Lassleben (1998). They too find that convergence of cognition leads to modifications in organisational knowledge. However, in this case they argue that the

stimulus for learning is change and a need for organisations to develop resilience and problem solving abilities.

This is an interesting point since it could be argued that if an organisation does not perceive a need for change, or to develop resilience to some challenge, then the organisation will not be stimulated to learn. Klimecki and Lassleben (1998) describe how organisations that do not recognise and act to rectify errors and gaps in their performance are unlikely to be able to generate organisational learning. Much of the stimulation to act depends upon those within the organisation being able to communicate and make errors and gaps in performance known to those with the ability to legitimate and drive through change, thus supplying the stimulus for organisational learning. Klimecki and Lassleben (1998 p419) continue this argument in terms of whether the role of communication is distributive in spreading new information and knowledge within an organisation or is generative in creating new organisational knowledge. They conclude that "organisational learning – the transformation of organisationally shared reality constructions – is generated by communication". The role and importance of communication is worth further examination.

Effective communication is dependent upon parties being able to both transmit and receive information. Communication will not have taken place if information transmitted by an individual or group is not heard, or is ignored, by another individual or group. This situation may well occur within organisations when workers views, criticisms and knowledge are disregarded by those such as managers and leaders that are in a position to cultivate learning. The argument here is that workers may be seen as passive receivers of information given to them by specialist training staff (Poell et al 2000). In actuality workers within organisations may well develop and communicate their own knowledge and view of organisational reality.

This reality may be very different from that of management or training staff (Poell et al 2000; Brown and Duguid 1991). In order for communication to fulfil its generative role in organisational learning, the organisation must embrace the dynamic and diverse nature of communication and learning within organisations (Poell et al 2000).

Poell et al (2000) propose that learning network theory could be employed as an interpretive framework through which organisational learning could take place. The success of this model depends upon the use of learning actors, e.g. managers and employees; learning processes e.g. policies, and the implementation of learning programmes, and finally learning structures e.g. the stable patterns that emerge over time when learning activities take place. This learning network theory recognises employees as vital components in organisational learning and enables communication between the diverse groups and individuals involved within the organisation. As a consequence communication is able to act as the stimulus for generating organisational learning. To those with experience of working within large, publicly funded, bureaucratic organisations such as the health service, much of what Poell et al (2000) argue in regard to failed communication and the disregard of the opinions of those in what might be described as ordinary working positions may well ring true.

In their analysis of organisational learning theory applied to the public sector Finger and Burgin Brand (1999) point out that public sector organisations have many similarities with private organisations, however, the environment in which they operate is often more complex and bureaucratic. The environment in which public sector organisations operate is increasingly liable to change and challenge from the private sector, national government and from an increasingly demanding and litigious public (Finger and Burgin Brand 1999; Attwood and Beer 1998). To enable public sector organisations to adapt to their changing and

challenging environment Finger and Burgin Brand (1999 p136) argue that they must develop a "collective learning process".

The ability of a public sector organisation to carry out this process would be dependent on it having a variety of organisational capacities. The organisation would need the individual and collective capacity to learn and communicate within groups and teams. It would also need the structural and cultural capacity within the organisation to foster learning e.g. through participation and appreciation of learning. The role and capacity of leadership to encourage learning would be vital to success (Attwood and Beer 1998). Finally, the organisation must have the capacity to organize its day to day work, its production, in such a way that learning is supported (Finger and Burgin Brand 1999). The implementation of organisational learning theory within a public sector organisation that has the capacities outlined above, could assist it in responding and adapting to change, whilst simultaneously making a contribution to the development of theory (Attwood and Beer 1998; Finger and Burgin Brand 1999).

To this point this chapter has provided some definitions of learning, briefly outlined some individual learning theories and suggested how they might be linked with clinical practice. It has also been claimed that pedagogical teaching has been widely used in healthcare education (Ironside 2001; Bedi 2004). Some more detailed examination of organisational learning theories has also been presented and some discussion of their application to clinical practice and infection control has been offered. This chapter will now further discuss the role of learning theory within clinical practice and infection control.

Learning in clinical practice

Many of the problems associated with defects in clinical practice and a failure to learn from past mistakes can be attributed to much of healthcare learning, knowledge and practice being based on ritual, custom and tradition rather than evidence (Davies and Nutley 2000; Eraut et al 1995). This ritual and traditional learning and practice may itself result from the training and learning of clinical staff.

Commonly, pedagogical classroom based teaching and training is aimed at providing clinicians with explicit knowledge for their use within practice (Davies and Nutley 2000). However, when individuals are taken away from the classroom and placed within the realms of clinical care, the use of this explicit knowledge derived from notes, databases, guidelines etc is to some extent pushed aside and replaced by the use of ritualised custom and practice (Davies and Nutley 2000). This ritualised practice is to some extent based on the tacit knowledge that is learnt and shared by those operating within the workplace. It is the knowledge used to get by in practice, it is the knowledge gained by the novice within a new area of practice (Nonaka et al, 2000; Wenger 2000). This division of explicit knowledge gained and used in the classroom and tacit knowledge learnt and employed in practice leads to circumstances where individuals working in clinical practice may base their opinions and practices on two possibly contradictory theories, their espoused theory and their theory used in practice (Argyris and Schon 1996; Strange 1996).

This division of espoused and practiced theory may be linked to the recurring concept of a theory – practice gap found within the literature (Badger 2000). This gap implies that

theoretical or explicit knowledge may not be compatible with or suitable for use within practice, instead it is moulded to fit the constraints of day to day working practice and consequently becomes the tacit knowledge learnt and shared by those within the area of practice. This point links with the concept of power and the socialisation of newcomers into the knowledge and practices of the established order. In support of this argument Feldman (1997) finds that truth is an instrument of power which constructs its own reality. The established order within a workplace have the power to produce their own version of reality within their working area, they may possibly have their own version of the truth and their own true way of practicing and socialising newcomers into it (Feldman 1997).

This division between espoused theory based on explicit knowledge and theory in practice based on tacit knowledge might lead to the assumption that tacit learning and use of theory in practice in some way provides a corrupted and less valuable form of knowledge and practice. However, there is evidence within the literature that contradicts this assumption and instead highlights the use of tacit knowledge and learning within practice as a means to improve clinical performance (Fox and Bennett 1998). For example, Davies and Nutley (2000) argue that organisations should recognise, evaluate, and where necessary change practices while preserving their tacit, embedded position within the custom of the organisation. Fox and Bennett (1998) are more specific in their support of the use of learning within practice, they find that commonplace ward activities such as hand-overs, reports, and ward rounds support learning by defining behaviour and standards of practice acceptable within the workplace. Cope et al (2000) appear to agree with the claims of Fox and Bennett (1998), they find that experts do not derive their expertise from rules or explicit and higher order knowledge; instead it is learned through a depth of practically gained experience. This expertise may in turn be passed on to novices through exposure to common workplace activities and practices (Fox and

Bennett 1998; Cope et al 2000; Sole and Edmondson 2002). It is through this process of developing shared knowledge, that a shared identity; understanding and mental model is created of how procedures should be carried out (Kim 1993; Stamps 1997).

Perceiving and correcting errors, and learning from past mistakes might be aided by embedding learning within hands on practice, and encouraging those involved in practice to evaluate and change practices when necessary (Davies and Nutley 2000). The need to acknowledge and learn from past mistakes has been stressed in the literature and it has been claimed that changes in health service policy in the UK have intended to change the organisational culture of the health service with the purpose of improving learning and performance (Davies and Nutley 2000). The aim of this cultural change within the NHS is to create an environment which encourages learning and innovation while recognising and learning from past mistakes (Davies and Nutley 2000). This claim is supported by Fox and Bennett (1998) who observe that it is not teaching that enables those in clinical practice to improve their performance, rather it is learning and its facilitation.

The claims of Davies and Nutley (2000) and Fox and Bennett (1998) both suggest that some change of perspective has taken place within the health service. The emphasis of learning in clinical practice has moved towards improving clinical performance at the point of contact with the patient. This change of emphasis has also been accompanied by a realisation that good clinical performance relies on more than pedagogic classroom based teaching, instruction and explicit knowledge (Durrance 1998). The need to recognise and change poor practice and unlearn previous knowledge and ways of doing things within the workplace has also been recognised (Davies and Nutley 2000). Of crucial importance to this unlearning and

relearning in practice is the presence of an "evident logic" (Philips 1989 p8), an unambiguous structure by which learners can understand their learning goals and establish why these goals need to be accomplished. In criticism of learning in infection control it could be suggested that it is a lack of this clear evident logic, a reason to change and gain knowledge of new ways of working in both clinical practice and in education that may impair learning. For example, it has been previously argued that due to the very nature of their transmission, a person may transmit an infection and not be recognised to be doing so. If procedures carried out by carers are not seen as being unsuccessful in preventing the transmission of infection it is possible that the procedure may become culturally learnt (Schein 1989) and consequently widely employed in practice. In these circumstances an evident logic or reason to change practice and learn new ways of working has not been made clear to the carers (Philips1989; Goldrick and Larson 1993). As a result of these circumstances, basic detection and correction of error, the single loop learning described by Argyris and Schon (1996) may be absent in much of clinical infection control practice.

Much of the literature devoted to infection control practice and learning contributes to these circumstances in clinical practice through its focus on pedagogic teaching rather than learning, and on providing explicit knowledge rather than harnessing tacit knowledge to improve practice. For example, in the investigation of ward based learning by Gould (1996) it is claimed that wards are the ideal environments to learn clinical practices. In investigating wards as an educational environment Gould (1996) employed educational interventions within the wards, these interventions consisted of five teaching sessions of thirty minutes duration. These interventions were aimed solely at groups of nursing staff; some teaching sessions were cancelled because nurses were unable to attend because of pressures of work. In discussing

these interventions Gould (1996) concludes that difficulties in providing the teaching package contributed to its lack of impact on the wards.

Gould's (1996) investigation of ward based learning is in fact an investigation of ward based teaching based upon a subject centred form of pedagogy. In this the classroom as a site of explicit knowledge transfer has simply been swapped for a hospital ward which itself at times may present a context less than conducive to the learning of explicit knowledge. In defence of Gould's (1996) intervention, some form of pedagogic teaching in practice may be successful in facilitating learning, for example through the use of pedagogic spaces where learners are able to learn experientially and through reflection on and in practice (Guile and Griffiths 2001). However, Gould's (1996) intervention failed to consider the use of such experiential or reflective learning and was instead an example of traditional, didactic, pedagogic teaching.

Gould's (1996) investigation also demonstrates a policy of exclusivity in that only nurses were invited to take part. Gould (1996) has assumed that learning will occur through the teaching of explicit knowledge within an area of clinical practice. Gould's (1996) conclusion that the educational interventions used in the investigation had little impact in practice supports the notion that the provision of teaching will not necessarily lead to learning.

This assumption that teaching will lead to learning is also demonstrated by Desai et al (2000) in their evaluation of a computer assisted learning package. In discussing this evaluation Desai et al (2000) claim that education and training is vital in infection control as it will improve compliance with policies. Furthermore, Desai et al (2000) find that contact with the infection control team and access to information sources such as guidelines remain a

foundation of teaching which will subsequently reinforce knowledge and inform decision making. In their evaluation of the computer assisted learning package Desai et al (2000) found that its use led to medical students improving their infection control knowledge just as effectively as those exposed to a formal, pedagogic lecture. Although Desai et al (2000) demonstrated that a computer assisted learning package may be as effective as a lecture in increasing infection control understanding, no attempt was made to show how this increased understanding was transferred into clinical practice. Similarly, Desai et al (2000) failed to establish whether changes in practice through the use of this understanding were lasting, or whether the use of this knowledge was eroded over time. In other words Desai et al (2000) failed to demonstrate that learning – the acquisition of new knowledge leading to a demonstrable and replicable change in behaviour, has taken place (Kim 1993).

Both Gould (1996) and Desai et al (2000) have tried to employ explicit knowledge and inappropriate teaching methods associated with it in areas of hands on, tacit, clinical practice (Elliot 1996). The failure of these explicit teaching interventions to achieve a significant impact in clinical practice and learning may be in part due to their failure to embrace and exploit the use of tacit learning opportunities amongst all staff employed within the clinical area.

Within much of the literature on education in infection control a recurrent assumption is made – that teaching equals learning. This assumption is unsafe to make as it fails to consider cultural, historical, or organisational structural factors that are determinate of the learning process (Antonacopoulou 2001). Furthermore, this assumption is reinforced by the lack of literature that critically examines the use of learning theories in practice (Courtney 1998).

Courtney (1998) is critical of the type of educational interventions employed by Gould (1996) and Desai et al (2000), arguing that although they may increase individuals' appreciation of the importance of infection control they do not lead to any retained learning that contributes to

an improvement in practice. Courtney (1998) argues that theoretical understanding, practical experience, and the context in which actions take place are all vital in improving learning and practice. Courtney (1998) suggests that instead of using educational strategies based on the transfer of explicit knowledge to those involved in clinical practice, new strategies aiming to combine infection control theory and practice within context should be developed with the aim of changing clinical practice and behaviour.

This is supported by Goldrick and Larson (1993) and their survey of learning styles and strategies used in infection control. Goldrick and Larson (1993) support the use of experiential learning based on Kolb's (1984) model as a means by which those involved in clinical practice can learn from the combination of theory, experience and practice, observation and review, analysis and planning and finally modification of experience and intervention in practice. In supporting the use of experiential learning in infection control Goldrick and Larson (1993) agree with the view of Philips (1989) that an evident logic should underpin the learning experience. Goldrick and Larson (1993) argue that in order to change the behaviour of those in clinical practice and reduce the transmission of infections then this process of change must be fortified by reason and a rational, logical argument that is understandable and establishes why learning and change is needed.

Summary

This chapter has attempted to provide some outline on theories of learning, how we learn as individuals, in social groups and within organisations. In regard to organisational learning, this chapter has discussed aspects of it that might be used to develop a broader learning environment in practice and may also through implementation within a public sector organisation, lead to some development in theory.

Recurring themes are found within the organisational learning literature, such as the recognition, importance and use of tacit learning and knowledge. The development of situated, context specific knowledge that is owned, validated and generated by its users in practice and is underpinned by explicit knowledge and organisational learning theories such as community of practice and knowledge creation theory may arguably be seen as a potentially valuable learning device within clinical practice.

Within hospital wards and departments there are already multidisciplinary teams that could possibly be encouraged and developed into fledgling communities of practice in which knowledge could be generated and distributed. The motivation and potential leadership is also arguably already in place on the wards and departments amongst the staff. By developing these multidisciplinary teams, and by generating, maintaining, distributing and utilising knowledge through them an improvement in clinical practice may be achieved. In pursuit of this aim some contribution to organisational learning theory may also be made.

This chapter has also paid particular attention to learning in clinical practice and the control of infection. It has been argued that to some extent clinical practice has not been based upon sound and valid evidence but instead on ritual, custom and tradition. This ritualised practice may itself be sustained by those in power endorsing its use. Equally an unquestioning and uncritical attitude amongst those whose practice is based upon tradition may well contribute to ritualised practice becoming embedded within organisational custom and subsequently learnt and assumed as good practice. This unquestioning and uncritical attitude to ritual knowledge amongst its users may in turn contribute to the development of a theory – practice gap and circumstances in which errors and mistakes in practice are not recognised, consequently learning from mistakes may fail to occur.

Within the literature discussing learning in infection control a recurring and unsafe assumption is made that teaching will lead to learning. In addition it has been claimed that the use of learning theory has not been greatly investigated or implemented within the realm of infection control. This situation has been contributed to by infection control failing to present the kind of evident logic of Philips (1989), which may persuade individuals and organisations to change and acquire knowledge of new ways of working in both clinical practice and in education.

It might be concluded then that learning within infection control should aim to combine explicit, formal learning with tacit, hands on learning, and that this combined learning should take place within the workplace. Furthermore, the educational experience within the workplace should itself be underpinned by appropriate learning theory. The learning experience should be evidence based, with the commitment of the learners and the endorsement and support of those empowered within their employing organisation.

Learners should be encouraged to experiment and share their experiences within the learning environment, these experiences and the shared mental models that are built from them should be questioned and critically evaluated in practice by those that use them. This critical evaluation may then in turn be used to drive and instigate further experimentation and learning through the transformation of experience.

The previous chapter discussed the recent history of infection control in UK hospitals. The size, cost and character of the problems caused by HCAI have been considered and some outline given of the various organisational, professional, societal and educational influences

which may affect the control of infection in hospitals. It has been argued that much of the fundamental knowledge, theory and science of infection control has been known since the nineteenth and early twentieth centuries thanks to the work of Lister, Semmelweiss and others (see: Jarvis 1994). It has been contended that this body of knowledge may fail to be fully implemented in practice, which in turn contributes to the infection risk within hospitals. It has also been argued that previous educational interventions have been shown to be effective in temporarily improving infection control practice, but in order to maintain a consistent improvement in practice some form of longer term educational or learning process was required.

This situation begs the question – how might this learning process be achieved? It could be argued that to aid any answer to this question the concept of learning, or more precisely, learning in the control of infection must be investigated. In carrying out this investigation, this research aims to provide a means by which infection control knowledge and practice may be improved, whilst also making some contribution to the theoretical aspects of learning, sharing and applying knowledge within organisational settings.

The following chapter will present a research model which combines learning theories and perspectives with the aim of achieving some understanding of the creation, sharing and use of knowledge in infection control and healthcare.

Chapter 3

A Research Model

This chapter discusses the division between espoused and actual practice in infection control and will present a research model to investigate and possibly close that division. The following true story gives an indication of the nature of some of the problems faced in infection control education.

An infection control nurse (ICN) is visiting some student nurses on a ward. The student nurses are in the very early stages of their training; this is the first ward they have ever worked on. They have been working on the ward for a month now. The ICN is very keen on education, she recognises the importance of knowledge and training and its use in the control of infection. The infection control nurse makes sure that she gets a forty-five minute opportunity to teach basic infection control precautions to all student nurses before they are placed on their first wards. Today she is visiting the students that she taught a few weeks ago, she just wants to check that they are getting on ok.

On arrival on the ward the ICN begins to observe the practices of staff on the ward, this is something she is skilled in and over the years she has learned how to blend into the background and become virtually invisible while she watches. She sees one of the student nurses. The student is walking and carrying equipment to and from an isolation room. The student enters and leaves the isolation room several times then moves on to care for another patient in another part of the ward. The student nurse does not wash her hands after leaving the isolation room or before attending to the next patient.

The ICN confronts the student nurse – "What are you doing?" she asks, "You were taught to wash your hands when leaving isolation rooms and before going to other patients, not to just go from patient to patient. Where did you learn to behave like that?"

"I don't know," replies the student nurse "everyone else on the ward does the same".

Introduction

The two previous chapters have given the reader an introduction to the recent history of infection control in hospital, a description of problems associated with the control of infection and an outline some of the various influences that may affect the control of infection in hospitals. Theories of learning relating to individuals, groups and organisations that might also lend themselves to describing and analysing the learning environment and processes found in clinical practice have also been discussed.

It has been suggested that a disparity may exist between espoused and actual practice. Strange (1996) finds that a division between explicit knowledge gained in the classroom and tacit knowledge learned in practice may lead to individuals developing two contradictory theories, their espoused theory and their actual theory in practice. Huzzard and Ostergren (2002) support the argument of Strange (1996) finding that espoused practice may be based upon explicit learning whilst actual practice may be based upon tacit learning. This division between espoused and practiced theory has been described in the literature as the theory – practice gap (Badger 2000). This chapter intends to present evidence indicative of a division between espoused infection control practice, based upon recognised good practice and microbiological theory (Mandell 2000) and actual practice in the workplace. The chapter will

also discuss the influences and assumptions made in practice and in learning that may have contributed to the development of the division between espoused and actual practice.

This chapter will propose a research model by which the division in espoused and actual practice in infection control may be investigated and better understood. This model will also bring together and employ individual and organisational learning perspectives and theoretical frameworks with the aim of providing a better understanding of the nature of learning and knowledge creation in infection control and healthcare. In developing this better understanding it is hoped that some contribution can be also be made to learning theories employed.

This chapter will begin with a review of the main issues identified in the previous chapters and that are fundamental to the research model presented.

Evidence of a division between espoused and actual practice

The microbiological theory that supports contemporary infection control advice is neither new nor unproven (Mandell 2000). Much of it is based upon the accepted and established work of nineteenth century scientists such as Lister and Semmelweiss (Carter 1983; Newsom 2002). The gap between this established microbiological theory and its implementation in modern infection control practice, is revealed by the literature highlighting the failure to employ basic infection control precautions such as handwashing and aseptic technique in clinical practice (Yentis 1993; Larson and Kretzer 1995; Pittet et al 2000) which has in turn lead to a resurgence in HCAI (D.O.H 2002).

A variety of causes for the failure to employ infection control precautions have been suggested in the literature. These suggested causes include fear of infection, cultural and social influences, ethnic backgrounds and religious beliefs (Soule and Huskins 1997; Valimaki et al 1998; Papadopoulos 1999). Sadala (1999, p808) argues that caring for patients with infectious diseases is an area of practice characterised by anxiety and prejudice where "knowledge and science-based practices intermingle with cultural images and information and with stories recorded since ancient times". MacQueen (1995) finds that cultural influences upon individuals may lead to them basing their infection control practice upon ritual rather than on established microbiological theory. Larson and Kretzer (1995) suggest that individuals may simply forget or lack knowledge of the precautions required.

One result of this failure to employ infection control precautions is an increase in the risk of transmitting infection. The impact of this increased infection risk and a further indication of the division between espoused and actual practice is provided by the Cooke report (PHLS 1995) which estimated that 1% of all deaths in the United Kingdom might be attributable to healthcare acquired infection (HCAI), while in another 3% of deaths HCAI's may have been a contributing factor. An estimate of the financial costs of infection is given by Plowman et al (1999) who found that infected hospital patients incurred costs 2.9 times greater than non-infected patients. Plowman et al (1999) estimate that HCAI cost the NHS in England £986.36 million annually.

It should be emphasised that that not all infections can be prevented, but it has been argued that approximately a third of HCAI's could be prevented by better application of infection control measures based upon sound microbiological theory (PHLS 1995).

If it is accepted that a division exists between espoused and actual practice in infection control, and the desirability of bringing actual practice closer to its espoused and microbiological theory based counterpart is also accepted, - then the creation and continued existence of this division should be investigated. By obtaining a better knowledge of the division between espoused and actual practice in infection control, interventions aimed at closing the division may be better informed.

Why is there a division in espoused and actual practice?

Some possible contributory factors to the division, such as fears and cultural factors have already been discussed (Soule and Huskins 1997; Valimaki et al 1998; Papadopoulos 1999; Sadala 1999). In response to the suggestion of Larson and Kretzer (1995) that individuals may simply forget that precautions are required or lack knowledge of the precautions required it might be suggested that some form of educational intervention might be appropriate. Within the infection control literature there is evidence of such interventions being attempted (Dubbert et al 1990; Larson and Kretzer 1995; Jarvis 1994). However, these attempted educational interventions were based upon the transmission of explicit knowledge through the use of formal educational sessions and achieved at best a transient improvement in practice (Jarvis 1994).

An example of the use of formal educational sessions aimed at improving clinical practice in a neonatal intensive care unit is provided by Shaw and Tanner (2003). Neonatology along with other medical specialities such as oncology, transplantation or orthopaedic surgery are areas in which infections may be rapidly manifested and patients may be particularly vulnerable (Shaw and Tanner 2003). Within these areas it may be possible to view good infection control

practice that reflects explicit knowledge applied in practice. An example of this is provided by Oddie and Embleton (2002) in their use of explicit knowledge of factors predisposing to early onset neonatal group B streptococcal sepsis. By applying this explicit knowledge in practice Oddie and Embleton (2002) are able to demonstrate a reduction in risk to women and neonates. In their study of handwashing practices within a neonatal intensive care unit, Shaw and Tanner (2003) use teaching sessions based on the transmission of explicit knowledge as a means of improving what was already recognised as infection control practice of a standard higher than might be seen in other clinical areas. In common with the findings of Jarvis (1994) some immediate improvement in practice was achieved by the teaching sessions. However, Shaw and Tanner (2003) make no claims as to the lasting effect of the teaching sessions; instead they stress the need for repeating and continuing the teaching sessions.

The failure of such educational interventions to achieve a sustained improvement in practice and their apparent ubiquity underlines an assumption made in much of the literature on education in infection control – that teaching equals learning. This assumption is reinforced by the lack of literature within infection control education that critically examines the use of learning theories in practice (Courtney 1998).

Improvement of infection control practice has been achieved on occasions when staff within clinical areas have demonstrated a commitment to improving their own practice. In doing so they have adopted, endorsed and reinforced improved practice within their own working area (Leclair et al 1987). It is this adoption and endorsement of beliefs and attitudes amongst the clinical staff that can either reinforce good practice based upon established infection control guidance (Leclair et al 1987) or alternatively lead to the reinforcement, support and continuation of poor infection control practice (Feather et al 2000).

It has been found that clinical areas that adopt and endorse higher standards of infection control practice, are areas in which patients are particularly vulnerable and where the consequences of infections are easily seen e.g. neonatology (Shaw and Tanner 2003). It is this ability to recognise and reflect upon the consequences of infection that informs and reinforces the need for good infection control practice and serves to retain the use of some residual explicit knowledge in practice.

This evidence suggests that in terms of achieving some sustained impact on infection control practice, more formal, explicit, classroom based educational interventions may be ineffective. Instead, some form of learning in practice, similar to that discussed in chapter two, appears to be effective in sustaining a negotiated and agreed level of practice within a group of clinical staff. However, this agreed level of practice may not necessarily reflect established best practice in infection control (Badger 2000). This locally agreed and negotiated level of practice may in turn lead to the manifestation of divergent espoused and actual practice amongst clinical staff (Badger 2000). It is this divergence that characterises the division between espoused and actual practice.

A locally agreed and negotiated level of practice might to some extent be influenced by the kind of contextual issues discussed in chapter one. For example, it is not impossible to imagine that issues of professional power, gender and workload (Foucault 1980; Doyal 1994; Gaffney 1990) as discussed previously may have some influence on individuals' espoused and actual practice and could in turn contribute to any division between them. Further investigation of these issues are beyond the scope of this research that focuses on knowledge and learning. However, the research should be mindful of and be prepared to discuss wider contextual issues as they may contribute to any division between espoused and actual practice.

A similar point could also be made in regard to the heuristics used by individuals in their clinical practice.

Gilovich et al (2002 p3) describe heuristics as the "normal, intuitive responses" used by individuals to interpret and respond to questions of probability or prediction. Tversky and Kahneman (1982) similarly find that individuals rely on limited heuristic principles when assessing or predicting risks or outcomes. These basic heuristic principles are often useful but may also lead to individuals making errors (Tversky and Kahneman 1982). These errors may be contributed to by the "illusion of validity" that occurs when individuals have confidence in their beliefs and predictions in contradiction to contrary evidence (Tversky and Kahneman 1982 p9). In their discussion of heuristics in clinical practice Davies et al (2002 p724) find that clinicians may have difficulty in distinguishing valid and invalid variables, this may lead to the development of "false beliefs". It has been argued that within areas of patient care, uncertainty and the use of intuition amongst clinical staff are unavoidable, it is under these conditions that staff use and rely upon their own heuristics (Hall 2002). This uncertainty and the use of intuition and heuristics in response to it may be reduced through the use of evidence-based decision making and increasing insight based upon education (Hall 2002). However Hall (2002 p216) concludes that within clinical care an "irreducible intuitive element" vulnerable to the influence of heuristics will remain. This irreducible use of intuition and heuristic processes in clinical decision-making might have some influence on any locally agreed and negotiated level of practice. Likewise it may also contribute to a division between individuals espoused and actual practice.

The division between espoused and actual practice implies that explicit knowledge may not be found suitable for use within clinical practice; instead it is altered, adapted and compromised

to suit the demands of day to day working practice and the beliefs and values of those that employ it (MacQueen 1995; Badger 2000; Feather et al 2000). Reber (1993) in his discussion of implicit learning finds that it is acquired without any deliberate effort to learn and in the absence or lack of explicit knowledge of the topic concerned. It is this implicit learning that is fundamental to adaptive behaviour and the generation of tacit knowledge which is itself used to guide decisions and actions in daily working practice (Reber 1993).

This division of espoused and actual practice and the creation of tacit knowledge through implicit learning as described by Reber (1993) may be compared to the "espoused theory" and "theory in use" found by Argyris and Schon (1996 p13). They find that espoused theory may be based upon explicit knowledge such as policies and guidelines and may be used to explain or account for intended or planned behaviour. However, this espoused theory based upon explicit knowledge may be "incongruent" with actual behaviour based upon theory in use (Argyris and Schon 1996 p14). This theory in use is implicit in the performance of actual behaviour; it is derived and developed through the observation of the behaviour of individuals and their adaptation to their working environment and tasks, it is informed by the rules, attitudes and beliefs held and shared by these individuals (Argyris and Schon 1996).

The findings of Reber (1993) and Argyris and Schon (1996) appear to support the view of Badger (2000) that altered, adapted and compromised explicit and implicit knowledge may become the tacit knowledge learnt and shared by those within clinical practice (Badger 2000).

The research model presented here aims to achieve an understanding of the division between espoused and actual practice. The model will propose a paradigm based upon learning theories, by which the division between espoused and actual infection control practice may be

reduced and brought closer to acknowledged best practice based upon microbiological theory. The model is not a reflection of a simple training need; instead it aims to demonstrate and critically examine the utility of learning theories in infection control and offer an alternative to the didactic, pedagogic teaching of explicit knowledge, and the recurrent assumption found in infection control - that teaching inevitably leads to learning (Courtney 1998).

To achieve this the model will integrate learning theories that provide a perspective through which to view the development of the division in espoused and actual practice and provide a framework for the investigation of means by which the division may be closed and infection control procedures brought closer to established good practice based upon sound microbiological theory. To aid this, this chapter will now briefly discuss individual and organisational learning theories that are key to the development of this research model.

Experiential learning

An experiential learning model provides the beginning of the research model (Kolb 1984). This model is closely comparable with established models used in assessing and implementing care in clinical practice (Eraut et al 1995) and as such may be familiar to many clinical staff. This model operates through four stages of interpretation, planning, implementation and review. However, the successful implementation of this model and the value of the learning experience it provides may be greatly influenced by environmental and social influences (Eraut et al 1995) and by the validity of the information utilized by the model (Kolb 1984). It could be speculated that these social influences may lead to an individual's experiential learning in clinical practice being to some extent based upon an interpretation of practices carried out by other colleagues in clinical practice. This clinical practice may itself not be

based upon valid information. This speculation appears to be supported by the argument of Schein (1989).

Cultural learning

Through cultural learning the values and practices of a social group are learnt by individuals (Schein 1989). If viewed as successful then these practices and values may become sub-conscious assumptions that these values and practices are valid and correct and be further propagated within the social group. However, in the realm of infectious disease, it is possible that individuals may embrace values and carry out practices that will transmit infection without that transmission ever becoming apparent to them. Consequently, culturally learnt values, beliefs and practices may not be based upon the assumption of their success in preventing the spread of infection but rather on an inability to perceive and reflect upon their failure.

Reflective practice and delusional knowledge

The concept of reflective learning as described by Schon (1987) is familiar to many within clinical practice, where the use of reflective diaries is encouraged (Cotton 2001). However, due to the delay in which infections manifest themselves individuals may fail to perceive that they have unwittingly transmitted infections through their clinical practice. These individuals may base their reflective learning on incomplete or incorrect perceptions and beliefs in regard to their practice (see Figs 1&2.).

Figure 1. A reflective learning cycle in clinical practice.

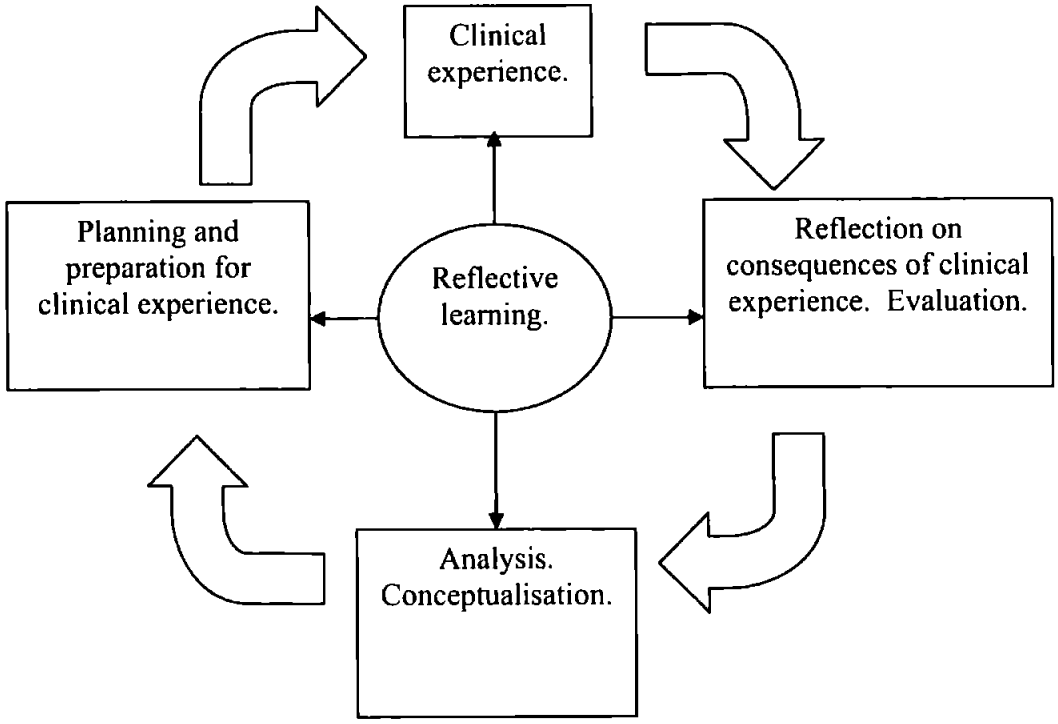
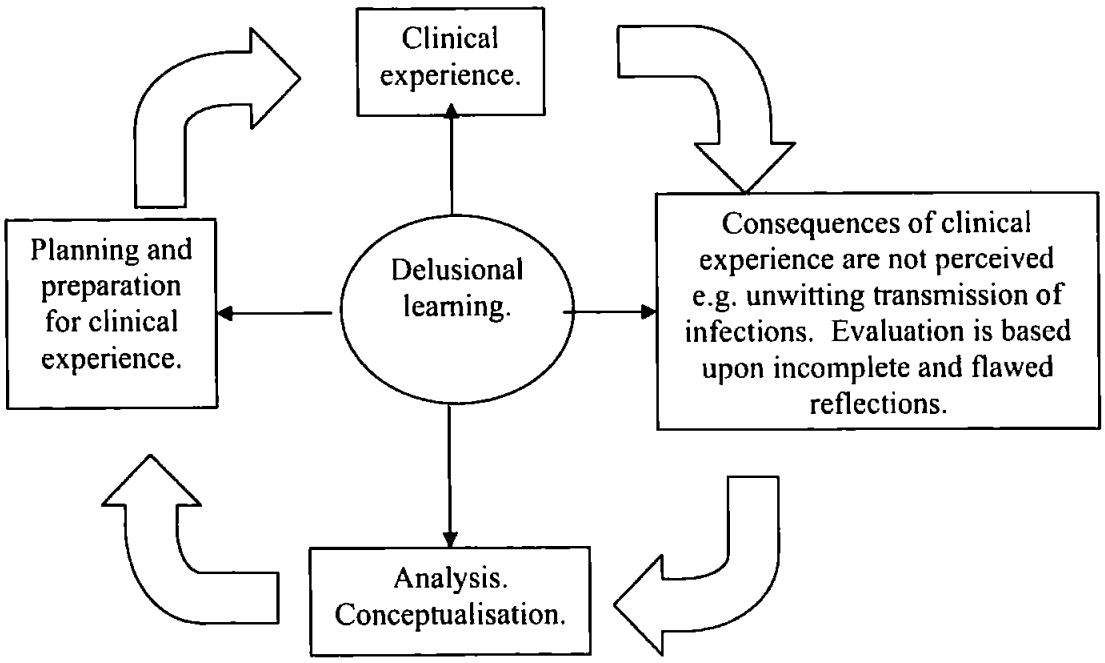


Figure 2. A delusional learning cycle in clinical practice.



This process of learning through flawed reflections may lead to individuals' developing deeply held beliefs and values in regard to their clinical practice (Durrance 1998). However, these

values and beliefs may also be divergent from valid and established infection control guidance and as such contribute to the division between espoused and actual practice. This form of learning may be better described not as learning from reflection but rather as learning from delusion (Long and Newton 1997).

Delusions and delusional knowledge.

Delusions can be described as strongly held, false beliefs; these beliefs may persist even when confronted with compelling counter argument and data (Collier et al 1999; Georgaca 2000). Delusions have also been described as flawed conclusions derived from inadequate data (Barker et al 1997). These false beliefs and flawed conclusions are the result of problems in individuals' perceptive or cognitive ability (Georgaca 2000), for example as a result of psychiatric illness or as the result of an inability to recognise and reflect upon actions and make correct conclusions based upon those reflections. The production of unsound conclusions and false beliefs based on the flawed processing of inadequate data is arguably central to the development of delusional knowledge. This form of knowledge clearly differs from that defined by Nonaka et al (2000 p7) as a "justified true belief".

Delusional knowledge and its relationship with time, superstitious knowledge and cognitive inertia.

The fact that there is inevitably some delay before infections manifest themselves and that as a result of this delay individuals may fail to perceive that they have unwittingly transmitted infections suggests that timing has a role to play in the development of delusional knowledge. Similarly, the delusional learning of Long and Newton (1997) has similarities to the

superstitious learning described by Kim (1993) and with the cognitive inertia described by Hodgkinson (1997).

Kim (1993) finds that in superstitious learning the links between action and response are lost. Actions are taken, observations and reflections are made and learning occurs but there is no valid basis for associations made between action and response. Levitt and March (1996) support the argument of Kim (1993), they find that superstitious learning occurs when the links between actions and outcomes are defective. Levitt and March (1996) further argue that in situations where superstitious learning occurs, knowledge and practice that is associated with success is reinforced. It is at this point that it could be argued that superstitious learning differs from delusional learning. Delusional learning is not based on associating practice with success; rather it is based upon a failure to fully perceive and reflect upon the consequences and shortcomings of actions taken by individuals and the wider organisational groups to which they belong. When individuals and groups fail to reflect fully and perceive the consequences of their actions they learn not through association with success but by lacking recognition of failure.

It is in the area of timing that delusional knowledge differs from the concept of cognitive inertia. Hodgkinson (1997) argues that the concept of cognitive inertia is based upon individuals becoming dependent on their mental models and that these models fail to take account of changes in their working conditions and environment. These mental models and individual perceptions become "out of step" with the circumstances in which the individuals find themselves operating (Hodgkinson p922 1997). George and Jones (2001) support the views of Hodgkinson (1997); they find that individual and group cognitive and interpretative processes that are slow to respond to change may cause inertia. This combined with deterrents

to change such as fixed organisational culture, rules and procedures may lead to an inability to change and adapt to changing circumstances or environment. Azar (2000) similarly finds that reliance on mental models that are out of step with changing circumstances is a source of cognitive inertia. Interestingly, Azar (2000) claims that these mental models may be changed when individuals are presented with information or key facts that force them to recognise their error. This is the very thing that ICT's have been attempting for many years with little apparent success. As has been stated earlier, ICT's have historically relied upon the pedagogic presentation of key facts and explicit knowledge (Courtney 1998).

Throughout Hodgkinson's (1997) discussion of cognitive inertia there is a notion of time and timing influencing its creation and effect. Hodgkinson (1997 p926) describes companies needing to respond quickly to market forces, keeping pace with changes, responding to volatile and turbulent environments and changes "over a relatively short time period". It is this notion of cognitive inertia being found and generated in environments of rapid and volatile change that sets it apart from delusional knowledge. For example in infection control, working environments e.g. hospital wards, have essentially changed little over the years, sick patients continue to be cared for in beds, micro-organisms and infection risk remain. Similarly, individual and group mental models of infection control procedures have to some extent become fixed and ossified under the influence of factors such as cultural learning, tradition and ritual practice (Schein 1989; Biley 1997; Philpin 2002).

The true story at the beginning of the chapter highlights how practices persist and spread tacitly to new members of staff even when these staff are exposed to key facts and information intended to cause change as suggested by Aznar (2000). It is these practices, based upon strongly held, false beliefs that persist over long periods of time even when confronted with

compelling counter argument and data that characterise and are based upon delusional knowledge.

Dissemination of delusional knowledge.

Deeply held and valued tacit learning based upon delusion may in turn be shared and assimilated by others (Durrance 1998). Senge (1993 p74) discusses "cause – effect relationships", these provide a feedback process based upon a reciprocal flow of influence. This influence can itself become both cause and effect (Senge 1993). Thus feedback based upon delusional knowledge can cause and effect its nature. For example, reinforcing and increasing its use will produce more feedback to its users. These users of delusional knowledge continue to see this knowledge as useful and valid and further propagate its use. Senge (1993) points out that persistent and repetitive patterns of influence such as this can cause stagnation or deterioration in practice.

Through the dissemination and assimilation of delusional knowledge, for example through the use of shared mental models (Kim 1993), the division between espoused and actual practice may be maintained and expanded.

Mental Models

Mental models are viewed as the means by which learning and knowledge may be shared amongst individuals which in turn influences and guides individual and consequent organisational behaviour (Kim 1993). Kim (1993) cautions that shared mental models may contribute to the development of counterproductive practices. The risk of developing these

counterproductive practices will arguably be increased if shared mental models are based upon the kind of delusional knowledge described above. However, mental models that are grounded by and validate a body of established infection control knowledge that is itself based upon sound microbiological theory could also be employed to bring espoused and actual practice closer together. A body of knowledge such as this could be maintained and developed within a community of practice.

Communities of Practice and Knowledge Creation

Wenger et al (2000) argue that communities of practice constitute an organisation's store of knowledge; as such they represent a flexible and dynamic knowledge resource that enables learning within an organisation. Communities of practice are characterised by common purpose, mutual commitment and a sharing of resources (Wenger et al 2000). These resources may include explicit and tacit knowledge sources e.g. policies, attitudes, beliefs and shared mental models (Wenger et al 2000; Kim 1993).

A core concept of community of practice theory is that of situated learning - the process where explicit knowledge e.g. guidelines and procedures, and tacit knowledge e.g. beliefs and skills are learnt within practice, in a working environment (Lave and Wenger 1991). Another key component of the theory is that of legitimated peripheral participation - in which individuals within the community may progress from a passive and peripheral position within the community to one of core membership or leadership as knowledge, skills and ability is gained (Wenger et al 2000).

The use of communities of practice in clinical areas has been explored by Bleakley (2002). Bleakley (2002) describes ward-based communities of practice, arguing that they are able to utilise a variety of resources to generate and share learning. Through these communities of practice learning is not limited to explicit and structured knowledge, instead individuals are able to learn tacitly and through the use of legitimate peripheral participation progress from novice to expert (Lave and Wenger 1991; Bleakley 2002).

Communities of practice could be built upon the existing multi-disciplinary teams and communities found in hospital wards and departments (Bleakley 2002). These already existing multi-disciplinary teams demonstrate many of the qualities Wenger et al (2000) find within communities of practice. For example, ward teams demonstrate a commitment to a common purpose i.e. caring for their patients, which in turn unites members of the team; they have a mutual commitment through which members learn with and from each other and also share communal resources such as the ward environment, equipment, skills and the jargon of their profession (Wenger et al 2000).

These already existing multi-disciplinary ward teams or fledgling communities of practice may only further serve to store, generate and share delusional knowledge and learning (Durrance 1998). This delusional knowledge and learning may be based upon a combination of experiential, cultural and reflective learning that fails to recognise the consequences and failings of clinical activities that transmit infections. This form of knowledge is tacit. Tacit knowledge can be described as subjective and intuitive, it may be expressed in technical or clinical skills, it is dynamic and internalised within its holders; it is embedded within actions, values, ideals and commitments (Nonaka et al 2000).

Nonaka et al (2000) present their SECI model of socialisation, externalisation, combination and internalisation to demonstrate how tacit knowledge is generated and employed by individuals within organisations. Through the process described by the SECI model, explicit knowledge is transformed and internalised within individuals as tacit knowledge (Nonaka et al 2000). This internalised knowledge in turn creates "tacit knowledge bases" which guide and inform the actions and practice of individuals (Nonaka et al 2000 p11). Learning in practice facilitates much of this process, and through this continuous process knowledge is generated, renewed and shared within organisations (Nonaka et al 2000). As with the fledgling communities of practice found by Bleakley (2002), the SECI model and the learning in practice of Nonaka et al (2000) could, if unguided and uncontrolled, lead to the generation and sharing of delusional knowledge (Durrance 1998).

A research model

It has already been stated that within infection control education, learning theories have not been widely employed or critically evaluated, instead there exists an assumption that the didactic teaching of explicit knowledge within classrooms or similarly formal settings will result in learning (Courtney 1998). It can be argued that this assumption, and the lack of deliberate and planned application of learning theory in practice has contributed to the division between espoused and actual infection control practice.

The employment of some explicit knowledge in practice may be seen in areas where patients are at greater risk from infection and their consequences are easily viewed and reflected upon (Shaw and Tanner 2003). However, it can be contended that explicit knowledge as taught by infection control teams has not been internalised and transformed by its users into the tacit

knowledge described by Nonaka and Takeuchi (1998). Instead, it could be claimed that the explicit knowledge taught by infection control teams has to some extent been replaced by delusional knowledge generated through a combination of experiential, cultural and reflective learning that has not been guided by educationalists and fails to recognise the consequences and failings of clinical activities that transmit infections (Kolb 1984; Schein 1989; Schon 1987). Arguably, it is this delusional knowledge that has been internalised and become the deeply held, tacit knowledge valued by its users. This delusional knowledge is stored within multi-disciplinary ward teams that have similarities to communities of practice (Wenger et al 2000) and may be mediated through shared mental models as described by Kim (1993).

The arguments and evidence given above suggests that learning theory e.g. experiential learning, cultural learning and mental models may be used to understand the development and maintenance of a division between espoused and actual practice in infection control.

The proposed research model (Figure 3.) presents a paradigm based upon the learning theory that has provided some understanding of the development and maintenance of the division between espoused and actual infection control practice. The research model aims to increase this understanding and suggest means by which the division may be reduced and brought closer to acknowledged best practice based upon sound learning and microbiological theory. In doing so it aims to contribute to, and critically examine the use and value of learning theories as an alternative to the pedagogic, formal teaching that has dominated infection control education.

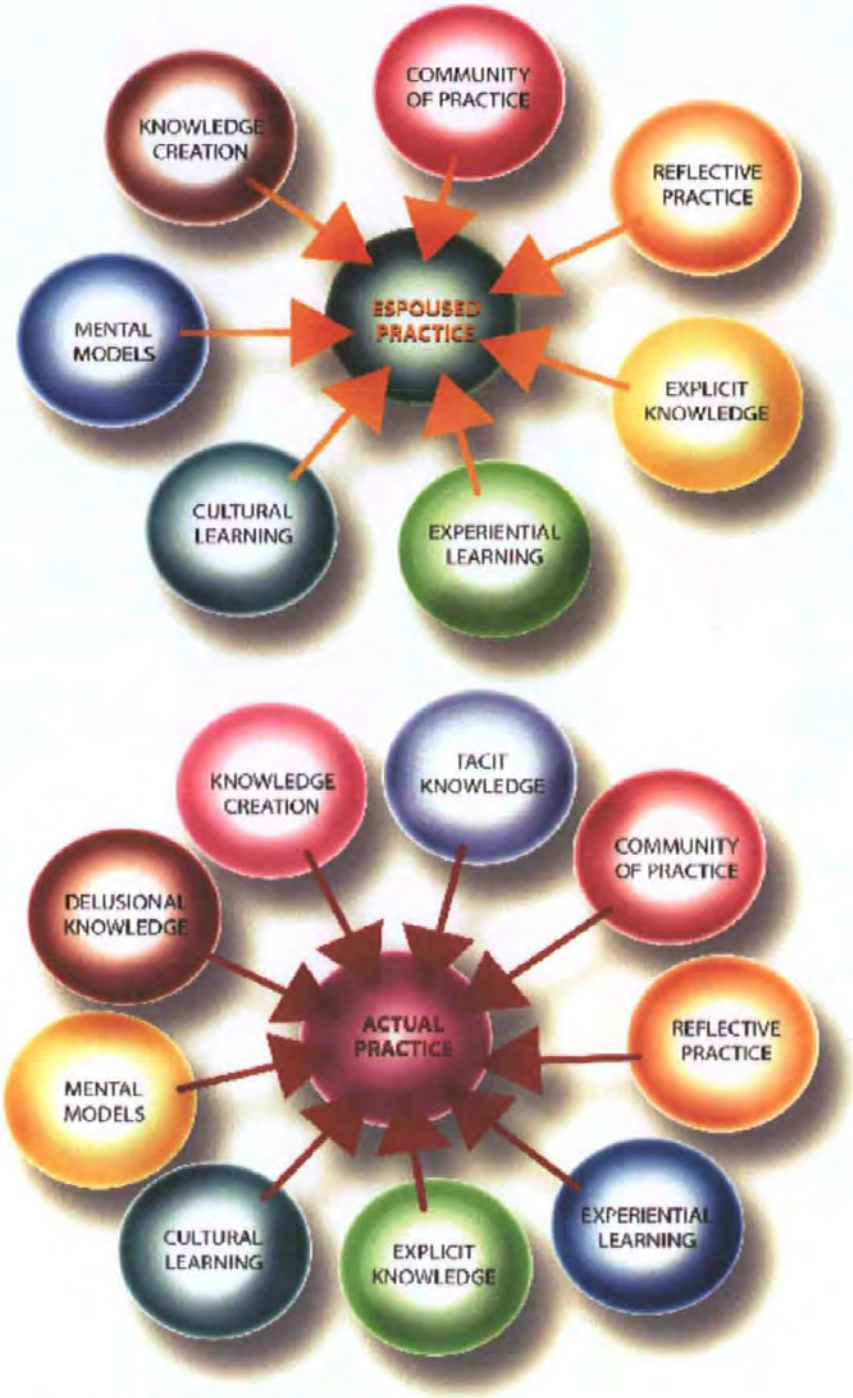


Figure 3. Research Model.

Espoused practice in infection control may be considered to be that which is based upon and complies with recognised good practice and sound microbiological theory. The model presented above indicates how espoused practice may be influenced and underpinned by a variety of knowledge sources. Actual practice in infection control as presented in the model

above (Figure 3.) may be influenced by similar knowledge sources. However, the presence of delusional knowledge that is tacit in nature and based upon strongly held, persistent and readily mediated false beliefs contributes to actual practice and its divergence from espoused practice.

By replacing delusional knowledge with knowledge that complies with recognised good infection control practice and theory, and exploiting the means by which delusional knowledge is learnt and transmitted tacitly, the gap between espoused and actual infection control practice may be closed.

Summary

This chapter has presented evidence to suggest that a division between espoused and actual infection control practice exists. Some idea of the scale and the implications of this division are provided by the financial costs and rates of infection found by Plowman et al (1999) and the Public Health Laboratory Service (PHLS 1995). In reviewing previous chapters, influences, assumptions and learning theories that may have contributed to the division and are fundamental to the research model have been identified.

The research model presented focuses upon the role of learning theory as a means of gaining a better understanding of the division between espoused and actual infection control practice and the utility of learning theory as a means of bringing actual practice closer to espoused practice based upon established infection control guidance and sound microbiological theory. Based upon this model, the research intends to empirically investigate how closely local

infection control practice reflects that portrayed in the literature, whether this supports the notion of a division between espoused and actual practice, and if so what knowledge and learning underpins this division. The research will also aim to investigate, and develop upon existing resources, relationships or structures that may be used to enable the creation and application of knowledge with the intention of reducing any gap between espoused and actual practice in infection control.

The design and methods used to implement this investigation are given in the following chapters.

Chapter 4

Methods

This chapter aims to provide a discussion of topics considered in developing the methods to be used in the proposed research project. The chapter will begin by discussing the nature of the research, its design and philosophy, followed by an examination of the specific areas of enquiry of the proposed research. The chapter will also include an overview of research methods available for use in the proposed research project, this aims to indicate the methods and philosophical notions considered before suggesting and arguing in favour of the proposed research methods.

The research model presented in the previous chapter focused upon the role of learning theory as a means of gaining a better understanding of the division between espoused and actual infection control practice. The research model also discussed the utility of learning theory as a means of bringing actual practice closer to espoused practice, based upon established infection control guidance and sound microbiological theory (Argyris and Schon 1996; Strange 1996; Badger 2000; Huzzard and Ostergren 2002). Consequently, the research methods used in the proposed research should aim to be congruent with this theoretical focus.

Easterby-Smith et al (2002) discuss three outcomes of research intended to develop theory, i.e. discovery, invention or perhaps appropriately in regard to the proposed research; reflection - where existing theory such as community of practice theory is re-examined or re-applied in a new or different context. Results of this re-examination and re-application may lead to change, development or modification of existing theory. The proposed research offers an opportunity for existing theory, such as knowledge creation or community of practice theory to be applied to a particular practical problem e.g. flawed infection control practice. It may

then be developed and modified within the context of infection control practice with the dual aims of development of theory, and providing some means of addressing the practical problem (Easterby-Smith et al 2002).

At this point it is worthwhile to further consider what constitutes theory and its relationship with research philosophy. Sommer and Sommer (1991 p4) describe theory as "logical constructions that explain natural phenomena" which are "supported by or refuted by empirical findings". Another definition of theory is supplied by Strauss and Corbin (1998 p168) who find that theories are "plausible relationships proposed among concepts and sets of concepts". It is interesting that the definition of Sommer and Sommer (1991) leans towards a more positivist philosophy with its reliance upon measurable, empirical findings. On the other hand Strauss and Corbin (1998) lean towards a more phenomenological viewpoint with their suggestion that theory can be constructed from convincing associations between concepts, ideas and notions. These definitions indicate that individuals' understanding of valid theory may be dependent upon their own research philosophy and that from which the theory was derived (Hughes 1990). Hughes (1990) goes on to argue that not only are individuals and theories influenced by their research philosophy, but that all research methods are similarly committed to a view of the world and how it is known, for example through positivist or phenomenological philosophies.

Those that embrace a positivist research philosophy assume that the social world is external, measurable only through objective means, and that knowledge, reality and theory is only significant when based upon objective observation of this external social world (Hughes 1990; Clark 1998; Easterby-Smith et al 2002). Payne (1997) argues that much early nursing research adhered to a positivist philosophy, often in an attempt to gain credibility in the eyes

of more established academic fields that leant heavily on positivism, such as the natural sciences and medicine. Clark (1998) agrees with the argument of Payne (1997) but goes on to argue that while positivist philosophical concepts may have been used historically in nursing, they have also been criticised and subsequently been found to be incompatible with some areas of healthcare and nursing research. An example of such criticism finds that positivism is reductionist in its pursuit of objective knowledge through the application of mechanistic, universal rules that do not lend themselves to achieving an understanding of the experiences of individuals (Hughes 1990; Clark 1998).

Positivism has also been claimed to be an inappropriate philosophical approach to research intent on developing an understanding of the attitudes, beliefs and interpretations of the person (Hughes 1990; Clark 1998; Denzin and Lincoln1998; Easterby-Smith et al 2002).

For example DeVaus (1996 p6), describes an "experimental model" based upon a positivist philosophy in which a researcher takes a group of patients, provides a treatment to the group such as a new antibiotic regime then measures its effectiveness through a combination of questionnaires, use of control groups and statistical analysis. This model may be highly successful in demonstrating the efficacy of the new treatment, but may provide little or no information on the experiences, values and beliefs of the group of patients receiving the treatment. The experimental model outlined by DeVaus (1996) would reveal little about the ability of patients to tolerate the treatment, the value they attach to its therapeutic effect, their belief in the need to continue to take the new treatment despite any side effects, or needs for social support to enable them to comply with the treatment. Similar issues to those outlined above are found in Chan and Iseman's (2002) review of current medical treatment for

tuberculosis and arguably highlight some of the strengths, weaknesses and criticisms made of positivism (Hughes 1990; Clark 1998; Denzin and Lincoln1998; Easterby-Smith et al 2002).

The criticisms of positivism outlined above should not necessarily lead to the conclusion that there is no role for a positivist philosophy in healthcare research or in this proposed research project. DeVaus (1996) and Strauss and Corbin (1998) both look to draw attention to the strengths of a positivist philosophy, particularly in regard to enabling quantification of the efficacy of a new form of treatment, drug or other form of intervention. As discussed in chapter three, the proposed research aims to demonstrate and critically examine the utility of learning theories in infection control practice. Consequently, it could be concluded that some form of empirical study and educational intervention in practice may be needed to enable this demonstration and critical examination, and that this may in turn lend itself to a positivist research philosophy. On the other hand, empirical research need not develop solely from a positivist philosophy, and alternatives such as phenomenology might also be considered (Clark 1998).

Phenomenology has been described as a philosophy in which reality is subjective; it is socially constructed, interpreted and given meaning by people. Individuals' actions are guided by their beliefs, experiences, and understandings of their circumstances and not solely as a response to "external stimuli" (Easterby-Smith et al 2002 p30). Consequently, the social world is not external and objective as contended by positivism but is instead subjective, open to interpretation and qualitative analysis (Hughes 1990).

Qualitative research has been described as research which produces results without the aid of quantification or statistical analyses (Strauss and Corbin 1998). Instead it provides an

interpretative analysis which can refer to people's lives, experience, behaviour, beliefs, organisational function and cultural phenomena. This non statistical analysis and interpretation allows the discovery of concepts and relationships within the data which can then be organised into a scheme of explanation and theory (Strauss and Corbin 1998). Informed by a phenomenological philosophy, qualitative researchers strive to interpret and understand the socially constructed realities of the participants in research and develop theory from that understanding (Glesne 1999). Easterby-Smith et al (2002) summarise the strengths of phenomenology and qualitative study, finding that it has the ability to view how change progresses, to understand meanings, to adapt to emerging new issues and ideas and contribute to the development of theory. This paradigm appears to sit well with the definition of theory supplied by Strauss and Corbin (1998 p168) who find that theories are "plausible relationships proposed among concepts and sets of concepts".

In regard to data gathering in qualitative research, Easterby-Smith et al (2002) argue that it is carried out in a natural rather than artificial way. This is supported by Payne (1997 p105) who describes a "naturalistic" paradigm in which the social world is studied in as "natural state as possible" with data gathered being a representation of that world or reality, this data can then be qualitatively analysed and used to generate theory. Clark (1998) continues this argument finding that qualitative research carried out for example in the "naturalistic paradigm" described by Payne (1997 p105) may employ diverse, yet valid research methods and data sources. Empirical research carried out within such a natural and representative environment may have a lower risk of producing data that may be based upon some "systematic and culpable error" or bias (Lowe 1993; Hammersley 2000 p164).

Based on the evidence presented above it follows that some form of qualitative and phenomenological method and philosophy is suited to the proposed research. The research aims to develop theory; the participant groups may well be small, small enough to allow some form of data gathering exercise to take place within their "natural environment". Developing an understanding of the participants' experience, behaviour, beliefs, and organisational function will provide data upon which an interpretative analysis could be based which would in turn inform theory development. However, this ignores the potentially valuable role that research methods based upon a positivist philosophy may have in enabling quantification of the effectiveness of some new form of educational intervention in practice as suggested in the previous research model. Consequently, a combination of research methods, rooted in their own research philosophies, may be utilized in the proposed research.

Such a pluralist approach is supported by the literature that rejects as an appropriate research paradigm, the notion of a single philosophical view and the use of methods embedded within that philosophy (Hughes 1990; Watson 1997; Clark 1998; Easterby-Smith et al 2002). Watson (1997 p5) argues that adopting a polarising "either/or" approach and restricting a research project to a particular research philosophy is unnatural and "stultifying". On the other hand, a pluralist approach accepts, balances and draws upon strengths, weaknesses and tensions provided by methods drawn from differing research philosophies which leads to a more complete understanding of the phenomena under investigation (Watson 1997). In his discussion of post-positivism, Clark (1998) recognises that data should not be excluded on the grounds of the research philosophy from which it is derived, finding instead that triangulation of data obtained through qualitative and quantitative methods based upon positivist and phenomenological philosophies can make a valuable contribution to the development of knowledge and subsequent theory. This form of triangulation of data is also supported

elsewhere in the literature (Jick 1979; Hammersley and Atkinson 1989; Easterby-Smith et al 2002).

There is much in the literature to support of the use of multiple, combined and eclectic research methods as an attempt provide more reliable data, counter threats to the validity of single source data and allow more confidence in the results of the research (Sommer and Sommer 1991; Atkinson and Hammersley 1998; Glesne 1999; Easterby-Smith et al 2002). Crano (1981) argues that the need for triangulation stems from the inability of any single measure to provide a complete and flawless picture of the phenomenon under investigation. However, the judicious choice and adoption of differing, and acknowledged to be imperfect, individual measures may well collectively contribute to a clearer understanding of the phenomena being investigated (Jick 1979; Crano 1981).

Jick (1979) outlines a study in which over a period of several months data were collected using a variety of methods including interviews, observation of participants and the use of unobtrusive measures – in this case the observation of research participants accessing material from their employers library archive. Quantitative data obtained from the observation of archive use was compared with and supplemented the qualitative data obtained from the other methods used. Collectively the results achieved by the varying methods used were largely "consistent and convergent" and allowed for greater confidence in interpretations (Jick 1979 p 607).

The evidence arguing in favour of a pluralist approach and the model outlined above could be used to inform the research philosophy and methods to be used in this proposed research. For example, qualitative methods such as interviews and observation of participants might be used

to gain an understanding of their views, attitudes and beliefs in regard to their infection control knowledge and any educational intervention carried out in their area of practice. To supplement these methods, some form of unobtrusive measure that provides a quantitative assessment of participants' infection control practice could offer a means of triangulation and subsequently increasing confidence in the results obtained and interpretations made (Jick 1979; Sommer and Sommer 1991; Atkinson and Hammersley 1998; Glesne 1999; Easterby-Smith et al 2002). A pluralist research strategy that adopts research methods associated with both positivist and phenomenological research philosophies may well be appropriate for the proposed research. However, before any conclusion over research philosophy and methods to be employed is made, specific goals of the research and methods that might be employed to achieve them should be further considered.

Previous chapters have argued that examples of poor infection control practice are not difficult to find within hospitals in the United Kingdom. This poor practice has contributed to an increasing incidence of HCAI that has been estimated to cost the NHS around a billion pounds annually (Plowman et al 1999; D.O.H 2002; D.O.H 2003; N.A.O 2004). It could be suggested that before any local intervention is carried out with the intention of improving infection control practice, some form of local investigation, for example within a particular ward or department, should be carried out intending to establish whether local practices accurately reflect the picture portrayed within the literature. If local infection control practices were found to be unusually good then clearly this might make further improvement difficult and hinder accurate evaluation of any subsequent intervention. Similarly, if local infection control practices were found to be particularly poor, then this too might impede accurate evaluation of any subsequent intervention and may also present ethical considerations for the researcher. Establishing that the infection control practices of a prospective local site or sites for any

intervention are typical of the picture portrayed in the literature will arguably allow for a more confident claim that data obtained will be from the kind of representative and natural environment described by Payne (1997) and Easterby-Smith et al (2002).

Other arguments have also been presented previously, for example, that infection control practice may be a reflection of the teaching and learning of infection control knowledge. Evidence has been presented which indicates that much infection control education provided by infection control teams is based upon the delivery of explicit knowledge, presented in formal, classroom teaching settings and is underpinned by an assumption that teaching equals learning (Gould 1996; Desai et al 2000). Evidence has also been presented which suggests that infection control education might also occur without the explicit involvement of the infection control team. Instead, it has been argued that knowledge of infection control may be gained informally for example via the kind of cultural learning described by Schein (1989). Furthermore, it has been argued that this knowledge, gained informally and lacking direction from the infection control team, may not be based upon sound microbiological and infection control theory (Mandell 2000) and may in turn reinforce poor practice.

The differing sources of infection control knowledge outlined above may well have contributed to the development of a disparity between healthcare workers espoused and actual practice. It has been argued that a division between explicit knowledge gained in the classroom and tacit knowledge learned in practice may lead to individuals developing two contradictory theories and modes of practice (Strange 1996). Huzzard and Ostergren (2002) argue that espoused practice may be based upon the kind of explicit learning and teaching carried out with the involvement of the infection control team (Gould 1996; Desai et al 2000), whilst actual practice may be based upon the kind of cultural, tacit learning in practice

described by Schein (1989). Evidence of a gap between espoused and actual practice in infection control is found in the literature and is arguably exposed by the failure of healthcare workers to employ in clinical practice basic, well known and well established infection control precautions such as handwashing and aseptic technique (Yentis 1993; Larson and Kretzer 1995; Pittet et al 2000).

Many causes for the failure to employ infection control precautions have been suggested in the literature. Suggested causes include fear of infection, cultural and social influences, ethnic backgrounds, religious beliefs, lacking knowledge or simply forgetting that precautions are required (Larson and Kretzer 1995; MacQueen 1995; Soule and Huskins 1997; Valimaki et al 1998; Sadala 1999). It has also been suggested in the previous research model that delusional knowledge i.e. strongly but falsely held values and beliefs, based upon deficient information that may be divergent from valid and established microbiological and infection control guidance, may also contribute to the division between espoused and actual practice (Long and Newton 1997; Barker et al 1997; Durrance 1998; Collier et al 1999; Georgaca 2000).

It could be argued then that before any educational intervention is carried out intending to develop theory and improve infection control practice, some further local investigation of any theory – practice gap (Badger 2000), and the possible causes of it should be carried out. This investigation may well reveal valuable evidence of the sources of knowledge employed in practice and how these sources might be further developed and exploited by any subsequent educational intervention. For example, such sources of knowledge employed in practice may include the existing multi-disciplinary teams and communities found in hospital wards and departments (Bleakley 2002). Bleakley (2002) claims that these communities and teams already demonstrate many of the qualities of the communities of practice described by Wenger

and Snyder (2000) and consequently could be further developed and exploited as knowledge sources in practice.

In summary then it could be claimed that before any educational intervention is carried out, some form of "baseline observation" should be carried out with three clear intentions. Firstly, discovering whether local infection practice reflects the picture portrayed by the literature and whether any proposed sites for any future intervention are representative of this picture. Secondly, determining what influence existing knowledge and learning may have on infection control practice and whether this has contributed to any theory – practice gap. Thirdly, gathering information on any existing knowledge resources, relationships or organisational links that may be further developed during any subsequent educational intervention. Information gained from this baseline observation may then be used in conjunction with knowledge gained from the literature to guide and inform any subsequent educational intervention in practice.

However, at this point it may be worth sounding a note of caution. The investigation and baseline observation advocated above would be required to continue for some period of time to allow some confidence in the accuracy of its observation and the evidence gained from it. During this unspecified period of time it may well be possible for research participants to develop some level of awareness of the aims of the research and possibly of the intentions of any subsequent educational intervention. For example, if a researcher was to spend a period of weeks or months investigating the sources of infection control knowledge, its application in practice and how it is valued or believed in by a group of healthcare workers on a particular ward, then it may not be unreasonable to conclude that the group of healthcare workers will themselves eventually develop some knowledge of the aims of the research and any

subsequent intervention. To counter this, the researcher may choose to attempt to disguise the true aims of his or her research but this would arguably create further ethical issues that would need to be resolved. Participants in the baseline observation, as a result of them developing the kind of awareness described above, may be at risk of altering their behaviour according to this new awareness and knowledge and creating a research environment that may no longer be natural and representative as advocated by Payne (1997) and Easterby-Smith et al (2002). This could in turn lead to the kind of "systematic error" and some consequent bias of the data obtained (Lowe 1993; Hammersley 2000 p164).

This could clearly have implications for the evaluation of any subsequent intervention that might be seen to be based upon erroneous or flawed evidence. It could therefore be concluded that to reduce this risk, the proposed research should take place in two phases. Firstly, a baseline observation phase and secondly an educational intervention phase located in two separate but similarly representative sites. Separating the proposed research into two discrete phases will allow for the second phase to take place in a site where the risk of participants altering their behaviour on the basis of knowledge gained from the previous phase has been reduced, and yet allows the second phase to be informed and guided by evidence gained from the first phase and theoretical knowledge gained from the literature. However, it could also be concluded that some further consideration of possible research methods to be used in both phase one and phase two should be carried out. This chapter will now provide some descriptive overview of research methods available and considered for use in the proposed research project, beginning with some discussion of qualitative methods such as grounded theory.

Strauss and Corbin (1998 p12) view grounded theory as the science and art of analysis and define it as "theory derived from data, systematically gathered and analysed through the research process". They go on to argue that grounded theory allows theory to emerge from the data, that this theory is likely to closely resemble "reality", and that it can also offer insight, understanding and a guide to action while encouraging creative thinking. In their description of the analytical techniques used in grounded theory Strauss and Corbin (1998) discuss how the creative and imaginative use of data coding and constant comparative analysis of data contributes to theory building, provides analytical tools, a systematic approach and helps to consider alternative meanings of phenomena. This imaginative use of coding can be further enhanced by the use of "theoretical sensitivity" i.e. the use of professional knowledge and personal and professional experience (Strauss and Corbin 1998 p173). However, some caution should be exercised in relation to the use of theoretical sensitivity. In grounded theory, emergence is the cornerstone of theory building, and prudent researchers should steer clear of any pre-conceived ideas or frameworks when beginning an investigation, allowing concepts and theory to freely emerge from the data (Strauss and Corbin 1998).

Data sources that lend themselves to grounded theory analysis include interviews, observation, and perhaps opportunely in view of this proposed research project, qualitative and quantitative data may be combined in some way (Strauss and Corbin 1998). Arguably, grounded theory could be an appropriate method to use in both phases of the proposed research. One of the claimed strengths of grounded theory is theory development, which is one of the primary aims of the research (Strauss and Corbin 1998). Grounded theory could be used to gather and analyse data from the anticipated small participant groups based on individual hospital wards or departments using for example interviews and observation.

A means of analysing data obtained from grounded theory is described by Burnard (1991). Burnard (1991 p461) offers a method of "thematic content analysis" developed from methods of analysis described in the literature on grounded theory and other sources of qualitative data. The aim of this analysis is the production of a thorough, methodical and informative picture of the themes, topics and matters raised by the data which can in turn be used to inform theory development. The validity of this picture may be checked through subsequent peer review of the data and its analysis, or by follow up consultation with research participants (Burnard 1991). This form of analysis would lend itself to use in the proposed research with its aims of critically examining and demonstrating the utility of learning theories in infection control education and practice, whilst also attempting to make some contribution to organisational learning theory. Such a method of thematic analysis may also be used to examine the data obtained from other qualitative methods such as ethnography.

Atkinson and Hammersly (1998) find that in ethnographic research, emphasis is placed on the investigation of the nature of social phenomena. The data used is often unstructured, derived from small sample groups and its analysis is interpretative of meanings, beliefs, attitudes and actions (Goldbart and Hustler 2005). In ethnographic research, the ethnographer spends time taking part in the daily lives of the participants; watching, listening and questioning in order to obtain data on the issues that are of concern, through this process an understanding of values and beliefs that shape social behaviour may be gained (Hammersley and Atkinson 1989). Rosenblatt (1981) similarly finds that through extended periods of contact, the ethnographer may be enabled to develop understandings that could not have been achieved in the short term. Interestingly, Rosenblatt (1981) goes on to argue that through this type of extended contact, some baseline observation, akin to that advocated in the first phase of the proposed research

may be achieved and subsequently enable the research to perceive changes and the effects of any ensuing intervention or event.

In addition to achieving this form of baseline observation, ethnographic investigation has also been found to be of significant value in developing theory through its ability to accurately reveal the attitudes and beliefs of participants and so confront misconceptions and preconceptions held by the researcher (Hammersley and Atkinson 1989; Goldbart and Hustler 2005). This provides some counter to the risk of a research project being influenced by preconceptions based upon the kind of theoretical sensitivity advocated in grounded theory (Strauss and Corbin 1998).

Through extensive first hand contact and involvement with participants in their working practice, the ethnographic researcher is able to iteratively test and gain confidence in his or her understanding of the studied phenomena, thus providing a rich and illuminating source of knowledge upon which theory may be developed (Hammersley and Atkinson 1989; Goldbart and Hustler 2005). This form of theoretical development may also be supported and informed by other sources of data. Hammersley and Atkinson (1989 p23) are critical of research that relies on a "single study model" and regard the use of multiple data sources such as interviews and participant observation as a strength of ethnography. This multi source character of ethnography lends itself to triangulation with various data sets obtained from a variety of methods which in turn allow for more confidence in understandings gained, interpretations made and subsequent theory developed (Jick 1979; Rosenblatt 1981; Hammersley and Atkinson 1989; Easterby-Smith et al 2002).

Glesne (1999) develops upon the arguments of Atkinson and Hammersly (1998) and contrasts traditional and critical ethnography. Glesne (1999) finds that while traditional ethnography aims to interpret and describe the experience and perspectives of research participants, critical ethnography aims to involve the participants as co-researchers in a combination of investigation, education and action. In this way the research process itself becomes an educational endeavour which in turn may lead to collective action and change in practice. Again in contrast to traditional ethnography, critical ethnographers make their values explicit; research may be politically motivated and challenge existing value systems. Such challenging of values could well be seen as being a desirable feature of ethnographic methods in view of the negative findings of Feather et al (2000) regarding the attitudes and beliefs of healthcare staff in relation to infection control.

The discussion of critical ethnography is further developed by feminist ethnographers in their discussion of issues of race, gender, class, culture and ethnicity (Glesne 1999). It can be argued that issues such as these must be considered within the proposed research, as they may possibly have influence over the behaviour, beliefs and attitudes of both the research participants and the ethnographic researcher (Glesne 1999; Goldbart and Hustler 2005). For example, in the case of the proposed research, the primary researcher will be a white, male, former infection control nurse. It may be unreasonable to assume that whilst carrying out the proposed research this individual will be able to entirely divorce himself from any biases or prejudices he or the research participants may have, or dissociate himself from any influence he may have on the research participants or vice versa as a result of pre-existing knowledge, background or simple presence. Consequently, caution should be taken to consider these potential sources of bias and influence, and actions taken if needed to reduce their potential impact. Notwithstanding the need for caution as expressed above, ethnographic research has a

history of successful use in healthcare research as a means of investigating organisational and cultural influences upon service delivery, exploring the perceptions of healthcare workers and patients, or studying the impact of healthcare interventions (Goldbart and Hustler 2005).

Some form of ethnographic investigation might be considered appropriate for this research. For example, in the proposed first phase, an ethnographic approach could be used which involves the participants as co-researchers in achieving the baseline observation discussed previously. In the proposed second phase, participants and the researcher could continue to be involved in a combination of investigation, educational intervention and action explicitly targeting areas of infection control practice with the clear intention of developing and applying some form of organisational learning theory. This application of theory is likely to represent some kind of educational endeavour for the research participants, for example through the recruitment of participants as opinion leaders as a means of developing a clinical environment in which they are able to guide the learning agenda and assist in the development, creation and application of infection control knowledge (Nonaka et al 2000; Wenger 2000; Driver 2002). However, it should be remembered none the less that healthcare staff participating in the research may already have a demanding workload and may not be willing or able to become the type of co-researchers described by Glesne (1999). Any research methods that could be perceived by the research participants as too challenging might be a disincentive to take part in the research, to its subsequent detriment.

Ethnographic methods offer not only the opportunity of gaining knowledge of the existing beliefs and values held by participants, but also to observe and record any changes in those beliefs and values during the course of any attempted educational intervention. Subsequent actions in practice based upon these changed attitudes, beliefs and values may also be

observed and recorded. Knowledge gained from this process could then be used to inform and develop theory. Both phase one and phase two of the proposed research lend themselves to the employment of ethnographic methods. In both phases, data could be obtained through a combination of interviews and observation of participants in practice. This data could then be analysed using the method of "thematic content analysis" previously described (Burnard 1991 p461) as a means of informing and developing theory. To increase confidence in the understandings gained from the analysis of this ethnographic data, it could then be combined, compared and triangulated with data derived from other sources (Jick 1979; Rosenblatt 1981; Hammersley and Atkinson 1989; Easterby-Smith et al 2002). Other possible methods and data sources that could be considered for use in such a combination will now be discussed.

Action research has been described as a research method which is aimed at having a direct impact on the field being investigated (Easterby –Smith et al 2002). Glesne (1999) agrees with this description, contending that the essential intent of action research is to cause change and provide solutions to problems. Glesne (1999) also argues that action research is derived from the positivist paradigm and works within cycles of discovery, intervention and evaluation. Data may be gathered using qualitative or quantitative methods and its analysis may take the form of discussion amongst participants and stakeholders (Glesne 1999). On the face of it, this research method may not seem to be primarily focussed on the development of theory. This point appears to be supported by examples of action research carried out within healthcare that aim to identify problems and provide practical solutions for them, whilst making only limited efforts at discussing or generating theory (Bennett 1998; Baillie 1999; Badger 2000; Bate 2000; Coghlan and Casey 2001). This argument is supported by Bate (2000) who finds no distinct role for theorising within action research. However, Sommer and Sommer (1991 p7) find that action research may provide a simultaneous contribution to theory

and practice, for example through experimental work that can be revised and evaluated before being implemented into a "natural environment".

In regard to the proposed research, particularly the second phase in which some form of educational intervention study may occur, action research arguably has an appeal with its intent to change practice and solve problems. However, at this point it may be worthwhile attempting to indicate where the proposed educational intervention may differ from an example of an action research project. If the essential intent of the proposed research was the improvement of practice, then action research as a research method would have to be considered as an appropriate means of achieving this. However, the proposed research with its educational intervention also seeks to build and develop theory. A criticism that could be made of action research is that theory building is not its primary intent. Any theory generated may be as a result of the evaluation, revision and implementation of the experimental work of Sommer and Sommer (1991) or the potentially time consuming analysis of participant/stakeholder discussion data described by (Glesne 1999). This may not be a reasonable expectation of the participants in the proposed research, with their demanding pre-existing clinical workloads. It could also be argued that this method of data analysis might be seen to lack the rigour of other research methods such as grounded theory with its emergence of theory from systematically gathered and analysed data (Strauss and Corbin 1998 p12) or the "thematic content analysis" of Burnard (1991 p461). Consequently, the proposed research and its educational intervention whilst informed and guided by action research in regard to its ability to have an impact on practice and provide solutions to problems, may also need to investigate and incorporate other research methods to provide an appropriate means of informing the development of theory that will avoid or reduce the risk of having an adverse impact on participants workload to the potential overall detriment of the research.

Moving further away from a positivist philosophy leads to the post modernist approach to research. Williams and May (1996) find the beginnings of postmodernism in the work of Nietzche and his argument that the world is viewed and interpreted through differing but equally valid ideas and beliefs. Whilst post modernism may be seen to be rooted in cultural pursuits, for example art and dance, it could also be seen as a means of criticising aims, values, and philosophic and scientific analyses that have traditionally been considered valid. As a result of this criticism it has been suggested that post modernism has provided a way of "pulling the rug from under the feet of traditional scientific foundations" (Williams and May 1996 p158).

An example of a research project based upon a post modernist philosophy is described by Usher (1997). The project involved curriculae in a womens' study course. Conventional methods were used e.g. data gathering from interviews. The project researcher specified seven research aims, none of these were intended to measure or quantify a phenomenon or attitude. Neither did any of these research aims intend to develop theory or test hypotheses. The researcher's aims were to "create a space" for those not normally heard, move outside of conventional tests and scientific research, generally to create, move, question, challenge and explore various aspects of the population studied. Data was analysed and presented using four narrative tales each of which presented a different perspective on the data.

It is very difficult to see how a post modernist method such as that described above could be successfully used within the proposed research. The methods described above, because of their deliberate intention to move outside of convention and scientific research do not lend themselves to a project that intends to develop theory and improve clinical practice. The proposed research should aim to produce evidence that may be understood and subsequently

valued by clinical staff involved in infection control practice. These clinical staff may be drawn from the medical, nursing or other healthcare professions that may favour a positivist philosophy (Payne 1997). For the proposed research to be completed successfully it will need to recruit and retain clinical staff as participants. It is debatable whether some clinical staff would be willing to take part in or be convinced by the results and any theory generated by the sort of post modernist model described above. If it is accepted that the proposed research should aim to produce evidence that may be understood and subsequently valued by clinical staff that may favour a positivist philosophy, then the use of some form of quantitative, positivist methods and data sources should also be considered.

It has already been suggested that participant groups to be employed in both phases of the proposed research are likely to be small. However, it may be possible to monitor and obtain some quantitative measure of infection control practices demonstrated in both phase one and phase two of the proposed research. This may be achieved for example by observation and recording of infection control practice during critical incidents e.g. handwashing, aseptic technique or disposal of clinical waste (Kemppainen 2000; Urquhart et al 2003). This form of observation and recording could be carried out as part of the baseline observation of phase one of the proposed research, and also as a means of revealing any changes in practice during or subsequent to the educational intervention of phase two. Many examples of critical incidents such as handwashing, carrying out of aseptic technique or disposal of clinical waste are likely to take place during a typical working day on a hospital ward or department, and when observed and recorded over a period of time they may make up a substantial "sample group" which could lend itself to some form of quantification and analysis.

The use of critical incident monitoring in healthcare research is well reported in the literature (Kemppainen 2000; Urquhart et al 2003), where it has been described as an adaptable research method that has been used to investigate various areas of clinical practice (Kemppainen 2000). An incident that might be considered critical could be described as an event in which behaviour exhibited is crucial and determines outcomes (Kemppainen 2000). For example handwashing could be seen as a crucial infection control precaution and its practice may determine the risk of transmission of infection. Data gathering methods reflect the flexibility of critical incident analysis and may include interviews or direct observation of discrete episodes of clinical practice (Kemppainen 2000; Urquhart et al 2003). Perhaps pertinently in regard to the proposed research, it has been argued that critical incident research methods may be readily combined with other research methods (Urquhart et al 2003).

Easterby-Smith et al (2002 p95) also describe a "critical incident technique", in which an observed activity that is complete enough to allow some form of deduction or prediction about the individual carrying out the activity can be used to tease out information from respondents, for example in conjunction with individual interviews. Easterby-Smith et al (2002 p132) also describe a quantitative use of observation i.e. "activity sampling". In this technique observations can be made of individuals at work, activities and processes are classified and recorded and may be analysed using some form of quantitative analysis.

Some form of critical incident analysis, based upon observation of discrete episodes of patient care relating to infection control may lend itself to the proposed research and readily allow data derived from it to be combined with that from other research methods. Through the use of critical incident monitoring and activity sampling such as that described above some understanding of local infection control practices and baseline observation might be achieved

in the first phase of the proposed research. This method could also be applied in the second phase of the proposed research to monitor any observed changes in infection control practice during the educational intervention. Incidents observed during both phases of the proposed research could be recorded, measured and used to inform follow up interviews or discussions with participants as advocated by Easterby-Smith et al (2002).

The critical incident analysis described above could be effective in obtaining some degree of quantification of critical incidents observed during both phases of the proposed research. This might allow for some comparison of practice with that described in the literature and before, during and after any educational intervention. Data obtained from the use of critical incident analysis and activity monitoring could be employed in a repertoire of quantitative methods in order to inform and develop theory.

Further quantitative data on the effectiveness of the educational intervention intended in phase two of the proposed research might be obtained through the use of a questionnaire survey. This questionnaire study could be distributed to participants of phase two of the proposed research before and after the implementation of the educational intervention with the intention of measuring any changes in attitudes, beliefs and knowledge during the intervention.

Strauss and Corbin (1998) suggest that quantitative methods such as surveys that make use of questionnaires may be used to develop and test hypotheses, for example, it could be hypothesized that some educational intervention in practice could effect a change in infection control knowledge and its application in practice. Glesne (1999) also agrees that quantitative methods can be used to test hypotheses and to look for measurable, causal explanations for the phenomena being researched and that through this process theory may emerge. It has already

been stated that the aims of the proposed research are to develop upon pre existing organisational learning theory and to demonstrate that through the application of this organisational learning theory, an improvement in infection control practice may be achieved. Consequently it could be suggested that a positivist, quantitative method such as the use of a questionnaire survey could be employed as an appropriate method for use in this proposed research project, and could provide a useful data source to combine and triangulate with data obtained from other qualitative and quantitative methods also employed (Jick 1979; Rosenblatt 1981; Hammersley and Atkinson 1989; Easterby-Smith et al 2002). However, before any commitment is made to the use of questionnaire surveys and the data they may reveal, arguably some consideration of the statistical analysis of this quantitative data is required.

It could be estimated that the total number of healthcare staff available to participate in either phase of the proposed research is unlikely to exceed fifty. There is evidence within the literature to suggest that small sample groups such as that which might be recruited in the proposed research may not be appropriate for use with some quantitative methods and that the results of research using small sample groups may not always provide an accurate representation of the population they represent (Glesne 1999; Sommer and Sommer 1991; Oppenheim 1992).

Easterby-Smith et al (2002) give an example of the sample size required to answer a simple yes/no question in a questionnaire with a standard error no greater than 5%. They estimate that the sample size needed to provide 95% accuracy when answering this question would be 96 individuals. This estimate does not allow for any non-response to the questionnaire which could be estimated at 50%. This estimate of course does not make any allowance for the need

to break the sample group down into smaller sub-sets. DeVaus (1996) recognises the need to break a sample group into sub-sets and suggests that as a "rule of thumb" the smallest sub-set should have between fifty and one hundred members when using quantitative methods and using conventional parametric statistical analyses. This argument is supported by Sommer and Sommer (1991) and by Hoinville and Jowell (1987) who argue that any sample group intended for use with quantitative research methods and parametric statistical analyses should be big enough to include sufficient numbers within the sub-sets and that the prime determinant of sample size is often the size required of the sub-sets. Hoinville and Jowell (1987) agree with DeVaus' (1996 p73) "rule of thumb" and also find that sub-sets should contain between fifty and one hundred members. Clearly, the proposed research is unlikely to recruit sample groups of the size advocated above. Consequently, in this case, the use of positivist, quantitative methods that rely on the use of parametric statistical analysis may not be appropriate. Nonetheless, such a suggestion does not take into consideration the contribution that non-parametric statistical methods might make to the proposed research.

Non-parametric statistical methods are designed for use when analysing small data sets derived from small population sample groups such as those that might be recruited to the proposed research (Lehmkuhl 1996; Sprent and Smeeton 2000). The employment of non-parametric statistics have been advocated as a robust means of identifying and measuring changing attitudes and relationships in behavioural research (Lehmkuhl 1996) and as such they offer some means of providing a positivist, quantitative component to the research. For example the Wilcoxon Signed Ranks Test is a non-parametric statistical test that may be used with small sample groups. This test may be used in circumstances when data is paired, e.g. data is obtained from individuals before and after they are exposed to some form of intervention and may indicate changes attributable to this intervention (Conover 1980). It

could be concluded then that in phase two of the research, some form of questionnaire survey which intends to investigate changing attitudes, beliefs and the application of knowledge amongst participants, with the data it reveals analysed using non - parametric statistical methods may provide a valuable source of evidence.

Further valuable evidence that may be used to support or disprove data gained from other qualitative and quantitative methods may also be obtained through the use of unobtrusive measures.

Examples of unobtrusive measures used in research are provided by Webb et al (1966). They discuss a study in which the quantity of food consumed on a hospital ward was measured not by observation and recording of food eaten by individuals on the ward, but by measuring the weight of food delivered to the ward and the weight of food waste removed from it. In another study, the popularity of museum exhibits was investigated not by inviting museum visitors to complete an interview or questionnaire, but by measuring the wear of floor tiles directly in front of the museum exhibits, thus indicating that the most popular exhibits were those adjacent to the most badly worn floor tiles (Webb et al 1966).

Unobtrusive measures gather data "by means that do not involve direct elicitation of information from research subjects" (Lee 2000 p1). Individuals are not aware that they are being observed or investigated thus reducing the risk of them altering their behaviour in response to any recognised acts of observation or investigation (Webb et al 1966). The use of unobtrusive measures e.g. data gained from the examination of records, archives or rates of consumption of materials allow the acquisition of information without identification or manipulation of research participants (Webb et al 1966). Unobtrusive measures are non

reactive, i.e. they avoid problems caused by the presence of a researcher, for example Hawthorne effects (Lee 2000). Unobtrusive measures report actual behaviour as opposed to that claimed by research participants, and when used in conjunction with other research methods allow much greater confidence in understandings gained and conclusions made (Webb et al 1966; Kellehear 1993; Lee 2000).

Unobtrusive measures are able to reveal something about the relationships between ideas, beliefs, attitudes and their expression through individuals' behaviour or the use of materials associated with that behaviour (Kellehear 1993). Lee (2000) supports this argument, finding that questions regarding individuals' attitudes and beliefs may be effectively addressed by observing their behaviour or investigating the physical evidence caused by such behaviour. Kellehear (1993) further argues that unobtrusive measures are ideal for observing changes in activities that occur over a period of time. Through such a process of observation, social correlations, for example the consumption of materials or use of equipment associated with a particular form of behaviour may be unobtrusively measured. This observation and measurement may in turn provide some indication over time of trends or changes in patterns of consumption of materials or use of equipment (Lee 2000).

Some disadvantages of unobtrusive measures as a research method can also be suggested (Kellehear 1993). Firstly, if research participants become aware of the unobtrusive measures being carried out then data obtained may be skewed by selective consumption or retention of materials. Secondly, the unobtrusive measures to be employed must be chosen with care to ensure that they will provide evidence characteristic of the true behaviour of the research participants. Thirdly, evidence gained from the use of unobtrusive measures may be at risk of distortion, for example the evidence gained from the unobtrusive measurement of equipment

or materials used in infection control practice on a hospital ward could be distorted by an outbreak of diarrhoea and vomiting amongst staff and patients on the ward. However, Kellehear (1993) argues that these potential disadvantages and risks to the validity of data obtained through unobtrusive measures can be minimised through the combination and triangulation of research methods and evidence gained.

The use of unobtrusive measures may be an appropriate research method to be employed in the second phase of the proposed research. The use and consumption of materials routinely used in infection control practice, for example soap or paper towels might be unobtrusively measured throughout the duration of the educational intervention intended in the second phase of the proposed research. Data gained from this observation could be compared to previous patterns of consumption within the site of the intervention and to other areas within the hospital in which the research is situated. This observation and comparison could reveal changes in the use of materials associated with infection control practice, which may in turn indicate changes in the actual rather than the claimed behaviour of research participants (Webb et al 1966; Kellehear 1993; Lee 2000). Evidence such as this when combined with that gained from other data gathering methods could provide an indication of any impact that might be caused by the educational intervention in the second phase of the proposed research. It could also be argued that the use of data gathered from unobtrusive measures could act to counter any risk of Hawthorne effects caused by the presence of the researcher during the educational intervention (Lee 2000).

This chapter has so far provided some discussion relating to the design, philosophy and specific areas of enquiry of the proposed research. It has also provided some overview of research methods available and considered for use in the proposed research project. Having

considered these options this chapter will now discuss the methods selected for use in carrying out the proposed research.

As suggested earlier in this chapter, the proposed research will adopt a pluralist philosophy and will use a combination of qualitative and quantitative measures as a means of triangulating evidence and so gaining greater confidence in interpretations and conclusions made (Jick 1979; Hammersley and Atkinson 1989; Easterby-Smith et al 2002). Also as suggested earlier, the proposed research will take place in two separate phases in two separate but similarly representative sites. The use of two separate sites will arguably help to retain research environments that are natural and representative as advocated by Payne (1997) and Easterby-Smith et al (2002). Thus reducing the risk of "systematic error" and consequent bias of data obtained (Lowe 1993; Hammersley 2000 p164).

Initial investigation has indicated that two renal units based in two separate district general hospitals will be willing to be the sites of the first and second phases of the proposed research. These renal units lend themselves to the proposed research as they both contain relatively stable population groups of both staff and patients that will allow continuity of data gathering. The nature of the work carried out within the renal units' exposes staff, patients and visitors to infection risk and in managing this risk staff are required to demonstrate their infection control knowledge. Finally the researcher was an infection control nurse and has previous experience of working on a renal unit which might help in developing a working relationship with the staff of the two renal units'.

The first phase of the research will aim to gain a better understanding of local infection control practices and how closely they reflect the picture described in the literature. The first phase of

the research will also aim to reveal any division between espoused and actual infection control practice and begin to investigate the utility of learning theory as a means of closing this division.

The first phase of the proposed research will employ a primarily ethnographic approach (Goldbart and Hustler 2005); however some quantitative data will also be obtained and used to inform further qualitative analysis. For example the observation, quantification and recording of "critical incidents" in infection control, such as handwashing or aseptic technique may be used as a means of comparing local infection control practice to that described in the literature and may also be used to prompt further ethnographic enquiry with participants, for example through observation and discussion in practice or through individual interviews with participants (Easterby-Smith et al 2002).

Data gathering in the first phase of the research will continue for a six month period, with the researcher visiting the ward or department on at least a weekly basis and spending time on the renal unit observing, questioning and participating in the daily working lives of the research participants. Through this extended period of contact, some understanding and interpretation of the attitudes, beliefs and values that shape the behaviour of the research participants may be gained (Jick 1979; Rosenblatt1981; Hammersley and Atkinson 1989; Goldbart and Hustler 2005). All staff involved in "hands on" patient care on the ward or department will be offered the opportunity to take part in the research. Only those that give their consent to take part will be recruited as participants in the research, and only with their permission will observations and interviews be recorded and later transcribed. Information gained from observation and interviews will be kept securely and be treated with strict anonymity and confidentiality. Observation notes and interview recordings will be transcribed into text held on a password-

protected computer. Observation notes, interview recordings and typed transcripts will not contain participants' names. Transcribed notes and interview recordings will be analysed using a qualitative data analysis software package i.e. MAX-qda.

Data gained from this ethnographic approach will be analysed using Burnard's (1991 p461) method of "thematic content analysis". This analysis will aim to produce a thorough, methodical and informative picture of the themes raised by the data which may then be used in combination with knowledge gained from the literature to inform the second phase of the research and further theory development.

The second phase of the proposed research will be sited in a second renal unit within another district general hospital. The second phase will differ from the first phase in that it will be designed as an educational intervention in practice, informed and guided by the knowledge and evidence gained from the literature and the first phase of the proposed research. This second phase educational intervention will be underpinned by, and employ organisational learning theory as a means of improving the acquisition and application of infection control knowledge in practice. Once again all staff involved in "hands on" patient care on the renal unit will be offered the opportunity to consent to take part in the research. The process of gaining participants consent, obtaining, recording, transcribing and analysing ethnographic data used in the first phase of the research will generally be followed in the second phase.

Data gathering in the second phase of the research will also continue for a six month period, with the researcher spending similar amounts of time on the second renal unit as in the first phase of the research. Data will again be gathered using a combination of qualitative and quantitative measures.

Firstly, an attitude survey/questionnaire based upon a Likert scale will be undertaken at the beginning and at the end of the six month educational intervention. The use of surveys such as this have been advocated in the literature as a means of quantifying the impact of some new form of intervention (DeVaus 1996; Strauss and Corbin 1998) and may reveal useful data on any changes in attitudes, beliefs and knowledge amongst participants subsequent to the educational intervention. The population group likely to take part in this pre/post educational intervention survey is likely to be small, renal units may typically be staffed by only around 40-50 clinical staff providing "hands on" patient care. Consequently, non-parametric statistical methods, designed for use when analysing small data sets derived from small population groups will be an appropriate method of analysing the statistical data obtained from this attitude survey/questionnaire (Lehmkuhl 1996; Sprent and Smeeton 2000).

Secondly, an ethnographic, participant observation and interview component will be used with the aim of obtaining some understanding of the attitudes and beliefs of research participants (Hammersley and Atkinson 1989; Goldbart and Hustler 2005). This ethnographic component may be an effective means of detecting any changes in participants' attitudes, beliefs, knowledge and its application in practice during the educational intervention.

Thirdly, unobtrusive measures will be used to quantify the use of materials consumed during practice related to infection control e.g. liquid soaps, latex gloves, and plastic aprons. Data on the supply and use of these materials will be obtained from the hospital pharmacy and the renal unit stores administrator. This data will be reviewed on a weekly basis during the researcher's visits to the renal unit. These unobtrusive measures will aim to measure any changes in consumption of these materials during the educational intervention and compare

these changes to previous patterns of consumption within the renal unit and elsewhere within the hospital.

The use of attitude survey/questionnaires and unobtrusive measures such as those outlined above will work to counter potential problems caused by the presence of the researcher when carrying out the ethnographic component of the second phase of the proposed research (Lee 2000). The employment of a pluralist philosophy and the combination of quantitative and qualitative measures described above will also work to counterbalance and compensate for the strengths and weaknesses of each individual research method used, and when used in conjunction they will obtain accurate and precise evidence of the phenomena observed during the proposed research. However, while the methods outlined above may be seen as an effective means of gathering evidence, the ethics of carrying out such research within a healthcare environment have yet to be considered.

Piper and Simons (2005) discuss the importance of ethical responsibility in carrying out social research and propose that principles such as informed consent, confidentiality, anonymity and the role of ethical committees and professional ethical guidelines should be considered before embarking on any empirical social research. In regard to informed consent, Piper and Simons (2005) argue that all participants involved in research must give their permission only after they have been fully acquainted with its purposes and possible consequences. Achieving this may at times be problematic, as for example it may not be possible for the researcher to predict all possible consequences associated with taking part in the research (Piper and Simons 2005). Instead, some form of continuously negotiated form of consent could be used in which changes in the research or previously unforeseen consequences of it are discussed with

participants, following this, participants will be free to withdraw their consent if they so wish (Piper and Simons 2005).

In regard to confidentiality, this principle should not only cover a research participant's right to talk in confidence but also to allow them the right to refuse to permit any publication of material that they consider may be potentially harmful to them (Piper and Simons 2005). The risk of publication of potentially harmful material may be reduced by maintaining the anonymity of research participants. However, in some circumstances this anonymity may not be easily maintained, for example in small participant groups. In such circumstances the researcher should discuss this problem with specific participants whose anonymity may be jeopardised and seek their consent before continuing with the research (Piper and Simons 2005).

Piper and Simons (2005) also find that social researchers have increasingly been informed by ethical guidelines produced by professional organisations such as the Nursing and Midwifery Council (NMC). The proposed research, mindful of the principles discussed above will be informed, designed and executed in full accordance with established principles for research involving human participants. Broad guiding principles for designing and carrying out research will be adhered to, these include respect for all individuals involved in the research, beneficence, justice, informed consent, openness, honesty, right to withdraw, protection from harm and confidentiality (Olsen et al 2003; Nursing and Midwifery Council's Code of Professional Conduct 2004).

The role of ethical committees as a means of ensuring that researchers have considered ethical issues and consequently design research projects with the intention of protecting participants from harm is well established within healthcare research (Piper and Simons 2005). In both phases of the proposed research, guidance and the approval of local research ethics committees will be sought and obtained before proceeding with the empirical research.

Summary

This chapter has discussed the nature, design and philosophy of the proposed research. It has also provided some examination of specific areas of its enquiry, and included some overview of research methods available and considered for use in the proposed research. The chapter has concluded that a pluralist philosophy employing qualitative and quantitative research methods should be adopted in the proposed research. It has also been concluded that the research should be carried out in two discrete phases in two separate sites. This chapter has also briefly discussed ethical issues that must be considered when working with human participants in healthcare research. Further specific detail of the research methods used and ethical considerations made will be examined in the following chapters that discuss both Phase One and Phase Two of the proposed research.

Chapter 5

First Empiric Phase

Introduction

In order to gain a better understanding of any division between espoused and actual infection control practice and to begin to investigate the utility of learning theory as a means of closing this division, a study of infection control practice and the knowledge underpinning these practices was completed. The study employed an ethnographic approach, with both participant observation and semi structured interviews with respondents used as means of data gathering.

The study was carried out on a renal unit within a district general hospital. This unit was divided into 3 discrete areas; a 28 bedded pre-dialysis and general medical ward, a haemodialysis unit with 12 dialysis stations in daily use and a small continuous ambulatory peritoneal dialysis (CAPD) unit used to train CAPD patients in maintaining their own CAPD at home. The pre-dialysis ward provides a round the clock service to in-patients. The haemodialysis unit routinely dialyses around 30 - 40 patients a day in 3 shifts, however acutely unwell patients may be dialysed on the unit at any time. The CAPD unit arranges for its patients to be admitted when they are physically well enough to be able to learn how to manage their own CAPD at home, usually only one or two CAPD patients are in the training unit at any time.

The study was carried out over a six month period from September to the following April. During these six months, the renal unit was visited and observed on 14 occasions.

Observations took place in all three clinical areas. Visits to the unit averaged around 5 hours in duration and enabled observation of distinct episodes of clinical work. For example when one group of haemodialysis patients are being "taken off" of their dialysis machines and the next group are almost simultaneously being "put on" the dialysis machines, another example would be the timing of a visit to coincide with a consultant ward round on the pre-dialysis ward.

During these visits individual members of the nursing and medical staff were observed carrying out their normal clinical practice, whilst carrying out this observation the participants and the observer discussed aspects of their clinical practice, knowledge and experience. Staff observed were predominantly female; only two members of staff observed were male. Staff were predominantly from the United Kingdom and had English as their first language; only two members of staff were from outside the United Kingdom and had English as their second language.

The purpose of the observations was to investigate actual infection control practices of individuals within the unit and reveal any divisions between their espoused and actual practice. For the purpose of the study, espoused practice may be defined as that described within the hospital infection control policies, such practices or a very close approximation of them were routinely claimed to be the normal practice of participants in the study. Espoused practices that lent themselves to observation included handwashing and the disposal of clinical waste. Observation of aseptic technique when "putting a patient on" or "taking a patient off" of a dialysis machine was more problematic in that observation of this could at times become intrusive for both staff and patient. For this reason observations primarily focussed upon

handwashing and disposal of clinical waste. Criteria for satisfactory handwashing and disposal of clinical waste were guided by the hospitals own infection control policies.

For the purpose of the study satisfactory handwashing was defined as:

- Wetting hands with warm running water
- Application of liquid soap
- Lathering of all surfaces of the hands for 15 seconds
- Thorough rinsing of the hands with warm running water
- Thorough drying of the hands with paper towels

As an alternative to this procedure physically clean hands could be decontaminated using a small quantity of alcohol gel applied to all surfaces of the hands.

Satisfactory clinical waste disposal was defined as the immediate disposal of sharps into sharps bins, or the disposal of other clinical waste into designated clinical waste bins.

Observations of clinical practice and any discussions with participants that took place during the observations were recorded onto tape, and then transcribed into text. Following observation, individuals were invited to take part in taped follow up interviews. The aim of these interviews was to further investigate any divisions between espoused and actual practice, reveal sources of knowledge used in practice, consider the willingness of participants to challenge poor practice and to explore participants views on how and where infection control knowledge and skills could be best learnt. These interviews took place in private in areas separate from the renal unit. Interviews typically took around 40 minutes to complete. On occasions there were difficulties in completing interviews as the participants continued to have a clinical workload during the interviews. This was best overcome by other members of staff

covering the participant's workload for the duration of the interview. Interviews were recorded onto tape, and then transcribed into text. The transcribed text of both observations and interviews were entered onto a computer and analysed using a qualitative data analysis software program (MAXqda). Data obtained through observation was analysed separately to that obtained via interview. Analysis of the data was informed and guided by Burnard's (1991) model of analysing transcripts in qualitative research. The intention of this was to produce a thorough and methodical record of the themes and topics raised in both the observations and the follow up interviews. In this iterative process, transcripts were read, re-read and the themes raised within the transcripts were coded (Burnard 1991). Segments of transcripts were then allocated to these codes. These codes were then grouped together under more general, inclusive code headings e.g. clinical practices, educational findings and contextual issues. These codes and their allocated segments of transcripts were then used to inform the following commentary and argument. The excerpts from transcripts presented below have been chosen because of their ability to inform this commentary and argument. To maintain confidentiality, research participants referred to in interviews or observations are identified by fictitious initials, e.g. "A". In excerpts from observations and interviews, the researcher is identified with the initial "R". This chapter will present and discuss the findings of the study in three sections; firstly findings from the observational phase of the study, secondly findings and discussion derived from the interview phase and then finally a summary which will discuss the findings as a whole.

Results of the observational phase

Stemming from the work of Semmelweiss (Carter 1983), handwashing has been identified as a means to drastically reduce the transmission of infection and it remains the most fundamental

of infection control precautions. However, multiple studies have demonstrated a failure to adequately carry out this simple infection control practice (Pittet et al 2000; Dubbert et al 1990; Larson and Kretzer 1995; Jarvis 1994).

It is perhaps unsurprising that the observations of practice on the renal unit demonstrate failings in regard to handwashing practice similar to those reported in the studies discussed above. On numerous occasions poor handwashing practices were observed on the unit. Of a total of 127 recorded occasions when handwashing was carried out, 74 (58%) of these demonstrated poor handwashing practice. These figures compare with those of Jimenez et al (1999) who in their audit of handwashing practices within a dialysis unit reported handwashing rates of 32.4% following some form of clinical activity and only 3% prior to such activity.

Some of the occasions of poor handwashing practice recorded in the local study may well be attributed to factors such as a lack of time or knowledge of specific infection risk. For example on one occasion a participant while being observed in practice stated that they were:

"In a bit of a rush and cut corners basically on the hand washing". (A)

On other occasions participants failed to wash their hands after caring for patients with methicillin resistant *Staphylococcus aureas* (MRSA) or *Clostridium difficile.* On these occasions participants were ignorant of the need for handwashing or claimed not to know that the patients were colonised with these organisms. However, it could be suggested that lack of time or knowledge of a specific infection risk might not explain other frequent occasions when poor, excessively brief or non-existent handwashing was observed. Feather et al (2000) have

argued that the failure to carry out basic infection control procedures such as handwashing exposes individuals' fundamental beliefs and values. Given the above evidence from the observations and the argument of Feather et al (2000) it could be speculated that those observed failing to carry out correct handwashing practices were in fact revealing their own beliefs in regard to handwashing, furthermore it could be suggested that these beliefs are based upon learning and knowledge that has not been sufficient to stimulate correct handwashing. Certainly, there is evidence produced by the follow up interviews of individuals that took part in the observations to support this argument. This evidence will be further discussed later.

Not all observed handwashing was poor, on many (53 recorded) occasions good examples were observed. However, of these 53 occasions 12 were associated with either a consultant ward round on the pre-dialysis ward or with the CAPD area.

In regard to good handwashing practice on the ward round an interesting observation was made by the senior house officer (SHO). He claimed that while he had been working with this particular nephrology team he had discovered an expectation that they all should use good infection control precautions including hand decontamination. Furthermore, it was not unusual for the consultant to confront team members when bad practice was observed, this might be done in a light hearted way, but it was accepted practice, and according to the SHO, had a positive impact on infection control practice. This positive impact was also referred to by participants in their follow up interviews and will be further considered in the discussion of the interview findings.

Good standards of handwashing within the CAPD area may be attributable to it status as a training area in which a knowledge of excellent hand hygiene and aseptic technique as a

means of avoiding complications such as peritonitis is routinely shared amongst the staff of the unit and is stressed and demonstrated to patients in training (Wilson et al 1994). This sharing of knowledge amongst staff and patients was also referred to by participants in their follow up interviews and will be further considered in the discussion of the interview findings.

In regard to the examples of good handwashing on the haemodialysis area, the observations indicate that some form of distraction or social activity may contribute to a longer time spent on handwashing. For example, occasions were noted when the observer witnessed:

> *"Another hand washing episode, 30 seconds that time and it seemed to take longer because B was being distracted and having a conversation at the same time. Similar to what I saw last week, people were washing their hands longer if they were distracted and in conversation whilst they were doing it".* (R)

No reference to observations of this kind being previously reported has been found. However further investigation of this phenomenon may be warranted as a means of improving handwashing practice.

Another participant from the haemodialysis area that demonstrated consistently good handwashing for the duration of her time being observed attributed her good practice to the fact that she had previously worked on a ward where there were many patients with MRSA and to help with their management there was a consistent level of input from infection control nurses working on the ward. As a consequence of this, the participant claimed that learning took place on the ward consistently over a period of time. The participant believed that as a result of her experience she had understood and believed in the importance of hand washing.

Some level of contrast was observed between the occasionally poor handwashing practice on the renal unit and the consistently good disposal of sharps and other clinical waste. For the purpose of the study, good practice was defined as practice in keeping with the hospitals own infection control policies. Of 114 incidents of good infection control practice observed in total during the study 61 involved good management and disposal of clinical waste. In the entire 6 month study, poor clinical waste disposal was observed on only 3 occasions. Of these 3 occasions one could arguably be attributed to contextual issues, the following excerpt from an observation highlights these issues:

> *"I've just now watched some blood being taken from a patient in an office – they are so short of room on this unit that they end up taking patients into offices to take blood. The nurse quite successfully got the blood from his arm and then that was the first time I'd seen any problems at all with sharps disposal and clinical waste disposal – the needle was re-sheathed and there were no sharps bins around at all, so then she ended up with this re-sheathed needle being carried from one end of the unit to the other virtually to be put into a sharps bin. I can't remember seeing an example of bad practice like that previously."* (R)

In this example it could be that poor practice was contributed to by the lack of space and adequate facilities in which to carry out clinical tasks.

Good and on occasion, exemplary examples of sharps disposal were routinely observed, particularly within the haemodialysis area. The following extract from an observation highlights an example of good practice:

"A had taken over from another nurse to put a patient on with an AV fistula. She connected the patient up when the needles were already in, so after A had connected the patient up she realised that on the trolley there should have been an orange needle and a green needle that were used for giving the patient some Lignocaine, and she realised that the two needles weren't there. I saw her look, looking again and then look again, because she knew that they should be there and she couldn't see them, so rather than just screw up all the clinical waste and throw it away in the bin, she made the point of going off to find the nurse that had previously been putting the patient on to ask what had happened with the green and orange needles. She found out that they'd already been got rid of, so then she knew that the situation was safe, but she wasn't going to get rid of the waste until she knew that it was safe." (R)

In discussion with participants during observation of practice, evidence emerged of an informal narrative within the unit, and that this narrative might have some positive influence on the management of clinical waste. Participant's reported that in regard to the avoidance of sharps injuries and infection with blood borne viruses (e.g. hepatitis B and C) much of the information they had gained was from word of mouth and stories exchanged by staff within the unit. It could be suggested that within the haemodialysis area, an area in which the historical and present day risk of staff acquiring infections with blood borne viruses is well documented (Jimenez and Sanchez-Paya 1999; CDC 2001), a form of learning drawing upon the use of narrative has and is taking place. Leight (2002) finds that narratives in practice provide a foundation for learning and the analysis of information, through learning such as this Diekelmann (2001) argues that communities are constructed. These communities may renew and redevelop themselves as the narrative learning upon which they are based changes. For

example, due to the continuing accumulation of knowledge on their nature and methods to prevent their transmission, the narrative of blood borne virus transmission in dialysis units in the early 1970's is likely to be different to that of the present day (CDC 2001). Consequently the narrative and the information contained within it may well change too to reflect the current reality and situate it within contemporary practice (Frid et al 2000).

It might also be speculated that this narrative learning prompted by the risk of blood borne virus transmission may also have some influence on the use of gloves within the renal unit.

A reliance on the use of gloves instead of handwashing or as an addition to poor handwashing was demonstrated during the observational phase of the study. The following excerpts from observations highlight occasions when gloves were used as an alternative to correct handwashing:

> *"Didn't notice any hand washing, but she was using her latex gloves. So I'm starting now to wonder whether or not there is a reliance on the latex gloves in place of hand washing."* (R)

> *"The hand washing technique in between patients is a matter of a few seconds now – the technique is wrong. Not all surfaces of hands are covered and it is just like a very perfunctory kind of thing. Having said that, she does make sure that she puts some latex gloves on and there are clean latex glove changes between each patient."* (R)

This reliance on the use of gloves has also been described elsewhere in the literature. For example, Jimenez et al (1999) found that gloves were used in 100% of occasions when dialysis unit staff carried out care on patients connected to haemodialysis machines. It could be argued that the knowledge gained from the narrative described above - of a history of renal unit staff themselves becoming infected with blood borne viruses acquired from their patients - is influential in creating a reliance on gloves as a means of presenting a physical barrier to infection between the member of staff and the patient. This argument appears to be supported by Jimenez and Sanchez-Paya (1999) who find that healthcare workers in dialysis units may be more concerned about the possibility of acquiring infections from their patients rather than they themselves transmitting infections to their patients.

Knowledge of the consequences of infection amongst renal staff might also be a factor in the reliance on gloves as a means to prevent infection. For example, a healthcare worker, particularly one working within a dialysis unit is arguably likely to be aware of the consequences of any potential blood borne virus infection both in terms of health and future employment risks. It is this learning and knowledge of the consequences of infection that to some extent underpins the reliance on gloves as a replacement for good handwashing practices. However, there is evidence to suggest that a reliance on gloves may also be contributed to by contextual issues such as a lack of time in which to wash hands correctly, heavy workloads or a greater demand for handwashing in areas where large numbers of invasive procedures are carried out (Panhotra et al 2004; Jimenez and Sanchez-Paya 1999). Similar contextual issues to those described in the literature were also observed in the study.

Successful dialysis relies on some form of invasive procedure, either through the insertion of a catheter into the patients' peritoneal space or achieving access to the patients' blood through

the insertion of needles or catheters into the patients' blood vessels. When this reliance on invasive procedures is combined with heavy workloads it is possible to see how contextual issues, similar to those discussed by Panhotra et al (2004) and Jimenez and Sanchez-Paya (1999) may have some impact on the practices demonstrated by the staff of the renal unit. The following excerpt from an observation highlights how the workload of a member of the renal unit team may have influenced their infection control practice:

> *"That was the first hand washing – probably about 10 seconds, so not really as it should be. Emm... noticeable thing – the first thing you notice with C in contrast with the other people that I've been observing, they are only interested in getting their own patients on and their own patients off and doing their own workload – you can see that C is watching everybody and everything that is going on in the unit and trying to make sure that it is all running smoothly. So there is a different kind of emphasis to her work."* (R)

In this instance, the member of staff being observed was in charge of the unit during that particular day and as such had a combined clinical and managerial workload. On another occasion during the day when this member of staff had been relieved of her managerial role then similar poor handwashing was not observed. This observation supports the argument of Gould et al (1996) who find that the performance of infection control tasks is adversely influence by workload. The above example highlights how increased workload may have contributed in some way to the poor handwashing demonstrated during the observation. This argument appears to be supported by evidence provided in the follow up interviews, and will be further discussed later.

Another contextual issue raised by the observation of staff was of lack of space, equipment and a working environment that supported good infection control practice. It has already been argued that poor practice in the management of clinical waste within the renal unit was contributed to by the lack of space and adequate facilities in which to carry out clinical tasks. Similar circumstances were revealed in other areas of the unit. The following excerpt from an observation highlights the problems of maintaining good infection control practice on the pre-dialysis ward:

> *"There are obviously problems here where we've got a bay full of Clostridium difficile patients that should be in isolation, we've got MRSA positive patients out on the main ward and this is purely down to pressure on beds and unable to find side rooms to put these people in."* (R)

The D.O.H (2002; 2003) list many factors that have led to the resurgence of HCAI. In this list they include the mixing of patient populations, for example caring for infected or colonised patients on a main ward when they would normally be required to be isolated in side rooms. The D.O.H (2002; 2003) also identifies pressure on beds which in turn leads to increased patient movements within hospitals as another infection risk. In the light of the D.O.H (2002; 2003) findings and the circumstances described in the excerpt above it is arguably possible to see the potential impact of these contextual issues on infection control practice. It could be contended that existing practice or any attempt at improving infection control practice may be constrained by the kind of contextual issues described above, and that any further investigation into means by which infection control practice might be improved should be mindful of such contextual issues.

Within the constraining circumstances of the pre-dialysis ward and on the unit generally the issue of leadership and its relation to learning and practice emerged during the observations. For example, from observing a ward round on the pre-dialysis ward it became clear that the consultant was very careful in his handwashing after attending to his MRSA positive and *Clostridium difficile* positive patients. He was also very encouraging in the use of alcohol gel as a form of hand decontamination amongst his team. The use of alcohol gel appeared to have been readily taken up by the other members of the medical team. In discussion with two members of the junior medical staff while observing their practice, both pointed out that their consultant was enthusiastic and rigorous in the use of handwashing and alcohol gel. Both claimed that as a result of the consultant's example of good practise, they too had become more likely to wash their hands correctly and furthermore both had endeavoured to become examples of good practice themselves.

The medical and nursing staff employed on the observed ward round on the pre-dialysis ward constituted a small community of practice. In defining communities of practice Wenger (2000 p208) argues that they consist of three core elements; a commitment to "joint enterprise" which binds members of the community, "mutual engagement" through which members learn with and from each other and a "shared repertoire of communal resources".

In the case of the ward round these three core elements were clearly demonstrated. The joint enterprise of the ward round staff was the management and provision of care for their patients. Their mutual engagement was their discussion and learning from each other whilst carrying out their clinical practice. Their shared repertoire of communal resources included a combination of explicit and tacit knowledge sources such as patients' notes, X-rays, and reference books; it also included their own knowledge and beliefs. It could be suggested that

through this community of practice learning was seen to be taking place, for example in handwashing. If we accept that the ward round did constitute a community of practice then it could be further argued that the consultant was instrumental in leading and generating the knowledge within it and furthermore applying this new knowledge through his junior staff in clinical practice.

Leadership such as that described above sits well with the argument of Nonaka et al (2000). They find that assistance and leadership for the participants within a community should be available from capable individuals with specific knowledge and ability, they further argue that leadership such as this is vital to knowledge creation. Wenger (2000) recognises that experts give legitimacy to a community and have the ability to maintain a focus and direction to its learning. This was arguably demonstrated on the ward round. The consultant could legitimately claim to be the leader of the medical team, and consequently was able to guide the learning and set the learning agenda during the ward round.

Other examples of learning in practice were also discovered during the observational phase of the study. For example, the consultant on the ward round whilst being an enthusiastic advocate of handwashing could possibly be excused for not being an expert in microbiology. Consequently, he was initially unaware that the use of alcohol gel was unlikely to be adequate to prevent the transmission of *Clostridium difficile.* During observation of the ward round the consultant revealed that it was knowledge and learning gathered whilst working on the ward that prompted him to change from his previous incorrect hand decontamination practice of using alcohol gel, to using handwashing with soap and water after tending to patients with *Clostridium difficile.* Following this learning and subsequent change in practice the consultant again acted as an example and advocate of handwashing to his staff.

Evidence gained from the observations suggests that "hands on" practice is not only an effective means of learning but also that this learning may not always be based upon knowledge gained from explicit sources such as policies, service manuals and procedures etc, but that this learning may be tacit in nature (Nonaka 2000; Wenger 2000).

Clear examples of tacit learning in practice were discovered during the observational phase of the research, in one example members of staff had developed a method of altering the settings on their dialysis machines without "de-sterilising" their gloves e.g:

> *"D just altered the settings or the controls on the machine, emm it's got one of these touch sensitive LCD screens and she's got gloves on and some gauze over the index finger of the glove."* (R)

> *"...worth mentioning when I come back to interview E afterwards was the business with wrapping a piece of sterile gauze around the index finger of her gloved hand so that she could adjust the settings on the machine."* (R)

When questioned during observation about this practice both nurses in the examples given above claimed that this practice was something that they had learnt and developed on the unit. No policy, procedure or documentation advocating the use of sterile gauze wrapped around fingers as a means to prevent "de-sterilising" gloves was found on the renal unit or within the literature.

Another example of tacit learning was found in the use of Betadine antiseptic solution. Betadine solution is normally used for skin disinfection (BNF 2002), however within the renal

unit it was being smeared onto latex gloves in order to allow staff to better handle dialysis equipment, e.g:

> *"Unusual business with the Betadine being spread over the hands – it is not being done for any kind of aseptic technique purposes, it turns out this is something that F has learnt in practice – it is something that isn't in any of the books or any of the procedures, but it is something that she was shown by her mentor when she first started on the ward."* (R)

The above examples demonstrate the local development and transmission of tacit knowledge in practice. This tacit knowledge is similar to that described by Nonaka et al (2000) and Wenger (2000), in that it is expressed in the skills and "hands on" know-how of nurses who have themselves internalised this knowledge, share a belief in its utility, and perceive it as useful knowledge that is worthy of transmitting to others. The examples of tacit knowledge developed on the renal unit indicate that the knowledge generated within practice is dynamic, internalized within its holders and embedded within actions, values, ideals and the commitments of those that employ it (Nonaka et al 2000). Furthermore, this tacit knowledge learnt by individuals in practice such as that described above, may not be based upon sound evidence and theory. Consequently, this may result in individuals developing knowledge and applying practices that do not conform with the espoused practice of their employing organisation.

Further conclusions could also be made from the observational phase of the study. The study was carried out with the intention of gaining a better understanding of any division between espoused and actual infection control practice and to begin to investigate the utility of

learning theory as a means of closing this division. The observational phase of the study clearly demonstrated that a division between espoused and actual practice exists on the unit, particularly in regard to handwashing.

In other areas of practice such as disposal of clinical waste little evidence of a division between espoused and actual practice was revealed. However, in the case of clinical waste disposal evidence was found to suggest that some form of learning in practice, based upon an iterative and continuing narrative may have contributed to the excellence in clinical waste disposal witnessed during the observations. It could be further suggested that this narrative learning and excellence in clinical waste disposal is indicative of the attitudes and beliefs of the renal unit staff. Arguably, the unit staff demonstrated a belief in the value of good clinical waste disposal and the knowledge that underpins it. Conversely, it could be speculated that in failing to carry out handwashing as effectively as they carry out clinical waste disposal the unit staff again demonstrated and exposed their deep-seated attitudes, beliefs and values in regard to handwashing (Feather et al 2000). A better knowledge of these attitudes, beliefs and values may arguably inform and guide any intervention intended to narrow the division between espoused and actual practice in handwashing.

Evidence gained through the observations of practice also suggested that the narrative learning described above in combination with contextual issues such as workload and lack of time have contributed to a reliance on the use of gloves as replacement for the use handwashing. Contextual issues such as workload which have been exposed by the observations have also been seen to constrain and hinder current infection control practice on the unit and may arguably also constrain and hinder any future interventions intended to improve practice.

Clear evidence of learning in practice has been produced by the observations. Examples of this include the narrative learning that underpins clinical waste disposal, the consultant ward round that resembled a small, mobile community of practice making its way through the pre-dialysis ward, and the generation and transmission of tacit knowledge within the haemodialysis area of the unit.

The next section of this chapter will discuss the evidence gained in the interview phase of the study and will further examine and consider the attitudes, beliefs, and knowledge that underpins the practices and findings found during the observational phase.

Results of the interview phase

As argued previously, handwashing remains the most fundamental of infection control practices. The observational phase of the study produced some evidence of a division between espoused and actual practice in handwashing. The interview phase of the study produced further evidence of this division and of the knowledge and beliefs that may underpin it.

During interviews participants consistently claimed that their knowledge of handwashing i.e. when and how to do it, was based upon what they had previously learnt in classroom based lessons, often taught by infection control nurses. For example:

> *"Eemm...it was done in the first year really, we had what was called clinical skills and they just basically went through hand washing and hand washing techniques."*
> *(G)*

R: "So from the classroom stuff that you had back when you were a first year really it's hand washing."

G: "Hand washing was the main thing that they talked about."

R: "Anything else that's kind of stuck with you that you can recall?"

G: "No not really – that's all they really mentioned."

"The one thing I think that they drummed into us more than anything was universal precautions and hand washing basically was the key thing."(F)

In the case of some participants, for example newly qualified nurses, these teaching sessions may have been a relatively recent event. For others, these sessions may have occurred many years previously. However, whether a recent occurrence or not, the participants claimed that their knowledge of handwashing was based upon what they had learnt in classroom based lessons. Few participants claimed to have learnt their knowledge of handwashing in practice. Those that did referred to the ways in which learning in practice had enabled them to "individualise" their handwashing technique, participants had altered and adapted their technique to suit their own requirements rather than alter it to comply with espoused practice:

"Emm...probably when ...when I've washed my hands and I'm like doing an aseptic technique, I turn the tap off with my elbow rather than going back and turning the tap off with my hand and then picking up something. I've seen that on the renal unit." (B)

"That was from here... yeah...emm...I think my hand washing and every thing...is probably my own personal thing..." (F)

Some evidence of the effectiveness of formal lessons or learning in practice in instilling a belief in the value of handwashing was found during the interviews, e.g.:

> *"Just if you don't wash your hands effectively then you end up ... there's bugs on your hand that you can't necessarily see, you can see the dirt and other things but there's bugs that we all carry around that takes a bit more to wash off, really." (G)*

The case of one particular individual participant highlights how classroom based learning of handwashing technique failed to be applied in practice. The individual participant in question was a very experienced healthcare worker. During observation, this individual demonstrated consistently poor or inadequate handwashing. For example, on occasions little or no soap was used, on others the brevity of handwashing was such that it made the exercise meaningless. Yet this individual when interviewed stressed repeatedly how during classroom based lessons she had learnt both handwashing technique and the value of it as a means of preventing infection. Furthermore, this individual believed that the handwashing knowledge she had learnt in class was being transferred into practice. This phenomenon was similarly demonstrated by other participants. Another participant that also consistently demonstrated poor handwashing when observed claimed when interviewed that she had retained and used knowledge learnt in class:

> *"We were shown over a sink how to actually wash and how many times you should rub over there and this way, that way, and you know ..... because those sort of things do stick because they are standing there and talking and go over things over and over again ...so yeah it does stick." (H)*

The above supports the contention that the knowledge learnt in classrooms and to a lesser extent, that learnt in practice has not been retained, internalised, believed in and valued in such a way as to be transferred into practice and stimulate correct handwashing. It might even be suggested that those participants who believe that their actual, and observed to be inadequate, handwashing practice is compliant with espoused practice may hold false beliefs that may also be described as delusional. Certainly, the knowledge that underpins the practice of these participants clearly differs from that defined by Nonaka et al (2000 p7) as a "justified true belief". The actual practices of these individuals and the learning that underpins them have been based upon an assumption of their adequacy (Kim 1993) and have not been tested or compared against the reality and requirements of espoused practice. This according to Long and Newton (1997) may contribute to the development of self-defeating systems and poor practices. These poor practices and the untested assumption of sufficient knowledge may also be compared to the use of heuristics which in turn contribute to the "illusion of validity" discussed by Tversky and Kahneman (1982 p9). This illusion of validity, based upon the use of heuristics and the application of untested knowledge may result in participants developing false beliefs and basing their practice upon these beliefs (Davies et al 2002).

This is not to suggest that in all cases the learning discussed in interviews and observed in practice was based upon an illusion of validity, unsound beliefs and unchallenged knowledge. During interviews, participants expressed a willingness to challenge practices and the knowledge that underpins them.

During the observational phase of the study, the SHO had pointed out the positive impact of challenging practices when they were perceived and understood to be poor. Participants during interviews claimed that they too would be prepared to challenge poor practice

regardless of who was carrying out the practice. Participants claimed that issues related to professional power or hierarchy would not interfere with their willingness to challenge poor practice. For example, when discussing her willingness to challenge bad practice demonstrated by a consultant one experienced nursing participant claimed:

> *"Yeah I would find it hard, but I think I would say, I would say something, I'd just try and think of a tactful way of saying it without sort of putting the blame on to them and sort of, you know, point out that they've done something wrong." (I)*

Similarly, a very junior, female member of medical staff was equally prepared to challenge the practice of her more experienced, male colleagues.

The willingness to challenge practice described in the interviews constitutes a form of learning in practice which could be further developed e.g. when poor practice is seen it is challenged and corrected in practice. However, it could also be argued that this form of learning would depend upon the ability of individuals to successfully perceive poor practice. This may not necessarily be possible if practice and the knowledge that underpins it is based upon the illusions of validity and false beliefs described above (Tversky and Kahneman 1982; Davies et al 2002). On the other hand, in particular areas where good handwashing practice appears to be established, recognised and shared, for example within the observed CAPD area, learning in practice, and challenging of poor practice is already taking place (Wilson et al 1994). This form of learning appears to sit well with the findings of Kim (1993). In as much as this learning within the CAPD area not only results in the demonstrated and observed acquisition and application of knowledge, skills and know-how, but also results in a development of *know-why*, a conceptual belief and understanding of the need and value of handwashing.

This understanding and belief may be derived from the nature of the work carried out within the CAPD unit i.e. the training of patients in the management of their own CAPD. Fundamental to the achievement of this is instilling within the patients themselves not only the know-how of aseptic technique and correct handwashing but also the know-why that underpins it, that correct handwashing and aseptic technique are vital in the prevention of infections such as peritonitis and the further consequences of these complications.

During interviews CAPD staff did not appear to suffer the same constraints of workload and lack of time in which to carry out handwashing as claimed by their haemodialysis colleagues. When interviewed, some disparity was discovered in regard to the attitudes to handwashing amongst the CAPD and haemodialysis staff. For example a CAPD nurse explained that she was unwilling to "cut corners" when handwashing and stated that:

> *"You just stand there and think how long have I been standing here washing my hands, and you think it's like I was saying 5 minutes, but it has probably only been a minute, 2 minutes or something like that and I do think ...why should it be the hand washing, why shouldn't it be something else that gives? You find it very difficult and I suppose you're playing a game with yourself really, you're balancing out... have my peritonitis rates changed? No." (J)*

Whereas amongst the haemodialysis staff the following responses were typical when discussing handwashing technique:

> *"It's a busy environment and you'd expect things...people sometimes do take short cuts." (F)*

"I know sometimes you're rushing about and you may not always spend as much time as you should do washing your hands." (D)

The contrast in the statements of the CAPD and haemodialysis staff is arguably indicative of differing attitudes and values regarding handwashing amongst individual members of staff on the unit. It is arguably these differing attitudes and values, some of which may themselves be based upon the false beliefs described by Davies et al (2002) and the "illusion of validity" of Tversky and Kahneman (1982 p9) that contribute to and help to maintain the division between the espoused and actual practice in handwashing on the renal unit. That such a division exists is highlighted by the case of the participant that when interviewed claimed to have learnt, valued, believed in and retained handwashing knowledge gained in the classroom but then entirely failed to apply this knowledge when observed in practice.

Other factors may also contribute to the division between espoused and actual practice. Statements made during interviews appear to support the findings of the observational phase of the study and suggest that contextual issues such as increased workload, lack of time, facilities and equipment may all have a detrimental influence on handwashing and infection control practices generally. This argument is well supported in the literature (Panhotra et al 2004; Jimenez and Sanchez-Paya 1999; Needleman et al 2002; Gould et al 1996).

When interviewed, participants supported the findings of the observational phase of the study and referred to increased workload leading to poor or deficient handwashing and increased reliance on the use of gloves as a replacement for handwashing:

"If you're really busy you just put the gloves on..." (H)

"I mean it's probably being rushed around a lot – when you're rushed off your feet and an alarm goes off on a machine and you've got your gloves on where you take a patient off.....you use the same glove and switch the machine off – you shouldn't do that really." (K)

"Yeah, sometimes you just put gloves on without washing your hands. You just stick gloves on because you think well I've got my gloves on now that will be alright and my hands are clean because I've only just washed them, although I don't think I've washed them 20 times, but you just think well I've washed them loads today and they'll be fine. If you're really busy you just put the gloves on..." (H)

The statements made during interviews support the notion that within the renal unit the use of gloves as a substitute for handwashing has to some extent become accepted practice, particularly when staff are busy and workload is heavy. It might also be speculated that this form of behaviour has been learnt in practice, for example through the narrative learning discussed previously which is prompted by the risk of blood borne virus transmission. Further evidence supporting this speculation and of learning in practice was revealed during interviews, for example in regard to the management of clinical waste and sharps disposal. The following extracts from interviews reveal how clinical waste management is learnt on the renal unit and also arguably reveals how members of the unit staff value the importance of this:

R: "What about things like your sharps disposal and aseptic technique, that kind of thing?"

D: "What where did I learn it? ...well I would have been taught that here. The aseptic technique when I was a student doing ENB136, I was shown how to do that...by one of the other staff."

R: "So where did you actually learn to do that?"

D: "Here... yeah I would have learnt that here on the renal unit."

"Emm...since qualifying and you know being here, the only actual sort of infection control things is obviously the risk of needle stick injuries working on a unit such as this and that's it." (A)

"Well, I mean certainly if I'm teaching somebody...emm then I do stress the importance of disposing of sharps carefully and yeah we do tell people about the risks." (C)

"You're screening for Hepatitis and also if we have a new acute patient that hasn't been screened, we have to isolate their machine until we've got a negative result back on them. So I think people are constantly reminded of the seriousness of blood borne viruses yeah." (C)

"I suppose safe disposal of sharps, emm the correct way to put on a sterile glove – I remember being taught that, em...err...the importance of disposing of dirty stuff you know not mixing your dirty stuff and your clean things you know on the trolley, things like that I suppose. I suppose that's the sort of stuff you learn in practice from other people yeah." (G)

This learning of sharps disposal and clinical waste management in practice clearly differs from the classroom based learning of handwashing technique claimed during interviews. The knowledge of clinical waste management gained in practice also arguably differs from classroom based knowledge on handwashing in that it was consistently seen to be applied in practice during the observational phase of the study. This consistent application of knowledge in practice resulted in the observational phase of the study discovering little evidence of a division between espoused and actual practice in clinical waste disposal. This contrasts with the situation found in regard to handwashing and arguably suggests that learning in practice may be more effective in enabling the application and use of infection control knowledge gained in practice.

This argument supports the conclusions of Courtney (1998) in her criticism of the primarily classroom and explicit knowledge based educational interventions employed in infection control. Courtney (1998) argues that although these interventions may increase individuals' appreciation of the importance of infection control they do not lead to any retained learning that contributes to an improvement in practice. Courtney (1998) goes on to argue that in order to improve both learning and practice the learning experience should be based upon an understanding of underpinning theory gained through practical experience and set within the context in which the learning will be employed.

Plentiful evidence of learning in practice and potential opportunities for providing the sort of educational interventions advocated by Courtney (1998) was obtained during interviews. Participants consistently referred to their experiences of learning in practice, for example in regard to how they learn:

"Yeah, like you know you have your mentor on the ward and you learn from them and you copy them, you copy their practice when you learn it. I mean when you're very new, very inexperienced, yeah you just copy, when you get a bit more experienced you pick and choose don't you and you choose for yourself." (K)

The above statement suggests that over time the new member of staff with the aid of a mentor not only learns new skills and acquires new knowledge, but also develops a mastery of these skills and knowledge and an understanding of how, when and why these practices should be employed, thus allowing the learner to "pick and choose" when and how to apply knowledge in practice. The importance of good mentorship in this process was not lost on the staff of the renal unit:

"I think if the mentors are well trained in what they're supposed to do – they probably can pass it on easy as well because the mentor you work with all the time, while you like... infection control come for a day or for a couple of hours and then he's gone again. If you've got a mentor you work with them probably for 4 weeks, 6 weeks, every day you work you work with them. So if you have a good mentor who is trained and does his job well, I think thats the best way to learn." (K)

Mentors such as those described in the participants' interviews could arguably be compared with Raelin's (1999 p16) description of the "coach whose role is to help the professional learn the technical skills as well as the norms of behaviour of professional practice". These mentors also share some of the characteristics of the legitimated and expert leaders described by

Wenger (2000) in that they appear to have a role in guiding and focussing the knowledge creation process in practice.

This process of situated learning in practice in which novices under the guidance of mentors develop a mastery of knowledge and skills arguably sits well with the "legitimate peripheral participation" of Lave and Wenger (1991 p29) and the tacit knowledge creation described by Nonaka et al (2000). Learners develop the skills and knowledge they need to allow them to practice within their workplace. These skills, knowledge and their application in practice are continuously agreed and negotiated by the learners, their mentors and by others within the workplace. By implication the learners are continually interacting and reacting to changes in their understanding, experience and environment e.g. the changing narrative of blood borne viruses in dialysis. As a consequence of this process Lave and Wenger (1991) argue that divisions between intellectual and physical action, thought and involvement are lost. Evidence in support of this argument and suggesting that learning in practice took place on the renal unit without deliberate effort made on the part of the learner was produced by the interviews e.g.:

L: "When I was first on the wards it's...it's hard to know what now is what I knew before as to what I've been taught, because a lot of it is done without you realising."

R: "Just knowledge that you pick up?

L: "Yeah, I'm sure a lot of what I do is not necessarily sat down teach tell you to do it - a lot of it is picking up as you go along."

R: "And where do you pick it up as you go along?"

L: "From other people that you see."

R: "On the ward in the department?"

L: " Yeah, yeah."

"I suppose you do just do things automatically sometimes...Yeah, you do don't you... I suppose it's like a habitual thing, you just do it because that's what you do." (H)

The case of one particular participant not only supports the statement made above that "*you just do it because that's what you do*", but also the contention of Courtney (1998) in that explicit knowledge and educational interventions based upon its transmission may not lead to its retention and application in practice. In this particular case the participant was a senior member of the unit staff with many years of experience of working on renal units. When interviewed, the participant repeatedly stressed the importance of evidence based clinical practice and made frequent reference to the use of and practice guided by:

"The infection control policy we have to adhere to and also infection control guidelines we adhere to or the kind of policies and procedures that we adhere to ... basically it's connected to the infection control policy guidelines from the Trust." (M)

However, when previously observed in practice this participant had carried out a particular clinical procedure with a patient's haemodialysis equipment that did not appear to comply with local policies or to be based upon current evidence based practice. Consequently, the participant was questioned about this procedure when interviewed:

R: " Can you remember...that business with the steret, I was really interested in the steret business with the line, can you remember where you learnt that or how you learnt that."

M: " Who did I learn that from?...I think I must have learnt that...just thinking back, from one of the clinical nurse specialists who came down here to demonstrate the machine and I remember this is going back many years ago it certainly wasn't on these machines and I remember them saying at the time that if the alarm was showing air in bottle and unless it's actually visible and you have a big air bubble then its got to be very micro bubbles that you can't even see and possibly one of the other reasons that the alarm would show for that is there is no contact between the line and the bubble traps...and if you slightly wet it with the steret then contact... a better contact is made and it will get rid of the emm..."

R: "So that was just someone who showed you that and you thought oohh that's a ..."

M: "Well the fact that someone showed it to me and it worked...as sometimes the lines can get very hot and sometimes... so therefore the tubing can expand or contract or whatever and maybe the contact ...its supposed to make if the machine isn't particularly good."

R: "Right. Is that kind of thing written down anywhere? Is it in the machine guidelines? There's no literature to support that...?"

M: "Not that I've seen there's nothing to support that."

The above exchange demonstrates that even when participants claimed they were aware of the importance of explicit knowledge in the form of policies, and procedures etc, when faced with the challenge of managing and coping in practice they adapt their own individual practice and

in doing so may well rely upon tacit knowledge gained, used, and valued as effective in practice.

Evidence of this theme of adaptation of knowledge, particularly explicit knowledge such as in the example given above emerged during interviews with other participants. When asked whether their knowledge used in practice is the same as the knowledge they have gained through previous education and learning, participants claimed that:

> *"It's adapted isn't it, because the classroom situation is usually fairly ...it's always going to look at the ideal and in reality of course you can't always isolate every patient that's got C Diff or got whatever they've got...so yeah, yeah, I mean the classroom is the utopian idea as to how it should be isn't it?" (C)*

> *"...but a lot, as I said before during the theory in class, but I think that then kind of becomes adapted when you are out in a ward environment because the way things are taught in class isn't always how it then is when you're in a clinical environment." (I)*

> *"I think you do adapt it. Like with hand washing as an example, although you should do it for longer, I think if you try and make sure you use all the correct techniques while you're hand washing, but may be not for such a length of time then may be that's ..." (I)*

Again these statements appear to support Courtney's (1998) argument in regard to educational interventions based upon the transfer of explicit knowledge and their ineffectiveness in

enabling the retention and application of this knowledge in practice. It could also be argued that the adapted knowledge referred to in the interviews is the knowledge used to get by in practice, it is the knowledge gained by the novice within a new area of practice (Nonaka et al, 2000; Wenger 2000).

The above extracts from interviews arguably highlight a division between the explicit knowledge gained and used in the classroom and tacit knowledge learnt and employed in practice. This evidence of a division appears to support the arguments of Argyris and Schon (1996) and Strange (1996) who find that individuals working in clinical practice may base their opinions and practices on two possibly contradictory theories, their espoused theory and their theory used in practice. However, evidence emerged from the interviews which arguably suggests that participants may not have been developing two contradictory theories as Argyris and Schon (1996) and Strange (1996) propose. Instead it could be argued that participants were struggling to resolve two differing bodies of knowledge, their explicit knowledge derived from the type of educational interventions described by Courtney (1998) and their tacit knowledge learnt and used in practice (Nonaka et al 2000;Wenger 2000). In attempting to resolve this struggle participants referred to ways in which they attempted to combine knowledge from varying sources to suit their needs in practice:

> *"I think it's a combination of both. Yeah I do, it's a combination of both and I think the more you do it, it's more from the practical side because you're more aware of it aren't you rather than what you've pick up...the theory then sort of clicks in your mind some how if something happens and you think oohh yeah..."*
> *(H)*

"Like I was saying earlier you were first taught in the classroom and then you come out and use your skills and then you just ...your updating yourself...in your own workplace." (J)

"Obviously you learn it at school, you know, we did learn it at school, and then but you practice it when you're on the ward – you don't practice it in the school. It was probably like everything else you do it in the classroom once or twice...like you spend an hour and then, you know, you're on the ward and you follow your mentor." (K)

"I mean you can't really be told in a classroom how you should behave, but it's not until you get out on the wards you really see how people behave and you learn what the practice is I suppose." (G)

This theme of facing circumstances and problems unpredicted or unprepared for by classroom learning and of seeing how people manage these circumstances, the practices and skills they use and the knowledge that underpins them was further developed in the interviews. Participants claimed that a knowledge of the consequences of mistakes or errors in practice contributed to their learning and their subsequent behaviour in practice. Participants claimed that:

"Maybe not seeing the consequences, but being aware of the consequences. I don't think you always have to see it to be aware of it, you know, but I think yeah being made aware of it yeah, yeah. I don't think you necessarily have to see it, but

as long as you know if you don't do such and such basically that somebody with a central line could get septicaemia and die actually ultimately." (C)

In regard specifically to the risk of injuries from used needles and the subsequent risk of blood borne virus transmission it was claimed that:

"Yeah, I've learnt because I have seen it happen – really I've learnt that it's better and safer to have the bin next to you so you...you're not liable to injure anybody because the bin is just there. Nobody else can get in the way of that bin." (G)

Interestingly it was also claimed that:

"Because if you don't see the consequences and it's not an immediate thing you're going to see, you can detach it from the procedure you've done maybe." (L)

These statements indicate another form of contribution to the division between espoused and actual practice observed on the renal unit. Firstly, consider the situation of sharps and clinical waste management. This was observed to be almost uniformly excellent, and little evidence of a division between espoused and actual practice in clinical waste management was observed on the renal unit. Arguably, this is in part due to the immediacy of peoples awareness of problems with clinical waste management e.g. sharps inquiries, and the potential health, financial and working consequences of them. This can be contrasted with the situation of handwashing in which considerable evidence of a division between espoused and actual practice was observed on the renal unit. In the case of handwashing however, it can be argued that the consequences of problems or errors in practice may not be perceived for some time, if

at all. The nature of transmission of infection requires that some incubation period will occur between transmission of an organism and the appearance of symptoms caused by it. Before and during this incubation period many "hands on" clinical practices may have been carried out on an individual patient by various members of staff, any of which may have been responsible for the transmission of an infection. In these circumstances it is arguably easy to see how participants could claim that actions and their consequences may be detached and fail to be fully perceived.

It could be claimed that this detachment, this inability to see and reflect upon the link between an individuals' action e.g. poor handwashing and the consequences e.g. transmission of infections contributes to the division between espoused and actual practice on the renal unit. Evidence obtained through interviews indicated that participants were aware of both problems with reflection and its value in learning and practice. Participants agreed with the suggestion that in the case of handwashing, the consequences of problems or errors in practice may not be readily perceived, stating:

> *"I think it's a bit more difficult with haemo to actually determine if it was your technique or somebody else's because it's three times a week and you've got lots of different people." (N)*

> *"No you can't reflect on your own practice if you can't remember whether you've given them their infection or not." (G)*

However, not all evidence gained from interviews referred to failure to reflect and learn from reflection. One notable example of reflection being used to aid learning and improve practice

on the renal unit was discussed during interviews. In this example two members of staff had investigated the suitability of changing their usual practices in caring for CAPD catheter exit sites. Following investigation, changes had been successfully implemented in practice. This whole process had been prompted by:

> *"...reflecting on the practice we've done – looking at what we'd done and the infection rates and that sort of thing and then going on from that to what we can change." (D)*

Similar experiences were also described by staff working in the haemodialysis area. In response to an episode in which haemodialysis patients had developed infections, staff reported on how they had investigated and reflected upon their practice. In doing so they identified areas of practice which they felt could be improved, carried out the required improvements and in doing so reduced the risk of repeating the episode in which the haemodialysis patients had become infected.

Individuals also discussed the ways in which they reflect upon their practice and their motivation to do so, for example:

> *"I think you do it actually without consciously thinking of it, you don't actually sit down and think right I'm going to reflect now, but you do sit and think, well did I, did I teach that patient the best way for them, was it the easiest way for them..." (N)*

"I suppose I do actually on an ongoing way I do if I catch myself doing something I shouldn't have done I do sort of mentally tell myself off and reflect on why I did it and yeah so I do." (C)

The examples of reflection produced during interviews support the contention of Kofman and Senge (1993) in their comparison of learning in organisations to that found within sports or performing arts. Kofman and Senge (1993) claim that learning may be situated in the practice field, stadium, classroom, or workplace. However, to enable this they argue that learning and workplaces should be integrated to create a continuing process of action, experimentation and reflection. Arguably, to some extent such integration of action, experimentation and reflection was demonstrated in the above examples taken from interviews with renal unit staff.

That evidence of learning through reflection was found during interviews with renal unit staff may be unsurprising, as the concept and power of reflective learning is well recognized within healthcare education (Schon 1987; Hyrkas et al 2001). However, in their study of reflective learning within the wards of a large teaching hospital Hyrkas et al (2001) found that the learning experience provided by reflection may be diminished if the theoretical base which underpins it is confused, unclear or contradictory. The observational and interview phases of this study have produced evidence which suggests that just such an ambiguous theoretical base exists on the renal unit, for example in the inconsistent use of explicit theoretical knowledge in practice. It could also be concluded that this in addition has contributed to the division between espoused and actual practice found on the renal unit.

Summary

The aims of this study were to investigate practice on the renal unit, reveal whether there were any divisions between espoused and actual practice, discover sources of knowledge that underpin these divisions and practices and begin to investigate means by which these divisions may be closed. The study has been successful in revealing divisions in espoused and actual practice on the renal unit. In the case of handwashing, the most fundamental of all infection control precautions, actual handwashing in practice was clearly shown to differ from that which participants espoused. In some contrast to this little evidence was found of a division between espoused and actual practice in sharps and clinical waste management. This may in some way be related to the differing sources of knowledge and learning that underpin these practices. In the case of handwashing, evidence has been gained that suggests that this is based upon formal learning of explicit knowledge and that this explicit knowledge fails to be transferred from the classroom and applied in practice. In the case of sharps and clinical waste disposal evidence gathered suggests that this knowledge is primarily learnt tacitly, in practice and is readily re-applied and demonstrated in practice.

Further evidence of learning in practice was also revealed during the study, for example the narrative learning in relation to blood borne viruses and the ward round which could be seen as a mobile community of practice wending its way through the pre-dialysis ward. Evidence obtained in the study also suggests that it is this tacit knowledge, in preference to explicit knowledge derived from for example infection control manuals and written hospital procedures that is valued and relied upon when faced with the challenges of day to day clinical practice.

The study has also shown that during routine day to day clinical practice, contextual issues such as heavy workload and lack of equipment and facilities may have a negative impact upon infection control practice and may cause actual practice to differ from that which is espoused.

Any educational intervention intended to close divisions between espoused and actual practice should take note of the constraints that contextual issues might present. Similarly, interventions should be guided by the evidence of tacit learning in practice discovered by the study and aim to use this as a foundation for any future attempt to improve infection control knowledge and its application in clinical practice. Such interventions might for example be aided by the narrative learning which this study has shown to be effective in producing excellent practice in the management of clinical waste disposal. Future interventions might also aim to develop a form of community of practice similar to that seen to be effective in promoting good handwashing practice on the ward round described within this study. The following chapter discusses an intervention study designed with the intention of building upon the evidence discussed above while looking to investigate and employ tacit learning as a means of achieving and sustaining an improvement in infection control practice within a clinical environment.

First Empiric Phase - Stages of Development

September 2002	Begin literature review.
April/July 2003	Continue literature review. Develop research model. Begin planning of and negotiate access to the site of the first phase of empiric research.
July/August 2003	Continue literature review. Apply for and obtain local ethics committee approval for the first empiric phase of research.
September 2003 - March 2004	Continue literature review. Carry out the first empiric phase of the research.
April 2004 - September 2004	Continue literature review. Carry out analysis of the data obtained from the first empiric phase of the research and write a report of this (Chapter 5). Begin planning of the second empiric phase of the research.

Chapter 6

Second Empiric Phase

Introduction

The previous chapter discussed a study which was intended to gain a better understanding of any division between espoused and actual infection control practice and to begin to investigate the utility of learning theory as a means of closing this division. This better understanding was achieved by the study. This lead to the conclusion that any educational intervention intended to close divisions between espoused and actual practice should be guided by the evidence of tacit learning in practice such as that discovered by the study, and aim to use this as a foundation for any future attempt to improve infection control knowledge, and its application in clinical practice. It was also concluded that constraints that contextual issues might present in regard to any such interventions should be noted.

This chapter intends to discuss an intervention study which was carried out on a renal unit within a district general hospital. This study was not sited within the same renal unit as that discussed in Chapter Five. However, the intervention study builds upon and is underpinned by the findings of the study discussed in Chapter Five. The intervention study aimed to create a clinical environment in which participants contributed to the development and sharing of good infection control knowledge in practice, and guided by their knowledge of good infection control practice, participants would be enabled to challenge poor practice. Through this process the intervention study aimed to develop a clinical environment in which sustained and continuous tacit learning could lead to an improvement in infection control practice. In

considering and discussing the intervention study it was also hoped that some contribution to the theoretical concepts of organisational learning could also be made.

The unit in which the intervention study was sited divides into 2 discrete areas; a haemodialysis unit with 29 dialysis stations in daily use and a continuous ambulatory peritoneal dialysis (CAPD) unit used to train CAPD patients in maintaining their own CAPD at home. The haemodialysis unit is divided into 4 bays and 2 single bedded side rooms which are used for acute cases. The unit routinely dialyses up to 68 patients a day in 3 shifts. However, acutely unwell patients may be dialysed on the unit at any time. The CAPD unit arranges for its patients to attend for training as outpatients when they are well enough to be able to learn how to manage their own CAPD at home. Usually only one or two CAPD patients are being trained at any time. CAPD patients with complications such as peritonitis are usually admitted to a general medical ward which adjoins but is separate from the renal unit.

The intervention study was carried out over a six month period from April to the following September. During these six months, the renal unit was visited and observed on 23 occasions. Visits were usually made on a weekly basis. Observations mainly took place within the haemodialysis and CAPD areas; however, observations also occurred within the adjoining medical ward during doctors ward rounds. Visits to the unit averaged around 4 hours in duration and as in the previous study enabled observation of distinct episodes of clinical work such as when one group of haemodialysis patients are being "taken off" of their dialysis machines and the next group are almost simultaneously being "put on" the dialysis machines. On other occasions visits were timed to coincide with consultants ward rounds.

During these visits individual members of the nursing and medical staff were observed carrying out their normal clinical practice. Around 45 to 50 members of staff were working on the unit during the intervention study. This number varied at times during the study due to staff sickness, annual leave etc. Unit staff involved in the intervention study were predominantly female; 8 members of staff observed were male. Staff were mainly from the United Kingdom, all renal unit staff involved in the study were fluent in written and spoken English.

The nature of the intervention

The initial phase of the intervention consisted of the recruitment and preparation of 12 "opinion leaders". Of these 12 opinion leaders, 7 were nurses, 2 were doctors and 3 were healthcare assistants. The employment of such opinion leaders has been advocated in the literature as a means of guiding the learning agenda and assisting in the development of knowledge bases and the knowledge creation process (Nonaka et al 2000; Wenger 2000; Driver 2002); furthermore, studies and attempts to improve clinical practice have also used similar forms of intervention. For example, Brown et al (2003 p176), in their study of hand hygiene on a neonatal intensive care unit recruited a single senior nurse to act as an "opinion leader" within the unit to serve as an "exemplar of proper hand hygiene" whilst observing and engaging in discourse with participants. Stein et al (2003) in their survey of doctors and nurses knowledge, attitudes and compliance with infection control guidelines within a teaching hospital advocated the recruitment of members of senior staff to lead by good example, arguing that junior staff may follow examples set by role models. Scott et al (2005) continue to discuss the importance of leadership, arguing that good leaders are able to motivate staff

and develop effective teamwork whilst building an environment in which staff are comfortable with challenging the practice of others and welcoming challenges to their own practice.

In the intervention study, opinion leaders were recruited following discussion and agreement with the unit staff and management. Names of possible opinion leaders were suggested by the unit management. Characteristically, these were experienced members of staff that were considered by the unit management as likely to have the ability and confidence to adopt the role of opinion leader. These individuals were then approached by the researcher, provided with verbal and written information on the role, and asked if they wished to take part in the study as opinion leaders. Of those that agreed to become opinion leaders, 2 were already infection control link nurses and could consequently be expected to have some existing knowledge and experience of infection control practice and education (Teare 1998; Cooper 2004). The recruitment of 12 opinion leaders increased the chances that an opinion leader would be available on every shift on the unit during the intervention study. These 12 opinion leaders were the maximum number possible to recruit from the healthcare staff working on the unit. Other members of staff were suggested by unit management as possible opinion leaders; however these members of staff whilst prepared to take part in the study as a whole, declined to take part in the study as opinion leaders.

The initial phase of recruitment and preparation took place from the beginning of April to mid June. Typically, one or sometimes two opinion leaders were recruited and prepared on each of the researcher's visits to the unit. The opinion leaders were initially observed in practice for up to four hours and were provided as necessary with infection control training and advice in practice to ensure that their knowledge and practice reflected the hospital infection control policies. This training and advice was informed by the current policies and guidance made

available from the hospital infection control team and was provided by the researcher who was a qualified and experienced infection control nurse. Following on from the experience gained in the previous study, the intervention study primarily focused upon handwashing and disposal of clinical waste. The previous study had indicated that handwashing and the disposal of clinical waste were procedures that could be readily observed whilst also representing fundamental areas of infection control practice.

Once it was established by the researcher that the opinion leaders' usual practice reflected the hospital infection control policies, the opinion leaders were then encouraged to continuously exemplify, demonstrate and advocate good infection control practice whilst carrying out their normal working duties.

The opinion leaders were also encouraged to continuously challenge poor infection control practice when they encountered it and if necessary welcome questions and challenges of their own practice. In this way it was hoped that good infection control knowledge and practice would be shared and disseminated throughout the renal unit. Methods of challenging practice were discussed with the opinion leaders, for example both the researcher and the opinion leaders felt that a confrontational approach when challenging practice might result in a negative impact upon an individuals practice. Opinion leaders argued that in the majority of circumstances a more supportive approach would be more effective.

The opinion leaders were supported by the researcher, for example when opinion leaders had queries regarding specific areas of infection control practice or in carrying out their role they were able to approach the researcher for advice and opinions. Support from the researcher

was available through telephone conversations or in person on occasions when the researcher visited the renal unit. Requests for support were not frequently made.

Data Collection

A pluralist philosophy, using a combination of quantitative and qualitative measures, which were intended to offset and counterbalance the strengths and weaknesses of each individual research method was used with the aim of obtaining accurate, comprehensive and convincing evidence. Evidence gained from differing sources was triangulated to facilitate greater confidence in arguments and conclusions made on the strength of this evidence. In order to obtain as comprehensive a data set as possible and to allow triangulation of data, the study employed the following combination of data gathering methods:

- An attitude survey/questionnaire based upon Likert scaled items was undertaken prior to the beginning of the educational intervention and following its completion. Statistical data obtained from this survey was analysed using statistical package for the social sciences software (SPSS 11.5 for Windows) following discussion and advice from statisticians based at the University of Plymouth.

- Observation of and discussion with members of staff involved in hands on care of patients whilst on duty on the renal unit. Tape recorded notes made during these observations and discussions were transcribed into text, transferred onto a computer hard drive and analysed using MAX-qda qualitative data analysis software.

- The use of unobtrusive measures i.e. obtaining written data on the use of materials

consumed during practice related to infection control e.g. liquid soaps, paper towels, and plastic aprons. Data on the supply and use of these materials was made available by the pharmacy and the renal unit stores administrator. This data was reviewed on a monthly basis during the researcher's visits to the renal unit. The use of these unobtrusive measures aimed to measure any changes in consumption of materials during the educational intervention and compare these changes to previous patterns of consumption. Members of renal unit clinical staff were not informed of unobtrusive measures being used as a data gathering method.

- Tape recorded follow up interviews with renal unit staff were carried out following the completion of the intervention study. The aim of these interviews was to further investigate the data provided by the use of unobtrusive measures and to discuss the role of the researcher and any influence he may have had upon the intervention study. These interviews took place in private on the renal unit. Interviews typically took around 20 minutes to complete, they were then transcribed into text, transferred onto a computer hard drive and analysed using MAX-qda qualitative data analysis software.

Results gained from the methods discussed above were presented for peer review to a group of 25 infection control and health protection nurses.

Analysis of the data provided by observation, discussion and interview was informed and guided by Burnard's (1991) model of analysing transcripts in qualitative research. The intention of this was to produce a thorough and methodical record of the themes and topics raised in the observations, discussions with staff, and the follow up interviews. In this iterative process, transcripts were read, re-read and the themes raised within the transcripts

were coded (Burnard 1991). Segments of transcripts were then allocated to these codes. These codes and their allocated segments of transcripts were then used to inform the following commentary and argument. As in Chapter Five, to maintain confidentiality, research participants referred to in interviews or observations are identified by the provision of fictitious initials, e.g. "A". In excerpts from observations and interviews, the researcher is identified with the initial "R".

This chapter will present and discuss the results of the intervention study in four sections, beginning with the findings from the observational part of the study. Following this the chapter will discuss the findings derived from the attitude survey/questionnaires, unobtrusive measures and follow up interviews. Finally a summary will discuss the findings as a whole.

Results of observation and discussion with members of staff

Initial stages.

As discussed earlier, the initial phase of the intervention study focussed upon the recruitment and preparation of opinion leaders and ensuring that their infection control practice was correct and complied with hospital policies. As found in the previous study, fundamental areas of infection control practice such as clinical waste disposal and handwashing (Carter 1983) were readily observed whilst recruiting and preparing staff to take on the role of opinion leader. As found in numerous previous studies (Pittet et al 2000; Dubbert et al 1990; Larson and Kretzer 1995; Jarvis 1994), poor practice and failure to correctly carry out basic infection control practice was observed amongst opinion leaders during the intervention study's initial

phase of recruitment and preparation. Examples of poor practice were commonly observed in regard to handwashing, for example:

> *" A has just done a chest examination and knew she should decontaminate her hands, but for some reason, I don't know why, she decided to use alcohol gel and water so she has washed one off with the other."* (R)

In this instance a member of staff had incorrectly used an ineffective combination of alcohol gel and hot water as a method of hand decontamination.

Similar errors in practice were also found in regard to clinical waste disposal and in the use of protective clothing and equipment, for example:

> *"B has just finished taking a patient off, clinical waste in the main was got rid of properly, decontamination was done properly, aseptic technique was done properly, the only weak point about her practice is her disposal of sharps. She realises that she has got a weakness with it and I have just mentioned it to her again now, so she says she will attend to it, or try and make sure that she is a bit more careful with her sharps disposal in future and as we speak she is now bringing the sharps bin over to the next patient in readiness."* (R)

The following example of observed poor practice may also be seen as indicative of attitudes and beliefs found amongst some members of staff in the initial recruitment and preparation stage:

"He is not wearing gloves and is putting patients on. He has a problem with his skin, but he is given special gloves and he still won't wear them... and he just laughed at me." (R)

The above example suggests that during the initial recruitment and preparation stage of the intervention study unit staff, including prospective opinion leaders and senior members of unit staff, demonstrated values and beliefs that may not have been entirely supportive of the study. This argument certainly appears to be supported by the experience of one of the prospective opinion leaders. The following episode occurred at the beginning of the intervention study and involves a newly recruited opinion leader and a senior member of staff entering a single room in which a potentially infectious patient had been isolated:

"...a senior member of staff came in and spoke to the patient without washing her hands previously, she touched the patient and she walked out and didn't wash her hands, so I actually challenged her, she was a Sister a G grade, and when I challenged her she actually laughed and then the next time she came in she put her hands all over the patient, all over the table without actually washing her hands and she walked away. So I challenged her I said could you please wash your hands, she laughed and walked up the corridor." (C)

Examples such as those given above support the contention of Feather et al (2000) that such failures to carry out infection control practice reveal individuals' fundamental lack of belief in and value for infection control practice. It could also be contended that at this early stage of the intervention study, evidence was already available to suggest that previous learning and experience amongst some members of unit staff had not been sufficient to stimulate correct

infection control practices. Moreover it could be suggested that examples such as those given above indicated the nature of the challenge facing the study and its aim to create a clinical environment in which participants contributed to the development and sharing of good infection control knowledge in practice.

However, not all infection control practice observed during the initial recruitment and preparation stage was poor. The following example highlights how good standards of infection control practice could be found amongst the newly recruited opinion leaders:

> *"It is Monday 25th April, today I am working with D. D just washed her hands in preparation to taking a patient off the machine. Her hand washing technique was absolutely fine so she did as she should have done it when she should have done it, she is now putting her protective equipment on ready to take a patient off which is exactly as it should be."* (R)

If the contention of Feather et al (2000) is accepted, that failures to carry out infection control practice reveal a lack of belief in and value for infection control practice, then it might also be argued that when individuals do carry out correct infection control practice, they are equally revealing how they value and believe in its importance. This point is arguably important in regard to the recruitment and preparation of the opinion leaders, who as part of the intervention study would be aiming to change the attitudes, beliefs and values of their colleagues, through the continuous exemplification, demonstration and encouragement of good infection control practice, based upon their own values and belief in its worth.

As a result of taking on the role of opinion leader, members of unit staff would almost inevitably increase their individual workload. For example, opinion leaders were likely to find themselves in situations where they were required to demonstrate correct infection control

practice themselves, whilst also observing and if necessary challenging or praising the practice of others. Contextual issues such as workload and their potentially adverse impact on infection control practice were discovered and discussed in the previous chapter (Gould et al 1996). Similar issues involving workload and staffing levels were also discovered during the intervention study. At this point it may well be worthwhile further considering the background and context in which the intervention study took place.

Contextual issues.

Issues and problems raised by heavy workloads within healthcare have been discussed at some length within the literature (Gould et al 1996; Jimenez and Sanchez-Paya 1999; Hughes 1999; Minton 2000; Saulnier et al 2001; Bellman 2004; Panhotra et al 2004). Saulnier et al (2001), conclude that heavy workloads amongst nursing staff can be seen as a risk factor and may contribute to outbreaks of healthcare associated infection (HCAI). However, Saulnier et al (2001) do not specify how increased workload impacts upon "hands on" patient care and how this impact may increase infection risk. Hughes (1999) also discusses the impact of workload on healthcare and suggests that nurses are taught prioritisation skills which they are able to apply in practice. On occasions this prioritisation may be based upon the flawed attitudes and beliefs found by Feather et al (2000) and these flawed attitudes, beliefs and priorities may result in the increased risk of infection claimed by Saulnier et al (2001).

Certainly within the intervention study the issue of workload was raised on numerous occasions by many members of staff. The evidence gained from their discussion of workload appeared to agree with the suggestion that in circumstances where workload is heavy this may impact upon the practice and priorities of the staff (Hughes 1999; Saulnier et al 2001). The

following example highlights the experience of nurses working with extremely heavy workloads:

> *"Personally if we are really really busy I can see how some people do slip because if you are working on your own and you are trying to take off 14 patients you are running around and you do slip, it is just one of those things..."* (E)

Problems associated with workload during the intervention study were also seen on one or two occasions to be having an impact on the observational element of the research. The following tape recorded field note describes this:

> *"I have been here a couple of hours now and I have spent more time working and doing hands on care of patients than I have done for ages and that is just down to the fact that they just do not have enough staff to cover this ward properly today. They are absolutely frantic...I am more or less an extra pair of hands and an extra staff nurse at the moment. Under these circumstances you can really see why they are saying that they are not in a position to act as opinion leaders, they are just snowed under."* (R)

This point raised by opinion leaders, that during periods of extremely heavy workload they found it difficult to fulfil the role of opinion leader had not been considered in the planning of the intervention study and arguably revealed a weakness in its implementation. The following tape recorded field note illustrates this:

"B was also making the point that when they are actually concentrating on their own work these opinion leaders do find it difficult to observe other peoples practice so they are not really in a position to praise or challenge or criticise other peoples work because they are concentrating so hard on their own which is a point that I hadn't really thought about." (R)

However, evidence was also revealed during the progress of the intervention study which suggests that even when presented with difficulty in managing heavy workloads, opinion leaders continued to fulfil, value and develop a belief in the role:

"It is always in our heads to either remind ourselves or remind other members of staff, especially new members of staff that come on the Unit, to follow the infection control policy as closely as we can, even though sometimes we are short staffed we are always reminding ourselves to keep up our practices." (D)

In discussing her own feelings in regard to her role as opinion leader one member of staff reported that as a result of the intervention study she felt more able to give advice to others:

"...I was able to tell people yes or no, so it has empowered me." (E)

Evidence such as this supports Hughes (1999) argument that even in situations where healthcare staff are required to adapt to and prioritise their workload, they are able to multitask and carry out their multiple responsibilities. In the case of the opinion leaders, their continued support for the role in the face of heavy workload demands was indicative of their attitude and

belief in the role as a valuable means of generating infection control knowledge and applying this in practice.

Problems associated with workload and staffing are closely related. For example a heavy workload may be more manageable on a well staffed renal unit. Conversely, even a relatively light workload may present difficulties to a unit that has severe staff shortages. On occasions during the intervention study, staffing levels on the unit, particularly during the mid-summer months, were identified as being less than ideal. For example:

> *"Right it is just coming up to 11.15 and still on the 6th July, I can't believe the staffing levels here today, there are 2 trained nurses actually covering the Unit. All of them, all of the dialysis stations are being used up, there is a Registrar walking past me doing portering duties, he is wandering about with beds because there is no-one else actually to move patients around."* (R)

Problems with staffing were not only manifested by difficulties in ensuring that enough staff were available to adequately cover the renal unit. Staffing problems also manifested themselves in ensuring there were enough opinion leaders available to provide continuous exemplification, demonstration and advocating of good infection control practice on the unit. The following field note discusses the problems:

> *"It just goes to kind of support the idea that you do need to have a number of these opinion leaders if your are going to do this, bearing in mind I have had one go off sick with an accident at work, then I have got other people on annual leave, so if*

you have 10 maybe 12 on a unit like this where staffing levels are about 40 or so then you do need to have a good number." (R)

Generally, however it was possible to ensure that at least one opinion leader was on duty during every shift throughout the intervention study, and problems with workload and staffing were reduced before and after the mid-summer months during which staff might normally be expected to take annual leave.

It has been suggested both in the literature and in Chapter Five that contextual issues such as lack of time and heavy workloads might contribute to a reliance on the use of latex gloves as an infection control measure instead of handwashing (Panhotra et al 2004; Jimenez and Sanchez-Paya 1999). Interestingly, such a reliance on the use of gloves was not seen during the intervention study:

> *"...just watching B and F, two of the Opinion Leaders, getting themselves set up, there is nothing at all of this glove reliance, I mentioned about not washing hands before they put their gloves on, and I can't record the look on their faces, but affronted, I think would be the phrase. No way were they going to have that, they insist that they wash their hands first and then put their gloves on and then when the gloves come off they decontaminate their hands, there does not appear to be any replication of the glove reliance that I saw earlier* (in the previous study)." (R)

This does not suggest that gloves were used any less frequently than in the study discussed in the previous chapter or in the study of Jimenez et al (1999). The correct use of handwashing, in conjunction with the use gloves, as demonstrated during the intervention study does not

detract from the argument of Jimenez and Sanchez - Paya (1999) that gloves were relied upon by healthcare workers as a means of protecting themselves from potentially infectious patients. Rather, it could be suggested that the evidence produced by the intervention study supports the findings of Leight (2002) and Diekelmann (2001). For example, the offence and the "affront" that members of staff expressed when it was suggested that they might place some reliance on the use of gloves as an alternative, rather than in addition to handwashing is arguably indicative of a continuously developing and changing narrative, similar to that discussed in the previous chapter, through which communities are constructed, learn, value and share knowledge (Diekelmann 2001; Leight 2002). This contention appears to be supported by the claims of Oswick et al (2000 p888) who find that "organisational reality" e.g. the accepted need to both wash hands and wear gloves, is collectively mediated through narrative discourse by stakeholders within the social group. Through this process stakeholders are able to change, construct and reconstruct meanings and knowledge in relation to learning opportunities. The "affront" demonstrated by the opinion leaders in the intervention study could be seen as an expression of their own "organisational reality" based upon the narrative found in their workplace, which differed to that constructed on the unit discussed in the previous study.

Such a changing and developing narrative within the unit may itself have been influenced by other contextual issues such as the introduction of a new alcohol based hand disinfectant gel and the implementation of the National Patient Safety Agency's (NPSA) "Clean your hands campaign" in hospitals throughout the UK (NPSA 2004). The new alcohol gel was gradually introduced within the hospital and came into use on the unit during February and March, whilst the "Clean your hands campaign" began in February.

Evidence provided by the intervention study suggests that the new alcohol gel, at least during the days and weeks immediately after its introduction, was not well received by staff working on the unit:

> *"They don't like using the alcohol gel; they won't use it, the reason for that is that they claim it dries up their hands."* (R)

> *R: "And are they using the alcohol gel or are they using liquid soap"?*
> *G: "Um... some of the individuals aren't able to use the alcohol gel because they do get reactions to that."*

The above evidence suggests that the introduction of the new alcohol gel shortly prior to the beginning of the intervention study may well have focussed attention on and raised staff awareness of hand decontamination and that this may have had some impact upon the intervention study. This possible impact and the use of the new alcohol gel will be discussed later in the chapter.

It could also be argued that the "Clean your hands campaign" (NPSA 2004) would have been likely to have had some impact upon the unit and the intervention study. However, the findings of the intervention study reveal mixed views in regard to the effectiveness and impact of the "Clean your hands campaign", for example:

> *R: "Have you had anything to do with the clean hands campaign on the unit?"*

E: "Yes about sort of about 3 months ago we had the ultra violet box down, we had that down for a week and everyone from A grade right up to Consultants used it."

R: "That was how long ago?"

E:" That was about 3 months ago, since then we haven't had anything other than the poster out on the door as you come into the Unit."

The following excerpt is from a discussion with an opinion leader towards the end of the intervention study:

"...you know very few of the patients were exposed to the 'Clean hands campaign'. They all had a leaflet but judging by the amount that were left in the waiting room, they may well have read them, but they certainly didn't take them home. I think there has been publicity in the local papers and on TV and that sort of thing so I guess everyone's awareness is perhaps a little bit higher than say 6 – 8 months ago in general, but I really feel there has been a benefit of the research study that you have done here because someone has been coming back on several occasions and that keeps that awareness going rather than one hit and then it is on the back burner because some other topic comes up and then it doesn't come back again for another 12 months." (O)

The above evidence suggests that the "Clean your hands campaign" may have had some limited impact in regard to handwashing on the unit; however the evidence also suggests that the intervention study itself may also have had some influence upon infection control practice within the unit. Having spent some time considering and describing the context in which the

intervention study took place, this chapter will now discuss the impact it may have had on the unit.

Impact and progress of the intervention.

As stated earlier the aims of the intervention study included the creation of a clinical environment in which sustained and continuous tacit learning could lead to an improvement in infection control practice. Such a clinical environment could be said to resemble the type of community of practice described by Wenger (2000).

Communities of practice form around recognised knowledge needs. They are able to become part of an organisations social fabric and are able to spread and disseminate knowledge throughout an organisation (Wenger 2000). They are based upon three core elements; a commitment to "joint enterprise" which binds members of the community, "mutual engagement" through which members learn with and from each other and a "shared repertoire of communal resources" (Wenger 2000 p208). In the case of the intervention study it could be suggested that the unit's commitment to taking part in it amounted to a "joint enterprise". Similarly, any involvement of the opinion leaders and unit staff could be seen as "mutual engagement". As the intervention study progressed it was felt that the opinion leaders could become a "shared repertoire of communal resources" and could in turn lead and guide the dissemination of knowledge throughout the unit.

Leadership and guidance akin to this is supported by Nonaka et al (2000) who find that guidance, support and leadership should be available from individuals with specific knowledge and ability and is vital to the creation of tacit knowledge. This tacit knowledge

may be expressed in the skills and know-how of an experienced practitioner, or it can be found in the taken for granted beliefs, models and perceptions of individuals or groups (Nonaka et al 2000). Tacit knowledge is dynamic and internalized within its holders; it is embedded within actions, values, ideals and commitments, for example to the continuous exemplification, demonstration and encouragement of good infection control practice, as required by the intervention study (Nonaka et al 2000). The intervention study revealed plentiful evidence of a willingness to challenge, exemplify and praise practice, this evidence will now be further discussed.

In total 161 episodes related to challenging practice were recorded in the course of visits to the unit during the intervention study. However, this may underestimate the true extent of challenges made as there is evidence to suggest that challenging of infection control practice became a common occurrence as the study progressed:

> *F: "Even when you are not here it is still going on, there is still a lot of challenging and good practice going on."*
>
> *R: "So during the weeks in between my visits it still carries on?"*
>
> *F: "Absolutely yes."*

The following gives some example of the kind of challenges observed and recorded:

> *C: "The week before I went on holiday we were all challenging one another and it became a joke, but we were taking it very seriously and it made us all be very aware of hand washing and making sure that we were doing the right job and*

nobody took offence because it became a joke, but as I said we still took it seriously."

R: "So when you say we, who was we?"

C: "It was a group of untrained and trained nurses on the shifts that I was on with that week. We were checking everyone had their helmets on, that they wore their gloves, handwashing, wearing aprons, taking aprons off so the whole group of us we were doing it with one another".

R: "Was this on more than one occasion?"

C: "It was for the whole week."

The above example, in which challenging of practice is claimed to have been continued for a week suggests that challenging of practice by opinion leaders became a continuing feature of their daily work. This suggestion is supported by the comments of other opinion leaders:

R: "And when I am not here do you think that good practice continues or do people sort of realise that I am here?"

P: "No it does tend to continue and I think we are challenging each other as well, you know say someone perhaps forgets an apron or something whoever notices it actually does say look can you put an apron on or gloves, so there is challenging going on."

R: "So that is almost like becoming normal?"

P: "It is just part of the day yeah."

F: "A culture of challenging..."

R: "Is that what you have got here now"?

F: "I think so yes. Well, we all seem to have got into the way of challenging each other now, you know if we see something out of the ordinary....."

R: "It is not just infection control stuff now is it?"

F: "No it is not, it's all sorts".

This claimed "culture of challenging" appears to have spread and expressed itself in unexpected ways. For example, members of staff that had not been recruited or had declined to become opinion leaders were found to be challenging infection control practice. Areas of clinical practice not associated with infection control were challenged. Patients too felt able to become involved:

R: "And you have been challenging people down here?"

O: "Yes you know it almost comes as second nature now. What I have noticed down here though and I would just like to say that not for me personally but I have noticed that patients are challenging people which is quite interesting and I think that is very good".

In regard to patients willingness to challenge practice it is arguably difficult to estimate whether this was as a result of the "Clean your hands campaign" (NPSA 2004), the intervention study, some other phenomenon or a combination of influences. However, evidence previously discussed does arguably indicate that the "Clean your hands campaign" (NPSA 2004) may have had only a limited impact upon the unit. It is also worth noting that haemodialysis patients are likely to spend several hours, two or three times a week being dialysed. In many instances patients are encouraged to manage their own dialysis. Consequently, they may share knowledge and have opportunity to build relationships with

members of staff. These relationships and shared knowledge may have contributed to patients' willingness to challenge the practice of staff members. Similar relationships and knowledge may not however be demonstrated by other groups of patients within other clinical areas. It might therefore be suggested that any future investigation into the utility of employing a similar intervention study should take care in regard to both the site and timing of the study so as to avoid such potentially confounding factors.

Previously, contextual issues, particularly workload, staffing and its impact on the unit were discussed. In the case of the intervention study it is interesting to note that even when the unit was busy, opinion leaders, while recognising the difficulties presented by their workload, still attempted to maintain their role:

> *C: "Everybody is being very careful around me because I have challenged people, especially when they are really busy and they are just forgetting to wash their hands I have challenged them, so when they see me they look at me and then they go to the sink and wash their hands..."*
>
> *R: "But you think that actually challenging and praising is helping?*
>
> *C: "Yes definitely."*

This decision by the opinion leaders to persist with and maintain their role is indicative of their belief in its value and effectiveness in achieving an improvement in infection control practice. It could be suggested that this provides evidence to support the assertion of Feather et al (2000), that by choosing whether or not to carry out infection control precautions individuals' reveal their faith in and value for infection control practice. Furthermore it could be argued that by continuing to exemplify good practice, even when the demands of workload make this

difficult to do, opinion leaders were demonstrating how their tacit knowledge of the role and its effectiveness had been or was in the process of being internalized and embedded within their actions and values (Nonaka et al 2000).

Improving practice.

Evidence of improving infection control practice on the unit and the role of opinion leaders in this was revealed in discussion with the participants. Many of the opinion leaders and other members of unit staff claimed that infection control practice on the unit improved during the 6 months of the intervention study, and that this improvement was not limited to handwashing and clinical waste disposal:

> *"Within the dialysis unit I had noticed that there has been a general improvement on people dealing with sharps and everything else. Staff are actually becoming more confident with challenging other peoples practice. I think because we have been able to do that we feel more enabled, we challenge more, people are actually more expecting...because they suddenly realise yes I am doing that wrong, the next time I will make sure that I don't do that again, so that is constantly improving practice all the time. I think staff are also feeling a lot more confident in general challenging because they will challenge other practices, they will ask why staff are not putting patients on at the allocated times, why they are maybe not going to patients and checking on them and people are just generally more confident to do that which is improving the clinical practice in the unit as a whole." (G)*

Further evidence to support this assertion that infection control practice improved on the unit during the intervention study will be considered in the section of the chapter in which data gained from unobtrusive measures is discussed. However, within the data revealed by observation and discussion of practice, additional evidence of changes and improvements in practice is arguably found. The following excerpts while lengthy, illustrate how opinion leaders interacted with new or transient members of staff e.g. bank or agency staff during the course of the intervention study:

D: "Most of the staff that I have worked with are very much more aware than they were about the practices, it is always in our heads to either remind ourselves or remind other members of staff, especially new members of staff that come on the unit to follow the infection control policy as closely as we can."

R: "So you think practices have actually improved?"

D: "Yes I do. Even this morning a young lady joined us from the bank and I made a point of saying to her if you see me not washing my hands I want you to tell me and I will tell you if you don't wash your hands, we keep a balance up otherwise I find the approaches a little bit too aggressive so I always tell them that they are allowed to do the same for me."

N: "We have got 2 of the bank nurses that have been working down here over the last few weeks have approached us and said that they would be interested in joining the team, and they think we have got very high standards here which is good feedback. They are fairly new to the Trust so I guess they have still got fresh in their minds what they have been taught on their induction programme, but what

they have actually seen is maintaining that level of practice down here where some of the other areas they have seen unfortunately that seems to have slipped slightly or they are looked at quite peculiar if they go off and wash their hands before doing things or after doing things."

R: "That is what I am wondering, and whether down here is that we have got used to having high standards and we won't tolerate people coming in...?"

N: "Absolutely. It has definitely been of benefit and I think what it has shown is that you have to have to get to that place where all the staff want to maintain it and that has been a slow progression hasn't it, but we are there and that is brilliant."

It is worth noting that these exchanges took place in the last few weeks of the intervention study, and that the assertions made by participants in the excerpts were supported by the observation of practice. In the last few weeks of the intervention study it became increasingly difficult to observe episodes of bad infection practice particularly in regard to handwashing and clinical waste disposal. Similarly, incidents of challenging practice also become rarer and often appeared to involve transient or new members of unit staff. The following observation highlights how practice was seen to change in the course of the study:

"One of the HCA's was called to the telephone, on the opposite side of the desk was one of our Opinion Leaders, the HCA went to pick up the telephone and I had seen this HCA just put a new pair of gloves on, they were clean gloves, hadn't been in contact with the patient, he had just been going to see to a patient when he was called away to the phone, so he hadn't come in contact with a patient, he then went to answer the phone, went to take the phone from the hands of the opinion leader

staff nurse, who immediately challenged him and said what are you doing with those gloves on, picking him up obviously thinking that the gloves were contaminated and he would contaminate the phone. I don't believe that 6 months ago that would have been picked up on. That was very sharp, no mucking about." (R)

This argument, that practice changed and the nature and frequency of challenges to practice changed as the intervention progressed is supported by other comments made by opinion leaders, e.g.:

"Just spoken to A she hasn't had any experience of having to challenge practice recently, but she does claim that the reason she hasn't been doing that is because in her experience people have actually been carrying out correct practice." (R)

This experience, of opinion leaders finding that the number of challenges to practice they were required to make reduced as the intervention progressed, and of these challenges becoming increasingly focussed upon new or transient members of staff compares to the findings in the literature discussing the role of informal teams and their leadership.

Informal leadership.

Iacono (2003), points to the importance of informal leaders in healthcare as a means of providing learning opportunities, at the bedside, within clinical practice. In this way Iacono (2003) argues that informal leaders are adept and forceful in mobilising, persuading and guiding individuals whilst also overcoming resistant attitudes. However, Antrobus and Kitson

(1999) caution that this leadership and the influence it may exert must be based upon valid and legitimated knowledge, for example in the case of opinion leaders where their infection control practice has been closely observed, compared to hospital policy and validated by an individual recognised as knowledgeable and having some expertise in infection control.

Neubert (1999) in his study of informal leadership in manufacturing teams also finds that organisations are increasingly reliant upon informal leaders working within teams to improve practices. Interestingly, Nuebert (1999) argues that women are likely to successfully adopt informal leadership roles, and that these informal leaders may not necessarily be associated with any formal, hierarchical position within an organisation, instead they may be individuals identified or nominated by their co-workers. Clearly, the findings of Nuebert (1999) compare with the experience of the opinion leaders in the intervention study. Eight of the twelve opinion leaders were female, and all were identified and suggested as prospective opinion leaders by their colleagues. Neubert (1999 p637) goes on to discuss two perspectives on "leadership dispersion", arguing that one perspective i.e. increased dispersion through the use of numerous informal leaders may have a negative impact on outcomes. This argument does not appear to be supported by the evidence gained from the intervention study where the use of a considerable number of opinion leaders was required to increase the likelihood that at least one opinion leader would be on duty on every shift, allowing for absences such as sickness, annual leave etc. This pattern of employment of opinion leaders compares closely with the second perspective discussed by Neubert (1999) in which increased informal leadership dispersion though the use of many informal leaders can arguably lead to improved performance and cohesion amongst teams. This may be achieved through the employment of multiple perspectives, increased information exchange, feedback and goal setting (Neubert

1999; Pescosolido 2001) e.g. opinion leaders recognising, challenging and correcting poor infection control practice.

Pescosolido (2001) further develops the argument of Neubert (1999) in regard to informal leaders and introduces the notion that their efficacy may change over time. Pescosolido (2001) argues that informal leaders may initially exert a strong influence over decision making and goal setting amongst team members and that this may bring the practice of the collective groups closely into line with the goals, expectations and practices of the informal leader. If members of the team continue to maintain the expected practices of the informal leader, then the need or indeed the ability of the leader to continue to exert an influence is reduced (Pescosolido 2001). This argument appears to be supported by the evidence gained during the intervention study, in which opinion leaders were seen to have a positive impact on the practices of their colleagues, and that this impact reduced as the study progressed and improved standards of practice were maintained. Perhaps most significantly, the intervention study also revealed that the opinion leaders retained their ability to exert an influence and have an impact upon the practices of new or transient members of staff introduced into the team of healthcare workers employed on the renal unit.

Exerting influence.

The following evidence suggests that several methods of exerting influence and guiding practice as described in the literature were used by opinion leaders during the intervention study e.g. challenging of poor practice, praising of good practice and role modelling.

"I haven't challenged anyone but I have praised J because every time he sees a patient he always uses the hand gel afterwards, very good. He set himself up I think as a little model...he is he is very good." (H)

F: "Just one of the junior staff actually was doing a job and they actually remembered to take their gloves off and wash their hands and put a new pair on to do the rest of the procedure which I was quite impressed with."

R: "So you actually said something to them"?

F: "I did yeah I said well done that was brilliant."

R: "So actually the practice was entirely as it should have been done?"

F: "Yes absolutely, but I didn't really expect that person to sort of like take on board that they should have done that so I was quite impressed, yes."

R: "And what was their response?"

F: "Well they were really chuffed, like you would be, a bit a praise goes a long way."

"I was just speaking to J, opinion leader. J appears to be developing his own little way of going about this as an opinion leader. He is not challenging practice so much, but he really does seem to be setting himself up as quite a role model, and he was just saying he has been on a ward round with a consultant and he noticed how the consultant was quite stringent in hand decontamination and as J was watching that he remembered or thought about this role of his as an opinion leader, so he was decontaminating his hands too and then as he did it he was followed by the SHO, followed by the houseman, so it almost sort of percolated it's way down through the medical team, and J was pointing out that, he is now sort of

quite, considering the role quite a bit now when he is actually in practice and he has set about setting himself up as a role model, not so much as he is challenging practice, but an example of good practice for others to model themselves upon and he feels that his SHO's practice certainly is good and he has been observing him to make sure that it is as it should be and he feels that this acting as a role model does appear to be making a difference." (R)

In using differing methods of exerting influence, opinion leaders were demonstrating their ability to exploit what they saw as their strengths in regard to leadership (Antrobus and Kitson 1999; Iacono 2003). For example, opinion leaders that did not always feel entirely comfortable in challenging their colleagues were instead seen to actively praise good practice and adopt a position as a "role model" through which they could consistently provide positive criticism, advice, persuasion or vicarious experience for their colleagues (Pescosolido 2001 p76). These opportunities for members of unit staff to learn by modelling their practice on the good examples of their opinion leader colleagues could arguably be compared to the findings of Bandura (1977) and Bleakley (2002) in that individuals learn from and behave similarly to those that they have a high regard for and value.

By adopting strategies to exert influence that suited their own individual strengths, opinion leaders were to some extent expressing a form of "legitimate peripheral participation" as described by Lave and Wenger (1991 p29). For example some opinion leaders were seen to immediately adopt the role with an enthusiasm and willingness to challenge the practice of their colleagues. Others however were more reticent but were still observed to maintain the opinion leader role, for example through exemplifying good practice, with their subsequent level of participation changing and developing over time (Wenger 2000). In this way opinion

leaders, even if they were not entirely happy with a part of the role e.g. challenging senior members of staff, were able to maintain their availability as learning resources for their colleagues. This element of availability was seen to be a noteworthy factor during the intervention study.

Availability.

During the course of the intervention study opinion leaders were for varying periods of time absent from the unit or were involved in non-clinical duties that restricted or prevented them from carrying out their opinion leader role. For example one opinion leader working within the CAPD area was relocated on three occasions during the intervention study. This resulted in this individual finally being located in a working environment separated from the immediate, larger area of patient care and thus constraining the individual's opportunities to act as an opinion leader. Opinion leaders were also temporarily lost to the study due to sick leave, while others in more senior positions were required to attend to managerial duties which reduced their availability to act as the role required. Absences such as these were reflected upon in the following tape recorded field note:

> *"So I am looking down through the off duty for the unit, I know that J is now off, he is not around, G is on leave, D is a day off today, F is here, B is on annual leave, E is here, H is here, K is another one on annual leave. When you go down through the list, considering how many people were actually aimed to recruit in the first instance, I have lost quite a few people at times due to things like sick leave and annual leave and I know that K has been sick, H has changed his job so he has not been around, L is working in an area not actually on the unit so he has*

not been around to do anything. If I was doing this again I would need to be quite selective about the people I choose and make sure I have got numbers to actually cover the unit." (R)

These interruptions in the opinion leaders availability to fulfil their role and any consequent impairment of the intervention study may arguably have undermined the ability of the study to provide the kind of continuing learning curriculum described by Lave and Wenger (1991) in which they emphasise the importance of adequately employing knowledge assets that are viewed and valued daily by learners. It could be concluded that any further attempts to employ opinion leaders in a similar study should take note of the need to ensure adequate knowledge assets e.g. opinion leaders are available throughout the study. Considering this background of temporary absence of opinion leaders during the study it is arguably to their credit that they appeared to achieve some success in changing infection control practice. This change was on many occasions claimed to be in part achieved by simply raising awareness of infection control amongst those working on the renal unit.

Raising awareness.

It has been argued that education should aim to promote and raise awareness whilst enabling the communication of information, competency and know-how (Tones and Green 2004; Pittet 2004; Scott et al 2005). In response to this, modifications, for example to clinical practice, can be made in the pursuit of improved effectiveness. This mode of education is described by Tones and Green (2004) as being empowering rather than persuasive in nature. Through this increased awareness and empowerment individuals are arguably increasingly likely to contribute to the activities or aims of groups or communities with which they are involved

(Tones and Green 2004; Pittet 2004). Evidence of increased awareness such as that discussed by Tones and Green (2004) was readily revealed during the intervention study, for example:

> *"....more aware of it, so it is an automatic response really, go for your mask, put gloves on, put aprons on you know, wash hands, alcohol your hands in between patients and it just becomes so automatic to do it now, whereas before when we were so rushed some people were not doing it and now it just is second nature. I think right across the floor everyone is much more aware of it." (E)*

> *"I think people are more aware about washing hands between patients, I am." (P)*

The above evidence supports the notion that the transmission of information and the exertion of influence is able to raise awareness with a consequent impact upon practice (Pittet 2004). Such an impact upon practice was demonstrated by members of staff on the unit during the intervention study through their use of tacit learning and knowledge.

Examples of tacit learning and knowledge.

An example of existing tacit knowledge employed in practice on the unit was seen when nursing staff "took patients off" of their dialysis machines. During this procedure nurses wrapped pieces of sterile gauze around un-sterile bottles of Heparin; this was done to prevent them "de-sterilising" their latex gloves. In discussion with the nursing staff it became apparent that this procedure had been learnt on the unit and had developed into normal custom and practice. Further investigation revealed that this practice was not advocated in the unit procedure book or described elsewhere in the literature. This form of tacit knowledge

compares to that found in Chapter Five, where nurses used Betadine on their gloves or moistened the bubble traps of dialysis machines without recourse to any form of written policy or published guidance advising these procedures. The use of such tacit knowledge clearly indicates how tacit knowledge was readily accepted, used and woven into the daily practices of clinical staff on the renal unit.

Another example of tacit learning which indicates a change in attitudes and practice was described by one opinion leader following an experience whilst on a ward round with a consultant and a senior house officer (SHO). During the ward round the consultant examined a patient, washed his hands and then attempted to dry his hands on the curtains around the patient. At this point it was the more junior SHO, who had spent considerable time working with the opinion leader, that intervened and corrected the practice of the consultant. What made this incident notable to the opinion leader was that the SHO had at times previously not been seen to be such a keen employer or advocate of correct hand decontamination.

Other opinion leaders were clear that they not only expected members of staff to learn and maintain good standards of infection control practice whilst they were on the unit, but also to work in a way acceptable to the staff on the unit e.g:

> *D: "If they don't then we remind them because if they are not up to scratch, not up to speed with infection control practice and you can see that because they will walk around wearing their apron all the time or the same gloves all the time and you have to remind them on each occasion, take your apron off, take your gloves off and in the first hour or so it takes a bit of prompting and they don't realise that they are doing it."*

R: "So when they first get here that is what you expect and then you get them to behave the way you want them to?"

D: "Yes."

These examples support the contention that tacit learning evolves, is generated, shared and applied within its environment and the community in which it is used (Nonaka et al 2000; Wenger 2000). Opinion leaders, when expressing their expectations that colleagues should work and demonstrate knowledge in a manner sought by them, were also expressing their own commitments or beliefs based upon their own individual values. These expressions and the knowledge that underpins them could be described as socially constructed, dependent upon both individual and shared beliefs, values and understanding (Nonaka et al 2000).

Gradual development and continuing learning.

Individuals that have or are in the process of internalising and embedding knowledge, values and beliefs as described by Nonaka et al (2000) might well retain that embedded knowledge and employ it as part of a sustained and continuing learning curriculum as described by Lave and Wenger (1991). In this way, some continuing impact upon practice and its underpinning knowledge might be achieved. In regard to the intervention study, evidence to support this notion was mixed. Many of those questioned felt that the intervention study had enabled some continuing change and improvement in infection control practice. However, some participants in the intervention study suggested that practice might well decline and return to its previous levels:

"It just always happens, that when someone is around keeping an eye on you everyone tends to do it, but once that person has gone people tend to forget about it." (N)

Other participants expressed more enthusiasm for the intervention and its ability to achieve some level of persistent and continuing change and improvement in practice:

"All the time, I can guarantee you it is all the time. I will tell what is very specific, if I am working with another nurse like E who is also pro-active with her infection control so we remind each other." (D)

"I think people are a lot more confident in challenging. Practice is improving generally, occasionally you do have slips which are understandable, but I think people now are detecting that a lot more quickly and they are saying – do you realise you did that? And they are like oh gosh I completely forgot and so it is constantly improving all the time." (G)

"I mean every now and again I see a bit of bad practice, but it stands out now. It is exceptional rather than norm." (O)

The above responses were recorded within the six months duration of the intervention study and as such cannot be used to support any suggestion of a lasting impact or improvement in practice as a result of it. However, further evidence of some persisting impact and a maintained improvement of infection control practice was gained from follow up interviews

with opinion leaders carried out one month after the intervention study had ceased. This evidence will be further discussed later in this chapter.

Evidence of changes in attitudes and improvements in infection control practice during the intervention study is also revealed in the observations and field notes made throughout its course. At this point it is worthwhile to look again at the experience of one of the opinion leaders at the beginning of the intervention study:

> *"...a senior member of staff came in and spoke to the patient without washing her hands previously, she touched the patient and she walked out and didn't wash her hands, so I actually challenged her, she was a Sister a G grade, and when I challenged her she actually laughed and then the next time she came in she put her hands all over the patient, all over the table without actually washing her hands and she walked away. So I challenged her I said could you please wash your hands, she laughed and walked up the corridor."(C)*

Evidence of this kind suggests that in the early stages of the intervention, and at least amongst some members of unit staff, infection control practice and attitudes towards it left much to be desired. Certainly the sister involved in the above incident was an extreme example of the kind of flawed attitudes and beliefs discussed by Feather et al (2000) and demonstrated on numerous occasions in studies describing poor infection control practice (Yentis 1993; Larson and Kretzer 1995; Pittet et al 2000).

Within this context and against this background of flawed attitudes and beliefs, the intervention study was deliberately designed and intended to build slowly as increasing

numbers of opinion leaders were recruited and began to exemplify and praise good infection control practice whilst challenging and correcting poor practice. The decision to adopt this slow building approach was influenced by the well documented failure of interventions and "infection control campaigns" that have arguably relied upon much initial "fanfare" and input from members of infection control staff but have been able to achieve little more than a short term temporary improvement in practice (Jarvis 1994; Larson and Kretzer 1995; Kretzer and Larson 1998; D.O.H 2003). This intervention study aimed to slowly but deliberately develop a clinical environment in which individuals would be supported and enabled to learn from mistakes, question and discuss practice and mobilise the learning resources contained within the multi-disciplinary team (McDougall and Beattie 1998; Pittet 2004). Through this process, it was felt that the kind of continuing learning in practice described by Lave and Wenger (1991) might be achieved.

Written and tape recorded field notes made during the early to middle stages of the intervention study indicated that the slow and gradual approach was not immediately effective in achieving an impact in regards to infection control knowledge or practice on the unit. For example, written field notes from the 27/5/05 comment on concerns regarding the commitment to the project of some members of unit staff, a lack of awareness of the intervention study overall demonstrated by non-opinion leaders, and inadequate evidence of challenging of practice by the opinion leaders that had been recruited up to that point. However, field notes tape recorded a month later, when all twelve opinion leaders had been recruited and had been operating within the unit revealed a very different picture:

"Three weeks ago, or a month ago, I was really pessimistic I didn't think this was going to work at all, there didn't seem to be any interest in it, no-one seemed to be

doing any challenging, no-one seemed to be taking part in it at... but last week when I was here there was, to my eyes, a visible change in practice and a noticeable change in attitude and today that continued. There are people challenging, people are being praised, people are noticing that there is an increased use in infection control procedures. There is more hand washing going on, protective clothing is being worn as it should be, sharps are going into sharps bins when they should be, all the clinical waste is going into clinical waste bins." (R)

These observations support the assertions of members of the unit staff, both opinion leaders and non-opinion leaders, that during the intervention study poor practice was challenged, good practice was exemplified and praised, and arguably as a result of this, infection control knowledge and practice was improved. The following observations made in the final few weeks of the intervention study highlight examples of good infection control practice on the unit:

"I have been here for 3 hours, I have been watching peoples practice as best I possibly can, it is very, very difficult now to spot anything at all that I can criticise from an infection control point of view." (R)

"There is another staff nurse,... this is how picky I am getting now, who put the soap on her hands first before water when she was washing her hands, that was the only problem I could find with her practice. Apart from that I just cannot spot anything else that I would pick up and say that needs to be put right. So to my eyes anyway it does look as though this is getting better, that infection control

practice is consistently pretty good, certainly for the time I have been here it has been." (R)

It has been argued that workload and staffing may have an adverse impact on infection control practice (Hughes 1999; Saulnier et al 2001). Similarly, it could be considered that the slow, gradual approach undertaken by the intervention study was also to some extent victim of problems associated with workload. As suggested earlier in this chapter, by adopting the role of opinion leader, individuals might almost inevitably find their individual workload increasing with a subsequent impact upon their ability to fulfil and maintain the role. In such circumstances it could be suggested that sharing the burden of the opinion leader workload amongst a sufficient number of individuals enables a more effective implementation of the role. The evidence gained from the discussion with and observations of renal unit staff during the intervention study arguably supports the suggestion that when a sufficient number of opinion leaders are recruited, available and actively supporting the learning environment and experience, then changes in attitudes and improvements in infection control knowledge and practice may be achieved.

Further evidence of changes in attitudes and beliefs in regard to infection control was also revealed by the results of the attitude survey/questionnaire which was undertaken prior to the commencement of the intervention study and again at its completion. This evidence will now be discussed.

Results and discussion of the attitude survey/questionnaire

Fifty questionnaires were distributed amongst renal unit staff at the outset of the intervention study (Appendix 1). The overall aim of the questionnaire was to gain information on the respondents' attitudes and beliefs in regard to infection control and to reveal any changes in these attitudes and beliefs following the intervention study. The questionnaires consisted of 31 questions based upon Likert scaled items each with 6 available responses.

Some consideration was made in regard to the number of responses to be made available to respondents within the Likert scale used in the research. Providing increased options within a questionnaire may make the task of respondents easier, facilitate expression of complex judgments, allow a well differentiated response and enable easier identification of differing opinions amongst respondents (Hague 1993; Czaja and Blair 2005). On the other hand, limiting options within a questionnaire e.g. a 4 option Likert scale, may be effective in obliging respondents to choose a non – neutral option thus avoiding non – committal responses (Czaja and Blair (2005). However, this approach may be criticised as it may lead to respondents being denied the neutral option that they would choose if it were available to them. While expressing caution over the use of a neutral option within Likert scales, Oppenheim (1992) finds that such scales perform well in measuring participants' attitudes, enabling precision of measurement and a deeper, subtler exploration of the attitudes being investigated. As the latter points were considered to be important in this study in order to generate the richest possible data, Likert scaled items each with 5 available responses, including a neutral option, were employed.

The questionnaire also contained one free text question in which respondents could state what they felt was the most important influence upon their infection control practice.

Twenty two of the questionnaires distributed at the outset of the intervention study were completed and returned. Questionnaires were returned by those employed in a variety of professions on the renal unit including doctors, healthcare assistants and nurses. As the six month intervention study ended, follow up questionnaires were again distributed to the renal unit staff. On this occasion 20 of the 22 initial respondents completed and returned questionnaires. Two initial respondents were unable to complete follow up questionnaires, this was due to one respondent being on long term sick leave and the other having left the country. The remaining twenty follow up questionnaires were paired with their corresponding initial questionnaires and the responses analysed using statistical package for the social sciences software (SPSS 11.5 for Windows). Paired responses from the Likert scale based questions were analysed using either Wilcoxon or McNemar's nonparametric statistical tests.

Nonparametric tests were chosen as they are suitable for use when sample sizes are unavoidably small, as was the case in this research (Siegel and Castellan 1988). The McNemar test is appropriate to test for significant changes and may be used in "before and after" type research designs, on occasions when only two ordered responses are used by respondents e.g. agree or strongly agree out of a selection of, for example, 5 possible ordered responses on a scale (Siegel and Castellan 1988). In the case of the Wilcoxon Signed Ranks Test, this test is also applicable in "before and after" type research designs, but is appropriate to use when more than two ordered responses are used by the respondents e.g. disagree, agree or strongly agree out of a selection of, for example, 5 possible ordered responses on a scale (Siegel and Castellan 1988). The power of statistical tests i.e. "the probability of rejecting the

null hypothesis when it is false and thus should be rejected" is generally likely to increase with sample size (Siegel and Castellan 1988 p 11). As only twenty paired questionnaires were analysed, it should be recognised that the statistical power of the nonparametric tests used in this research was likely to be low.

In the case of the free text question, of the twenty paired questionnaires, fifteen respondents completed this question in both their initial and follow up questionnaire. Four completed this question in their initial questionnaire only and one respondent did not complete this question in either questionnaire. Free text responses were transcribed and transferred onto a computer hard drive and analysed using MAX-qda qualitative data analysis software.

The analysis of the data from twenty three of the thirty one Likert scale based questions contained within the attitude survey revealed no statistically significant change in attitudes or beliefs (see Appendix 2). This could arguably be attributable to flaws within the questionnaire. For example, in the initial questionnaire respondents commonly claimed to carry out good or very good infection control practice or possess good or very good levels of infection control knowledge; this subsequently allowed little scope for improvement to be demonstrated in follow up questionnaire responses. This finding may be attributable to pre-existing good practice on the unit, but could also perhaps be a further demonstration of the kind of delusional knowledge that was discussed in the previous chapter. Such delusional knowledge was arguably demonstrated by participants in the study discussed in the previous chapter. These participants were found to believe that their actual, and observed to be inadequate, handwashing practice was compliant with espoused practice. Consequently, the attitude survey questionnaire used in the intervention study may be criticised for not taking adequate consideration of and being informed by the results of the previous study.

The analysis of the data from eight of the thirty one Likert scale based questions contained within the attitude survey did reveal some statistically significant changes (see Appendix 2). The results of the statistical analysis of these eight questions indicate that following the intervention study, positive and desirable changes occurred in regard to participants' beliefs, practices and knowledge.

Positive changes were demonstrated by participants claiming to have greater belief in their ability to dispose of clinical waste correctly following the intervention study (Wilcoxon Signed Ranks Test $p = 0.20$). Participants also indicated that following the intervention study they were more confident in their ability to demonstrate good infection control knowledge in practice (Wilcoxon Signed Ranks Test $p = 0.034$) and in encouraging others to also carry out correct infection control practice (Wilcoxon Signed Ranks Test $p = 0.20$). These results from the statistical analysis appear support the claims of opinion leaders that "*a culture of challenging*" had emerged on the unit in which exemplifying and encouraging good practice whilst challenging bad practice had become a routine part of their usual working day.

The evidence gained from the statistical analysis also supports the notion that as the intervention study progressed it became increasingly difficult to observe poor infection control practice. Following the intervention study participants claimed to have greater confidence that infection control practice on the unit was correct and compliant with local policies (Wilcoxon Signed Ranks Test $p = 0.022$).

Participants also appeared to have increasingly recognised that their knowledge of infection control was gained from working with their colleagues in practice (Wilcoxon Signed Ranks Test $p = 0.047$). This evidence could be interpreted as an indication of the effectiveness of the

opinion leaders operating as sources of tacit knowledge in practice. However, this may not necessarily be an indication of respondents demonstrating a preference for tacit learning in practice, or a rejection of explicit sources of knowledge and information. Respondents also claimed an increased belief that infection control knowledge gained from explicit knowledge sources such as written materials was applied in practice on the unit (Wilcoxon Signed Ranks Test $p = 0.033$). This suggestion also appears to be supported by the responses to the free text question contained in the questionnaire. In this, respondents recognised explicit knowledge sources such as guidelines and policies as being influential in their infection control practice whilst also acknowledging the value of implicit knowledge sources such as personal experience and role modelling. Other responses gained from the free text question appear to concur with other themes raised within the data gained from observation and discussion with participants. Respondents for example claimed that a lack of resources and workload could present an influence on their infection control practice. In the case of workload there appeared to be some disagreement between the respondents as to how much influence on practice this might have. On the one hand respondents indicated that workload may have a detrimental impact on their practice while others claimed that increased workload would not cause them to *"take shortcuts"* in their practice.

These assertions appear to be supported by evidence gained from the statistical analysis of the data derived from the Likert scale based questions. Following the intervention study more respondents felt able to claim that their workload did not prevent them from carrying out correct infection control practice (Wilcoxon Signed Ranks Test $p = 0.044$). It is worth noting here that during the study; opinion leaders recognised that pressure of work had made it difficult for them to fulfil their role. However, evidence was also revealed by the observation and discussion with staff which suggests that even when presented with difficulties caused by

heavy workloads, opinion leaders continued to fulfil, value and develop the opinion leader role. The evidence gained from the statistical analysis is further support for the argument that even in situations where healthcare staff are required to adapt to their workload, they are able to multitask and carry out their multiple responsibilities in managing their workload (Hughes 1999).

In regard to the management of HCAI in general, data gained from the paired questionnaires revealed only weak evidence of an increased belief amongst respondents following the intervention study that HCAI could be managed (Wilcoxon Signed Ranks Test $p = 0.059$). This could be interpreted as a simple pragmatic response from the participants as it is widely recognised that HCAI is never likely to be entirely eradicated (D.O.H 2003). Alternatively, it could be suggested that this is an example of a failing in the questionnaire i.e. the questionnaire does not differentiate between successful or unsuccessful management of HCAI.

Further criticism could be levelled at the questionnaire and its analysis. For example, it has already been stated that twenty three of the questions contained within the questionnaire failed to reveal any statistically significant evidence. This may have been due to poor wording of the questionnaire and/or a lack of consideration and allowance for the kind of delusional knowledge that was demonstrated in the previous study, and which may have influenced subsequent questionnaire responses. In these circumstances the results of the eight questions that did reveal statistically significant evidence might also be questioned. In response to this it could be suggested that the shortcomings of the questionnaire should be recognised and noted to help prevent similar experiences recurring in the future. It should also be recognised that the total of 40 – 50 members of clinical staff available on the renal unit presented a small population group available to the study. However, the paired questionnaires and the results

obtained from their analysis were reviewed and agreed by a statistician employed by the University of Plymouth to have revealed small, but clear changes in attitudes, beliefs and knowledge amongst the staff on the renal unit. Supporting evidence of these changes is arguably revealed in the following discussion of the results of data gathered through the use of unobtrusive measures.

Results and discussion of unobtrusive measures

During the intervention study, unobtrusive measures were employed as a means of gauging and comparing any changes in the consumption of materials typically related to infection control practice e.g. plastic aprons or paper towels used for hand drying. Members of renal unit clinical staff were not informed of unobtrusive measures being used as a data gathering method. Examination of the data discovered by the unobtrusive measures shows that some changes in the consumption of materials typically related to infection control practice did take place during the intervention study.

Handwashing remains the most fundamental of infection control practices (Carter 1983), and any unobtrusive measures aiming to investigate changes in infection control practice should examine the use of equipment or consumables used in handwashing. Members of renal unit staff were usually able to choose from three different products when washing and decontaminating their hands i.e. liquid soap, alcohol gel or Hibiscrub a hand cleanser containing Chlorhexidine normally used prior to minor surgical or invasive procedures. The hospitals handwashing policy guided staff members in their choice of product to use. The policy advocates handwashing immediately before every episode of patient care and after any activity that results in hands becoming contaminated. This would normally require the use of

liquid soap; however alcohol gel can be used when hands are visibly clean.

During the intervention study it was not possible to monitor the consumption of liquid soap on the unit as data on its use was not recorded. However, data was available which allowed monitoring of the consumption of Hibiscrub, alcohol gel, plastic protective aprons, and paper towels used to dry hands following handwashing.

Data on Hibiscrub consumption was supplied by the hospital pharmacy. This data showed that in the period 1/5/04 to 31/10/04, two 500ml bottles of Hibiscrub were issued to the renal unit. This compares to zero bottles issued in the period 1/11/04 to 31/3/05) and four 500ml bottles being issued in the period 1/4/05 to 30/9/05 (the period corresponding to the intervention study on the unit). This level of use was confirmed as being in keeping with the policies and expectations of the hospital infection control team. It could be concluded that Hibiscrub was not commonly used within the unit prior to or during the intervention study and that the small changes in the use of this product are not sufficient evidence upon which to claim any impact on handwashing achieved by the intervention study.

Data on the use of alcohol gel was provided by the hospital administrator responsible for ordering and maintaining unit stores and supplies. This data revealed that in the 6 month period prior to the intervention study twelve 500ml bottles of alcohol hand gel were issued to the unit. This compared to fifty 500ml bottles of alcohol hand gel being issued to the unit in the period corresponding to the intervention study – April to September 2005. This evidence might be considered indicative of some change or improvement in handwashing practice by unit staff during the intervention study. However, the alcohol gel used on the unit during the study was a relatively recent replacement for a different product used in the preceding six

months. The increased use of alcohol gel seen during the period of the intervention study may have been a reflection of unit members of staff becoming familiar with and choosing to use a product that they favoured in comparison with its predecessor. It should also be noted that alcohol gels vary and may have differing characteristics e.g. viscosity, and may require more or less of the gel to be applied to the hands to effectively decontaminate them. Conversely, it should also be recalled that at least in the early stages of the intervention study evidence was found to suggest that the new alcohol gel was not well received by unit staff.

On the basis of the evidence presented above it is arguably difficult to conclude that the increase in alcohol gel use on the renal unit seen in the period April to September 2005 is even in part attributable to the intervention study.

It is regrettable that data on the consumption of the most commonly used handwashing product used on the unit i.e. liquid soap was not available. Liquid soap was supplied to the renal unit by a private contractor. Unfortunately this contractor did not keep any records of supply to or consumption of liquid soap on individual wards or departments. However, following handwashing with soap and water, hands need to be dried. On the renal unit paper towels were used for hand drying following washing and so by measuring the use of these paper towels some evidence of changes in handwashing practice may arguably be provided. Once again data on the consumption of paper towels was made available by the hospital administrator responsible for ordering and maintaining unit stores and supplies.

Four hundred and twenty paper towel rolls were issued to the renal unit in the six months prior to the intervention study. This compares to 588 of the same product being issued during the period of the intervention study. Unusually, extra supplies of paper towels were ordered by

the stores administrator as a result of their increased consumption during the intervention study.

The increased use of paper towels during the intervention study is indicative of improved infection control practice and more frequent washing and drying of hands using paper towels. This evidence appears to support the claims made by unit staff, that infection control practice e.g. handwashing (with the subsequent use of paper towels to dry hands) improved during the intervention study. Alternatively, it could be suggested that the paper towels may have been used for purposes other than hand drying, for example, drying up liquids that have spilled on to floors. However, it is difficult to imagine that the unit was prone to increased spillages and other occasions requiring the use of paper towels for non hand drying purposes during the period of the intervention study. In a conversation with the stores administrator during the study he claimed that he was unable to explain the increased consumption of paper towels and that similar increases had not been seen concurrently or previously on the unit or elsewhere in the hospital. These claims were further investigated in a follow up interview with the administrator which will be discussed later in this chapter.

Good infection control practice also requires the use of protective clothing such as latex gloves and disposable plastic aprons. The use of latex gloves as protection against infection in higher risk areas such as haemodialysis is well established (Jimenez et al 1999), and they were routinely seen in use on the renal during the intervention study. In regard to the use of protective plastic aprons, there is evidence within the literature to suggest that they may not always be used as required in clinical practice and that this may significantly contribute to the risk of transmitting infection (Candling and Stark 2005; Gamage et al 2005).

No significant changes in the use of gloves were detected by unobtrusive measures during the

intervention study. However, changes in the consumption of plastic aprons were seen. During the intervention study, 95 rolls containing 200 plastic aprons were issued to the unit. This compares to 65 rolls containing 200 plastic aprons issued in the preceding six months.

Once again it could be speculated that the increased use of protective plastic aprons was a response to the heightened awareness of infection control claimed by participants in the intervention study. In contrast to the situation regarding paper towels that may have been used for purposes other than hand drying, it is difficult to imagine alternative uses for disposable plastic aprons. It could be suggested then that the increased use of plastic aprons on the unit was prompted by the intervention study. However, caution should be used before making such claims as it should be recalled that the National Patient Safety Agency's (NPSA 2004) "Clean your hands campaign" was also being carried out throughout the hospital, including the renal unit, at the time of the intervention study. Evidence gained in the course of the intervention study revealed mixed views in regard to the effectiveness and impact of the "Clean your hands campaign". Nonetheless, the presence of the "Clean your hands campaign" on the unit at the same time as the intervention study arguably casts doubt over any claim that the increased use of materials such as paper towels or plastic aprons was as a result of the intervention study.

Results and discussion of a follow up interview with a hospital administrator

In order to further investigate the impact of the "Clean your hands campaign" and the changes in the consumption of materials described above, a follow up interview was carried out with the hospital administrator responsible for ordering and maintaining supplies on the renal unit. This follow up interview took place on the renal unit one month after the intervention study

ceased. In this interview the administrator confirmed that he had been solely responsible for the ordering of supplies on the unit for 18 months, including the duration of the intervention study. The administrator also confirmed that he routinely ordered and maintained supplies for other wards and departments throughout the hospital. As a result of his position the administrator was able to observe and compare differing patterns of consumption on wards and departments within the hospital. The administrator confirmed that during the intervention study the use of materials on the renal unit e.g. plastic aprons did increase:

> *M: "There seemed to be a peak around about June when there was an increase in several lines, there was aprons, gel and a few other things and that seemed to level off after a while."*
>
> *R: "Did it go back to its previous level of consumption in your opinion or did it go up and then stay up?"*
>
> *M: "I think with aprons we seem to be using a lot more at the moment definitely because the stock level is set for 5 and that is supposed to cover us for 2 weeks and that is not even lasting one sometimes."*

During the interview the administrator was quizzed over possible explanations for the increased use of materials. For example, were there any known seasonal changes in consumption, had there been outbreaks of infection that could cause increased consumption or could materials have been lost, stolen, borrowed or faulty thus requiring them to be returned and re-ordered. These possibilities were denied by the administrator who attributed the increased consumption of materials to greater use by staff on the unit:

R: "So you think... the only explanation that you can think of is that it might be genuinely used more?"

M: "Yes used more."

Similar increases in the consumption of materials e.g. paper towels were not seen elsewhere in the hospital over the corresponding time period:

R: "Paper towels because you said that the Renal Unit has started to use more paper towels?"

M: "Yes but I haven't seen much of an increase elsewhere."

R: "What, much or any?"

M: "Not as far as I am aware."

R: "No increase at all that you are aware of?"

M: "No."

It could be argued that if the "Clean your hands campaign" was successful in raising awareness and prompting the increase in the use of materials such as plastic aprons and paper towels seen on the renal unit, then it might be reasonable to expect similar results in at least one other area of the hospital. This would not appear to have been the case. The renal unit was the only area of the hospital during the period of the intervention study that was reported by the stores administrator to have demonstrated such an increase in the use of materials typically related to infection control practice.

Finally the administrator also confirmed that to his knowledge, members of the renal unit clinical staff i.e. those likely to be involved in the intervention study and users of the materials

monitored by the unobtrusive measures, were not aware of the monitoring of changes in consumption of materials, in his opinion:

> *"All the staff tend to be concerned about is that the stock is actually there from week to week, the levels themselves don't tend to interest them. Obviously as it is not part of their job." (M)*

Findings from the observational part of the study, attitude survey/questionnaires, unobtrusive measures and the follow up interview with the administrator responsible for stores and supplies on the unit arguably indicate that the opinion leaders and other unit staff involved with the intervention study contributed to changes and improvements in infection control practice on the renal unit. However, the role and contribution of the researcher in establishing and maintaining the intervention study and supporting the opinion leaders also requires investigation. This investigation was carried out through follow up interviews carried out with 3 opinion leaders.

Results and discussion of follow up interviews with opinion leaders

Follow up interviews took place in private, in an office on the renal unit, one month after the intervention study ceased. In general, interviews were around 20 to 30 minutes in duration. The interviews were semi structured with a list of 14 question prompts used for all 3 interviews. Interview responses were tape recorded, transcribed into text, transferred onto a computer hard drive and analysed using MAX-qda qualitative data analysis software. Analysis was guided by Burnard's (1991) model of analysing transcripts in qualitative research. Themes and topics raised in the follow up interviews will now be discussed.

The three opinion leaders agreed that the simple presence of an individual that was known to be interested in and observing the infection control practice of unit staff members had some impact which led to staff considering and reflecting upon their practice:

> *"Simply by being there I think and making us think about our practice and like I said and then it just started to become second nature and for me I started thinking more about what I was doing." (F)*

It could be suggested that the above interview excerpt is little more than an expression of some form of Hawthorne effect. That is to say that the act of a researcher simply paying attention to the participants involved in the intervention study resulted in their improved performance (Doyle 2003; McKenna 2000; Gray and Starke 1988). However, this suggestion could itself be challenged. For example, the observation of practice carried out by the researcher took place for around four hours each week, and each week it was likely that different members of staff would comprise the group being observed. The majority of the observation of practice and feedback provided in practice was carried out and provided by the opinion leaders at times when the researcher was not on the unit.

It could also be speculated that participants were in some way motivated to please the researcher. It may be worth noting that the researcher held no position within the employing trust other than a temporary, honorary contract which lasted only for the duration of the intervention study, and was in no position to offer any reward or favour to participants in the study. In these circumstances it could be considered questionable as to why or whether the participants would choose to act in a way intended to please the researcher, or to continue to behave in such a way during the researcher's absence. Moreover, it could also be suggested

that it would be dangerous to assume that members of unit staff that declined to take part in the study as opinion leaders were motivated by any desire to please the researcher.

It may also be worth recalling here that participants consistently claimed that exemplifying, challenging and praising practice continued and became "second nature" regardless of the presence of the researcher. Claims such as these support the argument of Driver (2002), that learning is accomplished through members of organisations assuming responsibility for particular tasks or duties e.g. handwashing, and making these part of their routine, day to day, working lives. Furthermore, it is worth recalling that participants claimed that other areas of clinical practice not associated with infection control or the intervention study were also increasingly challenged during the study. It may also be worth recalling that during the intervention study, patients also found themselves able to challenge practice.

In addition to this, other studies have used similar methods as the basis for their intervention, for example Brown et al (2003) advocated the use of a single opinion leader recruited from the staff of a neonatal intensive care unit as a means of instructing colleagues. Similarly, Rosenthal et al (2004) employed intensive care unit (ICU) staff to provide performance feedback to their colleagues. Rosenthal et al (2004) recognise the limitations of their study in regards to a lack of contemporaneous controls but were still able to conclude (without reference to possible Hawthorne effects) that their use of performance feedback had a positive impact on the rates of catheter associated urinary tract infection. The risk of some impact caused by a Hawthorne effect in regard to the intervention study should be noted, but similarly it should also be noted that evidence presented by the intervention study and supported by the literature, suggests that changes and improvements in infection control practice may have been the result of some learning in practice.

It could be further suggested that to some extent the researcher was seen to become not so much an external observer, but almost a part of the renal unit staff, particularly during the periods discussed earlier when the unit was short staffed:

> *"When we were short and you mucked in which we didn't expect anyway which was..., and then we were able to watch you and what you were doing as well which was quite interesting." (F)*

By consciously choosing to "muck in" and help where and when possible it could be argued that the researcher was deliberately demonstrating a desire to be helpful to the staff on the unit, not only in regard to infection control, but also in regard to other areas of clinical practice e.g. answering patient call bells or attending to dialysis machines. Through this policy of "mucking in" it could be suggested that supporting opinion leaders in their challenging of infection control practice became just another part of the researcher's activities on the unit. This suggestion appears to be supported by the opinion leaders:

> *"You came in and you made it an actual enjoyable process to do, you didn't come here and bark orders at us you didn't shout at us what are you doing! Why are you doing that? You just gave very gentle hints on did you realise that so and so etc or why are you doing that." (G)*

The above extract suggests that not only a supportive attitude, but also the language used by the researcher may have had some impact in convincing individuals to take or at least consider required or appropriate actions (Charvet 1997).

"You were making people think about what they were doing and why they were doing it and I think that is very much a very important part of the learning process." (G)

"I think that you actually brought the best out in individuals and like I said earlier on I think you made people feel comfortable about that change in role to actually challenge practice." (G)

The comments above could be seen as very flattering to the researcher; however they could also be seen as an indicator of a potential weakness in the interventions study. For example, how could the intervention study be replicated if its success was in some way dependent on the knowledge, attitudes and skills of the researcher? In response to this question the opinion leaders demonstrated a pragmatic approach:

"I don't think it would matter really, I think it (the person carrying out the role of the researcher) *could be an outsider maybe looking and questioning the practice that they were doing... so I think it is irrelevant whether it was from the university or infection control." (S)*

The opinion leaders appeared to be clear that any attempt to repeat the intervention study could be led by members of staff from the local infection control team, university, or for that matter from amongst the staff of the unit. However, the above evidence suggests that while it may well be possible to attempt to replicate the intervention study, the individual recruiting and supporting the opinion leaders would benefit from an ability to demonstrate a genuinely supportive attitude, a recognised proficiency in infection control, and an ability to use

language skills appropriately to persuade and convince participants (Charvet 1997). Through the use of skills such as these there is evidence to suggest that opinion leaders may have developed a feeling of empowerment that aided them in their opinion leader role:

> *"I think with you coming in and following up and getting feedback from any challenges that they had actually done made them feel once again more empowered, they felt more comfortable with that role." (G)*

Perhaps significantly, it appears that the opinion leaders that took part in follow up interviews a month after the intervention study had ceased, still felt that their empowerment and their ability to exemplify, challenge and praise practice persisted:

> *"I think this whole project has actually empowered individuals to question our practice, feel confident in questioning each others practices and when you see that an individual is doing something that they shouldn't have done or is questionable, people will now go up and actually say you should have washed your hands or why have you left the sharp on the trolley, why are you walking across the bay with sharps in your hand." (S)*

The above evidence supports the argument that empowered individuals are strengthened in their ability to take action and are more likely to contribute to the activities or aims of groups or communities with which they are involved (Tones and Green 2004; Pittet 2004). This empowerment claimed by the opinion leaders was to some extent derived from a raised awareness of infection control issues, and an increased recognition and appreciation of the opinion leaders own role (Driver 2002; Tones and Green 2004; Pittet 2004; Scott et al 2005):

"I think sometimes you are aware that things just slip, but you do go to them and say did you realise you have actually done that or you are doing this and you are trying to make sure you get time to tell them that they are still making small mistakes." (G)

"I think staff have generally become more aware of infection control aspects and handling of sharps, of disposal of waste etc." (F)

Evidence gained from the follow up interviews suggests that this increasing awareness, empowerment and subsequent impact upon practice gradually developed during the intervention study:

"The first three months were a bit difficult and then it just became second nature really." (F)

"I think individuals to start with did feel a little uncomfortable about questioning each others practices." (G)

"Well we were a few weeks into it before it started to take off in my view. I guess I mean before the complete group maybe started to take it on as opposed to those that you had been working with." (S)

These sentiments expressed within the follow up interviews support the evidence derived from both the observation and discussion with staff and the unobtrusive measures. This evidence also suggested that the intervention study had greater impact upon infection control practice

following its initial phase when all opinion leaders had been recruited. This slow, gradual impact contrasts with the type of intervention described elsewhere in the literature where interventions have been announced with a great amount of promotion and input from members of infection control staff and have achieved some short term, temporary improvement in practice (Jarvis 1994; Larson and Kretzer 1995; Kretzer and Larson 1998; D.O.H 2003). The intervention study also contrasts with the types of studies described above, in as much as the follow up interviews carried out one month after the intervention study had ceased, appear to provide some evidence of a continuing impact on infection control practice on the renal unit:

> *"I think sometimes you are aware that things just slip, but you do go to them and say did you realise you have actually done that or you are doing this and you are trying to make sure you get time to tell them that they are still making small mistakes, but generally people are a lot more careful about that and I think that after the research project has finished people are still being very careful about that and they are also feeling very confident about still approaching each other saying did you realise you did this or this has happened or make sure you wear your mask." (G)*

> *"I think the individuals that you chose to be the opinion leaders have kept that role and they feel that it is a very important role and they are still continuing to perpetuate that role." (G)*

Clearly, it should be remembered that the follow up interviews occurred only one month after the intervention study had ended and the evidence gained from the interviews can not be considered as compelling evidence of a sustained and continuing improvement in practice.

However, this evidence provides an indication, similar to that gained from the other methods of data gathering used during the intervention study; that change and improvement in infection control practice may have occurred during and as a result of the intervention study. Furthermore, the evidence also provides some suggestion that this change and improvement in infection control practice may have persisted in the weeks immediately following its cessation.

Summary

This chapter has discussed a six month long intervention study carried out on a renal unit within a district hospital. Guided and underpinned by organisational learning theory, in particular community of practice and knowledge generation theory (Nonaka et al 2000; Wenger 2000), the intervention study sought to employ opinion leaders as a means of developing a clinical environment in which infection control knowledge could be generated, shared and applied in practice with the subsequent aim of producing some discernable change and improvement in practice. A combination of data gathering methods were used during the study. Evidence gained from these combined methods appears to support the suggestion that contextual issues such as increased workload, reduced staffing levels and availability of knowledge resources, for example opinion leaders, may have some adverse effect on clinical practice. These circumstances may also have had some impact upon the ability if not always the intention of opinion leaders to fulfil their role as sources of tacit learning in practice. Discussion with opinion leaders indicated that even in times of heavy workload and reduced staffing, opinion leaders continued to value their role and when able continued to attempt to make some positive impact on infection control practice.

In doing this the opinion leaders appear to have gone some way in achieving the aims of the intervention study. Evidence gained from the study indicates that during the intervention study the renal unit gradually became a clinical environment in which various participants, opinion leaders, non opinion leaders and patients contributed to the challenging of poor practice and the exemplification, sharing and praising of good practice. Evidence gained from the study also suggests that this phenomenon was not limited to infection control practice alone, other areas of clinical practice were also exemplified, challenged and praised. This suggests that participants recognised the value and utility of the opinion leader role as a means of improving practice through the generation and sharing of tacit knowledge.

Evidence that the process of exemplification, sharing and praising of good practice lead to some improvement in infection control practice is revealed by the results of the combined data gathering methods used during the study. When examined in isolation, each of the data gathering methods provide some evidence of change and improvement in infection control practice. However, the reliability of some of this evidence could be questioned. For example, in the case of evidence gained from the unobtrusive measures – how much of the increased use of materials associated with infection control seen during the intervention study was as a result of the study? How much was as a result of new products being introduced to the unit, the "Clean your hands" campaign, or some other phenomenon? Similarly, questions could be raised in regard to the quantitative data obtained from the Likert scale based questionnaires and the qualitative data derived from the observation and discussion with unit staff. Clearly, weaknesses in data gathering methods should be recognized and noted.

Alternatively, when the results from the combined methods are brought together and considered collectively, they are able to compensate for weaknesses in each of the discrete

data gathering methods, and provide creditable evidence that not only did the intervention study contribute to a change and improvement in infection control practice on the renal unit, but that this improvement and change may have persisted for some time following the cessation of the study.

The final aim of this intervention study was to make some contribution to the theoretical concepts of organisational learning. This last aim will be discussed in the following chapter.

Second Empiric Phase - Stages of Development

September 2004	Continue literature review. Continue planning of and negotiate access to the site of the second phase of the empiric research.
October 2004	Continue literature review. Apply to the local ethics committee for their approval for the second empiric phase of research.
March 2005	Continue literature review. Obtain local ethics committee approval for the second empiric phase of research.
April - September 2005	Carry out the second empiric phase of the research.
September 2005 - April 2006	Carry out an analysis of the data obtained from the second empiric phase of the research and write a report of this (Chapter 6).

Chapter 7

Conclusion

Introduction

This final chapter will draw conclusions on the basis of the argument and evidence presented in the preceding chapters. Within this argument and evidence a series of propositions have been made regarding infection control knowledge, learning and practice. These propositions have suggested that within infection control education an assumption is made that teaching is the same as learning. Also, that in infection control practice, a theory - practice gap exists which is demonstrated by the division between espoused and actual practice. Furthermore, it has been argued that this gap/division is contributed to by the way that explicit and tacit knowledge is taught, learnt, shared and applied in practice. Finally, it has been claimed that the intervention study in the second empiric phase of this research has shown that tacit knowledge can be generated, shared, guided and informed by explicit knowledge e.g. handwashing policies etc in practice, and that its utilisation may have a positive effect on infection control knowledge and practice.

This chapter will discuss evidence gained from this research that may support or disprove these propositions. It will also present some examination and criticism of the methods used in this research and of the research model that underpinned their use. Further research opportunities and implications for future practice will also be discussed. Lastly, theoretical contributions this research may claim to make will be considered.

However, before continuing with the discussion of this research as outlined above, it may be helpful to consider the context in which it was carried out. The introduction chapter of this

research intended to provide some general illustration of the circumstances facing infection control in the UK. These circumstances may include amongst other things, poorly resourced ICT's with large and demanding roles (PHLS 1995), clinical staff with workloads that may preclude them from carrying out correct infection control precautions (Coia et al 2006), the emergence of so called superbugs (D.O.H 2002) and an increasingly challenging and litigious public (Kelleher et al 1994; Senior 2001). In addition to this, these circumstances may be added to by unfavourable hospital policies, cultures and cuts in funding that present obstacles to collaboration or innovation, and may motivate individuals to avoid involvement in new or potentially costly activities (Poland et al 2005).

Such circumstances were experienced in the first and particularly during the second empiric phase of this research. For example, in both empiric phases of this research participants were at times seen to be struggling with very heavy clinical workloads, and were also required to care for patients that were colonised or infected with "superbugs" e.g. MRSA. In addition, it might also be recalled that on occasions, clinical staff appeared to be less than supportive of the empiric research. The example of the ward sister in the second empiric phase of this research deliberately touching an infected patient and articles within the patient's room, before walking out of the patient's room while disregarding and laughing at an opinion leader is indicative of this less than supportive attitude. The contexts in which the empiric phases of this research were carried out were not always ideal or welcoming, and provided some degree of challenge.

Investigating the theory – practice gap

Earlier chapters in this research have contended that a theory – practice gap exists within the realm of infection control. This gap may be manifested by a division between the espoused and actual infection control practice of health care workers (Badger 2000). Moreover, it was suggested that this division may itself be based upon the use of two possibly contradictory bodies of knowledge in practice – explicit knowledge gained from classroom based, pedagogic instruction, and tacit knowledge that is experientially generated, shared and applied within the workplace (Strange 1996; Huzzard and Ostergren 2002).

The first empiric phase of this research was successful in investigating and confirming the existence of a theory – practice gap, and in gaining some understanding of the division in espoused and actual infection control practice. For example, during interviews carried out in the first empiric phase, participants consistently claimed that their knowledge of handwashing was derived from their experience of classroom based lessons, often taught by infection control nurses. This evidence appears to support the claim that, in common with other areas of health care education, infection control education may to a large extent be reliant upon the pedagogic transmission of explicit knowledge based upon a possibly unsafe assumption that teaching equals learning (Ironside 2001; Bedi 2004). This assumption may be seen as unsafe as it fails to consider cultural, historical, or organisational factors that may influence the learning process (Courtney 1998; Antonacopoulou 2001). Further evidence to support this notion is provided by observations made during the first empiric phase of the research. These observations revealed poor handwashing behaviour amongst participants comparable to that found in other studies in which handwashing was also disappointingly carried out (Dubbert et al 1990; Jarvis 1994; Larson and Kretzer 1995; Pittet et al 2000), and suggests that explicit knowledge fails to be transferred effectively from the classroom and applied in practice.

This kind of failure was exemplified by the participant in the first empiric phase who, during observation, demonstrated consistently poor or inadequate handwashing. Yet when interviewed this participant repeatedly claimed that through pedagogic, classroom based lessons based upon the transmission of explicit knowledge, she had learnt both handwashing technique and its value in preventing infection. Furthermore, this individual believed that the handwashing knowledge she had learnt in class was being transferred into practice. This phenomenon was similarly demonstrated by other participants and revealed that participants' actual handwashing in practice was clearly different from that which they espoused. Participants were seen to largely derive their espoused theory of handwashing practice from the pedagogic teaching of explicit knowledge, whereas their knowledge used when carrying out handwashing in practice was based upon knowledge created and shared tacitly within the workplace. The poor handwashing behaviour observed in practice was contributed to by participants' tacitly learning to alter and adapt their explicit knowledge based handwashing technique to suit both their own requirements and those of their workplace.

The gap between espoused and actual infection control practice may be contributed to by individuals struggling to employ and resolve two distinct and possibly conflicting bodies of knowledge – explicit knowledge gained from classroom based, pedagogic instruction, and tacit knowledge that is experientially created, shared and employed within practice (Strange 1996; Huzzard and Ostergren 2002). This struggle will be further discussed later in this chapter.

The situation discovered in the first empiric phase in regard to sharps and clinical waste management contrasts to that of handwashing in that little evidence was found of a division between espoused and actual practice. Participants espoused a knowledge and recognition of

the importance of sharps and clinical waste management and were observed to demonstrate this consistently well in practice. Evidence gained in the first empiric phase suggests that participants' sharps and waste management behaviour while underpinned by explicit knowledge e.g. waste disposal policies, was not primarily informed by explicit knowledge sources such as pedagogic teaching sessions as found in the case of handwashing. Sharps and clinical waste management practice was found to be largely guided by tacit knowledge that was valued, generated, demonstrated and readily re-applied by participants, in practice.

In the first empiric phase, tacit learning was seen to be an effective medium for generating and applying knowledge in practice. However, it may not always reflect best practice or the desired practice of the employing organisation. Within the first empiric phase of this research, examples of tacit learning were discovered such as the use of sterile gauze placed around fingers clad in sterile gloves to prevent them from being "de-sterilised" when participants handled the controls of dialysis machines. This tacit knowledge was subsequently found to lack any form of policy, literature or other form of explicit knowledge to support its use. This practice and its underpinning knowledge appeared to have been developed, shared, applied and incorporated within the accumulated tacit knowledge of the research participants.

The above example of tacit learning in practice amongst others discovered during the first empiric phase, produced convincing evidence in support of the assertion that tacit learning has a significant capacity to generate knowledge that may be effectively shared and readily applied in practice (Nonaka et al 2000; Wenger 2000). This in turn lead to the conclusion that the second empiric phase of this research should include an intervention study which would be guided by a combination of individual and organisational learning theories and evidence gained from the first empiric phase.

Combining tacit learning and learning theory in infection control practice

The intervention study investigated means by which a clinical environment or community could be created in which infection control knowledge could be guided by explicit knowledge e.g. hospital policies, whilst being generated and shared tacitly within practice. In achieving this it was hoped that actual infection control practice could be brought closer to that described within explicit knowledge sources and which individuals may espouse. To achieve this, 12 members of the multi-professional clinical team based within the site of the research were employed for 6 months as opinion leaders. Focussing chiefly on handwashing and the disposal of clinical waste, these opinion leaders were encouraged to continuously exemplify and advocate good infection control practice whilst challenging poor practice observed during their normal working duties.

This form of intervention could be seen to differ from many of the interventions described in the first chapter of this research. These interventions were found to have some initial, short term impact, which rapidly waned when the intervention ceased (Dubbert et al 1990; Larson and Kretzer 1995; Courtney 1998). Interventions such as that described by Gould (1996) relied upon infection control nurses providing formal, pedagogic, teaching packages to nursing staff in practice. The intervention study described here aimed to learn from the success of Leclair et al (1987) who found that some sustained improvement in infection control practice could be achieved by facilitating means by which multi-disciplinary clinical staff based within the site of the intervention, may demonstrate a continuing commitment to adopting, reinforcing and maintaining the intervention. In this way rather than achieving some short term impact that quickly wanes, the intervention study aimed to slowly increase its impact as opinion leaders were recruited and began to fulfil their role. This process might be compared

to an informal, persistent and continuous drip feed of knowledge, information and reinforcement of learning, based upon the kind of culturally constructed learning, curricula and tools described in chapter one of this research (Schein 1989; Applebee 1996).

Evidence gained from each of the multiple data gathering methods employed during the intervention study indicates that it was successful in contributing to the creation of a clinical environment in which various participants including opinion leaders, non opinion leaders and patients took part in the creation and application of tacit knowledge through a process of challenging poor practice whilst exemplifying, sharing and praising of good practice. The evidence obtained from the combined research methods used in the second empiric phase clearly indicates that tacit knowledge when generated, harnessed and employed in a deliberate, considered and guided manner, which is informed by explicit knowledge based upon recognised good practice and microbiological theory, can be effective in improving and maintaining infection control knowledge and its application in practice. However, evidence was also obtained which suggests that some unexpected phenomena may also have resulted from the methods used during the intervention study.

One of the key features of the intervention study was its intention to facilitate tacit learning as a means to improve infection control knowledge and practice amongst participants recruited from clinical staff. The active involvement of patients in this was not intended. As the intervention study progressed, participants claimed that a "culture of challenging" developed which expressed itself in unforeseen ways e.g. members of staff that had declined to become opinion leaders were found to be challenging infection control practice, areas of clinical practice not associated with infection control were challenged and patients also felt able to become involved in challenging practice. This may be seen as desirable evidence of the

effectiveness of tacit learning and the methods employed by the intervention study in generating and sharing knowledge in practice.

However, it could also be argued that these unanticipated phenomena demonstrate some weaknesses in the intervention study and its methods. For instance, evidence gained in the first empiric phase of this research highlighted how tacit knowledge could be generated, shared and applied within clinical practice without it having any support or validity based within explicit knowledge, theory or recognised best practice. To some extent the intervention study did not fully consider this evidence and subsequently failed to fully control and guide the knowledge creation and tacit learning that occurred during its course. While it might be considered advantageous to empower patients and encourage them to challenge poor practice when they witness it, this must only be carried out when there is confidence in the knowledge base that the patient has and draws upon to inform any challenge he or she might make. In the case of the intervention study, patients were not actively recruited to take part in it; consequently their infection control knowledge base was never assessed. Similar criticism might also be made in regard to individuals challenging other areas of clinical practice not associated with infection control.

The intervention study may well have been successful in demonstrating the utility of tacit learning combined with individual and organisational learning theories in developing an environment in which infection control knowledge may be generated and shared, but it failed to fully demonstrate an ability to guide this knowledge. This suggests that any future attempts to repeat the intervention study may benefit from facilitation and leadership that is able to visualise the possible and unexpected outcomes and phenomena that may be produced by it whilst working to maintain its momentum and sustainability (Evans 2003). Other criticisms

and comments may be offered in regard to the methods used in both the first and second empiric phases of this research.

Criticisms of research methods

Both of the empiric phases of this research were of six months duration and were sited within renal units within district general hospitals. These sites were chosen as they provided relatively settled population groups of both staff and patients that would allow some continuity of data gathering. The work carried out within the renal units' exposed staff, patients and visitors to infection risk and in managing this risk staff were required to demonstrate their infection control knowledge. Both empiric phases employed ethnographic methods, it was felt that the researcher's previous clinical experience of working in infection control and in renal units might aid the development of working relationships with research participants.

The employment of an ethnographic approach which entailed the researcher visiting the research sites and working alongside participants for prolonged periods of time contributed to the development of an understanding of the attitudes, values and beliefs that shaped the infection control knowledge and practice of participants in both empiric phases of the research. Certainly, the ethnographic observation of participants in the first empiric phase was valuable in that it achieved something resembling the baseline observation described by Rosenblatt (1981) which allowed local knowledge and practices to be gauged in comparison to those described in the literature. This baseline observation was then further used to inform the second empiric phase.

However, criticism can be made in regard to the ethnographic observational component within the first empiric phase of the research as it could have revealed a more complete view of handwashing practices demonstrated within the research site. The first empiric phase of the research identified a total of 127 recorded occasions when handwashing was carried out, of these occasions 74 (58%) demonstrated poor handwashing practice. These figures only refer to occasions when handwashing was seen to be carried out; they do not include occasions when research participants may have carried out clinical practices that required them to wash their hands but failed to do so. If these occasions had been recorded then it could be speculated that the overall picture of handwashing practices within the site of the first empiric phase might have been considerably bleaker.

Further criticism might be made of the interviews carried out within the first empiric phase of the research. Contextual issues such as heavy clinical workloads were clearly identified as having some impact on research participants; this on occasions resulted in difficulties in completing interviews as participants continued to have a clinical workload during interviews. To overcome this other members of staff covered the participant's workload for the duration of the interview, and participants were interviewed in areas separate, but as close as possible to the renal unit. This for example resulted in one memorable interview taking place in the physiotherapists "boot room" with both researcher and participant perched upon piles of ageing wheelchairs and Zimmer frames. Similar contextual issues – mainly regarding participants' heavy clinical workloads, lack of staff, resources and increasing health care productivity demands were identified in Chapter One, and in both empiric phases of this research, and would have to be considered in any similar research that might be attempted in the future. On the other hand, other contextual issues that were identified and discussed within Chapter One of this research such as race, gender or increasingly litigious members of

the public were not found to be an issue during either of the empiric phases of this study, but may be a concern if replicated elsewhere.

Some criticism and comment may also be made in respect of the research methods used in the second empiric phase of the research. As in the first empiric phase, an ethnographic approach was used and appeared to be helped by the researcher being able to draw upon previous renal and infection control knowledge and experience. On occasions the researcher was able to help participants when clinical workloads were heavy and limited numbers of staff were available to manage these workloads. This ability to "muck in" and help out when needed aided the researcher in gaining acceptance and in taking part in the daily lives of the participants, whilst supporting the opinion leaders in their role.

The researcher's previous experience, knowledge and pre-existing relationships with some members of staff within the site of the intervention study may have had some influence on its implementation. This could be seen as a manifestation of the kind of "theoretical positioning" discussed in Chapter One of this research (Caelli et al 2003 p9). This "theoretical positioning" recognises that researchers' decisions, assumptions and deductions may be influenced by their own personal and employment history, their background, knowledge and opinions.

However, the extent of the influence of the researcher upon the implementation of the intervention study was disputed by participants, with them claiming that the role of the researcher in supporting the intervention study and its opinion leaders could just as easily have been carried out by members of the local infection control team, university staff, or for that matter from amongst members of the clinical staff. In defence of this contention by participants it should be recalled that the infection control knowledge that primarily informed

the intervention study was derived from the written handwashing and clinical waste policies provided by the local infection control team. When participants directed infection control queries to the researcher, care was taken to refer these queries to local policies for advice. The researcher was not employed as an infection control nurse within the site of the intervention study, and was conscious of this and of the risks associated with providing advice that might contradict that of the local infection control team.

In the case of the researcher's renal knowledge, much of which had been gained more than ten years earlier; this appeared to be rapidly assessed by clinical staff employed in the site of the intervention study and was crushingly described as "de-skilled". Participants were grateful for whatever limited help the researcher could provide during periods of heavy workload, but it could be claimed that this level of help would not have been beyond that of any other individual that wished to involve themselves in the daily workload of participants in order to carry out some similar ethnographic investigation.

In regard to the researcher's pre-existing relationships with members of staff based within the site of the intervention study, it could justifiably be claimed that these relationships helped the researcher in gaining access to the site. On the other hand, it could also be claimed that the researcher had previously worked with only four members of clinical staff out of a total numbering around 45 to 50 individuals. This working relationship had ceased more than ten years previously. The researcher had not previously worked with any of the support staff. It could also be claimed that evidence gained during the initial phases of the intervention study indicated that being known to a handful of staff employed within its site, did not necessarily provide any assurance that the researcher or the intervention study was going to be well received by all members of clinical staff, or that this would have any impact on the study.

The attitude and language used by the researcher may have had some significant impact on the learning experience of participants in the intervention study (Charvet 1997). Again the researcher was conscious of this and endeavoured to be as low – key as possible with the intention of allowing the intervention study to build gradually under its own strength and at its own pace. The researcher considered appropriate role models and employed language that might be used to facilitate a supportive, non-confrontational and non-judgmental approach. Similar consideration and approaches could be also be adopted by others attempting similar research.

It could, regardless of the evidence and argument presented above, still be speculated that the role of the researcher may well have had some impact on the implementation and progress of the intervention study. However, actions and considerations taken by the researcher may have reduced this impact, and evidence to support this is produced by research participants. None the less any future attempts to repeat the intervention study or other similar research, should be mindful and critical of the potential influence and impact that the ethnographic researcher may have upon the site of the research and its participants.

In further discussion of the research methods used within the intervention study, criticism may also be levelled at its use of pre and post intervention study Likert scale questionnaires as data gathering methods. This questionnaire achieved some success in its distribution and response amongst participants and in its analysis which revealed some statistically significant changes in participants' attitudes, beliefs and knowledge. However, despite obtaining advice and making many attempts at redrafting the questionnaire, the wording of some questions within it did not allow sufficient opportunity for participants to express changes in their practice or knowledge, or make allowance for the type of delusional knowledge discussed within the

research model, and which will be discussed again later in this chapter. For example, question 6 of the questionnaire asked participants whether in their opinion they carried out correct infection control practice. In view of the examples of delusional knowledge and behaviour discovered in the first empiric phase, and exemplified by the participant who was convinced that her handwashing technique was correct even when it was repeatedly observed in practice to be inadequate, the wording of this question was perhaps unlikely to reveal significant changes in the participants' opinions.

The success of the intervention study in generating, sharing and applying knowledge in practice was to a large extent dependent upon the success of the opinion leaders in fulfilling their role. Potential opinion leaders were suggested by their managers and were recruited following discussion with them and obtaining their agreement to participate. Successful opinion leaders were motivated, possessed the knowledge and skills to fulfil the role, were visible to other members of clinical staff and were seen to be carrying out the role. A notable example of this failing to be the case was provided by an opinion leader that was motivated and keen to be involved in the intervention study, was well regarded by colleagues and was considered highly knowledgeable and skilled. However this opinion leader was employed within an area of the research site that was rarely visited by other staff members. This opinion leader retained the role for the duration of the intervention study but due to a lack of visibility and infrequency of working with other members of staff was rarely seen to exemplify good practice or have opportunity to challenge the practice of others. Nevertheless, other opinion leaders were successful and were also seen to adapt the role to suit their own strengths and personalities. An example of this was provided by an opinion leader that did little challenging of practice throughout the intervention study but instead consistently performed effectively as a role model and exemplified very high standards of infection control practice. Other opinion

leaders were seen to be confident and enthusiastic challengers of their own and their colleagues practice. Among these confident and enthusiastic challengers were nurses that had completed their nurse training either prior to, or after the changes in nurse education that took place during the 1990's. This does not appear to support the evidence found in Chapter One of this research, which suggests that nurses who completed their training subsequent to these changes may be more willing to challenge practice (Allen et al 2001; Jones 2005).

As speculated in Chapter One of this research, the support of medical staff for the intervention study and the willingness of doctors to take part in it as opinion leaders arguably contributed to its success, and further supports the notion that medical staff remain a powerful and influential professional group that are able to change and influence practice (Foucault 1980). It could be concluded that the support and endorsement of the intervention study by medical staff provided it with a degree of legitimacy which contributed to its influence upon participants.

Yet greater consideration could have been given to the recruitment of opinion leaders. It could have been foreseen that a role that included exemplification and the challenging of others would not sit well with members of staff working within relatively isolated areas. Similarly, more consideration could have been given to the numbers of opinion leaders recruited. The 12 opinion leaders recruited in the intervention study made it likely that an opinion leader would be available on every shift during the intervention study. However, if numbers of opinion leaders had been absent from work then this may possibly have undermined the intervention study. This notion appears to be supported by Zambarloukos and Constantelou (2002 p250) who find that the effectiveness of a learning environment within the workplace may be dependent on its ability to provide a "critical mass" of capable employees, that are able to

generate knowledge and enable learning. Any future research or attempts to repeat the intervention study should investigate means to recruit sufficient numbers of opinion leaders to provide such a "critical mass", and ensure that at least one opinion leader would be available to work on each shift within clinical areas in which other members of staff are able to perceive them fulfilling their role.

Combined within the research methods used during the intervention study, unobtrusive measures were successful in obtaining some objective evidence of changing infection control practice amongst participants Unfortunately, during the intervention study it was not possible to measure the consumption of liquid soap used in handwashing, as data on its use was not recorded by its suppliers or by its consumers. Had data on the consumption of liquid soap been available, then this could perhaps have given a direct indication of changes in handwashing behaviour amongst participants' during the intervention study. Nonetheless, evidence gained from the unobtrusive measurement of materials used in infection control such as plastic aprons and paper towels did reveal that similar changes in the consumption of these materials had not been seen prior to the intervention study or discovered elsewhere within the hospital during its course.

Of course these unobtrusive measures can only at best claim to be indicative of some change in infection control practice; they do not allow any conclusions to be made in regard to whether these changes in infection control practice had any impact on the number of infections transmitted during the course of the intervention study. To enable such conclusions to be made any similar future research should aim to obtain advice from and collaboration with microbiologists to enable some form of surveillance of infection transmission to be included within its research methods.

The research methods used in the empiric phases of this research have possessed both strengths and weaknesses, but when viewed in total, they were able to provide some means of obtaining credible evidence. Where weaknesses have been identified in the research methods, some suggestions have been made as to how these might be addressed in future attempts to repeat or replicate this research.

In a spirit of caution, no claims are made in regard to how this research may be generalised. However, it would appear that the model employed in this research may be applied in other clinical environments or where situated learning may take place. To enable greater confidence in such claims the research would require replication in a variety of settings.

Opportunities for further research

Replication might be described as the planned repetition of previous research with the intention of investigating whether the results of the previous research can be repeated (Fahs et al 2003). Such replication is crucial in correcting errors and validating research upon which new practices may be based or new theory developed and tested (Fahs et al 2003). Fahs et al (2003) focus primarily upon clinical practice, arguing that procedures should not be changed in the absence of convincing evidence of replication of the findings of previous research. However, newly developed theory should also be viewed with scepticism until it has gained support through replication. This replication may permit greater confidence in its results if it is able to demonstrate that results can be replicated in other settings and/or amongst other cultures (Schmieding and Kokuyama 1995; Fahs et al 2003). The arguments of Fahs et al (2003) and Schmieding and Kokuyama (1995) may be seen as significant in the case of this

research which not only intends to offer a means by which practical infection control problems may be addressed, but also to make a contribution to the theoretical concepts of learning.

Opportunities to replicate the intervention study used in the second empiric phase of this research have been presented. Infection control teams operating in the hospitals in which the empiric research phases were based have suggested investigating the feasibility of carrying out similar intervention studies within several other clinical areas. These attempts at replication would be supported by the local infection control teams and as such may possibly be able to include the previously advocated surveillance of infection within their research methods. Surveillance and replication of this nature may lend itself to some form of longitudinal study in which control groups may also be used to provide evidence of the intervention having some sustained impact upon knowledge, practice and infection rates. Attempts at replicating the intervention study in clinical areas other than renal units may also provide evidence of the robustness of the methods used in the intervention study, their ability to be more widely applied, and on the utility of the underpinning theories upon which they are based. These attempts at replication must also aim to achieve a greater understanding of the potential impact of contextual issues upon learning, knowledge and practice. Contextual issues such as power, gender, race and workload (Foucault 1980; Gaffney et al 1999; Doyal 1994; Bhopal 2001), may all have some influence on the creation, sharing and application of knowledge. Indeed, it could be suggested that workload, which this research has shown to have a considerable potential impact on infection control practice, may itself be a suitable area for further research in regard to its impact on learning and the use of knowledge in practice.

In addition to replication of this research, other topics revealed and discussed by this research may also be worthy of further enquiry. For example, the second chapter of this research in its

discussion of learning theories and learning in infection control drew attention to the need for individuals to unlearn previous knowledge that is used to inform poor practice, and instead change and develop new practices that are based upon an evident logic (Philips 1989). This evident logic must present a compelling and unambiguous means by which learners can identify their learning needs and establish ways by which they can be addressed. The delusional knowledge discussed within the research model and demonstrated within the empirical phases of this research illustrates the kind of knowledge that should be unlearnt. Further investigation is required in order to achieve a greater understanding of delusional knowledge, its creation, means by which it is shared and ways in which it might be unlearnt. This further investigation might, for example, choose to focus upon the use of intuition and heuristics in clinical practice and the contribution they may make to the development of false beliefs amongst clinicians. Further research may also aim to achieve a greater understanding of informal leadership and the role of the opinion leader in challenging poor practice, whilst effectively guiding, reinforcing and supporting learning in practice. Further investigation such as that suggested above and replication of the intervention study in multiple clinical areas may have some implications for practice.

Implications for practice

HCAI is hugely costly in terms of finance, morbidity and mortality (Plowman et al 1999), and yet the literature is replete with evidence suggesting that basic infection control practices such as handwashing, are carried out consistently badly (Dubbert et al 1990; Jarvis 1994; Larson and Kretzer 1995; Pittet et al 2000). Similarly, evidence is found in the literature to suggest that previous educational interventions have failed to produce an enduring improvement in infection control practices amongst health care workers (Kretzer and Larson 1998). Kretzer

and Larson (1998) also find that ICT's have been unable to provide any single educational intervention that has produced a sustained improvement in healthcare workers infection control practice. However, this study appears to clearly show that improvement in infection control practice may be achieved through the use of situated, tacit learning underpinned by organisational learning theories such as knowledge creation and community of practice theory. Furthermore, follow up interviews carried out with opinion leaders a month after the intervention study had ceased, indicated that they were continuing to exemplify, challenge and praise practice. The implication of this is that methods used in the intervention study have the potential to create a clinical environment or community in which the creation, sharing and application of situated, tacit knowledge may be maintained for some indeterminate time. This potential should be further investigated. For example, it could be speculated that successful replication of the intervention study within multiple wards or departments within a hospital might lead to the kind of community of communities suggested by Brown and Duguid (1991) in which further learning and innovation may be shared and supported. This learning and sharing knowledge need not necessarily be limited to infection control; arguably methods used within the intervention study may also be used in other areas of healthcare, for example, in moving and handling patients. However, development of communities that do focus upon infection control may however have implications for ICT's and their ability to provide support for them. This might possibly be seen as an opportunity to investigate the role of the opinion leaders and/or already existing infection control link clinicians in providing this support.

This topic of support links to an earlier stated contention, that any future attempts to repeat the intervention study and develop similar environments or communities may benefit from support and leadership that is able to preserve momentum and sustainability, whilst foreseeing any unexpected outcomes and phenomena that these attempts might produce (Evans 2003).

The issue of support will be further considered in the following criticism of the research model used in this investigation.

Criticisms of the research model and the construction of a revised research model

The research model begins with a discussion of the theory – practice gap. This discussion finds that this gap may be based upon individuals developing two contradictory theories derived from two differing bodies of knowledge - their espoused theory based on explicit knowledge and their actual theory in practice based upon tacit knowledge (Strange 1996; Huzzard and Ostergren 2002). This notion suggests that these two contradictory bodies of knowledge are in some way fixed, and conflicting with each other in use. However, evidence gained during the first empiric phase of this research seems to cast some doubt on this. Participants in the first empiric phase were found to be continuously struggling to resolve and merge these two differing bodies of knowledge to suit their changing circumstances and needs in practice. Participants' explicit and tacit knowledge was not necessarily seen as contradictory. However, the source and application of knowledge was influenced by contextual issues and circumstances in which participants found themselves. While the potential influence of contextual issues was recognised within the research model, it failed to fully anticipate what their impact might be upon participants in their attempts to adapt and combine knowledge from differing sources in practice and in the creation of any theory – practice gap.

The research model continues to build upon a combination of learning theories, beginning with experiential learning. In discussing this, the research model acknowledges the potential role of environmental or social issues in the learning experience and argues that this may to

some extent be influenced by learners' cognition and interpretation of the knowledge and practice of others. Within its experiential learning component, the research model could have found a role for the application of some andragogical learning theory in motivating participants to recognise their learning needs in context, and identify any gap between their espoused and actual practice (Coates 1995). Recognition of these needs and means to address them could have been assisted by participants adopting a facilitator/learner role (Nottingham Andragogy Group 1981). The inclusion of this andragogical facilitator/learner role within the research model could have provided some theoretical template upon which to build the role of opinion leader, as subsequently employed within the intervention study.

Experiential learning includes reflection as one of its key elements of (Kolb 1984; Burnard 1989; Coates 1995). The research model in its discussion of the role of reflection in learning, or perhaps more accurately the role of incomplete and flawed reflections; highlighted risks associated with the partial perception of consequences of clinical experiences which are evaluated through deficient reflective processes. Such flawed reflective learning could be described as learning from delusion (Long and Newton 1997). Evidence revealed in the first empiric phase of this research supports the proposition made in the research model in regard to learning based upon flawed reflections and delusion. Participants were found with strongly held false beliefs, for example in regard to handwashing practices. Participants were found to believe that their actual and observed to be poor handwashing practice was compliant with their espoused, explicit theory based practice. The research model proposed that delusional knowledge may result from individuals basing their beliefs and conclusions on information that has not been correctly perceived, understood or reflected upon due to problems with individuals' perceptive or cognitive ability (Georgaca 2000). Furthermore it was suggested that strongly held and valued tacit learning based upon delusion may in turn be shared and

assimilated by others (Durrance 1998). The research model argued that in this way delusional knowledge might become the kind of tacit knowledge relied upon and used in practice. However, evidence of delusional knowledge gained from the first empiric phase and its discussion within the research model was not fully considered or used to inform the second empiric phase of the research. Consequently, data gathering methods, such as the Likert scale questionnaire used in the second empiric phase, failed to fully account for this argument and evidence, and achieved only partial success as a data gathering tool.

The research model was limited in its ability to identify the risks presented to the learning process by the use of tacit learning based upon flawed reflections on and in practice. The research model may also be criticised for failing to suggest means by which such learning might be controlled or prevented. This control or prevention might have been aided by the research model including some means of providing greater guidance and leadership of the learning environment and experience. This guidance and leadership could be used to ensure that tacit knowledge gained and shared in practice is based upon sound and validated knowledge and not on assumptions of its adequacy (Kim 1993). This requirement for greater guidance and leadership supports the contention favouring the inclusion within the research model of something akin to the andragogical facilitator/learner role discussed earlier.

This aspect of leadership of the learning experience is also referred to within the research model in its discussion of community of practice theory. The employment of community of practice theory within the research model was to some extent successful in providing a theoretical perspective through which existing relationships and structures within the sites of the empiric research such as multi-disciplinary teams could be identified and viewed. The

intervention study in the second empiric phase of the research achieved some success in employing community of practice theory in developing upon these existing structures and relationships and in creating a clinical environment or community in which sustained and continuous tacit learning lead to an improvement in infection control practice. Elements key to the foundation of communities of practice such as situated learning, common purpose, mutual commitment and a sharing of resources were demonstrated by participants in the intervention study (Wenger and Snyder 2000). The learning environment was situated in clinical practice, common purpose and commitment was demonstrated by participants agreeing to take part in the intervention study and/or act as opinion leaders. Opinion leaders' exemplifying their tacit knowledge, attitudes, beliefs and shared mental models (Kim 1993; Wenger and Snyder 2000) could be claimed as evidence of sharing resources.

A further key element of community of practice theory is that of legitimated peripheral participation – the process by which individuals within the community may progress from a peripheral position to one of core membership or leadership as knowledge, skills and ability is gained (Wenger and Snyder 2000). This process was seen to take place within the intervention study. For example, as opinion leaders gained confidence in their tacit knowledge and opinion leader role they increasingly lead and contributed to the situated learning experience. Similarly, as the intervention study progressed, evidence was gained of non opinion leaders beginning to challenge practice. Finally, evidence was obtained of patients finding themselves in positions in which they too were confident in challenging the practices of clinical staff. Although as discussed in chapter six, it is worth recalling that renal dialysis patients with their frequent, repetitive and lengthy episodes of treatment may be more predisposed to challenging their carers than other groups of patients.

This process of movement from the periphery to the core, from partial involvement to leadership, and its potential consequences was not fully considered by the research model. Wenger (2000 p217) argues that within communities of practice a "learning agenda" or curriculum emerges. This may not be fixed or necessarily based upon instruction or guidance for best practice provided by agencies or experts outside of the community of practice (Lave and Wenger 1991). However, the curriculum may be lead by internal leaders found within communities of practice. These leaders may not necessarily be recognised experts; however expertise gives legitimacy to the community and may provide direction for its learning agenda (Wenger 2000). The risk of communities of practice acting as means to create, store and share delusional knowledge and learning derived from flawed reflections is recognised within the research model. However, once again the research model fails to acknowledge a need for the kind of experts described by Wenger (2000) that may have subsequently contributed to the legitimacy of the intervention study and provided its learning agenda with greater control and focus.

Without this guidance and legitimacy communities of practice may be in jeopardy of generating and sharing knowledge that may not be correct, valid and reflective of best practice. Evidence of such risk was revealed during the intervention study in which areas of practice unanticipated in the research model and distinct from infection control were addressed by research participants.

The final theoretical component included in the research model is that of knowledge creation. In discussing knowledge creation the research model briefly describes the socialisation, externalisation, combination and internalisation (SECI) model presented by Nonaka et al (2000). In this model explicit knowledge, for example from policies or procedures, is

transformed and internalised within individuals as tacit knowledge (Nonaka et al 2000). This internalised knowledge creates "tacit knowledge bases" which may be used to inform the actions and practice of individuals (Nonaka et al 2000 p11).

Knowledge creation similar to that described in the research model was seen to take place within the second empiric phase intervention study. For example, during their recruitment and preparation, opinion leaders were observed in practice and provided with infection control training and advice that was itself based upon the written content of the infection control policies of the host hospital. This written knowledge was combined with other elements of explicit infection control knowledge already known to opinion leaders and integrated into their mental models of infection control practice (Kim 1993; Nonaka et al 2000). Explicit knowledge e.g. hospital infection control policy, was arguably internalised by opinion leaders through their interactions with experience, clinical practice and the explicit knowledge they had been presented with. Through this internalisation process, opinion leaders transformed explicit knowledge into their own embodied tacit knowledge (Nonaka et al 2000). Through exemplification of good practice based upon this internalised and combined knowledge, opinion leaders were seen to be externalising and making this knowledge explicit to others. Evidence gained during the intervention study suggests that learning through some form of socialisation occurred as increasing numbers of opinion leaders were recruited, carried out their role and externalised their tacit knowledge. Evidence suggestive of learning through socialisation is revealed by opinion leaders claiming a decreasing need to challenge the practices of their colleagues as the intervention study progressed, and of what challenges opinion leaders did need to make becoming increasingly focussed upon new or transient members of staff.

It could be concluded that the knowledge creation process contributed to opinion leaders becoming "tacit knowledge bases" (Nonaka et al 2000 p11) which subsequently informed the knowledge and practices of their colleagues and contributed to the socialisation of newcomers into the tacit knowledge and practices held and employed within the site of the intervention study.

In reviewing the research model, a recurring theme is found of missed opportunities to include within it an element that is explicitly tasked with providing effective control, guidance, maintenance and support of the learning environment. Communities of practice or environments similar to that created during the intervention study, may have the potential to achieve wider organisational goals e.g. reduced infection rates. However, participants in these studies or communities must be responsible for their maintenance (Wenger 2000). Wenger (2000) goes on to argue that communities of practice require nurturing, support and resources from the wider organisation that both recognises and values their work. It was unfortunate that such support was not made available to this research and the intervention study. However, with the benefit of hindsight, the research model and the subsequent intervention study based upon it may have benefited from the inclusion and employment of individuals operating in a role that more clearly defined them as responsible for the support, maintenance and guidance of the learning experience. Individuals operating in this role might have been effective in providing greater guidance and legitimacy to the "learning agenda" (Wenger 2000 p217) thus reducing the risk of engendering the kind of unexpected and unanticipated phenomena discussed earlier in this chapter. In any attempts to repeat this research, the role of opinion leader could be augmented in order to achieve this more clearly focussed supportive and guiding role. This augmentation could allow some, or possibly all, opinion leaders to be

identified and supported in much the same way as the support for learning champions has been described in the literature.

Learning champions have been identified in the literature as being a valuable resource in implementing and maintaining innovations and new practices (Gomes et al 2001; Collinson and Gregson 2003). However, these learning champions must themselves possess the power and organisational support to allow them to operate effectively in their role (Gomes et al 2001; Issenberg et al 2003). Learning champions have been employed successfully in areas of health care. For example, Issenberg et al (2003) advocated the employment of clinical educators in the role of learning champion in the implementation of new technology in undergraduate medical training. Poland et al (2005) in their study of collaborative health care practice in Canada found that even within adverse hospital environments and cultures, committed and effective learning champions were successful in providing impetus and supporting new collaborative working practices. Interestingly, Poland et al (2003 p132) describe how learning champions operated successfully as "cultural interpreters" as collaborative projects moved from one setting to another. This could be a useful role and skill to adopt within the opinion leader role and employ in any attempts at repeating this research in new settings and amongst new cultures.

An augmented opinion leader role that benefits from greater organisational support and recognition may provide an effective means of guiding the learning experience in practice. This learning experience could also benefit from some application of pedagogic teaching and learning in practice.

Further criticism may be made of the research model in regard to its failure to fully consider or

include within it a role for pedagogic theory. The research model criticises infection control education, arguing that historically it has relied upon classroom based, pedagogic teaching of explicit knowledge, and an unsafe assumption that teaching inevitably leads to learning (Courtney 1998). The research model rejected any notion of pedagogy as a theoretical component to be included within it. As such it failed to recognise the role that pedagogic teaching had within the intervention study and also failed to recognise the potential value of intentionally including some pedagogical component within it.

Pedagogic teaching was seen to take place during the recruitment and preparation of opinion leaders. During this period, opinion leaders worked in clinical practice alongside the researcher, and as part of their preparation, opinion leaders were didactically shown and taught how to practice in keeping with the handwashing and clinical waste policies of the host hospital. Evidence of the effectiveness of this pedagogic teaching in practice is revealed by opinion leaders modifying their own practices to comply with hospital policies and then exemplifying these practices as part of their opinion leader role. This phenomenon supports the argument of Guile and Griffiths (2001) in regard to the application in practice of pedagogic learning and knowledge.

Guile and Griffiths (2001) find that pedagogic teaching that takes place in isolation and is not linked to context, leads to learners having difficulty in transferring knowledge into practice. Guile and Griffiths (2001) argue that pedagogic teaching should look to exploit opportunities raised by situated learning. These opportunities within situated learning have been described as "pedagogical spaces" in which individuals may also learn experientially (Guile and Griffiths 2001 p125). Within these spaces learners may be enabled to employ and test pedagogically derived explicit knowledge in context with the aim of developing new learning

that is readily applied in practice. The recruitment and preparation of opinion leaders in clinical practice provided a pedagogical space that, whilst unrecognised at the time, was effective in enabling pedagogic teaching and learning in practice to be employed effectively. In its dismissal of pedagogic theory, the research model failed to investigate, recognise and exploit opportunities to employ pedagogic spaces within a situated learning environment.

Criticisms and comments made in regard to the research model suggest that it could, in the light of experience from both empiric phases of this research, benefit from some updating and revision. A revised research model (Figure 4.) is diagrammatically presented below and aims to address criticisms made of its predecessor. The revised research model, while retaining elements found in the previous version, now more fully appreciates, and provides some indication of the impact and influence contextual issues and the environment may have on elements contributing to knowledge, practice and the learning climate.

Figure 4. Revised research model.

The model presented above indicates how practice may be influenced and underpinned by a variety of knowledge sources. These knowledge sources may themselves create further influence within and upon the surrounding learning environment. The above model also acknowledges the need for support and commitment from the wider organisation. The model also recognises the role that pedagogic teaching and learning in practice may have in creating

and applying knowledge within the workplace.

The previous version of the research model acknowledged that the environment may have some impact on learning, but its discussion of this impact was limited, and mainly referred to cognition and interpretation of the knowledge and practice of others within the environment. This discussion did not take account of the impact of more physical elements found within the environment and their potential impact on the learning climate e.g. workload, reduced resources, or challenging patients. Elements such as these were observed during both of the empiric phases of this research. The revised research model emphasises the importance of the learning climate and its ability to encompass within it, or for that matter exclude from it, sources of knowledge, learning and practice.

Emphasis on the importance of the learning climate is also found within the literature. Evans (2003) suggests that learning environments should aim to utilise formal and informal learning opportunities, facilitate the transfer of knowledge into practice and enable the sharing of knowledge whilst seeking out novel learning sources. Clarke (2005) argues that learning environments may benefit from supportive infrastructures, empowered individuals that are able to communicate and reflect effectively, and the utilisation of formal and informal learning opportunities. In addition, both Clarke (2005) and Kirby et al (2003) recognise that physical aspects of working environments such as equipment, technology, and workload may also have some influence on the learning environment. It could be concluded then that the previous research model neglected to fully account for the significance of the learning environment in which the empiric phases of this research were carried out and that the revised research model is correct in identifying the learning environment as a key factor which should be given greater consideration in any future iterations of this research.

In further discussing the learning environment Kirby et al (2003) argue that learning within the workplace will not be successfully achieved without the commitment and support of employers. The requirement for support, guidance and organisational legitimacy is made explicit within the revised research model. Such support and guidance may be underpinned by the adoption of the facilitator/learner role advocated by the Nottingham Andragogy Group (1981) and by the type of leadership Easterby-Smith et al (1998) argue is required to facilitate learning within communities of practice i.e. leaders that are genuinely empowered and legitimated while benefiting from commitment and support from their wider employing organisation. Recognised and empowered leaders such as this may have greater ability to provide legitimacy, and maintain a focus for the knowledge generated, learnt and applied within learning environments or communities of practice developed in future research projects (Wenger 2000).

A final additional component is found within the revised research model. This component recognises the value of pedagogical teaching and learning in practice. The role of pedagogy was perhaps too rapidly dismissed during the construction of the previous research model. This may be attributable to a desire to identify alternatives to the pedagogic teaching that healthcare and infection control education has historically relied upon (Ironside 2001; Bedi 2004). Pedagogic teaching in practice was seen to be effective during opinion leaders' preparation for the intervention study. During this preparation, opinion leaders worked with and were taught in practice by the researcher. Evidence of the effectiveness of this was provided by opinion leaders changing their practices to comply with the explicit knowledge based content provided during the pedagogic teaching. By employing pedagogic teaching methods in practice the revised research model acknowledges the argument of Guile and Griffiths (2001) and sees a role for the creation and employment of pedagogical spaces within

the workplace. Within these spaces learners may pedagogically gain explicit knowledge, and may also be able to apply and reflect upon this knowledge in practice. Through this experience new knowledge may be gained and assimilated into practice. These pedagogical spaces may arguably be created by educationalists or by the recognised and empowered leaders of Easterby- Smith et al (1998) and (Wenger 2000).

By incorporating new components, such as pedagogical teaching and learning in practice, while maintaining a greater awareness and consideration of the potential impact of the learning environment, the revised research model may arguably provide an effective template upon which to base future iterations of this research.

Clearly, criticisms may be made of the original research model (Figure 3.) that was used to underpin this research. Nevertheless, it could be argued that the original research model and the research project that it informed was able to demonstrate some success in practice and may also claim to make some contribution to theory. This contribution will now be discussed.

Contributing to Theory

This research has produced evidence to support the contention that tacit knowledge is created, shared and subsequently valued in clinical practice (Wenger 2000). Furthermore, much as Reber (1993) finds in the case of implicit learning, this tacit knowledge may be generated without any deliberate effort to learn and regardless of the absence or presence of any explicit knowledge on the topic concerned. Examples of this were found in the empiric phases of the research when clinical practices were observed that lacked any support or foundation in explicit knowledge sources, such as written policies or procedures. Similarly, clinical

practices were also observed that did not comply with available explicit knowledge sources, but were instead guided by tacit knowledge generated and shared in practice. This evidence indicates that tacit learning in clinical practice, or perhaps more precisely in the case of this research, infection control practice, may occur without the direct involvement of infection control teams or educators that continue to rely upon pedagogic, classroom based teaching of explicit knowledge as their primary form of educational intervention (Courtney 1998; Ironside 2001; Bedi 2004). As a consequence of this, knowledge gained may be flawed, lead to poor practice and the transmission of infection.

Arguably, tacit learning in practice provides an area of opportunity for educationalists and for infection control. By harnessing, guiding and managing the tacit learning experience, something approaching the learning without deliberate effort, as described by Reber (1993) might be used as a means of creating infection control knowledge and improving practice. The opportunity and potential provided by tacit knowledge creation and application as a learning resource in infection control has previously lacked investigation or employment as a means of developing theory or improving knowledge and practice.

It is in this investigation and employment of tacit knowledge that this research can claim to have achieved success. In achieving this, the intervention study in the second empiric phase of this research combined and applied individual and organisational learning theories within a new and challenging area of practice. Evidence gained during the intervention study indicates that it successfully achieved changes and improvements in participants' infection control knowledge and practice leading to the development of what one participant described as a "culture of challenging". As this culture of challenging developed, new and transient members of staff employed within the research site were seen to undergo a form of

socialisation into the accepted behaviour, expectations and tacit knowledge of the host community. Through this socialisation, participants were seen to become further sources of support for the community.

The evidence gained from this research study clearly indicates that tacit knowledge is generated within clinical practice regardless of the presence or absence of explicit knowledge. However, when this knowledge is harnessed and guided so that it is supportive of, and compliant with, established good practice and explicit knowledge sources, then it offers a potentially valuable and effective learning experience that may continue to be utilized, even within challenging learning environments. These learning environments, even challenging ones, may be considered part of the communal resources that Wenger et al (2000) find are components of communities of practice.

Of the learning theories combined and employed within the intervention study, community of practice theory was of some significance (Wenger 2000). In its employment of community of practice theory, the intervention study provides some indication not only of the theory's capacity to be applied successfully in the clinical workplace, but also of its resilience within challenging environments.

The site of the intervention study exhibited many of the contextual issues described earlier in this chapter (Kelleher et al 1994; Senior 2001; D.O.H 2002; Poland et al 2005; Coia et al 2006). As such it differed from many other environments in which the application of community of practice theory has been documented, such as in banking, car manufacturing, government agencies or amongst service technicians (Brown and Duguid 1991; Wenger and Snyder 2000).

It could be argued that these environments offered some level of stability that was not available to the intervention study. For instance, in addition to the contextual issues discussed earlier, participants in the intervention study were required as part of their normal duties to care for their patients. In caring for their patients, participants were presented with a context that could spontaneously make great demands upon them that could not necessarily be anticipated or predicted. For example, those experienced in clinical practice may be familiar with the way in which a smoothly running ward or department can be rapidly thrown into disarray by a sudden deterioration in the condition of an existing patient or the arrival of an acutely unwell patient that makes increasing demands on staff or presents them with challenging behaviour. The environment in which the intervention study took place contrasted to some extent with other environments discussed in the literature, and could at times be unstable, challenging, hostile even, and less than conducive to learning. Nevertheless, evidence was gained of the intervention study facilitating tacit learning within this challenging clinical environment. Having carried out an extensive literature review it would appear that similar evidence has not been reported elsewhere.

It may be reasonable to question just how successful a similar intervention study might be if it had the kind of wider organisational support advocated by Wenger (2000) or was faced with a less challenging context. Learning environments or communities of practice similar to that developed during the intervention study, may possess an ability to continue to provide a learning experience and display a degree of resilience to challenging environments that may not have been documented previously. These environments or communities may offer educationalists a chance to provide learning opportunities within areas of clinical practice that may previously have been considered unsuitable due to unfavourable contextual issues that

they may present, such as heavy workload, reduced staffing levels or challenging behaviour of patients.

It could be speculated that the relationship of the opinion leader role to that of the participants' normal daily workload might in some way have contributed to the resilience demonstrated during the intervention study. It could be suggested that the role of opinion leader effectively became just another part of the participants' working day and duties, and was not intended or observed to become a separate entity added to existing responsibilities. As such creating, transmitting and receiving tacit knowledge became an integral and unobtrusive part of participants working and learning experience in much the same way as Lave and Wenger (1991) find that through participation in situated learning and practice, divisions between intellectual and physical action, thought and involvement are discarded.

In light of this it is worthwhile re-considering the role of experiential learning in this process and how research participants with clinical workloads were able to find opportunities to adopt and learn from changing perspectives e.g. from actor to observer, from physical involvement to detached objectivity as suggested by Kolb (1984).

During the intervention study participants were seen to change their perspectives during their clinical practice. Opinion leaders and other participants demonstrated "hands on" physical involvement, for example during patient care or during exemplification of good practice. Similarly, during normal working practice, participants could be seen as observers of the opinion leaders carrying out their role. These opinion leaders could themselves be seen as detached and analytic in their observation and evaluation of other participants practice following challenges to poor practice or exemplification of good practice. The methods used

within the intervention study may have aided participants and facilitated them in changing their perspectives unobtrusively and within their normal clinical practice, thus making some contribution to their experiential learning experience. This unobtrusive form of situated learning in and during practice provides participants with opportunities to create, test and share knowledge and skills. Evidence gained during the intervention study reveals that participants valued these opportunities and the knowledge gained from them. This valued knowledge, created, used and shared in practice provided the foundation of the resilience of the learning experience seen in the intervention study. Furthermore, it could be argued that the learning environment, opportunities and resilience exhibited during the intervention study warrant further investigation as they could, with adequate support from the wider organisation, offer a means of sustaining the creation, sharing and application of good infection control knowledge in practice.

The learning experience described above may in any future iterations of this research be improved upon by considering the criticisms offered in regard to this research and its underpinning research model. Future iterations of this research may also benefit from consideration of theories not discussed within this research such as learning organisation theory. Learning organisations may be considered aspirational and characterised by their ability to provide learning opportunities whilst maintaining adaptive capacities when faced with changing contexts and environments (Senge 1994; Finger and Burgin Brand 1999; Sadler - Smith 2006). The adaptive and facilitative capabilities of learning organisations could clearly be an asset to any future attempts to repeat this research and may warrant further investigation.

Attempts at repeating this research may also benefit from further development of the methods used in the intervention study and integrating within them the kind of situated, pedagogic learning in practice and augmented opinion leader role previously discussed.

This suggestion should not necessarily be seen as an indication that the pluralist approach and methods used in this research were unsound. This research has been able to obtain qualitative evidence of participants' attitudes, beliefs, knowledge and values. This evidence has been vital in informing and guiding the intervention study and the learning experience it provided. The research methods used were also able to provide some quantitative measure of the effectiveness of the intervention study. This may be of some significance for any attempts at replication of this research, as those that might retain the power to support and resource these may arguably have a positivist inclination.

As discussed earlier, senior members of clinical staff employed within local hospitals have indicated an interest in repeating the intervention study within multiple clinical areas. In any planning and preparation for these new intervention studies it must be remembered that research is an iterative process. It must also be hoped that any future attempts to carry out these intervention studies will be able to use evidence and knowledge gained from this research to inform further enquiry, create knowledge, improve practice and develop theory.

Summary

The goals of this research were to provide some understanding of any division between actual and espoused practice in infection control. To use this understanding in combination with knowledge and evidence gained from the literature, to create a clinical environment in which

learning theory might be used to mobilise resources in creating, sharing and applying infection control knowledge in practice, thus reducing any division between espoused and actual practice. The research also aimed to make some contribution to learning theory.

The first empiric phase of this research provided evidence supporting that within the literature suggesting that a gap between espoused and actual infection control practice exists, and found that this may be contributed to by tacit learning in practice. The intervention study employed in the second empiric phase of this research built upon knowledge gained from the first empiric phase, and employed tacit learning underpinned by explicit knowledge sources and learning theory in practice; achieving some success in improving infection control knowledge and practice. The research claims to make some contribution to theory in identifying tacit learning as a resource previously lacking investigation or use in infection control which might provide a means to achieve and integrate learning in practice. This research also discovered evidence of the resilience of communities of practice and their ability to offer learning opportunities within challenging environments.

Evidence of the resilience of communities of practice within challenging clinical environments and the effectiveness tacit learning as a means of generating and applying knowledge in practice may have implications for the practice of healthcare educationalists and may also present opportunities to provide new learning experiences within clinical practice.

APPENDICES

Appendix 1.

Attitude Survey for 2nd phase

Please tick the box that you agree with

I am a:-

Dietician [ ]
Doctor [ ]
Nurse [ ]
Physiotherapist [ ]
Radiographer [ ]
Other (please specify) [ ].....

	Strongly Disagree	Disagree	Neither Agree nor disagree	Agree	Strongly agree
1. Good infection control practice contributes to the health of patients.	[ ]	[ ]	[ ]	[ ]	[ ]
2. Good infection control practice contributes to the health of members of staff.	[ ]	[ ]	[ ]	[ ]	[ ]
3. I believe in the importance of clinical waste disposal.	[ ]	[ ]	[ ]	[ ]	[ ]
4. I believe in the importance of handwashing.	[ ]	[ ]	[ ]	[ ]	[ ]
5. I am unaware of correct infection control practice.	[ ]	[ ]	[ ]	[ ]	[ ]

	Never	Rarely	Occasionally	Mostly	Always, without exception
6. I carry out correct infection control practice.	[ ]	[ ]	[ ]	[ ]	[ ]
7. I carry out correct clinical waste disposal.	[ ]	[ ]	[ ]	[ ]	[ ]
8. I carry out correct handwashing.	[ ]	[ ]	[ ]	[ ]	[ ]
9. I am able to recognise poor infection control practice by others.	[ ]	[ ]	[ ]	[ ]	[ ]
10. I am willing to challenge poor infection control practice when I see it demonstrated by others regardless of their profession or grade.	[ ]	[ ]	[ ]	[ ]	[ ]
11. I am willing to have my own infection control practice challenged by others regardless of their profession or grade.	[ ]	[ ]	[ ]	[ ]	[ ]

	Strongly Disagree	Disagree	Neither Agree nor disagree	Agree	Strongly agree
12. I am continually learning infection control knowledge in practice.	[ ]	[ ]	[ ]	[ ]	[ ]
13. I demonstrate good infection control knowledge in practice.	[ ]	[ ]	[ ]	[ ]	[ ]
14. I encourage colleagues to carry out correct infection control practice.	[ ]	[ ]	[ ]	[ ]	[ ]
15. Infection control practice in this unit is correct and complies with current policies.	[ ]	[ ]	[ ]	[ ]	[ ]
16. My knowledge of infection control is partly based upon knowledge gained from written materials.	[ ]	[ ]	[ ]	[ ]	[ ]
17. My knowledge of infection control is partly based upon knowledge gained from working with colleagues in practice.	[ ]	[ ]	[ ]	[ ]	[ ]
18. My knowledge of infection control is partly based upon knowledge gained from taught lessons.	[ ]	[ ]	[ ]	[ ]	[ ]
19. I believe that infection control knowledge gained from written materials is applied in practice on this unit.	[ ]	[ ]	[ ]	[ ]	[ ]
20. I use infection control knowledge gained from colleagues in my every day practice.	[ ]	[ ]	[ ]	[ ]	[ ]
21. My workload prevents me from carrying out correct infection control practice.	[ ]	[ ]	[ ]	[ ]	[ ]
22. Lack of infection control equipment prevents me from carrying out correct infection control practice.	[ ]	[ ]	[ ]	[ ]	[ ]
23. My espoused practice in regard to handwashing is the same as my actual practice.	[ ]	[ ]	[ ]	[ ]	[ ]
24. My espoused practice in regard to clinical waste disposal is the same as my actual practice.	[ ]	[ ]	[ ]	[ ]	[ ]
25. Handwashing protects me from the risk of infection.	[ ]	[ ]	[ ]	[ ]	[ ]
26. Handwashing protects patients from the risk of infection.	[ ]	[ ]	[ ]	[ ]	[ ]

	Strongly Disagree	Disagree	Neither Agree nor disagree	Agree	Strongly agree
27. Clinical waste disposal protects me from the risk of infection.	[ ]	[ ]	[ ]	[ ]	[ ]
28. Clinical waste disposal protects patients from the risk of infection.	[ ]	[ ]	[ ]	[ ]	[ ]
29. Hospital acquired infection is something that can be managed.	[ ]	[ ]	[ ]	[ ]	[ ]
30. My knowledge of infection control can influence infection control practice on this unit.	[ ]	[ ]	[ ]	[ ]	[ ]
31. My beliefs in regard to infection control can influence infection control practice on this unit.	[ ]	[ ]	[ ]	[ ]	[ ]

32. Please state what is the most important influence (positive or negative) on your actual infection control practice:-

Appendix 2. Analysis of data obtained from the attitude survey/questionnaires based upon Likert scaled items.

Pre intervention study 22 questionnaires were completed and returned for analysis.

Post intervention study 20 questionnaires were completed and returned for analysis.

Therefore 20 pre and post intervention study questionnaires were paired and analysed. Analysis of 8 questions contained within these paired questionnaires revealed statistically significant evidence of participants claiming changes in their beliefs, knowledge and practice. This evidence is presented below:

7. I carry out correct clinical waste disposal.

Pre intervention Q7		Post intervention Q7	
Occasionally -	1	Occasionally -	0
Mostly -	9	Mostly -	4
Always -	10	Always -	16
TOTAL -	20	TOTAL -	20

Wilcoxon Signed Ranks Test = .020

13. I demonstrate good infection control knowledge in practice.

Pre intervention Q13		Post intervention Q13	
Neither agree nor disagree -	3	Neither agree nor disagree -	0
Agree	- 12	Agree	- 12
Strongly agree	- 5	Strongly agree	- 8
TOTAL	- 20	TOTAL	- 20

Wilcoxon Signed Ranks Test = .034

14. I encourage colleagues to carry out correct infection control practice.

Pre intervention Q14		Post intervention Q14	
Strongly Disagree -	1	Strongly Disagree -	0
Disagree -	1	Disagree -	1
Neither agree nor disagree -	1	Neither agree nor disagree -	2
Agree -	11	Agree -	6
Strongly agree -	6	Strongly agree -	11
TOTAL -	20	TOTAL -	20

Wilcoxon Signed Ranks Test = .020

15. Infection control practice in this unit is correct and complies with current policies.

Pre intervention Q15		Post intervention Q15	
Disagree -	2	Disagree -	0
Neither agree nor disagree -	7	Neither agree nor disagree -	2
Agree -	8	Agree -	13
Strongly agree -	3	Strongly agree -	5
TOTAL -	20	TOTAL -	20

Wilcoxon Signed Ranks Test = .022

17. My knowledge of infection control is partly based upon knowledge gained from working with colleagues in practice.

Pre intervention Q17		Post intervention Q17	
Strongly disagree -	1	Strongly disagree -	0
Disagree -	3	Disagree -	2
Neither agree nor disagree -	0	Neither agree nor disagree -	1
Agree -	15	Agree -	9
Strongly agree -	1	Strongly agree -	8
TOTAL -	20	TOTAL -	20

Wilcoxon Signed Ranks Test = .047

19. I believe that infection control knowledge gained from written materials is applied in practice on this unit.

Pre intervention Q19		Post intervention Q19	
Neither agree nor disagree -	7	Neither agree nor disagree -	4
Agree -	13	Agree -	11
Strongly agree -	0	Strongly agree -	5
TOTAL -	20	TOTAL -	20

Wilcoxon Signed Ranks Test = .033

21. My workload prevents me from carrying out correct infection control practice.

Pre intervention Q21		Post intervention Q21	
Strongly disagree -	1	Strongly disagree -	5
Disagree -	9	Disagree -	10
Neither agree nor disagree -	4	Neither agree nor disagree -	2
Agree -	4	Agree -	2
Strongly agree -	2	Strongly agree -	1
TOTAL -	20	TOTAL -	20

Wilcoxon Signed Ranks Test = .044

29. Hospital acquired infection is something that can be managed.

Pre intervention Q29		Post intervention Q29	
Disagree -	1	Disagree -	1
Neither agree nor disagree -	1	Neither agree nor disagree -	0
Agree -	15	Agree -	12
Strongly agree -	3	Strongly agree -	7
TOTAL -	20	TOTAL -	20

Wilcoxon Signed Ranks Test = .059

Analysis of a further 23 questions contained within the paired questionnaires did not reveal statistically significant evidence of participants claiming changes in their beliefs, knowledge and practice. Results of this analysis are presented below:

1. I Good infection control practice contributes to the health of patients.

Pre intervention Q1		Post intervention Q1	
Agree -	4	Agree -	2
Strongly agree -	16	Strongly agree -	18
TOTAL -	20	TOTAL -	20

McNemar Test = .625

2. Good infection control practice contributes to the health of members of staff.

Pre intervention Q2		Post intervention Q2	
Agree -	7	Agree -	7
Strongly agree -	13	Strongly agree -	13
TOTAL -	20	TOTAL -	20

McNemar Test = 1.000

3. I believe in the importance of clinical waste disposal.

Pre intervention Q3		Post intervention Q3	
Agree -	4	Agree -	4
Strongly agree -	16	Strongly agree -	16
TOTAL -	20	TOTAL -	20

McNemar Test = 1.000

4. I believe in the importance of handwashing.

Pre intervention Q4		Post intervention Q4	
Agree -	4	Agree -	2
Strongly agree -	16	Strongly agree -	18
TOTAL -	20	TOTAL -	20

McNemar Test = .625

5. I am unaware of correct infection control practice.

Pre intervention Q5		Post intervention Q5	
Strongly disagree -	6	Strongly disagree -	10
Disagree -	10	Disagree -	6
Neither agree nor disagree -	2	Neither agree nor disagree -	1
Agree -	0	Agree -	0
Strongly agree -	2	Strongly agree -	3
TOTAL -	20	TOTAL -	20

Wilcoxon Signed Ranks Test = .525

6. I carry out correct infection control practice.

Pre intervention Q6		Post intervention Q6	
Mostly -	18	Mostly -	13
Always -	2	Always -	7
TOTAL -	20	TOTAL -	20

McNemar Test = .063

8. I carry out correct handwashing.

Pre intervention Q8		Post intervention Q8	
Mostly -	13	Mostly -	11
Always -	7	Always -	9
TOTAL -	20	TOTAL -	20

McNemar Test = .687

9. I am able to recognise poor infection control practice by others.

Pre intervention Q9		Post intervention Q9	
Rarely -	0	Rarely -	1
Occasionally -	3	Occasionally -	2
Mostly -	10	Mostly -	7
Always -	7	Always -	10
TOTAL -	20	TOTAL -	20

Wilcoxon Signed Ranks Test = .439

10. I am willing to challenge poor infection control practice when I see it demonstrated by others regardless of their profession or grade.

Pre intervention Q10		Post intervention Q10	
Rarely -	1	Rarely -	0
Occasionally -	3	Occasionally -	2
Mostly -	8	Mostly -	8
Always -	8	Always -	10
TOTAL -	20	TOTAL -	20

Wilcoxon Signed Ranks Test = .272

11. I am willing to have my own infection control practice challenged by others regardless of their profession or grade.

Pre intervention Q11		Post intervention Q11	
Occasionally -	1	Occasionally -	1
Mostly -	4	Mostly -	2
Always -	15	Always -	17
TOTAL -	20	TOTAL -	20

Wilcoxon Signed Ranks Test = .414

12. I am continually learning infection control knowledge in practice.

Pre intervention Q12		Post intervention Q12	
Disagree -	1	Disagree -	0
Neither agree nor disagree -	2	Neither agree nor disagree -	1
Agree -	9	Agree -	10
Strongly agree -	8	Strongly agree -	9
TOTAL -	20	TOTAL -	20

Wilcoxon Signed Ranks Test = .377

16. My knowledge of infection control is partly based upon knowledge gained from written materials.

Pre intervention Q16		Post intervention Q16	
Disagree -	3	Disagree -	2
Neither agree nor disagree -	1	Neither agree nor disagree -	4
Agree -	16	Agree -	10
Strongly agree -	0	Strongly agree -	4
TOTAL -	20	TOTAL -	20

Wilcoxon Signed Ranks Test = .582

18. My knowledge of infection control is partly based upon knowledge gained from taught lessons.

Pre intervention Q18		Post intervention Q18	
Strongly disagree -	1	Strongly disagree -	2
Disagree -	4	Disagree -	2
Neither agree nor disagree -	3	Neither agree nor disagree -	3
Agree -	9	Agree -	9
Strongly agree -	3	Strongly agree -	4
TOTAL -	20	TOTAL -	20

Wilcoxon Signed Ranks Test = .439

20. I use infection control knowledge gained from colleagues in my every day practice.

Pre intervention Q20		Post intervention Q20	
Disagree -	3	Disagree -	1
Neither agree nor disagree -	11	Neither agree nor disagree -	2
Agree -	6	Agree -	10
Strongly agree -	0	Strongly agree -	7
TOTAL -	20	TOTAL -	20

Wilcoxon Signed Ranks Test = 1.000

22. Lack of infection control equipment prevents me from carrying out correct infection control practice.

Pre intervention Q22		Post intervention Q22	
Strongly disagree -	4	Strongly disagree -	6
Disagree -	10	Disagree -	12
Neither agree nor disagree -	4	Neither agree nor disagree -	2
Agree -	1	Agree -	0
Strongly agree -	1	Strongly agree -	0
TOTAL -	20	TOTAL -	20

Wilcoxon Signed Ranks Test = .118

23. My espoused practice in regard to handwashing is the same as my actual practice.

Pre intervention Q23		Post intervention Q23	
Disagree -	2	Disagree -	2
Neither agree nor disagree -	4	Neither agree nor disagree -	2
Agree -	14	Agree -	12
Strongly agree -	0	Strongly agree -	4
TOTAL -	20	TOTAL -	20

Wilcoxon Signed Ranks Test = .153

24. My espoused practice in regard to clinical waste disposal is the same as my actual practice.

Pre intervention Q24		Post intervention Q24	
Disagree -	1	Disagree -	1
Neither agree nor disagree -	2	Neither agree nor disagree -	1
Agree -	14	Agree -	13
Strongly agree -	3	Strongly agree -	5
TOTAL -	20	TOTAL -	20

Wilcoxon Signed Ranks Test = .366

25. Handwashing protects me from the risk of infection.

Pre intervention Q25		Post intervention Q25	
Neither agree nor disagree -	1	Neither agree nor disagree -	0
Agree -	11	Agree -	10
Strongly agree -	8	Strongly agree -	10
TOTAL -	20	TOTAL -	20

Wilcoxon Signed Ranks Test = .317

26. Handwashing protects patients from the risk of infection.

Pre intervention Q26		Post intervention Q26	
Neither agree nor disagree -	1	Neither agree nor disagree -	0
Agree -	9	Agree -	7
Strongly agree -	10	Strongly agree -	13
TOTAL -	20	TOTAL -	20

Wilcoxon Signed Ranks Test = .102

27. Clinical waste disposal protects me from the risk of infection.

Pre intervention Q27		Post intervention Q27	
Agree -	10	Agree -	5
Strongly agree -	10	Strongly agree -	15
TOTAL -	20	TOTAL -	20

McNemar Test = .125

28. Clinical waste disposal protects patients from the risk of infection.

Pre intervention Q28		Post intervention Q28	
Agree -	10	Agree -	5
Strongly agree -	10	Strongly agree -	15
TOTAL -	20	TOTAL -	20

McNemar Test = .125

30. My knowledge of infection control can influence infection control practice on this unit.

Pre intervention Q30		Post intervention Q30	
Neither agree nor disagree -	6	Neither agree nor disagree -	2
Agree -	11	Agree -	12
Strongly agree -	3	Strongly agree -	6
TOTAL -	20	TOTAL -	20

Wilcoxon Signed Ranks Test = .071

31. My beliefs in regard to infection control can influence infection control practice on this unit.

Pre intervention Q31		Post intervention Q31	
Disagree -	1	Disagree -	1
Neither agree nor disagree -	4	Neither agree nor disagree -	1
Agree -	11	Agree -	9
Strongly agree -	4	Strongly agree -	9
TOTAL -	20	TOTAL -	20

Wilcoxon Signed Ranks Test = .071

Descriptive statistics derived from the pre-intervention questionnaire:

	N	Mean	Std. Deviation
Q1.1	22	4.8182	.39477
Q2.1	22	4.6818	.47673
Q3.1	22	4.8182	.39477
Q4.1	22	4.8182	.39477
Q5.1	22	2.3636	1.39882
Q6.1	22	4.0909	.29424
Q7.1	22	4.5000	.59761
Q8.1	22	4.3182	.47673
Q9.1	22	4.2727	.70250
Q10.1	22	4.2273	.86914
Q11.1	22	4.7273	.55048
Q12.1	22	4.1818	.79501
Q13.1	22	4.0909	.61016
Q14.1	22	4.0000	.97590
Q15.1	22	3.6364	.90214
Q16.1	22	3.6818	.71623
Q17.1	22	3.6364	.95346
Q18.1	22	3.5000	1.10195
Q19.1	22	3.6818	.56790
Q20.1	22	4.1818	.66450
Q21.1	22	2.8182	1.18065
Q22.1	22	2.3182	1.04135
Q23.1	22	3.7273	.76730
Q24.1	22	4.0455	.72225
Q25.1	22	4.4091	.59033
Q26.1	22	4.4545	.59580
Q27.1	22	4.5455	.50965
Q28.1	22	4.5455	.50965
Q29.1	22	4.0455	.65300
Q30.1	22	3.9545	.72225
Q31.1	22	3.9545	.78542

Descriptive statistics derived from the post-intervention questionnaire:

	N	Mean	Std. Deviation
Q1.2	20	4.9000	.30779
Q2.2	20	4.6500	.48936
Q3.2	20	4.8000	.41039
Q4.2	20	4.9000	.30779
Q5.2	20	2.0000	1.41421
Q6.2	20	4.3500	.48936
Q7.2	20	4.8000	.41039
Q8.2	20	4.4500	.51042
Q9.2	20	4.3000	.86450
Q10.2	20	4.4000	.68056
Q11.2	20	4.8000	.52315
Q12.2	20	4.4000	.59824
Q13.2	20	4.4000	.50262
Q14.2	20	4.3500	.87509
Q15.2	20	4.1500	.58714
Q16.2	20	3.8000	.89443
Q17.2	20	4.1500	.93330
Q18.2	20	3.5500	1.23438
Q19.2	20	4.0500	.68633
Q20.2	20	4.1500	.81273
Q21.2	20	2.2000	1.10501
Q22.2	20	1.8000	.61559
Q23.2	20	3.9000	.85224
Q24.2	20	4.1000	.71818
Q25.2	20	4.5000	.51299
Q26.2	20	4.6500	.48936
Q27.2	20	4.7500	.44426
Q28.2	20	4.7500	.44426
Q29.2	20	4.2500	.71635
Q30.2	20	4.2000	.61559
Q31.2	20	4.3000	.80131

Appendix 3. Letters of ethical approval for the first and second empiric phases of research.

South West Peninsula NHS
Health Authority

CORNWALL RESEARCH ETHICS COMMITTEE
Chairman: Rev'd Dr D H James
Co-ordinator: Mrs C D Thomas
Tel: 01872 252071
Fax.: 01872 252071
E-mail carmen.thomas@rcht.swest.nhs.uk

8 August, 2003

REC REFERENCE NUMBER: 44.7.03 Please quote this number on all correspondence

CONFIDENTIAL
Mr A Nichols
Community Infection Control Nurse
John Keay House
St Austell

Dear Andy

Research protocol: Organisational learning in healthcare: mobilising knowledge resources in the control of infection
REC reference number: 44.7.03
Protocol number: N/A

As you know the Cornwall Research Ethics Committee reviewed your application on 31 July 2003ate]. The documents considered were as follows:-

South and West Application Form, your CV undated, staff information Version 1 undated, staff participant consent form Version 1 undated, Patient information letter Version 1 undated, Patient consent form Version 1 undated, Research proposal Version 1 undated,

The members of the Committee gave approval for your research on ethical grounds providing you comply with the conditions of approval set out below and withdraw the patient information letter and consent form:-

Conditions

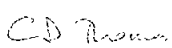
- You do not recruit any research subjects unless you have received a notification of no objection from the relevant locality agent
- You do not undertake this research in a NHS organisation until the relevant NHS management approval has been received.
- You do not deviate from, or make changes to, the protocol without prior written approval of the Cornwall REC, except where this is necessary to eliminate immediate hazards to research participants or when the change involves only logistical or administrative aspects of the research. In such cases the Cornwall REC should be informed within seven days of the implementation of the change.
- You complete and return the standard progress report form to the Cornwall REC one year from the date on this letter and thereafter on an annual basis. This form should also be used to notify the Cornwall REC when your research is completed and in this case should be sent to this REC within three months of completion.
- If you decide to terminate this research prematurely you should send a report to this REC within 15 days, indicating the reason for the early termination
- You advise the Cornwall REC of any unusual or unexpected results that raise questions about the safety of the research.
- The project must be started within 3 year of the date on this letter

Heligan Portakabin
Royal Cornwall Hospitals NHS Trust
Truro, Cornwall TR1 3LJ

NHS RECs are compliant with the International Conference on Harmonisation/Good Clinical Practice (ICH GCP) Guidelines for the conduct of trials involving participation of human subjects.

Your application has been given a unique reference number, please use in on all correspondence with the REC

Yours sincerely



Mrs Carmen D Thomas
LREC Co-ordinator

Enclosures

List of members present and members who submitted written comments

Heligan Portakabin
Royal Cornwall Hospitals NHS Trust
Truro, Cornwall TR1 3LJ

NHS

South West Devon Research Ethics Committee
Room 101B
ITTC South Building
Tamar Science Park
Davy Road
Derriford
PLYMOUTH
PL6 8BX
Telephone: 01752 315267
Facsimile: 01752 315268
Email: halina.pounds@phrt.swest.nhs.uk

11 March 2005

Mr Andrew Nichols
Senior Lecturer
University of Plymouth
Faculty of Health and Social Work
Portland Square, Drake Circus
Plymouth
PL4 8AA

Dear Mr Nichols

Full title of study: ***Organisational learning in healthcare: Mobilising knowledge resources in the control of infection.***
REC reference number: ***05/Q2103/21***

The Research Ethics Committee reviewed the above application at the meeting held on 08 March 2005.

Ethical opinion

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

However, the Committee commented that it felt that as the Renal Unit was essentially a sterile unit, it would have been better had you chosen to do this exercise on the Renal Ward. The Committee also felt that the attitude survey will not demonstrate a definite change of practice due to its structure and you are likely to get similar answers each time it is completed.

However, the Committee has not yet been notified of the outcome of any site-specific assessment (SSA) for the research site(s) taking part in this study. The favourable opinion does not therefore apply to any site at present. I will write to you again as soon as one Local Research Ethics Committee has notified the outcome of a SSA. In the meantime no study procedures should be initiated at sites requiring SSA.

Conditions of approval

The favourable opinion is given provided that you comply with the conditions set out in the attached document. You are advised to study the conditions carefully.

Approved documents

The documents reviewed and approved at the meeting were:

Document Type:	Version:	Dated:	Date Received:
Application		14/02/2005	16/02/2005
Investigator CV			16/02/2005
Protocol			16/02/2005
Copy of Questionnaire			16/02/2005
Letters of Invitation to Participants	2	03/02/2005	16/02/2005
Participant Information Sheet	2	03/02/2005	16/02/2005
Participant Consent Form	2	03/02/2005	25/02/2005
Professional Indemnity Certificate		02/09/2004	16/02/2005
Liability Insurance Summary			16/02/2005
E-mail from Prof Sadler-Smith		02/02/2005	16/02/2005
E-mail from PHNT Finance Manager		25/01/2005	16/02/2005
CV of Supervisor	1	11/10/2004	16/02/2005

Management approval

The study should not commence at any NHS site until the local Principal Investigator has obtained final management approval from the R&D Department for the relevant NHS care organisation.

Membership of the Committee

The members of the Ethics Committee who were present at the meeting are listed on the attached sheet.

Notification of other bodies

The Committee Administrator will notify the R&D Department for NHS care organisation that the study has a favourable ethical opinion.

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees (July 2001) and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

05/Q2103/21	Please quote this number on all correspondence

With the Committee's best wishes for the success of this project,

Yours sincerely

MR A. J. R BEAUCHAMP
Dip. Healthcare Ethics
Chairman

Enclosures *List of names of Committee members*
Standard approval conditions
Site approval form (SF2)

Appendix 4. Participant information sheets and consent forms used in the first empiric phase of the research.

Staff information letter.

Organisational learning in health care: Mobilising knowledge resources in the control of infection.

Dear Colleague,

I hope that you do not mind me writing to you about a research project that I am hoping to undertake on the renal unit. I am an infection control nurse working for the Cornwall and Isles of Scilly Health Protection Unit. I previously worked on the renal unit in Plymouth.

In collaboration with the University of Plymouth and Treliske Hospital I am undertaking some research that aims to look at infection control practice amongst staff on hospital wards and the use of educational theory in improving practice. During this research I hope to observe members of staff while they work. Some members of staff may also be interviewed. Only with their permission will interviews be recorded and later transcribed. Information gained from observation and interviews will be kept securely and be treated with strict anonymity and confidentiality. Observation notes, interview recordings and typed transcripts will not contain participants' names.

I hope to use the findings of this research to improve infection control practice and ultimately to reduce the risk of infection to patients and staff.

There is no obligation to help me with this project. If you do not want to participate and allow me to observe you while you are working then that is not a problem. If you are prepared to participate then please complete the attached consent form and return it to me.

If you agree to participate and then later change your mind for any reason, you may withdraw at any stage.

I thank you in anticipation and look forward to your reply.

Yours sincerely

Andy Nichols.
Community Infection Control Nurse.

STAFF PARTICIPANT CONSENT FORM

Project Title: Organisational learning in healthcare: Mobilising knowledge resources in the control of infection.

Please circle your answer.

Have you read the staff information letter ? Yes / No

Have you had the opportunity to ask any questions? Yes / No

Have you received enough information about the study? Yes / No

Do you understand that you are free to withdraw from the study at any time, without having to give a reason for doing so? Yes / No

Do you agree to take part in this project? Yes / No

Signed.....

Date.....

Name in Block Letters.....

Appendix 5. Participant information sheets and consent forms used in the second empiric phase of the research.

Study of the use of organisational learning in the control of hospital acquired infection.

You are being invited to take part in a research study. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following carefully and discuss it with others if you wish. Ask me if there is anything that is not clear or you would like more information. Take time to decide whether or not you wish to take part.

Thank you for reading this.

1. **The purpose of the study:-**
   To collect data on the attitudes, beliefs, knowledge and clinical practices of staff in regard to infection control. It is hoped that by applying organisational learning theory during the course of the study, some changes and improvements in these attitudes, beliefs and clinical practices may be achieved.

2. **Why have you been chosen?**
   Because you are involved in patient care within the renal unit. All staff involved in patient care on the renal unit will be invited to take part in the study.

3. **Do you have to take part?**
   It is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part you are still free to withdraw at any time and without giving a reason.

4. **What will happen to you if you take part?**
   You will be asked to complete a questionnaire at the beginning and the end of the six month study. You may also be observed when working on the renal unit. Observations will be tape recorded. A written transcript of this will then be made in order for the data to be analysed, all information collected during the course of the study will be kept strictly confidential. You will also be invited to consider, discuss and if necessary challenge your own infection control practices and those of your colleagues. You will be asked for your permission to use the data obtained from the questionnaires and observation in this study.

5. **What are the possible disadvantages of taking part?**
   None.

6. **What are the possible benefits of taking part?**
   You will help to complete a study that might provide useful information on means of reducing the risk of transmitting hospital acquired infections.

7. **What happens when the research study stops?**
   You will be informed about this and its cause.

8. **Will taking part in the study be confidential?**
   All information collected during the course of the study will be kept strictly confidential. Any information about you gathered during the study will have your name removed so that you cannot be recognised from it.

9. **What will happen to the results of the research study?**
   The results of the research study will be used as part of a PhD thesis. This thesis will also be used to inform papers that will be submitted for publication. If you wish, you can have a copy of the published results. You will not be identified in any thesis/publication.

10. **Who is organising and funding the research?**
    This study is part of a PhD research project being carried out through the Business School at the University of Plymouth. It is not funded by any organisation or company.

11. **Who has reviewed the study?**
    The Plymouth Local Research Ethics Committee.

12. **Contact for further information:-**
    If you have any queries please contact Mr A Nichols, Senior Lecturer, Faculty of Health and Social Work, University of Plymouth, Drake Circus, Plymouth. PL4 8AA. Telephone: 01752 233389

STAFF PARTICIPANT CONSENT FORM

Project Title: Organisational learning in healthcare: Mobilising knowledge resources in the control of infection.

Please circle your answer.

Have you read the staff information letter ? Yes / No

Have you had the opportunity to ask any questions? Yes / No

Have you received enough information about the study? Yes / No

Do you understand that you are free to withdraw from the study at any time, without having to give a reason for doing so? Yes / No

Do you agree to take part in this project? Yes / No

Signed.....

Date.....

Name in Block Letters.....

REFERENCES

Albanese M. (2000) "Problem-based learning: why curricula are likely to show little effect on knowledge and clinical skills," *Medical Education*, Vol. 34, No. 9, pp. 729-738.

Allen S. Clark S. Toby, J. Smart, D. and Moore F. (2001) "Developing an integrated nursing team approach." *Nursing Standard*, Vol. 15, No. 28, pp. 43-45.

Antonacopoulou E. P. (2001) "The Paradoxical Nature of the Relationship Between Training and Learning." *Journal of Management Studies*, Vol. 38, No. 3, pp. 327-350.

Antrobus S. and Kitson A. (1999) "Nursing leadership: influencing and shaping health policy and nursing practice." *Journal of Advanced Nursing*, Vol. 29, No. 3, pp. 746-753.

Applebee A.N. (1996) *Curriculum as Convention.* Chicago: The University of Chicago Press.

Argyris C. and Schon D. A. (1996) *Organizational learning II : theory, method and practice.* Reading, Mass: Addison-Wesley Pub Co.

Armitage A. (1999) *Teaching and Training in Post Compulsory Education.* Buckingham: Open University Press.

Atkinson P. and Hammersley M. (1998) "Ethnography and Participant Observation". In N. K. Denzin and Y. S. Lincoln (Eds) *Strategies of qualitative inquiry.* London.: Sage Publications, Inc.

Attwood M. and Beer N. (1988) "Development of a Learning Organisation- Reflections on a Personal and Organisational Workshop in a District Health Authority." *Management Education and Development*, Vol. 19, No. 3, pp. 201-214.

Azar B. (2000) "The key to learning latitudes lies in correcting misconceptions." *Monitor on Psychology*, Vol. 31, No. 7. http://www.apa.org/monitor/julaug00/sw.html (6/7/06).

Badger T. G. (2000) "Action research, change and methodological rigour." *Journal of Nursing Management*, Vol. 8, No. 49, pp. 201-207.

Baillie, L. (1999) "Preparing adult branch students for their management role as staff nurses: an action research project."*Journal of Nursing Management*, Vol. 7, No. 4, pp. 225-234.

Baldwin T. T. and Ford J. K. (1988) "Transfer of training: A review and directions for future research." *Personnel Psychology*, Vol. 41, No. 1, pp. 63-105.

Bandura A. (1969) *Principles of behavior modification.* New York: Holt, Rinehart and Winston.

Bandura A. (1977) *Social learning* theory. Englewood Cliffs, N.J: Prentice-Hall.

Barker P. J. Reynolds W. and Stevenson C. (1997) "The human science basis of psychiatric nursing: theory and practice." *Journal of Advanced Nursing*, Vol. 25, No. 4, pp. 660-667.

Bate P. (2000) "Synthesizing Research and Practice: Using the Action Research Approach in Health Care Settings." *Social Policy and Administration*, Vol. 34, No. 4, pp. 478-493.

Bedi A. (2004) "An andragogical approach to teaching styles." *Education for Primary Care*, Vol. 15, No. 1, pp. 93-97.

Bellman L. (2004) "A qualitative evaluation of senior house officers' teaching and learning: towards sharing good practice." *Medical Teacher*, Vol. 26, No. 4, pp. 313-320.

Bennett B. (1998) "Increasing collaboration within a multidisciplinary neurorehabilitation team: the early stages of a small action research project." *Journal of Clinical Nursing*, Vol. 7, No. 3, pp. 227-231.

Bhopal R. (2001) "Racism in medicine." *British Medical Journal*, Vol. 322, No. 7301, pp. 1503-1504.

Bigge M. L. (1982) *Learning theories for teachers*. (4th edition) New York: Harper & Row.

Bigge M. L. and Shermis S. S. (1999) *Learning theories for teachers*. (6th edition) Harlow: Longman, Harlow.

Biley F. C. B. (1997) "Towards a defence of nursing routine and ritual." *Journal of Clinical Nursing*, Vol. 6, No. 2, pp. 115-119.

Bleakley A. (2002) "Pre-registration house officers and ward-based learning: a `new apprenticeship' model." *Medical Education*, Vol. 36, No. 1, pp. 9-15.

Bosanquet N (1983) *After the New Right*. London: Heinneman Educational Books Ltd.

British Medical Association and the Royal Pharmaceutical Society of Great Britain (2002) *British National Formulary*, BMA and the Royal Pharmaceutical Society of Great Britain, London.

Brown J.S. and Duguid P. (1991) "Organisational Learning and Communities of Practice: Toward a Unified View of Working, Learning, and Innovation." *Organisational Science*, Vol. 2, No. 1, pp. 40-57.

Brown S. M. Lubimova A. V. Khrustalyeva N. M. Shulaeva S. V. Tekhova I. Zueva L. P. Goldman D. and O'Rourke E. J. (2003) "Use of an Alcohol-Based Hand Rub and Quality Improvement Interventions to Improve Hand Hygiene in a Russian Neonatal Intensive Care Unit." *Infection Control and Hospital Epidemiology*, Vol. 24, No. 3, pp. 172-179.

Bullock A. and Woodings R. (1990) *Fontana Dictionary of Modern Thinkers*. London: Fontana.

Burnard P. (1991) "A method of analysing interview transcripts in qualitative research." *Nurse Education Today*, Vol. 11, No. 6, pp. 461-466.

Burnard P. (1989) *Teaching interpersonal skills: a handbook of experiential learning for health professionals*. London: Chapman and Hall.

Caelli K. Ray L. and Mill J. (2003) "Clear as Mud: Toward Greater Clarity in Generic Qualitative Research." *International Journal of Qualitative Methods*, Vol. 2, No. 2, pp. 1-24.

Candlin J. and Stark S. (2005) "Plastic apron wear during direct patient care." *Nursing Standard*, Vol. 20, No. 2, pp. 41-46.

Carr W. (1995) *For Education. Towards Critical Educational Enquiry*. Buckingham:Open University Press.

Carter K.C. (1983) *The Etiology, Concept, and Prophylaxis of Childbed Fever*. London: The University of Wisconsin Press.

Centres for Disease Control (2001) *Morbidity and Mortality Weekly Report*, Vol. 50, pp. 1-43.

Chan E. D. and Iseman M. D. (2002) "Current medical treatment for tuberculosis." *British Medical Journal*, Vol. 325, No. 7375, pp. 1282-1286.

Charvet S. R. (1997) *Words that change minds : mastering the language of influence*. (2nd edition) Dubuque, Iowa: Kendall/Hunt.

Chief Medical Office (2003) *Winning ways : working together to reduce healthcare associated infection in England*. Department of Health, London.

Clark A. M. (1998) "The qualitative-quantitative debate: moving from positivism and confrontation to post-positivism and reconciliation." *Journal of Advanced Nursing*, Vol. 27, No. 6, pp. 1242-1249.

Clarke N. (2005) "Workplace learning environment and its relationship with learning outcomes in healthcare organizations." *Human Resource Development International*, Vol. 8, No. 2, pp. 185-205.

Coates D. (1995) "The process of learning in dementia-carer support programmes: some preliminary observations." *Journal of Advanced Nursing, 31(4):850-6, 2000 Apr*, vol. 21, no. 1, pp. 41-46.

Coghlan, D. and Casey, M. 2001, "Action research from the inside: issues and challenges in doing action research in your own hospital." *Journal of Advanced Nursing*, Vol. 35, No. 5, pp. 674-682.

Coia J. E. Duckworth G. J. Edwards D. I. Farrington M. Fry C. Humphreys H. Mallaghan C. and Tucker D. R. (2006) "Guidelines for the control and prevention of meticillin-resistant Staphylococcus aureus (MRSA) in healthcare facilities." *Journal of Hospital Infection*, Vol. 63, No. Supp/1, pp. 1-44.

Collier J. A. B. Longmore J. M. and Brown T. (1999) *Oxford handbook of clinical specialties*. (5th edition) Oxford: Oxford University Press.

Collinson S. Gregson G. (2003) "Knowledge networks for new technology-based firms: an international comparison of local entrepreneurship promotion." *R and D Management*, Vol. 33, No. 2, pp. 189-208.

Conover W. J. (1980) *Practical nonparametric statistics*. (2nd edition) Chichester: Wiley.

Cooper T. (2004) "Delivering an infection control link nurse programme: improving practice." *British Journal of Infection Control*, Vol. 5, No. 6, pp. 24-27.

Cope P. Cuthbertson P. and Stoddart B. (2000) "Situated learning in the practice placement." *Journal of Advanced Nursing*, Vol. 31, No. 14, pp. 850-856.

Cotton A. H. B. (2001) "Private thoughts in public spheres: issues in reflection and reflective practices in nursing." *Journal of Advanced Nursing*, Vol. 36, No. 4, pp. 512-519.

Courtenay M. (1998) "The teaching, learning and use of infection control knowledge in nursing." *NT Research*, Vol. 3, No. 2, pp. 118-130.

Crano W. D. (1981) "Triangulation and cross cultural research". In M. B. Brewer and B. E. Collins (Eds) *Scientific Inquiry and the Social Sciences*. London: Jossey-Bass.

Daft R.L.and Weick K.E. (1984) "Toward a Model of Organisations as Interpretation Systems." *Academy of Management Review*, Vol. 9, No. 2, pp. 284-295.

Davies H. T. O. and Nutley S. M. (2000) "Developing learning organisations in the new NHS." *British Medical Journal*, Vol. 320, No. 7240, pp. 998-1001.

Davies R. M. Faust D. and Meehl P. E. (2002) "Clinical versus actuarial judgement," in *Heuristics and biases : the psychology of intuitive judgement*. Cambridge University Press, Cambridge.

De Vaus D. A. (1996) *Surveys in social research*. (4th edition) St. Leonards, NSW:UCL Press.

Denzin N. K. and Lincoln, Y. S. (1998) *Strategies of qualitative inquiry*. London: Sage Publications, Inc.

Department of Health. (2002) *Getting Ahead of the Curve: A strategy for combating infectious diseases*. London: Department of Health.

Desai N. Philpott-Howard J. Wade J. and Casewell M. (2000) "Infection control training: evaluation of a computer-assisted learning package." *Journal of Hospital Infection*, Vol. 44, No. 3, pp. 193-199.

Diekelmann N. (2001) "Narrative Pedagogy: Heideggerian hermeneutical analyses of lived experiences of students, teachers, and clinicians." *Advances in Nursing Science*, Vol. 23, No. 3, pp. 53-71.

Dodgson M. (1993) "Organizational Learning: A Review of Some Literatures." *Organization Studies*, Vol. 14, No. 3, pp. 375-394.

Doyal L. (1994) "Changing Medicine?". In J. Gabe D. Kelleher and G. Williams (Eds) *Challenging Medicine*. London: Routledge.

Doyle C. E. (2003) *Work and organizational psychology : an introduction with attitude*. Hove: Psychology Press.

Driver M. (2002) "Learning and Leadership in Organizations: Toward Complementary Communities of Practice." *Management Learning*, Vol. 33, No. 1, pp. 99-126.

Dubbert P. M. Dolce J. Richter W. Miller M. and Chapman S. W. (1990) "Increasing ICU staff handwashing: effects of education and group feedback." *Infection Control and Hospital Epidemiology*, Vol. 11, Vo. 4, pp. 191-193.

Durrance B. (1998) "Some Explicit Thoughts on Tacit Learning." *Training and Development*, Vol. 52, No. 12, pp. 24-29.

Easterby-Smith M. Snell R. and Gherardi S. (2003) "Organisational Learning: Diverging Communities of Practice?" *Management Learning*, Vol. 29, No. 3, pp. 259-272.

Easterby-Smith M. Thorpe R. and Lowe A. (2002) *Management research.* (2nd edition) London: Sage.

Eglin R. (1995) "Private Finance, Public Interest." *Management Today*, Vol. 5, p. 60.

Elliott P. (1996) "Handwashing practice in nurse education." *Professional Nurse*, Vol. 11, No. 6, pp. 357-361.

Elston M.A. (1991) Chapter 3. In J. Gabe M. Calman and M. Bury (Eds) *The Sociology of the Health* Service. London: Routledge.

Eraut M. Alderton J. Boylan A. and Wraight A. (1995) *Researching Professional Education.* The English National Board for Nursing, Midwifery and Health Visiting, London.

Evans C. (2003) *Managing for knowledge : HR's strategic role.* Oxford:Butterworth-Heinemann.

Fahs P. S. Morgan L. L. and Kalman M. (2003) "A Call for Replication." *Journal of Nursing Scholarship*, Vol. 35, No. 1, pp. 67-72.

Feather A. Stone S. P. Wessier A. Boursicot K. A. and Pratt C. (2000) "'Now please wash your hands': the handwashing behaviour of final MBBS candidates." *Journal of Hospital Infection*, Vol. 45, No. 1, pp. 62-64.

Feldman S. P. (1997) "The revolt against cultural authority: Power/knowledge as an assumption in organization theory." *Human Relations*, Vol. 50, No. 8, pp. 937-956.

Finger M. and Burgin Brand S. (1999) "The Concept of the Learning Organisation Applied to the Transformation of the Public Sector: Conceptual Contributions for Theory Development". In M. Easterby-Smith L. Araujo and J Burgoyne (Eds) *Organisational Learning and the Learning Organisation.* London.: Sage Publications.

Foucault M. (1980) *Power and* Knowledge. London: Harvester Wheatsheaf.

Fox R. D. and Bennett N. L. (1998) "Continuing medical education: Learning and change: implications for continuing medical education." *British Medical Journal*, Vol. 316, No. 7129, pp. 466-468.

Frid I. Ohlen J. and Bergbom I. (2000) "On the use of narratives in nursing research." *Journal of Advanced Nursing,* Vol. 32, No. 3, pp. 695-703.

Friedson E. (1970) *Profession of Medicine.* London: Harper and Row Publishers.

Friedson E. (1977) Chapter 1. In M. Stacey M. Reid C. Heath C. and R. Dingwall (Eds) *Health and the Division of Labour.* London.: Croom Helm.

Frost P.J. Moore L.F. Reis Louis M. Lundberg C.C. and Martin J. (1991) *Reframing Organisational* Culture. London: Sage.

Frost M. (1996) "An analysis of the scope and value of problem-based learning in the education of health care professionals." *Journal of Advanced Nursing,* Vol. 24, No. 5, pp. 1047-1053.

Gabe J. Calman M. and Bury M. (1991) *The Sociology of the Health* Service. London: Routledge.

Gaffney D. Pollock A. M. Price D. and Shaoul J. (1999) "The private finance initiative: PFI in the NHS--is there an economic case?" *British Medical Journal,* Vol. 319, No. 7202, pp. 116-119.

Gamage B. Moore D. Copes R. Yassi A. and Bryce E. (2005) "Protecting health care workers from SARS and other respiratory pathogens: a review of the infection control literature." *American Journal of Infection Control,* Vol. 33, No. 2, pp. 114-121.

Gamester C. F. Tilzey A. J. Banatvala J. E. (2006) "Medical students' risk of infection with bloodborne viruses at home and abroad: questionnaire survey." *British Medical Journal,* Vol 318, No. 7177, pp 158-160.

Georgaca E. (2000) "Reality and discourse: A critical analysis of the category of delusions." *British Journal of Medical Psychology,* Vol. 73, No. 2, pp. 227-242.

George J. M. and Jones G. R. (2001) "Towards a process of individual change in organizations." *Human Relations,* Vol. 54, No. 4, pp. 419-444.

Gilovich T. Griffin D. and Kahneman D. (2002) *Heuristics and biases : the psychology of intuitive judgement.* Cambridge: Cambridge University Press.

Glenerster H. (1991) Chapter 3. In H. Glenerster and J. Midgley (Eds) *The Radical Right and the Welfare State.* Hemel Hempstead: Harvester Wheastsheaf.

Glesne C. (1999) *Becoming qualitative researchers : an introduction.* (2nd edition) Harlow: Longman.

Goldbart J. and Hustler D. (2005) "Ethnography". In B. Somekh and C. Lewin (Eds) *Research methods in the social sciences.* London: Sage.

Goldrick B and Larson E (1993) "Learning styles and teaching/learning stategy preferences: Implications for educating nurses in critical care, the operating room, and infection control." *Heart and Lung,* Vol. 22, No. 2, pp. 176-182.

Gomes J. De Weerd-Nederhof P. Pearson A. and Fisscher O. (2001) "Senior Management Support in the New Product Development Process." *Creativity and Innovation Management*, Vol. 10, No. 4, pp. 234-242.

Gorelick C. Milton N. J. and April K. (2004) *Performance through learning : knowledge management in practice.* Oxford: Butterworth-Heinemann.

Gould D. (1996) "Hand-Washing: Can ward-based learning improve infection control?" *Nursing Times*, Vol. 92, No. 24, pp. 42-43.

Gould D. Wilson-Barnett J. and Ream E. (1996) "Nurses' infection-control practice: hand decontamination, the use of gloves and sharp instruments." *International Journal of Nursing Studies*, Vol. 33, No. 2, pp. 143-160.

Gray J. L. and Starke F. A. (1988) *Organizational behaviour : concepts and applications.* (4th edition) London: Charles E. Merrill.

Gross R. (1996) *Psychology: The science of mind and behaviour.* (3 rd edition) London: Hodder and Staughton.

Guile D. and Griffiths T. (2001) "Learning Through Work Experience." *Journal of Education and Work*, Vol. 14, No. 1, pp. 113-132.

Hall K. H. (2002) "Reviewing intuitive decision-making and uncertainty." *Medical Education*, Vol. 36, No. 3, pp. 216-224.

Ham C. (1999) "Improving NHS performance: human behaviour and health policy." *British Medical Journal*, Vol. 319, No. 7223, pp. 1490-1492.

Hammersley M. and Atkinson P. (1989) *Ethnography : principles in practice.* London: Routledge.

Hammersley M. (2000) *Taking sides in social research : essays on partisanship and bias.* London: Routledge.

Harrison A. Dixon J. New B. and Judge K. (1997) "Funding the NHS. Is the NHS sustainable?" *British Medical Journal*, Vol. 314, No. 7076, pp. 296-298.

Hill W. F. (1997) *Learning : a survey of psychological interpretations.* (6th edition) Harlow: Longman.

Hodgkinson G. P. (1997) "Cognitive Inertia in a Turbulent Market: the Case of UK Residential Estate Agents." *Journal of Management Studies*, Vol. 34, No. 6, pp. 921-946.

Hoinville G. and Jowell R. (1987) *Survey research practice.* Aldershot: Gower.

Horton R. (1998) "The realpolitik of a new National Health Service for the UK." *Lancet*, Vol. 351, No. 9096, pp. 76-77.

Howard S. (1993) "Accreditation of prior learning: andragogy in action or a `cut price' approach to education?" *Journal of Advanced Nursing*, Vol. 18, No. 11, pp. 1817-1824.

Hughes J. A. (1990) *The philosophy of social research.* (2nd edition) London: Longman.

Hughes M. (1999) "Nursing workload: an unquantifiable entity." *Journal of Nursing Management,* Vol. 7, No. 6, pp. 317-322.

Hutchinson L. Marks T. and Pittilo M. (2001) "The physician assistant: would the US model meet the needs of the NHS?" *British Medical Journal,* Vol. 323, No. 7323, pp. 1244-1247.

Huzzard T. and Ostergren K. (2002) "When Norms Collide: Learning under Organizational Hypocrisy." *British Journal of Management,* Vol. 13, No. SPI, pp. S47-S60.

Hyrkas K. Tarkka M. T. and Paunonen-Ilmonen M. (2001) "Teacher candidates' reflective teaching and learning in a hospital setting - changing the pattern of practical training: a challenge to growing into teacherhood." *Journal of Advanced Nursing,* Vol. 33, No. 4, pp. 503-511.

Iacono M. (2003) "Leadership at the bedside." *Journal of Perianesthesia Nursing,* Vol 18, No 5, pp. 348-351.

Ironside P. M. (2001) "Creating a Research Base for Nursing Education: An Interpretive Review of Conventional, Critical, Feminist, Postmodern, and Phenomenologic Pedagogies." *Advances in Nursing Science,* Vol. 23, No. 3, pp. 72-87.

Issenberg S. B. Pringle S. Harden R. M. Khogali S. and Gordon M. S. (2003) "Adoption and integration of simulation-based learning technologies into the curriculum of a UK Undergraduate Education Programme." *Medical Education,* Vol. 37, No. Supp/1, pp. 42-49.

Jarvis W. R. (1994) "Handwashing--the Semmelweis lesson forgotten?" *Lancet,* Vol. 344, No. 8933, pp. 1311-1312.

Jick T. D. (1979) "Mixing Qualitative and Quantitative Methods: Triangulation in Action", *Administrative Science Quarterly,* Vol. 24, pp. 602-611.

Jimenez D.A and Sanchez-Paya J. (1999) "Standard precautions in haemodialysis-the gap between theory and practice." *Nephrology Dialysis Transplantation,* Vol. 14, No. 4, pp. 823-825.

Jimenez D.A. Sanchez-Paya J. Gonzales C. Rivera F. and Antolin A. (1999) "Audit on the degree of application of universal precautions in a haemodialysis unit." *Nephrology Dialysis Transplantation,* Vol. 14, No 4, pp. 10001-10003.

Jones C. (2005) "We are all responsible." *Nursing Standard,* Vol. 19, No. 40, p. 72.

Jowett S. Walton I. and Payne S. (1994) *Challenges and change in nurse education - a study of the implementation of Project 2000.* National Foundation for Educational Research in England and Wales, Slough.

Kahneman D. and Tversky A. (1982) "Judgement under uncertainty : heuristics and biases". In D. Kahneman P. Slovic and A. Tversky (Eds) *Judgement under uncertainty : heuristics and biases.* Cambridge University Press: Cambridge.

Kellehear A. (1993) *The unobtrusive researcher : a guide to methods*. St. Leonards, NSW: Allen & Unwin.

Kelleher D. Gabe J. and Williams G. (1994) "Understanding medical dominance in the modern world". In J. Gabe D. Kelleher and G. Williams (Eds) *Challenging Medicine*. London: Routledge.

Kemppainen J. K. (2000) "The critical incident technique and nursing care quality research." *Journal of Advanced Nursing*, Vol. 32, No. 5, pp. 1264-1271.

Kim D. H. (1993) "The link between individual and organizational learning." *Sloan Management Review*, Vol. 35, No. 1, pp. 37-50.

King D. (1987) *The New Right Politics, Markets and Citizenship*. Basingstoke: Macmillan Education.

Kirby J.R. Knapper C.K. Evans C.J. Carty A.E. Gadula C. (2003) "Approaches to learning at work and workplace climate." *International Journal of Training and Development*, Vol. 7, No. 1, pp. 31-52.

Klimecki R. and Lassleben H. (1998) "Modes of Organizational Learning: Indications from an Empirical Study." *Management Learning*, Vol. 29, No. 4, pp. 405-430.

Knowles M. S. (1984) *Andragogy in action : applying modern principles of adult learning*. (1st edition) London: Jossey-Bass.

Knowles M. S. (1980) *The modern practice of adult education : from pedagogy to andragogy*. New York: Cambridge Adult Education.

Kofman F. and Senge P. M. (1993) "Communities of commitment: The heart of learning organizations," *Organizational Dynamics*, Vol. 22, No. 2, pp. 4-23.

Kolb D. A. (1984) *Experiential Learning: Experience as the source of learning and development*. Englewood Cliffs, New Jersey: Prentice Hall.

Kretzer E.K. and Larson E.L. (1998) "Behavioural interventions to improve infection control practices." *American Journal of Infection Control*, Vol. 26, No. 3, pp. 245-253.

Lam A. (2000) "Tacit Knowledge, Organizational Learning and Societal Institutions: An Integrated Framework." *Organization Studies*, Vol. 21, No. 3, pp. 487-514.

Larson E. and Kretzer E.K. (1995) "Compliance with handwashing and barrier precautions." *Journal of Hospital Infection*, Vol. 30, No. (Supplement), pp. 88-106.

Lave J. and Wenger E. (1991) *Situated learning : legitimate peripheral participation*. Cambridge: Cambridge University Press.

Leclair J. M. Freeman J. Sullivan B. F. Crowley C. M. and Goldmann D. A. (1987) "Prevention of nosocomial respiratory syncytial virus infections through compliance with glove and gown isolation precautions." *New England Journal of Medicine*, Vol. 317, No. 6, pp. 329-334.

Lee R. M. (2000) *Unobtrusive methods in social research*. Buckingham: Open University Press.

Lehmkuhl L. D. (1996) "Nonparametric Statistics: Methods for Analyzing Data Not Meeting Assumptions Required for the Application of Parametric Tests." *Journal of Prosthetics and Orthotics*, Vol. 8, No. 3, pp. 105-113.

Leight S. B. (2002) "Starry night: using story to inform aesthetic knowing in women's health nursing." *Journal of Advanced Nursing*, Vol. 37, No. 1, pp. 108-114.

Levitt B. and March J. G. (1996) Chapter 22. In M. D. Cohen and L. Sproull (Eds) *Organizational learning*. London: Sage Publications.

Long S. and Newton J. (1997) "Educating the gut: socio-emotional aspects of the learning organization." *Journal of Management Development*, Vol. 16, No. 4, pp. 284-301.

Lovell R. B. (1980) *Adult learning*. London: Croom Helm.

Lowe D. (1993) *Planning for medical research*. Middlesbrough: Astraglobe.

Lukes S. (1974) *Power : A Radical View*. London: The Macmillan Press Ltd.

Macqueen S. (1995) "Anthropology and germ theory." *Journal of Hospital Infection*, Vol. 30, No. SUP, pp. 116 -126.

Mandell G. L. Bennett J. E. Dolin R. Douglas R.G (2000) *Principles and practice of infectious diseases*. (5th edition) London: Churchill Livingstone.

Marton F. and Booth S. (1997) *Learning and awareness*. Mahwah, N.J: Lawrence Erlbaum Associates.

McDougal M. and Beattie R. S. (1998) "The missing link? Understanding the relationship between individual and organisational learning." *International Journal of Training and Development*, Vol. 2, No. 4, pp. 288-299.

McKenna E. F. (2000) *Business psychology and organisational behaviour : a student's handbook*. (3rd edition) Hove: Psychology Press.

Minton M. (2000) "Double whammy forces NHS staff to work harder." *Nursing Standard*, Vol. 14, No. 44, pp. 4-6.

National Audit Office (2004) *Improving patient care by reducing the risk of hospital acquired infection : a progress report : report by the Comptroller and Auditor General*. London: Stationery Office.

National Patient Safety Agency (2004) *Ready, steady, go! The full guide to implementing the "cleanyourhands" campaign in your trust*. National Patient Safety Agency.

Needleman J. Buerhaus P. Mattke S. Stewart M. and Zelevinsky K. (2002) "Nurse-staffing levels and the quality of care in hospitals." *New England Journal of Medicine*, Vol. 346, No. 22, pp. 1715-1722.

Neubert M. J. (1999) "Too Much of a Good Thing or the More the Merrier? Exploring the Dispersion and Gender Composition of Informal Leadership in Manufacturing Teams." *Small Group Research*, Vol. 30, No. 5, pp. 635-646.

Newsom S.W.B (2002) "The history of infection control : Joseph Lister." *British Journal of Infection Control*, Vol. 3, No. 2, pp. 21-23.

Nicolini D. and Meznar M. B. (1995) "The Social Construction of Organizational Learning: Conceptual and Practical Issues in the Field." *Human Relations*, Vol. 48, No. 7, pp. 727-746.

Nonaka I. and Takeuchi H. (1998) "The Knowledge-creating Company," in C. Mabey G. Salaman and J. Storey (Eds) *Strategic Human Resource Management*. London: Sage Publications.

Nonaka I. Toyama R. and Konno N. (2000) "SECI, Ba and Leadership: a Unified Model of Dynamic Knowledge Creation." *Long Range Planning*, Vol. 33, No. 1, pp. 5-34.

Nottingham Andragogy Group (1981) *Towards a developmental theory of andragogy*. Department of Adult Education. Nottingham: University of Nottingham.

Nursing and Midwifery Council (2004) *The NMC code of professional conduct: standards for conduct, performance and ethics*. London: Publications Department, Nursing and Midwifery Council.

O'Malley A. Varadharajan V. Lok S. (2005) "Hand decontamination by medical staff in general medical wards." *Journal of Hospital Infection*, Vol. 59, No. 4, pp. 369-370.

Oppenheim A. N. (1992) *Questionnaire design, interviewing and attitude measurement*. (2nd edition) New York: Pinter Publishers.

Oswick C. Anthony P. Keenoy T. and Mangham I. T. (2000)"A dialogic analysis of organizational learning." *Journal of Management Studies*, Vol. 37, No. 6, pp. 887-901.

Panhotra B.R Saxena A.K and Al-Arabi Al-Ghamdi A.M (2004) "The effect of a continuous educational program on handwashing compliance among healthcare workers in an intensive care unit." *British Journal of Infection Control*, Vol. 5, No. 3, pp. 15-18.

Parkin F. (1988) *Max Weber*. London: Routledge.

Payne S. (1997) Chapter 8. In R. Usher J. Powell and G. McKenzie (Eds) *Understanding social research : perspectives on methodology and practice*. London: Falmer.

Pescosolido A. T. (2001) "Informal Leaders and the Development of Group Efficacy." *Small Group Research*, Vol. 32, No. 1, pp. 74-93.

Philips G. (1989) "Education and training for the adult." *Journal of Systems Management*, Vol. 40, No. 4, p. 8.

Philpin S. M. B. and Jones A. R. (2002) "Rituals and nursing: a critical commentary." *Journal of Advanced Nursing*, Vol. 38, No. 2, pp. 144-151.

Piper H. and Simons H. (2005) "Ethical Responsibility in Social Research". In B. Somekh and C. Lewin (Eds) *Research methods in the social sciences*. London.: Sage.

Pittet D. (2004) "The Lowbury lecture: behaviour in infection control." *Journal of Hospital Infection*, Vol. 58, No. 1, pp. 1-13.

Pittet D. Hugonnet S. Harbarth S. Mourouga P. Sauvan V. Touveneau S. and Perneger T. V. (2000) "Effectiveness of a hospital-wide programme to improve compliance with hand hygiene." *Lancet*, Vol. 356, No. 9238, pp. 1307-1312.

Plowman R. Graves N. Griffin M. Roberts J.A. Swan A.V. Cookson B. and Taylor L. (1999) *The Socio-economic Burden of Hospital Acquired Infection*. London: Public Health Laboratory Service.

Poell R. F. Chivers G. E. Van der Krogt F. J. and Wildemeersch D. A. (2000) "Learning-network Theory: Organizing the Dynamic Relationships Between Learning and Work." *Management Learning*, Vol. 31, No. 1, pp. 25-50.

Poland B. Graham H. Walsh E. Williams P. Fell L. Lum J. M. Polzer J. Syed S. Tobin S. and Kim G. (2005) "Working at the margins or leading from behind?: a Canadian study of hospital-community collaboration." *Health and Social Care in the Community*, Vol. 13, No. 2, pp. 125-135.

Public Health Laboratory Service. (1995) *Hospital Infection Control: Guidance on the control of infection in hospitals*. London: Department of Health.

Raelin J. A. (1999) "The Design of the Action Project in Work-Based Learning."*Human Resource Planning*, Vol. 22, No. 3, pp. 12-28.

Rafferty A.M. (1996) *The Politics of Nursing Knowledge*. London: Routledge.

Reber A. S. (1993) *Implicit learning and tacit knowledge : an essay on the cognitive unconscious*. Oxford: Oxford University Press.

Rosenblatt P. C. (1981) "Ethnographic case studies". in M. B. Brewer and B. E. Collins (Eds) *Scientific Inquiry and the Social Sciences*. London: Jossey-Bass.

Rosenthal V. D. Guzman S. and Safdar N. (2004) "Effect of Education and Performance Feedback on Rates of Catheter-Associated Urinary Tract Infection in Intensive Care Units in Argentina." *Infection Control and Hospital Epidemiology*, Vol. 25, No. 1, pp. 47-50.

Sadala M. L. A. (1999) "Taking care as a relationship: a phenomenological view.", *Journal of Advanced Nursing*, Vol. 30, No. 4, pp. 808-817.

Sadler-Smith E. (2006) *Learning and Development for Managers*. Oxford: Blackwell Publishing.

Sardar Z. (1996) "Hospital Horror." *New Statesman*, Vol. 128, p. 45.

Saulnier F. F. Hubert H. Onimus T. M. Beague S. Nseir S. Grandbastien B. Renault C. Y. Idzik. M. Erb M. P. and Durocher A. V. (2001) "Assessing excess nurse workload generated by multiresistent nosocomial bacteria in intensive care." *Infection Control and Hospital Epidemiology*, Vol. 22, No. 5, pp. 273-278.

Schein E. H. (1989) *Organizational culture and leadership : a dynamic view*. Oxford: Jossey-Bass.

Schmieding N. J. and Kokuyama T. (1995) "The need for and process of collaborative international research: a replication study of Japanese staff nurse perceptions of head nurses' actions." *Journal of Advanced Nursing*, Vol. 21, No. 5, pp. 820-826.

Schön D. A. (1987) *Educating the reflective practitioner*. (1st edition) San Francisco: Jossey-Bass.

Scott A. A. Hughes J. and Hall D. (2005) "Views and understanding of senior nursing staff in relation to infection control." *British Journal of Infection Control*, Vol. 6, No. 2, pp. 23-26.

Senge P. M. (1994) *The fifth discipline : the art and practice of the learning organization*. London: Doubleday/Currency.

Senior K. (2001) "Can we keep up with hospital - acquired infections?" *The Lancet Infectious Diseases*, Vol. 9262, No. SUP, p. 8.

Shrivastava P. (1983) "A typology of organizational learning systems." *Journal of Management Studies*, Vol. 20, No. 1, pp. 7-28.

Siegel S. and Castellan N. (1988) *Nonparametric statistics for the behavioral sciences*. (2nd edition) London: McGraw-Hill.

Sims H. P. and Lorenzi P. (1992) *The new leadership paradigm : social learning and cognition in organizations*. London: Sage Publications.

Sole D. and Edmondson A. (2002) "Situated Knowledge and Learning in Dispersed Teams." *British Journal of Management*, Vol. 13, No. SPI, pp. S17-S34.

Sommer B. B. and Sommer R. (1991) *A practical guide to behavioral research : tools and techniques*. Oxford: Oxford University Press.

Soule B. M. and Huskins C. (1997) "A global perspective on the past, present, and future of nosocomial infection prevention and control." *American Journal of Infection Control*, Vol. 25, No. 4, pp. 289-293.

Sprent P. and Smeeton N. C. (2000) *Applied nonparametric statistical methods*. (3rd edition) Boca Raton: Chapman & Hall/CRC.

Spurgeon F. and Barwell F. (1991) *Implementing Change in the N.H.S.* London: Chapman and Hall.

Stamps D. (1997) "Communities of Practice: Learning is Social. Training is Irrelevant?" *Training*, Vol. 34, No. 2, pp. 34-44.

Starkey K. Tempest S. and McKinlay A. (2004) *How organizations learn : managing the search for knowledge.* (2nd edition) London: Thomson.

Stein A. D. Makarawo T. P. and Ahmad M. F. R. (2003) "A survey of doctors' and nurses' knowledge, attitudes and compliance with infection control guidelines in Birmingham teaching hospitals." *Journal of Hospital Infection*, Vol. 54, No. 1, pp. 68-73.

Stone S. P.(2001) "Hand hygiene--the case for evidence-based education." *Journal of the Royal Society of Medicine*, Vol. 94, No. 6, pp. 278-281.

Strange F. (1996) "Handover: an ethnographic study of ritual in nursing practice." *Intensive and Critical Care Nursing*, Vol. 12, No. 19, pp. 106-112.

Strauss A. and Corbin J. (1998) "Grounded Theory Methodology". In N. K. Denzin and Y. S. Lincoln (Eds) *Strategies of qualitative inquiry.* London: Sage Publications, Inc.

Strauss A. L. and Corbin J. M. (1998) *Basics of qualitative research : techniques and procedures for developing grounded theory.* (2nd edition) London: Sage Publications, Inc.

Teare E. (1998) "The missing link." *Nursing Times*, Vol. 94, No. 19, pp. 67-70.

The Concise Oxford Dictionary. (1991) (3rd edition) London: BCA.

Tones K. and Green J. (2004) *Health promotion : Planning and strategies for promoting health.* London: Sage Publications Ltd.

Turner B. (1987) *Medical Power and Social Knowledge.* London: Sage Publications Ltd.

Urquhart C. Light, A. Thomas R. Barker A. Yeoman A. Cooper J. Armstrong C. Fenton R. Lonsdale R. and Spink S. (2003) "Critical incident technique and explicitation interviewing in studies of information behaviour." *Library and Information Science*, Vol. 25, No. 1, pp. 63-88.

Usher R. (1997) Chapter 3. In R. Usher J. Powell and G. McKenzie (Eds) *Understanding social research : perspectives on methodology and practice.* London: Falmer.

Valimaki M. L. R. Suominen T. P. R. and Peate I. M. R. (1998) "Attitudes of professionals, students and the general public to HIV/AIDS and people with HIV/AIDS: a review of the research.", *Journal of Advanced Nursing,* Vol. 27, No. 4, pp. 752-759.

Warren C.A.B. and Rasmussen P.K (1977) "Sex and gender in field research." *Urban Life*, Vol. 6, No. 3, pp. 349-369.

Watson T. J. (1997) "Theorizing Managerial Work: a Pragmatic Pluralist Approach to Interdisciplinary Research." *British Journal of Management*, Vol. 8, No. 1, pp. 3-8.

Webb E. J. (1966) *Unobtrusive measures : nonreactive research in the social sciences.* Chicago: Rand McNally.

Wenger E. (2000) "Communities of Practice: The Structure of Knowledge Stewarding". In *Knowledge Horizons:The Present and The Promise of Knowledge Management.*Woburn M A: Butterworth-Heinemann.

Wenger E. (1997) "Practice, learning, meaning, identity." *Training*, Vol. 34, No. 2, p. 38.

Wenger E. (2000) "Communities of Practice and Social Learning Systems." *Organization*, Vol. 7, No. 2, pp. 225-246.

Wenger E. C. and Snyder W. M. (2000) "Communities of Practice: The Organizational Frontier." *Harvard Business Review*, Vol. 78, No. 1, pp. 139-146.

Williams M. and May T. (1997) *Introduction to the philosophy of social research*. London: University College London Press.

Wilson A. P. R. Scott G. M. Lewis C. and Neild G. (1994) "Audit of infection in continuous ambulatory peritoneal dialysis." *Journal of Hospital Infection*, Vol. 28, No. 4, p. -265.

Wislock R. F. (1993) Chapter 1. In D. D. Flannery (Ed) *Applying cognitive learning theory to adult learning*. San Francisco: Jossey-Bass.

Witz A. (1994) "The Challenge of Nursing". In J. Gabe D.Kelleher and G Williams (Eds) *Challenging Medicine*. London: Routledge.

Working Group for the Study of Ethical Issues in International Nursing Research (2003) "Ethical considerations in international nursing research: a report from the International Centre for Nursing Ethics." *Nursing Ethics*, Vol. 10, No. 2, pp. 122-137.

Yentis S. M. (1993) "Use of intravenous cannulae by junior hospital doctors." *Postgraduate Medical Journal*, Vol. 69, No. 811, pp. 389-391.

Zambarloukos S. and Constantelou A. (2002) "Learning and skills formation in the new economy: evidence from Greece." *International Journal of Training and Development*, Vol.6, No. 4, pp. 240-253.

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