Healthcare Professionals' Hand Hygiene: Predicting and Improving Practice

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Healthcare Professionals' Hand Hygiene: Predicting and Improving Practice

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Dedication

For my late parents who set me on this journey of learning and discovery and for Alan whose love, support, encouragement and quiet determination enabled me to complete it.

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Publications

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Jenner, E.A., Jones, F., Fletcher, B.(C)., Miller, L., & Scott, G.M. (2005). Hand hygiene posters: motivators or mixed messages? *Journal of Hospital Infection, 6* (3), 218-225. (attached).

Jenner, E.A., Jones, F., Fletcher, B.(C)., Miller, L., & Scott, G. M. (2005). Hand hygiene posters: selling the message. *Journal Hospital Infection, 56* (2), 77-82. (attached).

Jenner, E.A., Watson, P.W.B., Miller, L.R., Jones, F., & Scott, G.M. (2002). Explaining hand hygiene practice: an extended application of the Theory of Planned Behaviour. *Psychology, Health and Medicine, 7* (3), 311-326. (attached).

Jenner, E.A., Watson, P.W.B., Miller, L.R., Boniface, D.R., & Jones, F. (2001). A survey of student nurses' attitudes to hand hygiene practice. Proceedings from the *British Psychological Society, 9*(1), February, p.68. (attached).

Conference Presentations

Jenner, E.A. (2005). *Psychological influences on hand hygiene behaviour.* Invited paper. 8th Annual Conference On Practical Aspects Of Infection Control, Sheffield Teaching Hospitals, Sheffield Hallam University. 27th June.

Jenner, E. A., Miller, L., & Morgan, J. (2002, September). *Teaching hand hygiene – a practical approach.* Poster session presented at Fifth International Conference of the Hospital Infection Society. Edinburgh. Abstract book P12.05, p.78. (attached).

Jenner, E. A., Watson, P.W.B., Miller, L., Jones, F., & Scott, G.M. (2001, September). *Using a model to explain hand hygiene behaviour: a psychological approach.* Paper presented at the 15th International European Health Psychology Society conference at St. Andrews, Scotland. Abstract Book p.45.

Jenner, E. A.,Watson, P.W.B., Miller, L., Jones, F., & Scott, G.M. (2001, June). *Explaining hand hygiene practice: extending the Theory of Planned Behaviour.* Invited paper presented at 'Infex' conference organised by the Infection Control Nurses in the Oxford Region.

Jenner, E.A., Watson, P.W.B., Miller, L.R., Boniface, D.R., & Jones, F. (2001, April). *A survey of student nurses' attitudes to hand hygiene practice.* Paper presented at the RCN triennial international research conference, Glasgow. Refereed abstract, No. 272, p.62.

Jenner, E.A., Watson, P.W.B., Miller, L.R., Boniface, D.R., & Jones, F. (2000, September). *A survey of student nurses' attitudes to hand hygiene practice.* Poster session presented at British Psychology Society, Division of Health Psychology Annual Conference. University of Kent at Canterbury. Refereed abstract. Poster number 78, p.55.

Jenner, E.A., Watson, P.W.B., Miller, L.R., Jones, F., & Scott G.M. (2000, July). *Can a theoretical model explain hand hygiene behaviour?* Paper presented at a Symposium on Hot Issues in Handwashing at the Royal Institute of Public Health and Hygiene, London. Findings reported briefly in *Health and Hygiene* (2001), *22*(1), 12.

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Foreword

"Unassailable facts are unassailable only because an act of persuasion has been so successful that it is no longer regarded as one, and instead, has the status of a simple assertion about the world. In short, there are no facts that are not the product of persuasion……. and therefore no agreement, however securely based it may seem for the moment, is invulnerable to challenge." (Fish, 1986, p.194).

Abstract

This programme of research consists of eight studies which sought to determine how healthcare professionals' hand hygiene practice might be improved. The Theory of Planned Behaviour was used to isolate perceived cognitive and physical factors that may explain the variance in their hand hygiene behaviour. Practice was observed and healthcare professionals' understanding of the hand hygiene policy to which they were expected to adhere was assessed. Messages on hand hygiene posters were analysed. The effect of two educational interventions on students' attitudes was tested.

Achieving change will be challenging for several reasons. Healthcare professionals hold false perceptions about their hand hygiene behaviour; they think it is better than it is but their practice is unrelated to their intentions and self-reports of behaviour. Adherence to the national guideline was poor and practice was neither rational nor informed by risk assessment, even when caring for patients colonised with methicillin-resistant *Staphylococcus aureus*.

Student nurses' attitudes towards the importance of hand hygiene showed progressively downward trends between three cohorts in their first, second and third years of training. The difference was particularly pronounced between first and second years. Their attitudes also showed optimistic bias and false consensus beliefs. For all but one of the 11 clinical procedures measured, they said that they value hand hygiene practice significantly more than other nurses and doctors they work alongside.

A microbiology laboratory practical and a demonstration using a fluorescent cream and an ultra-violet light hand inspection cabinet were equally effective at enhancing students' attitudes towards hand hygiene, but the improvement was quickly eroded by their first experience of clinical practice.

Various factors in the clinical setting impact negatively on healthcare professionals' attitudes and practice and undermine the principles taught in the pre-clinical phase of training. These include poor role models, ambiguous hand hygiene policies and inappropriately framed messages on hand hygiene posters which lead to confusion in the minds of healthcare professionals about when hands should be washed.

In order to improve healthcare professionals' hand hygiene behaviour, it is necessary to disambiguate their understanding about when hands should be washed. There needs to be more emphasis on infection *prevention*. An active process called the Dynamic Assessment Strategy for Hand Hygiene (DASHH) offers one way of changing poor practice. It does this by teaching healthcare professionals to consider hand hygiene before and after care as separate activities requiring separate risk assessment. Such a strategy provides them with a simple mind map to make the quick informed decisions that are required on a busy ward. The effectiveness of the strategy needs to be evaluated. Observation should form part of the assessment to ensure that there is a beneficial outcome and that good practice is becoming a habit.

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List of Abbreviations

AMM	Association Of Medical Microbiologists
ANCOVA	Analysis Of Covariance
ANOVA	Analysis Of Variance
APIC	American Association For Professionals In Infection Control And Epidemiology
CCTV	Closed Circuit Television
CDCP	Centers For Disease Control And Prevention
CI	Confidence Interval
CMO	Chief Medical Officer
COSHH	Control Of Substances Hazardous To Health
DASHH	Dynamic Assessment Strategy For Hand Hygiene
DHSS	Department of Health And Social Security
DOH	Department Of Health
HAI	Hospital-Acquired Infection
HBM	Health Belief Model
HCP	Healthcare Professional
HH	Hand Hygiene
HIS	Hospital Infection Society
HPA	Health Protection Agency
HRDSU	Health Research And Development Support Unit
ICN	Infection Control Nurse
ICLN	Infection Control Link Nurse
ICNA	Infection Control Nurses' Association
ICU	Intensive Care Unit
IOR	Inter-observer Reliability
IV	Intravenous
MRSA	Methicillin-resistant *Staphylococcus aureus*
NAO	National Audit Office
NEB	Nebuliser
NG	Nasogastric
NHS	National Health Service
NPSA	National Patient Safety Agency
OR	Odds Ratio
PEG	Percutaneous endo-gastrostomy Tube
PHLS	Public Health Laboratory Service
PRECEDE	Predisposing, Reinforcing And Enabling Factors
RAE	Research Assessment Exercise
RCN	Royal College Of Nursing

SARS	Sudden Acute Respiratory Syndrome
SENIC	Study on the Efficacy of Nosocomial Infection Control
SPSS	Statistical Package For Social Sciences
TPB	Theory Of Planned Behaviour
TRA	Theory Of Reasoned Action
UV	Ultraviolet

Chapter 1

Introduction

Reducing the incidence of healthcare-associated infections is now a national imperative (Chief Medical Officer, 2004). Most of these infections are thought to be transmitted by the hands of healthcare professionals and handwashing[1] is considered to be the single most important measure to prevent hospital-acquired infections (Bauer et al., 1990). Indeed, Stone (2001, p.280) argues that *"The treatment effect is so great that if hand hygiene were a new drug, it would be used by all."* However, many studies have shown that hand hygiene practices are poor, especially among healthcare professionals. In a review of 11 studies, Pittet (2000) found only two reported handwashing adherence levels above 50%. Yet, as Goldmann and Larson (1992, p.120) point out *"Experts in infection control coax, cajole, threaten and plead, but still their colleagues neglect to wash their hands."* Improving healthcare professionals' hand hygiene practice is crucially important if hospital-acquired infection rates are to be reduced. Cooper et al. (1999, p.131) have shown that *"Even small increases in the frequency of effective handwashes were enough to bring endemic organisms under control."*

Various reasons for suboptimal practice have been identified and many studies have been undertaken in an attempt to improve healthcare professionals' hand hygiene practice. These include improving facilities for hand hygiene (Mayer et al., 1986; Connoly, 1998; Larson et al., 1991) training endeavours (Dubbert et al., 1990; Gould and Chamberlain, 1997;) and giving feedback on performance (Mayer et al., 1986; van de Mortel and Heyman, 1995). Unfortunately, these have all met with only limited success or none at all. Infection control practitioners and national agencies are now enlisting the help of patients by asking them to remind staff to wash their hands (McGuckin et al., 2001; National Patient Safety Agency, 2004). The wisdom of this is debatable. Gillespie (2001, p.298) argues that *"Clinical colleagues might view patient empowerment as a potentially detrimental influence on an open and co-operative doctor-patient relationship."* More importantly however, it is questionable whether it is appropriate to ask sick people to remind healthcare professionals to wash their hands; they have a 'duty of care' to do their patients no harm.

An alternative approach is to determine hitherto unidentified reasons to explain poor hand hygiene practice with a view to improving it. Such is the aim of this thesis.

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[1] The terms handwashing, hand hygiene, hand cleaning and hand disinfection are used interchangeably throughout, as appropriate.

Structure Of The Thesis

This thesis consists of eight studies: six quantitative and two qualitative. Study designs include self-report surveys, quasi-experiments and non-participant observation. Participants included student nurses on diploma and degree programmes, undergraduate paramedic science students, and qualified hospital staff including doctors, nurses, and professionals allied to medicine. Presentation of the studies is preceded by consideration of the ethical issues surrounding this programme of research and a literature review.

Specific Aims Of Research Studies

Study 1

The aim of the first study was to explore psychological constructs predictive of hand hygiene behaviour amongst clinical healthcare professionals to help determine how practice might be improved. A questionnaire was devised based on a theoretical model, which utilised variables from the Theory of Planned Behaviour (TPB) (Ajzen, 1985) and other variables drawn from the literature. Measures were taken of intention, behaviour, attitudes, perceived behavioural control, subjective norms, barriers, comparative risk and personal responsibility. Results showed that both attitudes and personal responsibility were strong predictors of an individual's intention to wash their hands and intention and perceived behavioural control were strong predictors of behaviour.

The next four studies explored the extent to which attitudes can be influenced by practical demonstrations of hand hygiene in the university and exposure to others' practice in the clinical setting.

Study 2

The aim of this study was to see if handwashing training was related to attitudes (towards self and important others), if the timing of this training in a three year course was important, and if exposure in the clinical setting to role models who fail to adhere to hand hygiene guidelines was a contributory factor in poor hand hygiene behaviours. Student nurses' attitudes towards the importance of hand hygiene showed progressively downward trends, optimistic bias and false consensus beliefs.

Study 3

Drawing on both existing theoretical approaches and practical intervention methods currently in use, this study sought to determine the extent to which a microbiology laboratory practical exercise impacted on undergraduate healthcare students' views on the importance of hand hygiene. Whilst the laboratory practical succeeded in enhancing attitudes, the effect had declined significantly by the end of their first clinical placement.

At the time this study was undertaken, it was not possible to recruit a control group as this practical was an integral component of the biosciences curriculum. The following year, owing to changes in the curriculum, there was an opportunity to enhance the validity of this study by recruiting a control group who had not participated in a microbiology laboratory practical.

Study 4

The aim of this study was to determine whether undergraduate healthcare students who have not participated in a microbiology laboratory practical exercise hold significantly less favourable views on the importance of hand hygiene compared with those who did participate in the microbiology laboratory practical exercise reported in Study 3. The results showed that the attitudes of the experimental group were significantly higher than the attitudes of the control group at first follow-up.

Study 5

The aim of this study was to test the extent to which a practical exercise using a fluorescent cream known as 'Glitter Bug' (Brevis Corporation) and an ultraviolet (UV) light hand inspection cabinet enhanced student nurses' attitudes towards hand hygiene in comparison with the microbiology laboratory practical reported in Study 3. The results showed that both teaching methods are equally effective at enhancing attitudes towards the importance of hand hygiene but the effect declines significantly after the first clinical placement.

Studies 2, 3, 4 and 5 all showed that students hold favourable attitudes towards the importance of hand hygiene at the start of their training and that these can be enhanced by different teaching strategies in the university. However, the effect was quickly eroded once they were exposed to other healthcare professionals' practice in the clinical setting. The question as to whether there were other negative influences in the clinical practice setting led to the following three studies.

Study 6

The fundamental assumption that healthcare professionals know when they should wash their hands was challenged by asking them to explain their understanding of the hand hygiene policy to which they were expected to adhere: *"hands should be washed before and after every significant patient contact."* In so doing, evidence was sought for the risk assessment strategies used by healthcare professionals to determine what they considered a significant contact to be. The findings suggest that their performance of risk assessment at the cognitive level is not only incomplete but appears to be passive rather than active.

Study 7

The aim of this study was to explore and evaluate the extent to which a random selection of hand hygiene posters utilised message-framing theory. The findings showed that not only did posters rarely use theoretical principles of message-framing, but they conveyed mixed messages.

Study 8

The main aim of this study was to determine whether healthcare professionals' hand hygiene practice bears any relationship to their self-report behaviour. It also sought to establish the extent to which they avail themselves of hand hygiene opportunities and whether this is influenced by the level of risk of cross-infection posed by the care activity performed. Observed practice was not only unrelated to healthcare professionals' self-reports of behaviour, but also showed very poor rates of adherence to national guidelines that failed to take account of risk, even with patients infected with methicillin-resistant *Staphylococcus aureus* (MRSA).

Conclusions And Recommendations

In the final chapter, conclusions are drawn and recommendations made for changes to clinical practice and education and training programmes. The central tenet that has emerged from this thesis is that healthcare professionals need to assess risks of cross-infection in order to be able to determine when hand hygiene is necessary. However, this programme of research has shown that they are unclear about how to do this. In order to disambiguate healthcare professionals' understanding about when to wash hands, an active process called a Dynamic Assessment Strategy for Hand Hygiene (DASHH) is proposed whereby they could be enabled to undertake an active risk assessment to determine the need for hand hygiene. Such a strategy would need to be tested empirically.

Chapter 2

Ethical Issues

This programme of research was conducted in accordance with the University of Hertfordshire's *Ethical Guidelines for Research With Human Subjects.* These guidelines were drawn up with reference to:-

1. The British Psychological Society's statement on Ethical Principles for Research with Human Subjects;
2. The British Psychological Society's code of conduct for psychologists;
3. Minutes of the meetings of the University of Hertfordshire's Ethics Committee;
4. Experience of the Department of Psychology Ethics Committee.

As a Registered Nurse, the researcher was mindful of the profession's code of professional conduct (Nursing and Midwifery Council, 2003) and the Royal College of Nursing's (RCN) guidance on ethical principles of beneficence and non-maleficence, respect for autonomy, confidentiality, anonymity and justice (RCN, 2004).

Approval By Ethics Committees

All studies were approved by the Ethics Committee of the Psychology Department, under delegated authority from the Ethics Committee of the University of Hertfordshire.

In addition, Studies 1, 6 and 8 were approved by the joint University College London/ University College London Hospitals Committees on the Ethics of Human Research. Study 8 was also approved by the Ethics Committee for The National Hospital for Neurology and Neurosurgery (NHNN).

Approval To Negotiate Access To The Research Sites

Studies 1, 6 and 8 were registered with the Research and Development Directorate at the University College London Hospitals which granted Trust approval for the studies to be conducted on their premises. Notwithstanding, the researcher was advised to seek the approval of the Medical Director of the National Hospital for Neurology and Neurosurgery for Study 8 to be conducted at that hospital. This was duly obtained with the advice that all the medical consultants should be informed about the study. Acting through the Consultant Clinical

Microbiologist, the researcher sought their support by addressing them at one of their monthly committee meetings. A ten-minute slot allocated to her on the agenda by the Chair was utilised to make a presentation, with overheads, explaining the purpose of the study and answering questions. The study was approved by all those present and permission granted to access staff and patients on the wards.

Support was elicited from the nursing staff with the help of the Director of Nursing and Ward Sisters/Charge Nurses. They arranged unit meetings at which the researcher explained the purpose of the relevant studies and answered questions. For Study 8, the researcher also met with the Head of the Professions Allied to Medicine to explain the purpose of the study and elicit support from the therapists.

As regards gaining access to health sciences students at the University of Hertfordshire, this was negotiated sequentially with the Head of Department for Pre-Registration Nursing, Programme Tutors, Cohort Tutors, Module Leaders and individual lecturers in charge of various classes. All were extremely facilitative as regards the supply of timetables and class lists. They allowed the researcher to gain access to the students both to inform them about the studies in which they were being invited to participate and to distribute consent forms and questionnaires.

The Associate Head of Biosciences and two demonstrators facilitated the microbiology laboratory practicals which comprised Study 3.

Health And Safety Issues

In accordance with Control of Substances Hazardous to Health (COSHH) regulations (Health and Safety Executive, 1994), four risk assessments on the potential microbiological hazards during laboratory practicals were performed prior to the start of Study 3 viz. Gram stain, examination of plates to visualise antibiotic resistance, streak plate technique and aerial contamination.

Participants were given information on the skin antiseptic to be used in the practical exercise. Those who had a known allergy to chlorhexidine gluconate were given the opportunity to wash their hands with soap instead.

Informed Consent

All prospective participants were given an information sheet explaining the aims of the relevant studies and what participation would entail (Appendix 1). After a minimum of 24 hours, their understanding was checked by the researcher prior to asking them to sign a consent form (Appendix 2).

For Study 8, oral consent was sought from patients prior to observation of specific care activities. The researcher explained that they would not be required to do or say anything and that they were not obliged to allow the researcher to observe their care activities. All willingly agreed.

Anonymity

Anonymity of all participants was guaranteed by assigning a code to each name. Only the consent form stated participants' details and these were kept separate from the completed data collection tools.

Confidentiality

Data were stored and accessed in accordance with the principles outlined in the Caldicott Report (Department of Health, 1997) and the Data Protection Act (The Office of the Data Protection Registrar, 1998). The data base management programme was controlled by a user identification and password security check at the start. Both passwords are known only to the researcher. If invalid passwords are keyed in, the programme is terminated after three attempts. Publications contain nothing to identify individual hospitals, staff, patients or students.

Role Of Researcher

The researcher was faced with an ethical dilemma as to how to separate the role of researcher from that of a Registered Nurse when practices were observed which gave cause for concern. In order to abide by the principle of non-maleficence, a decision was made to intervene only if any life-threatening practice was observed. Fortunately, this did not occur. However, poor practice was observed and this was discussed with the Ward Sister or Charge Nurse at the end of the observation phase. It was considered that intervention at the time would change the nature of the observation from non-participant observer to participant observer which would be counterproductive.

Chapter 3
Literature Review

Introduction

The literature review was preceded by methodical searches of the relevant literature and a variety of search methods were employed. Electronic data bases were searched including MEDLINE (via PubMED) (1966-2004), Cumulative Index to Nursing and Allied Health (CINAHL) (1982-2003), PsycLIT and later PsycINFO, Best Evidence (1991-2003) and the Cochrane Data Base of Systematic Reviews (1995-2004). A variety of key words and booleans were used, as appropriate, and the MeSH facility helped to link key words or terms and to exclude others. These included hospital-acquired infections, healthcare associated infections, isolation guidelines, handwashing, hand hygiene, hand cleaning, hand disinfection, hand antisepsis, risk perception, social cognition models, attitudes. Searches were also made by name of authors who were known to have published in the field of study, such as Ayliffe, Gould, Larson and Pittet. Papers from all countries were considered as long as they were in English, save that two seminal papers which were known to be written in German were obtained and subsequently translated.

Various web sites such as that for The Department of Health, were visited throughout the duration of the research process and relevant documents downloaded. Hand searches were also conducted using the reference lists from seminal papers and textbooks which produced a snowball effect.

This review begins by exploring the extent of hospital-acquired infections followed by an examination of the evidence that hand hygiene prevents cross-infection. This background information makes a powerful case that justifies the need for this programme of research. There then follows a critique of national and American hand hygiene guidelines and a consideration of the impact that isolation guidelines have had on hand hygiene guidelines. This reveals not only ambiguities, contradictions and omissions, but differences in philosophical approaches; some list rules to be followed whilst others promulgate risk assessment. The relative advantages and disadvantages of these two approaches are considered in turn. This raises questions about whether healthcare professionals actually understand when exactly they are meant to wash their hands and the extent to which they utilise risk assessment strategies to inform their decision-making. This leads to consideration of some key theoretical approaches relevant to risk perception and assessment including the precaution adoption process (Weinstein, 1988) and

Protection Motivation Theory (Rogers, 1975; 1983).

A review of observational studies of hand hygiene practice conducted mainly in acute care settings follows. These invariably report suboptimal adherence rates. However, the studies also reveal considerable variation between researchers' definitions of what constitutes a hand hygiene opportunity. Hence, until there is universal agreement as to when hands must be washed, adherence rates may be unreliable markers of good or bad hand hygiene practice.

There then follows a review of reasons for suboptimal practice and strategies to improve practice. Environmental barriers and psychological dimensions are considered which leads to a review of the relative merits of various hand hygiene products. This is followed by a consideration of influences in the clinical setting, such as role models, who may affect both attitudes towards hand hygiene practice and actual behaviour in either a negative or positive direction. The few studies that have explored the effects of good and bad role models are discussed. Studies demonstrating healthcare professionals' false perceptions about their hand hygiene behaviour are reviewed next. Strategies to enhance hand hygiene practice such as performance feedback and patient empowerment are then considered.

The literature on the efficacy of hand hygiene posters is then reviewed. Posters are commonly used by Infection Control Teams ostensibly to remind people about the importance of hand hygiene. The review reveals limited information about their usefulness. Principles of message-framing theory are discussed with a view to establishing criteria against which a sample of hand hygiene posters can be judged. The use of constructs such as personal responsibility and the merits of messages based on fear are also reviewed.

The next section examines education and training issues with discussion of the limitations of both pre-clinical and clinical education and training programmes on infection prevention and control in general and hand hygiene in particular. This reveals a gap in the literature on the assessment of effectiveness of hand hygiene teaching strategies used in undergraduate curricula. The impact of knowledge on attitudes and behaviour is considered and the effect of practical demonstrations is discussed.

Two key studies which have explored healthcare professionals' attitudes towards hand hygiene are then examined. The extent to which attitudes predict behaviour and behaviour predicts attitudes is considered. This facilitates a better understanding of the seemingly paradoxical findings that, although healthcare professionals say they believe hand hygiene is important and they report that their practice is good, when their practice is observed, it is shown to be poor. Such false beliefs pose particular challenges when attempting to improve practice.

Finally, the use of theoretical models in studies exploring infection prevention and control issues are discussed. These include the Health Belief Model (HBM) (Rosenstock, 1966), The Theory of Reasoned Action (TRA) (Fishbein, 1967), The Theory of Planned Behaviour (TPB) (Ajzen, 1985) and the PRECEDE model (an acronym for predisposing, reinforcing and enabling factors) (Green et al., 1980). This aspect of the review facilitated the development of an extended model based on the Theory of Planned Behaviour which was used to determine the appropriateness of future interventions.

Each section ends with a summary and the implications for research are indicated. The research questions generated from the literature review are shown in Table 1.

Table 1 Research issues/questions generated from the review of the literature

Aspect of Literature Reviewed	Research Issues/Questions Generated
Background • Hospital-acquired infection: the size of the problem • Evidence that hand hygiene prevents cross-infection	• Ethical justification in defence of need for programme of research
Hand hygiene guidelines and policies • When should hands be washed? • Rule set or risk assessment? • The influence of isolation guidelines on hand hygiene policies • Theoretical approaches relevant to risk perception and risk assessment	• How do healthcare professionals interpret the guideline *"hands should be washed before and after every significant patient contact?"* • To what extent is this interpretation guided by rule set or risk assessment? • Development of a proposal for a Dynamic Assessment Strategy for Hand Hygiene
Observational studies of hand hygiene practice • Reasons for suboptimal practice and strategies to improve practice • Environmental barriers • Psychological dimensions • Hand hygiene products • Role models and organisational aspects • False perceptions about hand hygiene behaviour • Performance feedback • Patient empowerment	• To what extent do staff adhere to the national guideline that hands should be washed *"before and after contact with each patient?"* • Is there a correlation between self-report hand hygiene behaviour and actual behaviour? • To what extent is hand hygiene behaviour before and after patient care influenced by the nature of the risk of the care activity performed, including care of patients with MRSA? • Which products do staff use for hand hygiene?
Studies on the efficacy of hand hygiene posters • Message-framing theory • Personal responsibility • Fear appeals • Factors adversely affecting efficacy	• To what extent do hand hygiene posters utilise message-framing theory? • Were the messages persuasive? • Was the information given correct and consistent? • To what extent were fear appeals used? • What was the presentation style of the posters?
Education and training issues in infection prevention and control • Pre-qualifying programmes • In-service education • The impact of knowledge on attitudes and behaviour • Practical demonstrations	• How effective is a microbiology laboratory practical educational intervention in teaching undergraduate healthcare students about the importance of hand hygiene? • How do their views differ from the views of students who did not participate in a microbiology practical? • How effective is 'Glitter Bug' in teaching students about the importance of hand hygiene?
Attitudes towards hand hygiene practice • The relationship between attitudes and behaviour	• To what extent do student nurses value the importance of hand hygiene in the context of certain clinical procedures? • To what extent do these perceptions change over time? • What are their views of other healthcare professionals' attitudes towards hand hygiene practices?
Social cognition models • Health Belief Model; Theory of Reasoned Action; Theory of Planned Behaviour; PRECEDE model • Multi-Dimensional Strategies	• To what extent can a theoretical model determine the variables which should be targeted when designing an intervention aimed at increasing appropriate hand hygiene behaviour?

Hospital-Acquired Infection: The Size Of The Problem

The last national survey to be conducted of infections in hospitals in England and Wales reported a 9% prevalence rate of hospital-acquired infections (HAIs) (Emmerson et al., 1996). The commonest infections, which constituted 66.5% of all infections identified, were those of the urinary tract (23.2%), surgical wounds (10.7%), lower respiratory tract (22.9%) and skin (9.6%). These morbidity rates are similar to those reported when the first prevalence survey of infection in hospitals was conducted (Meers et al., 1981) although direct comparisons are not possible due to methodological differences.

Approximately 370,000 patients per year acquire an infection whilst in hospital (Comptroller and Auditor General, 2000). Whilst it is true to say that many of these are minor, others may prolong the patient's stay and some may have more serious consequences, including death (Hone et al., 1981). Indeed, it has been estimated that 5,000 patients die every year from hospital-acquired infections and there are an additional 15,000 deaths per annum where infection is a contributory factor (Comptroller and Auditor General, 2000).

The socio-economic impact of hospital-acquired infections has been estimated at nearly £1billion per annum (Plowman et al., 1999). Hospital-acquired infections have social and humanitarian implications as well as adding to the cost of the National Health Service. Additional costs (and therefore potential savings) include sickness and supplementary benefits, loss of earnings and productivity, reduced income tax, extra staff time taken up by patient care, the expense of antibiotics, extra microbiology services and perhaps the provision of isolation facilities and attendant costs. The cost in terms of pain and distress to both the patient and family members cannot, of course, be calculated but should not be ignored. The numbers of clinical negligence claims due to hospital-acquired infections are increasing (Comptroller and Auditor General, 2004).

In a recent survey exploring the funding and organisation of infection control in National Health Service (NHS) hospitals, Croxson et al. (2003, p.71) reported that due to the vagaries of budgetary systems "*Almost all infection control professionals believed they were constrained in their ability to protect the hospital population from the risk of infectious disease.*" Although government policy dictates that specific funding for hospital infection control is formally made available, it does not always reach infection control teams. The extent to which senior management values infection control appears quite variable. These attitudes may permeate down throughout the organization, thereby affecting the organizational culture.

As part of its statutory responsibility to scrutinise all aspects of public spending and to provide an independent insight into the performance of public services, The National Audit Office (NAO) responded to the study by Plowman et al. (1999) by publishing its first report on hospital-acquired infection (Comptroller and Auditor General, 2000). This made 29 recommendations for improving the management and control of hospital-acquired infections and commented on the growing mismatch between what was expected of infection control teams and the staffing and other resources allocated to them. A follow-up report four years later found that adoption of the 29 recommendations had been patchy (Comptroller and Auditor General, 2004). Factors militating against improved infection prevention and control include: bed management policies (increased frequency in moving patients and a lack of sufficient beds to separate elective and trauma patients), high bed occupancy rates (71% of Trusts are operating with bed occupancy rates higher than the 82% target), a lack of isolation facilities and poor antibiotic prescribing policies (Taylor, 2004).

The problem is further exacerbated by an increase in the numbers of outbreaks of infection, such as *Norovirus* and multiple antibiotic-resistant organisms such as methicillin-resistant *Staphylococcus aureus* (MRSA) which is now endemic in our hospitals. In England and Wales, the numbers of reported cases of MRSA bacteraemias as a proportion of all *Staphylococcus aureus* bacteraemias are among the highest in Europe, at around 40% (European Antimicrobial Resistance Surveillance System, 2004). MRSA is spread predominantly by contaminated hands (Ayliffe and English, 2003) as are many other hospital pathogens such as *Streptococcus pyogenes* (Semmelweis, 1861); *Eschericia coli* and *Klebsiella aerobacter* (Salzman et al., 1967); *Klebsiella spp.* (Casewell and Philips, 1977); *Candida albicans* (Burnie et al., 1985) and respiratory syncytial virus (Isaacs et al., 1991). Today, it is universally accepted that direct contact is the commonest mode of cross-infection and hands are the commonest vehicle of cross-infection (Bauer et al., 1990). Failure to adhere to hand hygiene guidelines is a major cause of cross-infection in hospitals and *"Some trusts have made non-compliance with hand hygiene a disciplinary offence."* (Comptroller and Auditor General, 2004, p.34).

Whilst the eradication of all hospital-acquired infections is an unrealistic goal, there is a commonly held view that a sizeable proportion could be prevented if healthcare professionals adhered to hand hygiene guidelines. Estimates have been put variously at 50% (Meers, 1981; Haley et al., 1985; Ayliffe et al., 1993); 30% (DOH/PHLS, 1995a) and recently, a more conservative estimate of 15% has been made (Comptroller and Auditor General, 2000). However, even this reduction would result in a saving of £150 million which could be put to good use in the NHS. This would leave what Ayliffe (1986, p.91) calls "*The irreducible* *minimum.*" Research which aims to improve healthcare professionals' hand hygiene practice is therefore ethically justifiable and critically important.

Evidence That Hand Hygiene Prevents Cross-Infection

The value of improving healthcare professionals' hand hygiene behaviour was first demonstrated by Semmelweis over 150 years ago (Semmelweis, 1861). Whilst practising as an assistant accoucheur in Vienna, he investigated the epidemiology of puerperal sepsis (childbed fever). He noted that on the ward where deliveries were performed by medical students, 22% of the post-partum women died whereas on the ward where deliveries were performed by midwives, there was a much lower mortality rate of 2%. Knowing that medical students and doctors (including himself) who spent considerable time in the necroscopy room went straight to the wards and performed vaginal examinations on women in labour, he formulated the hypothesis that hands were the vehicles of cross-infection. He tested this hypothesis by introducing 'chlorina liquida' (an antiseptic) for doctors and medical students to wash their hands after performing post-mortem examinations and before examining women in labour. The ward where women had been delivered by midwives served as the control for his investigations (Newsom, 1993). The mortality rate amongst newly delivered women on the experimental ward fell from 22% to 11.4% and subsequently to 3.04% when he changed to using a cheaper solution of chlorinated lime. When he insisted that hands must be disinfected before each vaginal examination performed on patients in the wards the rate fell further to 1.28%. These results failed to impress the medical establishment and he later published "*two 'open' letters in which he accused the distinguished addressees of murder by ignoring his work.*" (Newsom,1993, p.178).

Apart from this seminal work, there are several other experimental studies which have shown that the implementation of hand hygiene reduces morbidity rates arising from infection in a variety of clinical and community settings. These are summarised in Table 2 (adapted from Larson, 1988; Bryan et al., 1995; Hand Hygiene Liaison Group, 2001a).

Although it did not explore the relationship between handwashing and infection rates, there is one other study of note: that reported by Mortimer et al. (1966). This was an experiment (which was presumably considered ethically sound at the time) designed to test the effect of handwashing on *Staphylococcus aureus* (*S. aureus*) transmission rates among babies in a hospital nursery. Newborn babies who were not initially colonised with *S. aureus*, shared a room with those who were known to be carriers of the organism. Physical contact with babies in the

Table 2 Studies providing evidence that handwashing prevents infection

			Elements of experimental design			
Year	Authors	Setting	Comparison group?	Randomisation?	Blinding?	Significant results
1977	Casewell and Phillips	Critical care unit, UK	Sequential	No	No	Reduced nosocomial infection[2] rates due to endemic *Klebsiella spp.*
1981	Black et al.	Child day care centres, USA	Concurrent	Yes	No	47% reduced incidence of diarrhoea
1982	Khan	Village in Bangladesh	Concurrent	Yes	No	67% reduced incidence of shigellosis
1982	Maki and Hecht	Critical care unit, USA	Cross-over design	No	No	Reduced incidence of nosocomial infections
1984	Massanari and Hierholzer	Critical care unit, USA	Cross-over design	No	No	Reduced incidence of nosocomial infections
1987	Stanton and Clemens	Village in Bangladesh	Concurrent	Yes	No	26% reduction of childhood diarrhoea
1989	Conly et al.	Medical ITU, USA	Cross-over design	No	No	Reduction in nosocomial infection rate from 33% to 11%
1990	Butz et al.	24 family day care homes	Concurrent	Yes	No	Reduction in symptoms of enteric disease OR for vomiting 0.35 (95% CI 0.20-0.56); OR for diarrhoea 0.175 (95% CI 0.54-0.72)
1991	Peters and Flick-Fillies	Maternity ward	Sequential	No	No	Reduction in puerperal mastitis
1992	Doebbeling et al.	Critical care unit	Crossover	No	No	Significant difference in nosocomial infection with one-handwashing product
1996	Shahid et al.	Village in Bangladesh	Concurrent	No	No	Reduced incidence of diarrhoea RR 0.38 (95% CI 0.33-0.43)
1997	Masters et al.	School classroom,USA	Concurrent	No	No	RR of gastrointestinal symptoms 0.43 (95% CI 0.25-0.73) and of all infection 0.75 (95% CI 0.60-0.95)

[2] i.e. Hospital-acquired infection.

experimental group was followed by handwashing with antiseptic soap for 10 seconds. Contact with those in the control group was not followed by handwashing unless considered absolutely necessary in which case hands were rinsed with running water only. Nurses caring for those in the control group were also told to change the nappy of a colonised baby before handling the other babies. Swabs taken from the nose and umbilicus of each baby on a daily basis revealed that the acquisition of *S. aureus* was 14% in the experimental group compared with 43% in the control group.

There are limitations in most hand hygiene studies such as lack of randomisation of participants to control and experimental conditions, insufficient power and the confounding effect of other infection control practices when attributing lower infection rates to improved hand hygiene. Nevertheless, the evidence that hand hygiene is an effective practice to prevent both the transmission of micro-organisms and subsequent infection is compelling. Healthcare professionals are therefore expected to adhere to a hand hygiene policy that has been ratified by the relevant Infection Control Committee. The next section explores the guidelines on which hand hygiene policies are based.

Hand Hygiene Guidelines And Policies

In its annual report, The Commission for Health Improvement (2003) noted concerns about handwashing and the paucity of good infection control policies which, when they existed, were often not followed. One possible reason why hand hygiene policies are not followed is that, as this review shows, the guidelines on which policies are based are inconsistent, conflicting, confusing and difficult to interpret. Consider, for example, advice concerning *when* hands should be washed.

When Should Hands Be Washed?

Both British and American guidelines (Tables 3 and 4 respectively) specify a range of tasks which should be preceded or followed by handwashing. However, *"Data are limited regarding the types of patient care activities that result in transmission of patient flora to the hands of personnel."* (Centers for Disease Control and Prevention (CDCP),2002, p.4). Consequently, guidelines may not be based on strong empirical evidence. For example, in the CDCP guidelines (CDCP, 2002), each of the 45 recommendations for hand hygiene is ascribed to one of five categories on the basis of existing scientific data, theoretical rationale, applicability and economic impact. Analysis of these shows that only 62% (28/45) are based on strong empirical evidence (Table 5).

Table 3 British guidelines for handwashing/decontamination

Public Health Laboratory Service (Ward et al.,1997)	Infection Control Nurses' Association (ICNA,1999)	epic guidelines (Pratt et al., 2001)
Handwashing is essential in the following situations: Before contact with susceptible sites e.g. wounds, burns, intravascular insertion sites Before performing invasive procedures, i.e. where natural defences against infection are breached Before contact with particularly susceptible patients, e.g. newborns, immuno-compromised Before handling food or medicines After hands have been contaminated, e.g. contact with body substances, soiled linen or equipment After gloves have been removed, as holes frequently develop while in use, and hands may be contaminated on removal After contact with a patient in isolation, or one colonised with micro-organisms of special clinical significance, e.g. multi-resistant bacteria After using toilet or toileting others	Some examples of when hands should be washed: Whenever hands are visibly dirty Any situation which involves direct patient/client contact e.g. bathing, assisting to move, toileting Before and after handling wounds, urethral catheters, intravenous lines Before preparing, handling or eating food Before caring for susceptible patients (immuno-compromised) Before leaving source isolation Before wearing sterile gloves After removing gloves After any possible microbial contamination After visiting the toilet After bed making After handling contaminated laundry and waste Before and after emptying urine drainage bags Before and after administering medication Before commencing work and after leaving a work area	Hands must be decontaminated immediately before each and every episode of direct patient contact/care and after any activity or contact that potentially results in hands becoming contaminated. Hands that are visibly soiled or potentially grossly contaminated with dirt or organic material must be washed with liquid soap and water. Apply an alcohol-based hand rub or wash hands with liquid soap and water to decontaminate hands between caring for different patients, or between different caring activities for the same patient. Remove all wrist and ideally hand jewellery at the beginning of each clinical shift before regular hand decontamination begins. Cuts and abrasions must be covered with waterproof dressings.

Table 4 Key aspects of the American guidelines for handwashing/hand antisepsis, according to category (CDCP, 2002)

Indications For Hand Hygiene	
Wash hands:	**Category**
When visibly dirty or contaminated with proteinaceous material or are visibly soiled with blood or other body fluids.	Category IA
Before eating and after using a restroom.	Category IB
Decontaminate hands before:	
Having direct contact with patients.	Category IB
Donning sterile gloves to insert a central intravascular catheter, peripheral vascular catheter, indwelling urinary catheter or other invasive device.	Category IB
Decontaminate hands after:	
Contact with a patient's intact skin e.g. when taking a pulse or blood pressure, and lifting a patient.	Category IB
Contact with body fluids or excretions, mucous membranes, non-intact skin and wound dressings if hands are not visibly soiled.	Category IA
Contact with inanimate objects (including medical equipment) in the immediate vicinity of the patient.	Category II
Removing gloves.	Category II
If moving from a contaminated-body site to a clean-body site during patient care.	Category II

Table 5 Rationale for hand hygiene recommendations made by CDCP (CDCP, 2002)

Category	Rationale	N
IA	Strongly recommended for implementation and strongly supported by well-designed experimental, clinical or epidemiologic studies.	8
IB	Strongly recommended for implementation and strongly supported by certain experimental, clinical or epidemiologic studies & a strong theoretical rationale.	20
IC	Required for implementation, as mandated by federal or state regulation or standard.	2
II	Suggested for implementation and supported by suggestive clinical or epidemiologic studies or a theoretical rationale.	13
No recommendation	Unresolved issue. Practices for which insufficient evidence or no consensus regarding efficacy exists.	2
Total		45

The British guidelines (Ward et al., 1997; ICNA, 1999) which specify handwashing before certain tasks and after others, have been somewhat compromised by recommendations made by the Hand Hygiene Liaison Group[3] (formerly the Handwashing Liaison Group). Initially, they called for an explicit standard to be set requiring hands to be decontaminated *before* (but not after) each patient contact (Handwashing Liaison Group, 1999, p.686). Later however, their draft hand hygiene standards recommended that a hand hygiene policy must include the requirement for hand decontamination *between* each close-contact patient procedure (Cookson et al., 2001, p.153). This change in the words regarding timing may be unhelpful. Furthermore, MacDermott (1999, p.518) expressed the view that *"A definition of what constitutes a patient contact requiring handwashing would have been helpful."* Rahman and Chattopadhyay (2000, p.249) also argued that *"It is not helpful to state that hands must be washed after a 'close contact' or 'prolonged contact' without describing what 'close contact' or 'prolonged' mean."* It is therefore not necessarily the case that *"healthcare professionals fail to understand the importance of handwashing"* (The Handwashing Liaison Group, 1999, p.686), but rather that the use of inconsistent terms by experts leads to confusion and makes healthcare professionals unsure about when exactly they should be performing this behaviour. The Hand Hygiene Liaison Group (2001b, p.244) advocated *"the use of alcohol-glycerol handrubs between every patient contact where there has not been actual soiling of the hands."* Again, what constitutes 'actual soiling' is open to a variety of interpretations and may well lead to confusion in the mind of the healthcare professional.

Clearly, there is a need for terms to be defined and standardised for such ambiguities have major implications not only for education and training but also practice. Indeed, Gerrish and Clayton (2004) reported that nurses are more likely to draw their knowledge from policy and procedure manuals than from research literature. It is therefore essential that such documents are research-based and easy to understand.

Guidelines may also overlook fundamental principles. For example, the latest guidelines from CDCP (2002) (Table 4) list various indications for hand decontamination before donning sterile gloves. However, performing a wound dressing is not one of them. Given that this is the

[3] An autonomous, self-funding, multi-disciplinary/organisational group consisting of expert representatives from the Hospital Infection Society (HIS), the Association of Medical Microbiologists (AMM), the Health Protection Agency (HPA) (formerly the Public Health Laboratory Service), the Infection Control Nurses' Association (ICNA), the Royal College of Nursing (RCN) and the Department of Health (DOH).

cornerstone of the 'aseptic technique', it is a surprising omission. These should be contrasted with the British guidelines (Ward et al., 1997; ICNA, 1999) (Table 3) which do list this task, in addition to many others. Whilst the lists do not purport to be exhaustive or exclusive, there is a danger that they may be perceived as such, especially by students.

Rule Set Or Risk Assessment?

Guidelines also vary in their philosophical approach. Those listing tasks that should be preceded or followed by hand hygiene promulgate 'rule set' (e.g. Ward et al., 1997; ICNA, 1999; CDCP, 2002), whereas other guidelines promulgate 'risk assessment' to determine the need for handwashing (e.g. Steere and Mallison, 1975; Larson, 1995; Pratt et al., 2001). Over the years, American and British guidelines have vacillated between the two approaches and there does not appear to be consensus as to which approach is preferable. Steere and Mallison (1975) acknowledged that hospitals were not able to motivate staff to wash their hands consistently before and after taking care of every patient, as recommended by the first guidelines to be published by the Centers For Disease Control (CDC) (CDC, 1970) and those produced by the American Hospital Association (1974). They also reasoned that risk factors, such as the susceptibility of the patient and type of contact made, affected the chances of transmitting organisms to or acquiring organisms from a given patient. They therefore argued that the real need for handwashing was before *and* after certain procedures and before caring for particularly susceptible patients. They concluded that:

> *"Personnel should wash their hands before and after significant contact with any patient. The risk of personnel acquiring transient hand carriage of organisms is usually greatest after contact with excretions, secretions or blood; patients at greatest risk are those undergoing surgery, those with catheters and newborn infants."* (Steere and Mallison, 1975, p.683).

The use of the word 'significant' implied that not all patient contacts necessitated a handwash; risk factors were specified for those that did. However, later American and British guidelines adopted a 'rule set' approach and recommended handwashing *before* certain tasks and *after* others (CDCP, 2002; Ward et al., 1997; ICNA, 1999), as shown in Tables 3 and 4.

Rule Set

Rule set engenders several problems. It fosters rote learning which requires a good memory but little understanding of *why* hand hygiene is required in the given situations. It therefore constrains critical and contingent thinking, which, as Hale and Swuste (1998) argue, makes people less able to perform well in novel situations. However, there may be some merit in listing indications for handwashing because, as Levy and Loftus (1984) point out, many research studies indicate that specific instructions are more likely to be followed than less specific instructions. Lawton and Parker (2002) explored the judgements of rule-related behaviour by healthcare professionals and the general public with regard to clinical guidelines and protocols. Their findings show that by complying with protocols

> *"The healthcare professional makes it more likely that their behaviour will be judged as appropriate, and if there is a negative outcome, compliance ensures that a complaint is less likely and that they will be less likely to be held responsible. In situations where compliance with a protocol results in a bad outcome the health care organization rather than the professional is more likely to be held to account."* (p.263)

Hence, prescribing rules to define behaviour also has benefits, provided they are adhered to.

Risk Assessment

The process of risk assessment requires healthcare professionals to assess the factors which pose a risk of cross-infection to the index patient, other patients and self. It is therefore essential that healthcare professionals know what might cause contamination but Prieto (2003) has shown that this is not necessarily the case. She found that nurses and healthcare assistants had misconceived ideas about the mode of transmission of micro-organisms and their potential to cause disease.

The latest British guidelines (Pratt et al., 2001, p.23) state that *"Hands must be decontaminated immediately before each and every episode of direct patient contact/care and after any activity or contact that potentially results in hands becoming contaminated."* (Researcher's emphasis). This would seem to include not only skin-to-skin contact with the patient but also equipment in the patient's environment. This adds an extra dimension to the meaning of 'significant contact'. These guidelines also suggest that prior to performing hand hygiene

> *"Four key factors need to be considered: the level of the anticipated contact with patients or objects; the extent of the contamination that may occur with that contact; the patient care activities being performed and the susceptibility of the patient."* (Pratt et al., 2001, p.23).

These are very similar to the recommendations of the American Association for Professionals in Infection Control and Epidemiology (APIC) (Larson, 1995) which state that

> *"The decision regarding when handwashing should occur depends on 1) the intensity of contact with patients or fomites* (items), *2) the degree of contamination that is likely to occur with that contact, 3) the susceptibility of patients to infection and 4) the procedure to be performed."* (p.253).

The risk assessment process requires the healthcare professional to have not only adequate information about the patient's condition and a good knowledge of microbiology, but also a reliable perception of risk. However, as Casewell and Phillips (1977) have shown, nurses' perceptions of risk are not always sound. They found that nurses' hands became contaminated with *Klebsiella spp.* whilst performing simple, non-invasive nursing activities and reported that *"These nurses considered that they had 'clean' hands, and would not normally have washed before attending another patient, unless they were about to undertake an aseptic technique."* (p.1316). It could be that the promulgation of risk assessment may result in lowered rates of hand decontamination because there was no perceived need to wash hands. Therefore, the risk assessment approach may simply not be workable or understood. As reported by Fox et al. (1974) and Larson and Lusk (1985), Fulkerson (1971) devised a ranking scheme to identify healthcare activities that are likely to cause contamination of the hands. These could be used to help healthcare professionals decide which tasks pose a significant risk of cross-infection. There is clearly a need for these to be determined empirically but this is outwith the scope of this thesis.

The guidelines also show that expert opinion regarding risk changes over time. For example, despite the aforementioned evidence that only slight contact with the patient's skin is sufficient to cross-contaminate nurses' hands with *Klebsiella spp.* (Casewell and Phillips, 1977), Garner and Favero (1985), who revised the second edition of the CDC guidelines written by Simmons et al. (1981), advised that handwashing was not necessary after *"superficial contact with a source not suspected of being contaminated, such as touching an object not visibly soiled or taking a blood pressure."* (p.7). This position is no longer accepted. The latest American guidelines (CDCP, 2002) state that hands should be decontaminated *"After contact with a patient's intact skin e.g. when taking a pulse or blood pressure, and lifting a patient."* (p.32). It could be inferred from the CDCP (2002) guidelines that *all* patient contacts are now to be regarded as 'significant' for there is no difference in terms of infection risk between taking a pulse and shaking a patient's hand. This change in emphasis may be due, in part, to the unabated spread of methicillin-resistant *Staphylococcus aureus* (MRSA), now endemic in many countries including the UK, which necessitates greater attention being paid to hand hygiene, as healthcare professionals' hands are the commonest vehicle of cross-infection (Ayliffe and English, 2003). There is of course a need for guidelines to be updated when microbiological problems evolve and challenge infection control efforts, but reasons for changes and rationale for practice need to be explained if healthcare professionals are to be persuaded to alter their behaviour. Changes in the intentions behind policies have to be known and understood by practitioners.

The Influence Of Isolation Guidelines And Barrier Precautions On Hand Hygiene Policies And Practice

A discussion about hand hygiene guidelines would be incomplete without acknowledging the way in which hand hygiene policies and practice have been influenced by isolation guidelines and practices. These have changed over the years. Some isolation guidelines are also based on a rule set approach to care, for example, Category Isolation (CDC, 1970) and Disease Specific Precautions (Garner, 1996a). These specify precautions to be taken according to either the mode of spread of the infection (e.g. airborne, direct contact, faecal-oral etc.) or the infection itself (e.g. pulmonary tuberculosis). Others, however, such as Universal Precautions (CDC, 1988) and Body Substance Isolation (Lynch et al., 1987) promulgate the principle of uniformity. Both were designed to protect staff from exposure to blood-borne pathogens through their work, and the latter also aimed to provide staff with relatively straightforward, unvarying procedures for limiting cross-infection. Glove-wearing was the mainstay of the barrier precautions for all anticipated contact with blood, secretions, non-intact skin and moist body substances and it was to be applied for *all* patients, irrespective of whether or not they were known to be infectious. This led one American anaesthetist to comment *"In practice, this means we now wear gloves at all times."* (Smith,1988, p.497). Jenner (1990) questioned the need to wear gloves when caring for non-infected patients. She argued for glove use to be rationalised highlighting the fact that intact skin is a valuable defence mechanism against infection. Many studies report very high adherence rates to glove use as a Universal Precaution. For example, Friere et al. (2000) reported 100% adherence and Madan et al. (2001) reported 98% adherence. However, these studies were conducted in dental care clinics and an emergency department respectively and may not necessarily be representative of practices in general wards. Nevertheless, these findings suggest that self-protection is a key factor in the decision to wear gloves. Furthermore, staff may believe that their use obviates the need for hand hygiene. Indeed, Lynch et al. (1987) initially stated that Body Substance Isolation meant that handwashing was required less frequently and the original description of this system explicitly stated that *"Handwashing is unnecessary......unless hands become visibly soiled due to punctures in the gloves."* (p.245). However, they later revised their position stating that handwashing is indicated whenever the hands are soiled and before each new patient contact (Lynch et al., 1990).

In the UK, it is now generally accepted that gloves should be worn whenever there is a chance of exposure to blood or other body fluids (UK Health Departments, 1998). Healthcare professionals who protect themselves in this way, (and not all do, see Stringer et al., 1991; Denman et al., 1993), may not perceive the need to wash hands if they erroneously believe that clinical procedure gloves are impervious; several authors have shown that they are porous (Daschner and Habel, 1988; Korniewicz et al., 1988). Hence, the UK Health Departments' (1998) guidelines on protection against infection with blood-borne viruses recommend that hands should not only be washed before and after contact with each patient, but also before putting on and removing gloves.

This review of hand hygiene and isolation guidelines has shown that healthcare professionals need to be able to risk assess when hand hygiene is necessary. The process of risk assessment is dependent upon an individual perceiving that a risk exists. The next section considers theoretical approaches relevant to risk perception and assessment.

Theoretical Approaches Relevant To Risk Perception And Assessment

Weinstein's (1988) 'precaution adoption process', which is based on behavioural decision theory (Edwards, 1954), assumes a series of steps preceding the adoption of preventive action to reduce the threat of negative consequences for one's health. First, people have to realize that a specific risk exists. Second, they have to realize that the risk is significant and can affect people. Third, they have to realize that they are vulnerable to the risk. Behavioural changes will be a function of the perceived severity of the consequences for one's health and the efficacy and costs of preventative behaviour.

It could be argued that the *main* purpose of hand hygiene in the clinical setting is to prevent patients from acquiring an iatrogenic or exogenous infection. However, it also protects healthcare professionals from acquiring an infection through their work. Yet, despite reported cases of occupationally acquired infections (Becker et al., 1989; Hadler, 1990; Burkholder et al., 1995), some researchers have suggested that healthcare professionals erroneously believe that they are not at risk of acquiring infections from patients (Larson, 1980; Preston et al., 1981; Donowitz, 1987; Pritchard and Hathaway, 1988; Korniewicz et al., 1990). Their judgement about such matters may be coloured by optimistic bias, that is a tendency to view oneself as less at risk than others (Weinstein, 1980; 1984) leading individuals to persist in practices that carry health-related risks.

Sutherland contends that people's attitudes towards risks are irrational (Sutherland, 1992). He argues that the availability error causes people to

> *"overestimate the dangers of dramatic accidents that kill several hundred people simultaneously in one place as compared to the more insidious killing of many people at different times and over wide areas."* (p. 253).

This concept may help explain why people's behaviour concerning infection prevention and control is often irrational. Whilst some hospital-acquired infections result in outbreaks, the vast majority present as isolated cases of an insidious nature. In countries such as Hong Kong, Singapore and Canada which were affected by the recent outbreaks of Sudden Acute Respiratory Syndrome (SARS) resulting in the deaths of several hundred people, including some healthcare professionals, there is reported to be *"A wholesale change in staff behaviour and full compliance* (i.e. with hand hygiene) *is now part of the culture."* (Comptroller and Auditor General, 2004, p.34). It will be interesting to see how long this lasts.

Protection Motivation Theory

Protection Motivation Theory (Rogers, 1975; 1983) argues that any information about a health threat initiates two cognitive processes: threat appraisal and coping appraisal. People will only respond appropriately to a health threat if they perceive themselves to be at risk and the behaviour to be efficacious. Self and Rogers (1990, p.345) argue that *"The major factors that increase the likelihood of performing the response are response efficacy and self-efficacy."* If this is applied to hand hygiene, the factors increasing the likelihood of this behaviour are the belief that washing hands is necessary to prevent cross-infection and the belief that one can do it. Factors decreasing the probability of handwashing are response costs such as the time it takes to perform the behaviour and side effects such as sore hands. The cognitive appraisal of these factors elicits motivation to protect oneself from the threat.

Enhancing healthcare professionals' perception of risk is important because it appears to be a key determinant of whether or not they wash their hands. One strategy that might facilitate this is a practical demonstration that *shows* the effects of poor hand washing. This is discussed later in further detail.

Summary And Implications For Research

The succession of guidelines and advice on both hand hygiene and isolation precautions which have been produced by both American and British experts have become increasingly complex, ambiguous and in some cases contradictory. Not only are there differences between the American and British guidelines on hand hygiene, but there are also differences between the various national guidelines. Some favour *rule set* which specifies when hands should be washed. Others favour *risk assessment* which relies on the individual making an informed decision as to whether their hands have been sufficiently contaminated to merit being washed or disinfected either before or after, before and after, or between care activities on both sequential patients and on the same patient. Glove wearing in accordance with Universal Precautions and Body Substance Isolation may have impacted on the extent to which healthcare professionals risk assess the need for hand hygiene.

It is clear therefore that there is a need to explore the extent to which healthcare professionals understand the factors that should guide their decision-making about hand hygiene practice at the cognitive level. This prompted a study to investigate healthcare professionals' understanding of the critical term used in their hand hygiene policy '*hands should be washed before and after every significant patient contact.*' Evidence was sought for the risk assessment strategies used in determining what they considered a significant contact to be.

<u>**Observational Studies Of Hand Hygiene Practice**</u>

Pritchard and Raper (1996, p.389) posit that *"Handwashing by hospital staff has become accepted as the single most important measure for preventing nosocomial infection."* If healthcare professionals really believe this, why then have so many observational studies shown that their hand hygiene practice is universally suboptimal? According to Fishbein (1984), while attitudes may be changed through *awareness* and *general* acceptance of counter-attitudinal information, behaviour change will only result if there is also *personalized* acceptance of the counter-attitudinal information. For example, healthcare professionals have been shown to believe that handwashing can prevent cross-infection (Alvaran et al., 1994), thus indicating *awareness* and *general* acceptance. However, their handwashing rates (i.e. their behaviours) are invariably suboptimal. This suggests that healthcare professionals are not persuaded that hand hygiene is essential.

Observational studies have been conducted, mainly in Intensive Care Units (ICUs), which document that healthcare professionals' hand hygiene behaviour is universally suboptimal and that this is an international problem (Table 6). Nurses tend to be the focus of most studies, probably because they are the most numerous practitioners and they have the most frequent contact with patients. Studies of nurses conducted in Turkey (Karabey et al., 2002) and England (Gould, 1994a) have reported adherence levels as low as 15% and 29% respectively. However, their levels of adherence are generally better than doctors' (see Albert and Condie, 1981; Kaplan and McGuckin, 1986; Meengs et al., 1994, Table 6). Tibballs (1996) found that doctors washed their hands on only 8.6% (range 0%-33%) of the occasions when it was deemed appropriate. Indeed, medical consultants are considered by some to be the worst culprits (Araf et al., 1999). Inconsistent with the general trend, two studies (Larson et al., 1992; Watanakunakorn et al., 1998) reported that doctors had better levels of hand hygiene adherence than nurses. However, given that most of the nurses studied are female and most of the doctors studied are male, it could be that gender rather than occupation is the true variable and this may be worth further exploration.

It is not only doctors and nurses who have poor hand hygiene behaviour. The handwashing practice of dentists and dental students has been video recorded (Porter et al., 1995) whilst Marcil (1993) explored the handwashing practice of occupational therapists by means of a telephone survey. Both studies reported suboptimal practice. Using covert observation in an ICU, Wurtz et al. (1994) found that respiratory therapists only washed their hands on 25% of appropriate occasions whilst electrocardiographic and radiographic technicians never did. In a similar setting and also using covert observation, van de Mortel and Heyman (1995) found that physiotherapists washed their hands after touching patients only 57% of the time whilst radiographers did so only 35% of the time.

Meaningful comparisons between the observational studies presented in Table 6 are difficult because of the different criteria used to define a handwashing opportunity and the different denominators used to measure frequency. For example, some observed contact with patients and equipment; others observed patient contact only, but even these studies varied. Most observed hand hygiene only *after* a patient contact whereas a few observed hand hygiene both *before and after* patient contact. In most studies, participants were not told the real reason for being observed whereas in a few, they were. In addition, the majority of the studies did not address issues of reliability of their findings. The numbers of observers (which was not always stated), ranged from 1-74, but the way in which they had been trained to observe and the issue of inter-observer reliability was addressed in only four studies, of which only two presented evidence of the test result.

Table 6 Observational studies of healthcare professionals' hand hygiene practice in acute care settings

Year	Authors	Setting	Participants	Nos. of observers; inter-observer reliability (IOR)?	Definition of adherence opportunity?	Numbers of observations	Staff aware of real reason for observation?	Average adherence
1981	Albert and Condie	2 medical ICUs, USA	Nurses n=15 Doctors n= 40 Other HCPs	2 No IOR	After direct contact with pt./equipment	40 hours over 2 months; 28 pts.	No	41% after contact Nurses 43% Doctors 28%
1986	Kaplan and McGuckin	1 medical and 1 surgical ICU	Nurses n=30 Doctors n=8 Technicians n=4	1 graduate student	After direct contact with pt./equipment	243 contacts 3h periods of observation	No	Nurses 63% Doctors 19% Technicians25%
1989	DeCarvalho et al.	Neonatal ICU, Brazil	Nurses and doctors	1 doctor	Before & after pt. contact	219 contacts 15 periods of 90 mins.	No	Nurses Before 68% After 51% Doctors Before 85% After 44%
1992	Larson et al.	Neonatal ICU, Peru, South America	HCPs	3, IOR discussed but no test used.	After pt. contact	697 contacts 1-2h period over 3 wks. total 24.5h	Yes	After 29% Nurse 18% Aux nurse 49% Doctor 20% Student nurse 30% Visitor 23%
1993	Zimakoff et al.	4 ICUs in Denmark and Norway	325 HCPs Nurses n=151 Doctors n=55 Others n=119	2	Yes, after contacts, some minor contacts omitted	1632 pt. contacts 40h per unit over 2 weeks	No	After 40% After glove use 57%
1994	Meengs et al.	Emergency dept.	n=35 Nurses n=13 Doctors n=11 Faculty n=11	1	Yes, after clean and dirty procedures	409 contacts over 1month	No	After 32% Nurses 58% Drs. 19% Faculty 17%
1994	Bartzokas et al.	UK	Senior doctors	Not specified	Compliance with standard recommendations	21 hrs.	No	2 handwashes were observed in 21 hrs of observation

Table 6 (continued). Observational studies of healthcare professionals' hand hygiene practice in acute care settings

Year	Authors	Setting	Participants	Nos. of observers; inter-observer reliability (IOR)?	Definition of adherence opportunity?	Numbers of observations	Staff aware of real reason for observation?	Average adherence
1994	Sproat and Inglis	11 ICUs, UK	HCPs (non-nurses)	74 nurses caring for patients; No IOR	Before and after pt. contact	381 obs on one shift in 11 ICUs	No	All staff n=381 Before 26% After 35% Doctors n=216 Before 16% After 25%
1994a	Gould	ICU, medical and surgical units in 2 hospitals, UK	Nurses n=173	More than one; No IOR	Yes; 8 occasions specified	Total nos. of obs. not stated. 2h periods	Yes	After 29%
1995	van de Mortel and Heyman	ICU, Australia	Nurses n=45 Doctors n=35 Radiographers n=15 Physiotherapists n=11	4 nurses No IOR	Hand contact with any pt.	Not stated	No	*After contact* Nurses 69% Doctors 41% Radiographers 35% Physiotherapists 57%
1995	Picheansatathian	Thailand	Nurses n=40	2	In accord with Universal Precautions policy	509 nursing procedures over 3 months	No	Before 2% After 29%
1996	Tibballs	ICU, Australia	Doctors n=61	1 doctor and several other nurses No IOR	Hand contact with any pt.	939 pt. contacts over 5 months	Covert for baseline and after IV Overt during intervention	8.6% (range 0%-33%) *Covert Baseline* Before 12.4%; After 10.6% *Overt* Before 32.7% After 33.3% *Covert f/up 7 wks* Before 68.3% After 64.8%

Table 6 (continued). Observational studies of healthcare professionals' hand hygiene practice in acute care settings

Year	Authors	Setting	Participants	Nos. of observers; inter-observer reliability (IOR)?	Definition of adherence opportunity?	Numbers of observations	Staff aware of real reason for observation?	Average adherence
1998	Watanakunakorn et al.	Med, Surg ICUs and general units, USA	HCPs	1 medical student	After pt. contact	686 pt. encounters over 6 wks	No	Nurses 33% Residents 59% Physicians 37% Others 4.2%
1999	Nishimura et al.	ICU, Japan	HCPs and visitors	CCTV	On entry to ICU	1030 entries 7 days	No	ICU staff 71% Non-ICU staff 74% Visitors 94%
1999a	Pittet et al.	All hospital wards and ICU, Switzerland	HCPs n=1043 Nurses n=520 Doctors n= 158 Others n=365	5 trained ICNs IOR test shown	Yes. Before and after pt. contact; after gloves	2834 opportunities, 105h	No	48% Nurses 52% Doctors 30%
2002	Karabey et al.	ICU, Turkey	n=32, Nurses n=23, Doctors n=6 Technicians n=2 Physio n=1	3 IOR test mentioned in pilot	Yes; adapted from CDC, APIC criteria	64h over 2 months 298 HH opportunities	No	Nurses 15% Doctors 0% Overall 13%
2003	Lankford et al.	ICU medical and surgical; hematology/ oncology; transplant units	n=? Nurses, doctors, other HCPs	4 IOR discussed, but no test used	Yes; on room entry; after each HH opportunity; adapted from CDC, APIC criteria	45h 729 HH opportunities	No	On room entry: Old hospital 12% New hospital 6% After all HH opportunities: Old hospital: 53% New hospital 23% After: 35.7% Before: 8.5%

Several studies have shown that hand hygiene rates after performing 'dirty'[4] procedures were especially low, for example Meengs et al. (1994) report a rate of 50% and Pittet et al. (1999a) report a rate as low as 11%. Other studies have shown that healthcare professionals frequently do not wash their hands even after caring for patients who are known to be infected (Donowitz, 1987; Korniewicz et al., 1990; Larson, 1980; Preston et al., 1981).

One study has shown that a significant number of healthcare professionals do not wash their hands after going to the toilet where the chance of hand contamination is very high. Hateley and Jumaa (1999) performed covert observations in public toilets to compare handwashing rates between healthcare staff and the general public. Although they found that handwashing was more common among healthcare staff than the public (men 59% versus 34% and women 83% versus 56%) they argue that *"Improving handwashing rates on the wards will continue to challenge us."* (p.518).

The hand hygiene behaviour of hospitalised patients has also been observed and they too frequently omit to wash their hands after using the toilet. Using an all male sample, Pritchard and Hathaway (1988) conducted a two-phase study where they first observed both ambulant and non-ambulant patients to determine the extent to which they washed their hands or were assisted so to do by their nurses after going to the toilet. In the second phase, a questionnaire was administered to the 20 patients and 12 nurses looking after them to determine knowledge and perception about the importance of handwashing. The primary study assumption that *"post-toilet handwashing is a desirable behaviour"* (p.72) was supported by the knowledge and beliefs held by the patients and nurses. In practice, however, only 50% of ambulant patients washed their hands after using the toilet and none of the bed-bound patients did so.

This of course not only reflects patients' poor personal hygiene standards but also poor standards of nursing care. What is not known however, is whether these findings would be replicated with a study population of female patients. Munger and Harris (1989) conducted an experiment on female students to test Wicklund's (1975) theory of self-awareness by comparing the incidence of handwashing in a public washroom with and without the presence of an observer. They found a significant difference between those who washed their hands after using the toilet when they knew they were being watched and those who washed their hands when they were unaware they were being watched (77% versus 39%).

[4] As defined according to Fulkerson's scale (Fulkerson, 1971) adapted by Fox et al. (1974) e.g. contact with patients' excretions/secretions.

Munger and Harris (1989, p.733) state that

> *"Washing one's hands after using toilet facilities is a social norm in our culture. With the possible exception of children and food handlers this norm is not to be monitored nor are explicit sanctions provided for violations."*

It could be argued, however, that their findings provide evidence that handwashing is not in fact a 'social norm'. Their findings are very similar to those reported by Pedersen et al. (1986, p.170) who conclude that *"Handwashing after going to the toilet appears to be a behaviour that results primarily from social pressure."* Perhaps social pressure is the key to improving handwashing behaviour on the wards. This will be considered further in the next section which explores reasons for non-adherence to hand hygiene policies and strategies that have been tested in attempts to improve practice.

Reasons For Suboptimal Practice And Strategies To Improve Practice

Environmental Barriers

The general research on hand hygiene has shown a variety of environmental factors that may constitute barriers to effective hand hygiene. These include harsh handwashing products (Zimakoff et al., 1992) and paper towels (Heenan, 1992) and inaccessibility or insufficient numbers of sinks (Kaplan and McGuckin, 1986). Numerous strategies have been tested in an attempt to target these perceived environmental barriers to performing the behaviour. These include changing the handwashing soap (Connoly, 1998) and providing an emollient soap (Kolari et al., 1989; Mayer et al., 1986). Others have tried to facilitate handwashing by, for example, introducing an automated sink for handwashing (Larson et al., 1991) and automated handwashing machines (Wurtz et al., 1994). Kaplan and McGuckin (1986) studied the effect of increasing the numbers, ratio and accessibility of handwash sinks and found that nurses in a unit with one sink per bed had a significantly higher number of handwashes than those in a unit where there was one sink to four beds (76% versus 51% respectively). However, Preston et al. (1981) found no significant increase in handwashing frequency in a new unit designed with more sinks, while Lankford et al. (2003) found that hand hygiene actually worsened when staff were moved from an old hospital into a new building with far better hand hygiene facilities.

Psychological Dimensions

There are, however, many psychological dimensions possibly involved in handwashing behaviour perhaps including the incorrect belief that gloves (which are worn to reduce risks from body fluids) remove the need to wash hands (Daschner, 1988; Korniewicz et al., 1988). Other reasons given for failing to wash hands include forgetfulness and handwashing not being a habit (Michiels et al., 2000), not being convinced of the benefits of handwashing (Weeks, 1999) and perceptions about a lack of time (Larson and Killien, 1982). Indeed, time constraints are perceived to be one of the biggest barriers to hand hygiene (Larson and Killien, 1982) even though this behaviour can be performed 'conscientiously' in 50-60 seconds (Mackintosh and Hoffman, 1984). The ideal duration for handwashing is not known and it is worth noting the difference in the lengths of time promulgated by various countries. For example, in the UK, the technique most commonly advocated takes 60 seconds and is based on a test procedure described by Ayliffe et al. (1978). In the USA however, guidelines produced by the Centers for Disease Control recommend that this behaviour can be performed in 10 seconds (Garner and Favero, 1985). However, despite this quicker technique, healthcare professionals still claim that they do not have time (Larson and Killien, 1982). Time constraints would therefore appear to be an important consideration and Voss and Widmer (1997) ask whether we can afford 100% compliance. Using a mathematical model, they calculated that in a 14-bed Intensive Therapy Unit with 12 staff each working eight hours, it would take 16 hours, or two full-time nurse equivalents a day to achieve 100% compliance with handwashing. Weeks (1999) estimates that by not washing his hands between each of the 60 'touch' contacts he has every day with obstetric patients, he saves on average one or two hours, equivalent to 15% extra staffing that would be needed to cover the extra time.

Hand Hygiene Products

In an endeavour to address perceptions about time constraints, a range of alcohol-based products have been marketed that can disinfect hands that are not visibly soiled in a fraction of the time it takes to wash and dry hands in the conventional manner. They include alcohol hand rubs (Mackintosh and Hoffman, 1984; Graham, 1990; Bischoff et al., 2000), alcohol wipes (Butz et al., 1990b) and alcohol-gel based products (Newman and Seitz, 1990) which can be applied and rubbed to dryness in five seconds whilst moving between patients. It was hoped that the introduction of such products would improve adherence. However, studies show conflicting results. For example, Bischoff et al. (2000) reported a significant increase in hand cleaning rates following the introduction of an alcohol hand rub, and compliance improved as accessibility was enhanced. This rose from 19% before patient contact and 41% after patient contact when there was one dispenser per four beds to 23% before and 48% after when there was one dispenser for each bed.

On the other hand, Doebbeling et al. (1992) compared the use of 4% chlorhexidine gluconate (a broad spectrum antimicrobial, liquid antiseptic handwash agent) versus 60% v/v isopropyl alcohol hand rub with the optional use of a separate non-medicated soap. They conducted a prospective multiple, cross-over trial in three ICUs. Dispensers for the hand cleaning agents were located at all sinks in the ICUs, as well as in the lavatories. In addition, individual dispensers containing the alcohol product were mounted on the wall at each patient's bed. Although adherence to handwashing instructions in the three units was significantly better during periods when chlorhexidine was available, the proportion of times hands were washed was suboptimal in both conditions: 42% during chlorhexidine use and 38% when the alcohol-soap combination was available. It appears, therefore, that perceptions about time constraints persist even where attempts to remedy the situation have been made.

Alcohol-based products are intended to be an adjunct to, not a substitute for handwashing (Meers and Yeo, 1978) and policies need to make this point clear. Their introduction into the clinical setting may need to be accompanied by in-service education whereby *all* healthcare professionals are taught about the indications for use as well as being shown how easy and quick it is to use them for hand hygiene. Although alcohol-based products are now commonly used for hand hygiene in European healthcare systems, this is not the case in the USA where medicated soap is more commonly used (Voss and Widmer, 1997). This is because, at present, n-propanol (an alcohol) is not listed in the Federal Drug Administration's Tentative Final Monograph for Healthcare Antiseptic Drug Products as an approved active agent for healthcare professionals' hand hygiene or surgical hand-scrub preparations in the United States (CDCP, 2002). In contrast, in the UK, Ayliffe et al. (2000, p.115) are of the opinion that "*Washing without a disinfectant is sufficient for most ward procedures.*" Table 7 presents indications for the use of common hand hygiene products based on recommendations made by Ayliffe et al. (2000).

Role Models And Organizational Aspects

Some researchers have investigated the effect on hand hygiene of organizational climate (Larson et al., 2000), organisational behaviour (Seto, 1995), social power (Seto et al., 1991a) and ward opinion leaders (Seto et al., 1991b). Gerrish and Clayton (2004) examined factors influencing the achievement of evidence-based practice. They found that nurses relied most heavily on experiential knowledge gained through their interactions with nursing colleagues, medical staff and patients to inform their practice. The ability of co-workers to influence an individual's practice in this way emphasises the power of good and bad role modelling.

Table 7 Hand hygiene products and recommended uses for ward procedures

Hand hygiene product	Action	Recommended use for ward procedures
Liquid soap	Social handwashing to remove dirt and dead skin squames and the bacteria present on them	General handwashing
Alcohol gel	Removal of transient micro-organisms from hands that are not visibly soiled	Special procedures such as changing an intravenous infusion (preceded by social handwash if hands are soiled)
Chlorhexidine gluconate (Hibiscrub)	Hygienic hand disinfection to reduce transient micro-organisms, especially Gram positive organisms	Handwashing in special units such as intensive care, infectious diseases, special care baby units and in general wards during an outbreak of infection
Povidone iodine (Betadine)	Hygienic hand disinfection to reduce transient micro-organisms, especially Gram negative organisms and spores	As above

Larson and Larson (1983) observed that junior doctors' handwashing practice improved when a consultant, the 'role model', set a good example by carefully washing his/her hands between each patient contact. Furthermore, Larson et al. (1986) showed that junior doctors may acquire poor handwashing practices from their peers. Similar findings have recently been reported by Lankford et al. (2003). They observed that healthcare professionals who were in a room with a senior (i.e. higher ranking) doctor or nurse or peer who did not wash hands were significantly less likely to wash their own hands. Further analysis of group behaviour showed that, compared to single person room entry, "*if either a higher ranking person or peer was in the room and performed hand hygiene, then the frequency of hand hygiene for others in the room was no better than that of a room which only one person had entered.*" (p.219). This, they argue, "*suggests that the effect of a role model is highly significant but most potent in negatively influencing hand hygiene behaviour.*" (p.220).

Kaplan and McGuckin (1986) recommend that medical staff should police themselves and each other. Such a view is endorsed by Raju and Kobler (1991) who encourage staff to gently point out violations of hand hygiene practice to each other, on the spot, irrespective of professional rank. Feather et al. (2000, p.62) posit that doctors' poor compliance "*may have its roots in a failure to learn this behaviour at medical college, where the influence of consultants and other role models may be critical.*" They base their view on observed behaviours of 187 candidates during the 1998 Final MBBS Objective Structured Clinical Examination at one clinical station.

This examination *"reflects learnt behaviours and attitudes of final year medical students 'absorbed' from role models within their training."* (p.62). They found that only 8.5% of candidates washed their hands after patient contact although this figure rose to 18.3% with the aid of handwashing signs. If qualified doctors and nurses cannot be relied upon to serve as good role models, teaching students about hand hygiene during their training assumes great importance. Educational and training issues are considered further in a later section.

Healthcare Professionals' False Perceptions About Their Hand Hygiene Behaviour

A major obstacle to improving hand hygiene adherence rates is the mismatch between healthcare professionals' perceptions of their own handwashing behaviour and their actual behaviour; they believe they wash their hands far more often than they really do. Hence, this false belief will mar their perception of the need to improve their practice.

In order to compare the frequency of actual handwashing with the subjective judgements of staff, Bartzokas et al. (1995) asked staff in two clinical areas to estimate how often, on average, they washed their hands each shift. Nurses on an orthopaedic ward reported a mean of 19.5 handwashes per shift (range 10-35) whilst doctors and nurses in a gynaecology clinic reported a mean of 24.8 handwashes per shift (range 10-40). These estimates were approximately three times greater than the observed frequency. Broughall et al. (1984) reported a mean self-report handwashing frequency of 24 per shift (range 5-40) with an actual frequency of 5-10.

In an intervention study conducted by Tibballs (1996), doctors were asked to estimate their own handwashing rate before patient contact. Their mean estimate was 73% (range 50-95%) compared with the covertly observed rate of 8.6% before and 10.8% after patient contact with an individual mean rate of 10% (range 0-33%). Several said that other doctors washed their hands infrequently. This study led Pritchard and Raper (1996) to express their concern that *"careful and caring doctors can be so extraordinarily self-delusional about their behaviour......"* (p.390).

Performance Feedback

Self-report studies show that healthcare professionals have an inflated impression of their own handwashing performance and this belief may well inhibit the success of interventions to increase adherence. Healthcare professionals therefore need to be confronted with the reality of their suboptimal practice. One way to do this is performance feedback. Studies have been conducted to investigate the effect of oral one-to-one feedback (Mayer et al., 1986; Nettleman et al., 1991) and written group feedback (Dubbert et al.,1990; van de Mortel and Heyman, 1995).

However, although this has been shown to enhance hand hygiene behaviour (Tibballs, 1996), it is not very practical as an everyday intervention because combining observation with routine duties is difficult and having an observer dedicated solely to the task is costly to maintain.

An alternative is to use a video camera; this has been employed in only three studies of handwashing behaviour. Porter et al. (1995) used it to monitor handwashing and gloving practices of dentists and dental students who were unaware of the purpose of the camera or when it was operating. The rate of hand hygiene prior to donning gloves was 23%; gloves were not worn on 13% of occasions when they should have been and were only changed in-between patients on 56% of occasions.

In Japan, Nishimura et al. (1999) used a video camera covertly to monitor the extent to which personnel and visitors adhered to a rule in their institution that hands must be washed before entry to the Intensive Care Unit. The rate of adherence by ICU and non-ICU personnel was 71% and 75% respectively (which the authors consider low), but visitors washed their hands on 94% of occasions which was significantly higher than rates achieved by personnel. On completion of the study, which lasted seven days, the authors revealed that a video surveillance study of handwashing had been carried out although they do not say *who* was informed. They claim that they were "*able to make an impression with the hard facts at our disposal*" (p.368) although the way in which this feedback was given and its effect on behaviour was not elaborated upon.

Scott Geller et al. (1980) used video surveillance as a feedback intervention to improve handwashing practices of catering staff in a university. The camera, which was set up in full view of employees, recorded for three hours every day for 30 days. On each day that feedback was administered, the frequency of handwashing more than doubled the highest pre-treatment level (from a mean of 2.1 to 5.0 handwashings per day).

The extent to which interventions have succeeded in improving adherence has varied but none of them succeeded in achieving and sustaining improved hand hygiene practice for any appreciable period of time. This may be because, according to Naikoba and Hayward (2001) who undertook a systematic review of the literature, the quality of research is generally poor. They highlight the difficulties of creating experimental conditions in the practice setting and the multiple limitations of most of the studies reviewed such as small sample size, short duration of follow-up, lack of control groups or use of inappropriate control groups and inability to blind subjects to the fact that they are being observed. One other limitation highlighted by Larson and Kretzer (1995) in their review of the literature was that none of the studies reviewed had designed the intervention on the basis of behavioural science theory.

Patient Empowerment

Given the limitations of the aforementioned efforts to improve healthcare professionals' hand hygiene practice, some researchers have attempted to generate social pressure by making patients and their visitors aware of the importance of hand hygiene. Jarvis (1994, p.1311) argued

> *"If healthcare workers cannot be educated to comply perhaps we should tell patients about the importance of handwashing: how many doctors and nurses would ignore a patient's request that they wash their hands first?"*

Patient empowerment has been explored with mixed results. Studies have been conducted whereby adult patients (Sen et al., 1999; McGuckin et al., 1999, 2001; Bischoff et al., 2000) as well as children and their parents (Hughes et al., 1986) are asked to remind healthcare professionals to wash their hands. The T. Bear Program, conducted on behalf of the National Institutes of Health in America, centred on a teddy bear that carried a slogan '*Handwashing prevents infection, it really does*', as a reminder to doctors and nurses to wash their hands (Hughes et al.1986). Unfortunately, the teddy quickly became colonised with a variety of hospital pathogens and concomitant cultures of the patients revealed similar isolates. The promotional toy was considered to pose an unnecessary expense and hazard. Goldmann and Larson (1992) reported that *"this approach was not tested rigorously and efforts to mount a nationwide campaign fizzled amid controversy and scandal"* (p.121).

The studies conducted by Sen et al. (1999) and Bischoff et al. (2000) were also unsuccessful. McGuckin et al. (1999) claimed success for their programme in America, but the reliability and generalisability of the findings of the study when replicated in England were limited by the very small sample size (McGuckin et al., 2001). Only 24 patients participated. Notwithstanding this limitation, the study conducted by McGuckin et al. (2001) prompted the National Patient Safety Agency (NPSA) to include patient empowerment as one of the elements in their multi-modal 'Clean Your Hands Campaign.' This has recently been launched throughout acute trusts in England and Wales (NPSA, 2004). It consists primarily of the provision of near patient (bedside and staff-carried) alcohol gel hand rub, empowerment of patients whereby they are provided with information and encouraged to ask staff if they have cleaned their hands before touching them and posters reminding staff to clean their hands. Studies on the efficacy of hand hygiene posters are considered in detail in the next section.

Summary And Implications For Research

Hand hygiene behaviour has been observed for a variety of reasons. For example to collect data on the frequency with which healthcare professionals adhere to hand hygiene opportunities. When combined with feedback, the data can be used as an intervention to improve practice.

Hand hygiene practice of healthcare professionals on the wards can be observed to obtain not only descriptive data of adherence rates, but also data to generate a better understanding of determinants affecting practice. These include establishing the extent to which hand hygiene behaviour before and after patient-care is influenced by the nature of the risk of the care activity performed and the choice of hand cleansing agent. Observational data can also be used to determine the extent to which actual behaviour correlates with self-reported behaviour. Given that such a study has never been done with a video camera, which has several advantages over observation with the human eye, ethical approval was sought and obtained to use Closed Circuit Television (CCTV) for such a study. However, some staff refused consent to being observed whilst the CCTV was on. This method of data collection was therefore abandoned and practice was observed by the author and an assistant instead.

Studies On The Efficacy Of Hand Hygiene Posters

As mentioned above, hand hygiene posters are one of the main components of the 'Clean Your Hands Campaign' (NPSA, 2004). These can be used to provide cues to action. Indeed, a poster campaign is the most usual strategy employed by Infection Control Teams to promote hand hygiene (Storr and Brind, 2003). Posters are, by their very nature, intended to be a way of exposing people to a persuasive message with the intention of bringing about a change in attitudes and/or behaviour. They have been used for a long time in health promotion and target a wide range of issues such as dental hygiene (Brown, 1969), exercise (Andersen et al., 1998), smoking (Auger et al., 1972; Groth-Marnat et al., 1996) and sexually transmitted diseases (DHSS, 1982). Studies investigating whether hand hygiene posters work show mixed results and few have been conducted to determine their efficacy as discrete entities.

Two studies investigating the efficacy of posters as an integral component of hand hygiene campaigns have shown them to be of little long-term value. Williams' (1987) campaign consisted of five components: the provision of an optimal soap manufactured to the cosmetic specifications of the staff, placing nine large posters bearing slogans such as *'scrub that bug'* and *'don't have a patient's death on your hands'* in every ward and clinic, showing a video entitled

'Clean Hands Save Lives' to medical and nursing staff on the wards, distributing a leaflet outlining the correct indications and technique for hand hygiene to staff and arranging media publicity, including newspapers, radio and television. The first two interventions (soap and posters) brought about a significant increase in frequency of handwashing and the third and fourth interventions (video and leaflets) resulted in a further significant improvement, which was maintained until the fifth intervention (publicity). However, a six-month follow-up measurement of handwashing frequency found a return to the baseline level.

More recently, Pittet et al. (2000) reported on a multi-faceted hand hygiene campaign, endorsed by management, which included the use of posters, alcohol-based hand rub at the bedside and performance feedback. Seventy different coloured posters in A3 size were produced. An artist translated the content of the promotional material, which was produced in consultation with groups of healthcare professionals across all wards and departments, into cartoon-like messages. They included topics such as nosocomial infection, cross-transmission, hand carriage, hand hygiene, hand disinfection and hand protection with creams. In order to encourage staff ownership of the campaign, the name of the ward that suggested the message appeared on the relevant poster. Five different posters were displayed simultaneously in 250 strategic sites throughout the hospital and they were changed weekly. Whilst the campaign resulted in an increased adherence to hand hygiene, the authors attributed this largely to the promotion of bedside antiseptic hand rubs, not the posters. Reasons for this are unclear and they acknowledge that one of the limitations of the study was the multi-modal nature of the intervention which made it difficult to assess which part of the strategy was the most effective. The questionable effectiveness of the posters may be due to the use of cartoons to transmit the messages. No literature could be found to support the use of humour in this way, so the evidence base for this clearly needs to be determined.

Lohr et al. (1991) tested the effect of printed signs stating *'Good patient care includes good handwashing'* on doctors' handwashing rates prior to patient contact. They were prominently displayed in the room where doctors gathered to discuss patients and review case notes. This type of reminder was ineffective in increasing handwashing adherence. Dorsey et al. (1996) tested the effect of placing brightly coloured fluorescent signs listing CDC recommendations for handwashing at every sink in an emergency department. There was no significant improvement in healthcare professionals' handwashing rates.

If posters are to be effective, messages should be framed appropriately. The next section explores how this should be done.

Message-Framing Theory

Tversky and Kahneman (1981) demonstrated that the impact of a behavioural alternative can be affected by whether it is framed in terms of its associated costs (loss frame) or benefits (gain frame), even when the two frames describe objectively equivalent situations e.g. 'smoking will shorten your life expectancy' versus 'you will live longer if you do not smoke'. Table 8 illustrates how hand hygiene messages might be framed according to losses or gains. Tversky and Kahneman (1981; 1992) proposed, and later refined, Prospect Theory which argues that people are risk averse. In other words, they avoid taking risks when gains are made salient but they are willing to take risks when losses are made salient. However, as Rothman and Salovey (1997) later showed, this is dependent upon whether the message is targeted at a prevention behaviour or a detection behaviour, the former being less risky and therefore best facilitated by gain-framed messages. This was supported by Detweiler et al. (1999) who showed that gain-framed messages were more effective than loss-framed messages at influencing peoples' intention to use sunscreen lotion. These studies would seem to offer very important insights into how messages for hand hygiene should be framed. However, although hand hygiene too is a health promotion behaviour, it differs in one crucial respect: hand hygiene in hospital is primarily for the benefit of others (i.e. patients) whereas sunscreen use is solely for the benefit of self. Therefore, findings such as those of Detweiler may have limited transferability to the hospital setting. Thus, although Rothman and Salovey (1997, p.3) argue that *"to the extent that people are motivated to seek health and avoid illness, healthy behaviours should be easy to promote,"* hand hygiene is not easy to promote. The difficulties of applying Prospect Theory to hand hygiene messages can be illustrated by the two examples shown in Table 9.

Example 1, which is a gain-framed message, shows several benefits for the patient, the hospital and society and one benefit for the healthcare professional. However, these are probably outweighed by the costs (real and potential) to the healthcare professional. In contrast, example 2, which is a loss-framed message, shows costs for the patient, hospital and society but one very important benefit for the healthcare professional, i.e. time saved in not cleaning hands. This highlights the importance of appealing to healthcare professionals' altruism and sense of 'personal responsibility' for their hand hygiene behaviour.

Table 8 Examples of loss-and gain-framed hand hygiene messages

Loss-framed		Gain-framed	
Attaining an undesirable outcome	Avoiding a desirable outcome	Attaining a desirable outcome	Avoiding an undesirable outcome
Unclean hands increase the risk of cross-infection.	Unclean hands will not reduce the cross-infection rate.	Cleaning your hands will help prevent cross-infection.	Cleaning your hands will decrease the risk of spreading infection.

Table 9 The application of Prospect Theory to hand hygiene messages

Message	Benefits (gain)	To whom?	Costs (loss)	To whom?
Example 1				
'Clean hands prevent cross-infection'	Prevent pain and suffering	Patient	Time taken to clean hands	Healthcare professional
	Reduce infection rate	Hospital		
	Prevent loss of work days	Society		
	Prevent self-infection	Healthcare professional	Other potential barriers e.g. dermatitis etc.	Healthcare professional
Example 2				
'Unclean hands spread infection'	Time saved in not cleaning hands	Healthcare professional	Pain and suffering	Patient
			Financial	Hospital and society

Personal Responsibility

The construct of 'personal responsibility' can be utilised to formulate messages to target health behaviours. Rothman et al. (1993) found that 'internally-orientated' messages designed to motivate and enhance attitudes and behaviour towards uptake of mammography screening were more effective than 'externally-orientated' or 'information-only messages' in producing the required behaviour. The relative efficacy of various message-framing techniques as described by Rothman et al. (1993) should perhaps be tested with regard to promoting hand hygiene.

This construct, which is not dissimilar from that of 'locus of control' (first described by Rotter, 1966 and later modified by Wallston, 1992), gives insight into an individual's sense of 'ownership' concerning health-related behaviours and outcomes. In an endeavour to enhance healthcare professionals' adherence to infection control guidelines, The Committee of Public Accounts (2000) has promulgated a philosophy that infection prevention is everybody's business, not just the specialists'.

Fear Appeals

Threat or fear appeals are sometimes used in attempts to change attitudes or behaviour. For example, a poster used in Williams' (1987) study showed a picture of a coffin (see Figure 1) to remind healthcare professionals that patients die from hospital-acquired infections transmitted by unwashed hands.

Figure 1 Poster illustrating fear appeal (Williams, 1987)

Fear-arousing communications have to generate the 'right' amount of fear. Janis and Fesbach (1953) showed that a minimal fear appeal was more effective than a moderate or strong appeal. They postulate that if too much fear is generated, so much anxiety is aroused as to cause avoidance and inattentiveness. This in turn impedes attitude or behavioural changes and is thus counterproductive. Indeed, Corah et al. (1977) point out that health educators and psychologists often conclude that health-threat communications should be avoided because they can backfire.

However, Self and Rogers (1990) argue that fear appeals will not backfire if people are persuaded they can cope effectively with the danger. Kirscht and Haefner (1973) used films about heart disease to investigate reactions to multiple messages concerning threats to health. They found that repetition of a high threat message increased the amount of interest shown in learning more about heart disease, principally by women, who were more motivated towards health matters to begin with. They concluded that *"Threatening content may be an appropriate component of a health message; that the fear aroused must be related to a personal concern to be effective; and that changes in cognitive factors produced via threat appeals can mediate later adaptive behaviour."* (p. 274). This suggests that the effectiveness of messages designed to improve hand hygiene may be enhanced if they emphasise the value of preventing self-infection as opposed to cross-infection.

Factors Adversely Affecting Efficacy

The difficulties faced by those who try to persuade healthcare professionals to wash their hands are further compounded by the fact that most Infection Control Teams appear not to be using posters to their maximum advantage. For example, Storr and Brind (2003) found that the frequency with which poster displays are changed varied from not at all or longer than six months (66%) to bimonthly or more frequently (12%). Thus, the success of poster campaigns may be limited by poor display.

Brown (1969) cautioned that *"Posters should not be confused with teaching charts"* (p.316) yet this seems to be what most hand hygiene posters are used for. Storr and Brind (2003) found that over half (54%) of the Infection Control Teams surveyed reported that they base their poster campaigns around the 'six step technique' (Ayliffe et al., 1978) as illustrated in Figure 2 which is a clear example of a training chart.

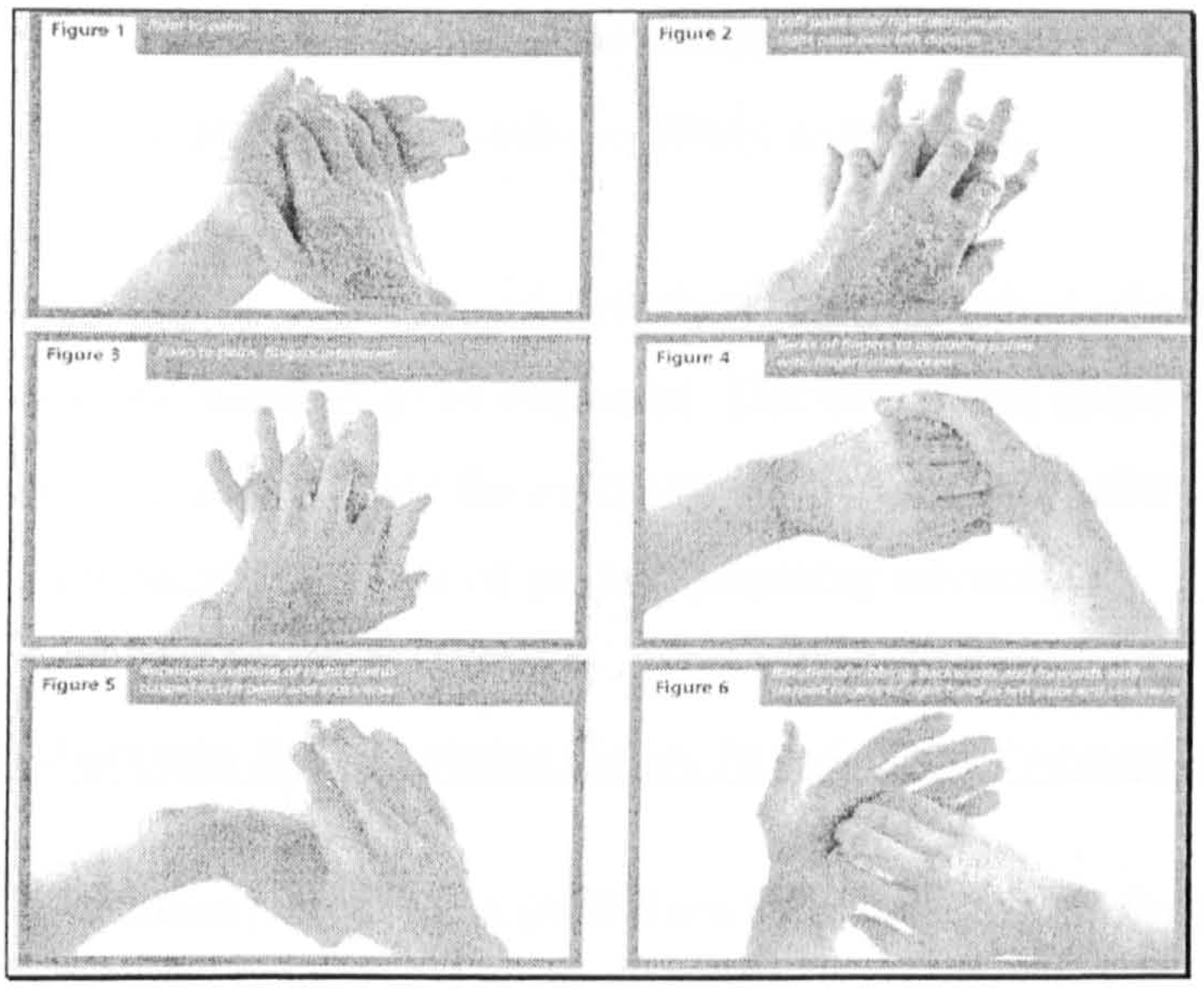

Figure 2 A training chart illustrating the 'six step technique' (Ayliffe et al., 1978)

As Alvaran et al. (1994) have shown, knowledge may not effect behavioural change in a positive direction. Indeed, it may effect it in a negative direction (Gruber et al., 1989). This suggests that healthcare professionals are not persuaded that hand hygiene is essential. Therefore, whilst training about how to wash hands is necessary, it is insufficient for behavioural change. Hence, posters which impart training messages only are unlikely to improve healthcare professionals' hand hygiene practice.

Summary And Implications For Research

Posters are a potentially powerful vehicle through which to deliver persuasive messages. However, the literature reviewed suggests that hand hygiene posters are not being used to their maximum advantage. Many focus on illustrating how hands should be washed, rather than on persuading healthcare professionals why the behaviour is necessary. As hand hygiene is a health promotion behaviour, messages, including fear appeals, to encourage healthcare professionals to clean their hands should be gain-framed. However, as discussed earlier, Protection Motivation Theory (Rogers, 1975; 1983) offers insights into why such messages may be insufficient by themselves to bring about a change in healthcare professionals' hand hygiene practice. When they assess the health threat, they may not consider themselves or their patients to be at risk of cross-infection. Consequently, they may need to be persuaded why handwashing is in their best interests as well as their patients'. Hence gain-framed messages should also appeal to healthcare professionals' sense of duty to protect their patients from harm. An alternative approach would be to use messages that highlight the gains for the healthcare professional and minimise the losses. They will then assess how easy or difficult it is for them to wash their hands. This would suggest that messages that target barriers to perceived behavioural control such as time constraints and sore hands are likely to be useful.

This section of the literature review has established criteria against which messages on hand hygiene posters can be evaluated. The aim of one of the qualitative studies in this thesis was to explore and evaluate the extent to which a random selection of hand hygiene posters utilised the theoretical constructs of message-framing advocated.

Education And Training Issues In Infection Prevention And Control

In addition to confusing guidelines and other reasons for suboptimal practice discussed above, another possible reason why hand hygiene policies are not followed is that, as the Comptroller and Auditor General (2004, p.39) reports, *"Pre- and post-registration medical and non-medical training have very limited coverage of infection control issues."* A report by The House of Lords Select Committee (2001) recommended that the General Medical Council, Nursing and Midwifery Council and the Health Professions Council should ensure that universities strengthen the clinical and public health aspects of infection control in their undergraduate syllabi.

Pre-qualifying Programmes

The inadequacy of medical undergraduate curricula in this regard has been highlighted over the years by Fraser (1967, 1969); Neu (1978); Emmerson and Ridgway (1980) and Moss et al. (1987). According to Mortimer (1999, p.546), the lack of microbiology education has resulted in *"Staff members who do not understand when and why to wash their hands."* Stone (2001), who argues that hand hygiene is the practice of evidence-based medicine, calls for medical school curricula to study the efficacy of educational programmes to improve hand hygiene.

Darley et al. (2000) investigated the experiences of doctors undertaking post-graduate clinical examinations. These ranged from a complete lack of opportunity to wash hands between short cases to being told at the outset that the use of alcohol hand rub or handwash was 'optional'. They argue that if *"hand decontamination featured routinely in post-graduate examinations, it would begin to feature more prominently in medical education and, more importantly, on the medical ward round."* (p.248).

Curricula for undergraduate nurse training are similarly weakened by the limited time devoted to the teaching of microbiology and infection control. Courtenay (1998) undertook a study to determine how the theoretical principles of infection control and the related practices were taught to student nurses at two colleges of higher education in the UK. Her findings revealed an inconsistency in the amount of time allocated to teaching theoretical principles and practices of infection control, as well as inconsistencies in the amount of time devoted to these aspects on diploma and degree pre-registration programmes. For example, the amount of time allocated to teaching the principles of infection control was nine hours on the Project 2000 diploma programme and only one hour on the BSc. programme. Little, or in the case of the BSc. programme, no time was spent teaching infection control practices. Elliot (1996) conducted a survey of 20 colleges of nursing and midwifery in England to determine the amount of time spent on handwashing education. He found that 13 provided three hours or less during the three-year training programme.

In-service Education

Given the shortcomings of these curricula, great emphasis has been placed on in-service education to teach healthcare professionals about the importance of handwashing. Strategies include giving theoretical sessions and practical demonstrations of handwashing on the wards (Courington et al., 1991; Gould, 1996; Gould and Chamberlain, 1997; Khatib et al.,1999) and devising motivational, educational 'games' (Walljasper, 1982; Resko and Chorba, 1992; Rowell and Spielvogle, 1996). Interventions have included the use of educational and feedback strategies (Conly et al., 1989; Dubbert et al., 1990); showing a training video on handwashing and distributing an educational leaflet (Bartzokas et al., 1994). Others have studied the use of 'reminders' such as signs (Ndawula and Cutter, 2001), labels with handwashing messages placed on ward equipment or property used by patients (Khatib et al., 1999) and hand hygiene posters (Williams, 1987) as previously discussed.

However, such programmes are not always successful. For example, Bartzokas et al. (1994) found that their educational and promotional campaign failed to have any effect on doctors' hand hygiene behaviour because they were reluctant to watch the training video on handwashing or to read the educational leaflet. Gould (1996) experienced problems of non-attendance when she attempted to deliver a ward-based teaching package to nurses which consisted of five sessions of 30 minutes each. Half the sessions were cancelled by the wards at short notice, usually because the ward had become too busy or because sudden changes to the duty roster resulted in nurses changing shifts.

Then again, continuing education programmes which have been successful initially are challenged by factors affecting sustainability. For example, Conly et al. (1989) found that the improvement in adherence rates resulting from feedback on hand hygiene practice continued for several months but was eventually reduced by staff turnover, generating the need for further intervention.

The Impact Of Knowledge On Attitudes And Behaviour

Another possible reason for the failure of educational and training initiatives may be the tendency to assume a relationship between the acquisition of knowledge and subsequent behavioural modification when, in fact, this may not be the case. This misconception was well illustrated by Williams (1987) who found that an increase in knowledge about hand hygiene did not translate into improved adherence to handwashing policies. This finding is supported by Gruber et al. (1989) who compared subjects' knowledge scores with their scores for implementation of Universal Precautions and found that those with higher knowledge in fact had *lower* practice scores ($r = -0.12$) thus demonstrating a marginally *negative* association. Alvaran et al. (1994) conducted a questionnaire survey to measure knowledge, self-reported practices and opinions about infection control and handwashing amongst nurses who worked in long-term care facilities. They found that there was no significant association between infection control knowledge and handwashing practices or opinions. Willy et al. (1990) found that compliance with improved working practice guidelines increases only when education alters perception of risk, as opposed to simply increasing knowledge.

Practical Demonstrations

Altering perceptions of risk is challenging, as previously discussed. It is especially challenging with regard to infection prevention because as Jenner et al. (1999) point out *"The interval between someone failing to wash their hands and a patient developing an infection makes it unlikely that the two events will be naturally associated."* (p.95). Furthermore, micro-organisms cannot be visualised with the naked eye, hence they are 'out of sight and out of mind'. Novel approaches for teaching hand hygiene are therefore required. Practical exercises can be arranged to *show* students why hand hygiene is important by demonstrating the effectiveness of handwashing either with the aid of microbiological culture plates or 'Glitter Bug' (Brevis Corporation), a fluorescent cream and ultraviolet (UV) light hand inspection cabinet. Although the use of 'Glitter Bug' is thought to be widespread in teaching programmes aimed at improving hand hygiene practice, there is little in the literature written about its use for this purpose. Elston (1998) described an induction programme for junior doctors whereby each one participates in a personal handwashing demonstration using the UV light system. Prior to this, Turner et al. (1994) used a similar preparation (Glo-germ, Brevis Corporation) to measure handwashing effectiveness, comparing an automated system with traditional manual handwashing. Scanlon and Leikkanen (1973) described the use of fluorescein powder and UV light to monitor the spread of contamination in a newborn nursery. However, the impact of neither this visual aid nor microbiology laboratory practicals as teaching tools has ever been reported in the literature.

According to Conner and Sparks (1996) education is an external variable that impacts on beliefs about, and evaluation of, outcomes which in turn impact on attitudes towards a target behaviour. Even if knowledge is not sufficient to change behaviour, it is likely to be a necessary prerequisite to behaviour change, for example, as a precursor to changing attitudes which are related to behaviour change. Attitudes towards hand hygiene practice are discussed in the next section.

Summary And Implications For Research

Although education alone is unlikely to impact upon handwashing behaviour, remedying curricula deficiencies is nonetheless a crucially important first step. Furthermore, it is important to ensure that the limited time devoted to teaching students about hand hygiene is used effectively. At the University of Hertfordshire, undergraduate healthcare students are taught about infection prevention and control not only through lead lectures in the classroom, but also through the aforementioned practical exercises in the microbiology laboratory and clinical skills laboratory.

Given that the effectiveness of this type of teaching strategy has not been reported in the literature, there is a need to determine the impact such practicals have on students' attitudes towards hand hygiene. These investigations were conducted as two quasi-experiments.

Attitudes Towards Hand Hygiene Practice

Apart from observing practice, measuring attitudes is another way to gain a greater understanding about why healthcare professionals do or do not wash their hands. Two key studies which sought to do this used a questionnaire based on multi-attribute utility theory (MAUT) (Larson and Killien, 1982; Zimakoff et al.1992). This theory emanates from Decision Making Theory (Edwards, 1954) and is a method for evaluating risks utilising a multi-objective approach (Soby, Simpson and Ives, 1993). This enables different factors to be evaluated independently then combined into an overall assessment. Individuals are assumed to maximize utilities in their daily choice behaviour. Hence, it would be predicted that hand hygiene would occur when the perceived advantages of doing so outweigh the perceived disadvantages.

In the questionnaire used by Larson and Killien (1982), various statements were clustered in four sub-categories: influences on self, patient influences, circumstances, habits and norms. Participants were asked to distribute 10 points among the statements in each category to represent the perceived importance of each value relative to the others. Then they had to divide another 10 points at each successive level of the hierarchy. This process yielded three weights which were then multiplied to obtain a rating of the relative importance of each value. The summed utility values in favour of hand hygiene outweighed the summed utility values against hand hygiene for the group as a whole. The most important reason for hand hygiene was judged to be 'prevention of the spread of infection among patients' followed by 'prevents my acquiring an infection' and 'contact with many patients' ranked third. 'Childhood habit' and 'peer influence' were ranked eighth and tenth respectively. In contrast, the most important reason given for not washing hands was 'being too busy' followed by 'minimal contact with infectious patients' and 'hand hygiene agent detrimental to my skin.' Statements such as 'not at risk from acquiring infections from patients' and 'patients unaware and unconcerned' were ranked sixth and eighth respectively. Doctors rated 'politeness and hygiene of washing hands' before 'patient contact' and the 'prevention of the spread of infection among patients' as more important than nurses did. Nurses rated the 'number of patient contacts' more important than doctors did. Self-report as regards frequency of hand hygiene showed almost half the nurses and 20% of the doctors thought they washed their hands more than 16 times a day. Differences between the frequent and non-frequent handwashers showed that 'peer influence' and the 'detrimental effect of frequent hand hygiene on the skin' were the two most important discriminators. However, whether a participant was a frequent or non-frequent handwasher, they placed the same weight on reasons for hand hygiene but the non-frequent handwashers placed significantly more value on certain reasons that argued against hand hygiene. By identifying factors that determine whether healthcare professionals wash their hands or not, this study has shed light on intervention strategies to improve practice. More emphasis needs to be placed on minimizing barriers rather than merely stressing the importance of hand hygiene.

Zimakoff et al. (1992) used the same questionnaire to investigate the attitudes of healthcare workers in 15 hospitals in Denmark and Norway. They found that doctors rated 'extensive contact with infected patients', the subjective 'feeling cleaner' and hand hygiene as 'polite and hygienic behaviour before patient contact' as more important than other healthcare professionals. They also rated 'teaching handwashing during their professional training' and 'risk of acquiring infection from patients' significantly less important than other groups of healthcare professionals. Doctors also gave the influence of 'poor peer example' a high score. Nurses rated 'preventing spread of infection among patients' and 'having been taught good hand hygiene habits during professional training' as more important than other groups. Respiratory therapists, nurses' aides and hospital porters were much more concerned about their own risks of acquiring infection from patients than were other groups.

The results of these studies need to be treated with caution given the opposing views concerning the dynamics of the relationship between attitudes and behaviour. These are considered next.

The Relationship Between Attitudes And Behaviour

Whilst Fishbein (1967) and Ajzen (1985) posit that attitudes predict behaviour, Festinger (1957) believed that the attitude-behaviour relation works the other way around and much research has shown that in fact attitudes frequently fail to predict behaviours. For example, LaPière's seminal work which was undertaken to explore Americans' racial prejudice against Asians (LaPière, 1934). This showed that although 92% of restaurateurs said they would not allow a Chinese person in their establishment, when these same establishments had been visited six months previously by the researcher accompanied by a Chinese couple, all but one had received them and given them courteous treatment. Wicker (1969) reviewed several dozen research studies investigating not only racial attitudes, but attitudes towards issues such as cheating and the church. He too found that peoples' expressed attitudes hardly predicted their varying behaviours. Myers (1999, p.132) argues that *"If people don't play the same game that they talk, it's little wonder that attempts to change behaviour by changing attitudes often fail."*

Summary And Implications For Research

Although expressed attitudes imperfectly predict behaviour, because both are subject to other influences, Myers (1999) draws on work by Fishbein and Ajzen (1975) to highlight the 'principle of aggregation'. This shows that the effects of an attitude on behaviour become more apparent when a person's aggregate or average behaviour is explored rather than isolated acts.

Measuring student nurses' attitudes towards hand hygiene and their perceptions of other healthcare professionals' attitudes towards hand hygiene at various stages in their three-year training programme may provide useful information concerning their hand hygiene practice. This was the focus of investigation for one of the quantitative studies undertaken.

Social Cognition Models

The nature of the attitude-behaviour relationship is explored further in this section by a consideration of various theoretical models which have been developed in order to explain the influence of beliefs on individuals' actions. These include the Health Belief Model (HBM) (Rosenstock, 1966; Becker 1974); the Theory of Reasoned Action (TRA) (Fishbein, 1967) and the Theory of Planned Behaviour (TPB) (Ajzen, 1985). The original aim of the HBM was to explain preventative health behaviours. The model consists of five core constructs, namely, perceived susceptibility, perceived severity, costs, benefits and cues to action. The TRA was developed to explore the relationship between attitudes, subjective norms and intention to perform a behaviour (Fishbein, 1967). In contrast to the HBM, the TRA places the individual within their social context. The TRA was later expanded by the addition of the construct of perceived behavioural control to form the TPB (Ajzen, 1985). The TPB consists of constructs believed to predict intention to perform behaviour. These are attitudes which can be defined as the extent to which individuals have a favourable or unfavourable evaluation of the behaviour; subjective norms which refer to a person's beliefs about whether significant others think s/he should engage in the behaviour and perceived behavioural control, which can be defined as the extent to which individuals believe that they have adequate resources, physical or cognitive, to perform the behaviour.

All these models are based on Decision Theory (Edwards, 1954) and most models of preventative health behaviours incorporate the recognition of one's own risk-status or vulnerability as an important condition for adopting behaviours that reduce these risks. One assumption of these models is that people are able to assess adequately the risks associated with their behaviour. This highlights the importance of establishing the extent to which healthcare professionals risk assess the need to wash their hands.

These models have been utilised in previous research to examine a wide variety of health behaviours such as the uptake of screening for cervical cancer (Hill et al., 1985), exercise (Norman and Smith, 1995), infant feeding (Swanson and Power, 2000) and behaviours to prevent infection with the Human Immunodeficiency virus (HIV) (Abraham and Sheeran, 1984). However, their use in the study of healthcare professionals' infection prevention behaviours is rather limited.

O'Boyle Williams et al. (1994) used the HBM to explore variables influencing workers' compliance with Universal Precautions. They suggested that an integrated approach incorporating engineering controls, cognitive approaches, behaviour modification strategies and training exercises for the improvement of technical skills was the best way forward. Goldenberg and Laschinger (1991) used the TRA model as a theoretical framework to test nursing students' responses to caring for AIDS patients on completion of a unit of learning. They found significant changes in both attitudes and subjective norms and consider that the TRA is useful as a framework for designing curricula components of AIDS education.

O'Boyle et al. (2001) used the TPB as an explanatory model to test for adherence to hand hygiene guidelines. In so doing, they also described relationships between motivational factors, adherence and intensity of nursing unit activity. Registered nurses working in critical and post-critical care units completed a self-report handwashing assessment inventory about motivational factors, intentions and the proportion of times they followed guidelines. Two weeks later their hand hygiene practice was observed while they provided patient care. Structural equation modelling was used to test the TPB based model. The results showed that the TPB variables predicted intention to handwash, and intention was related to self-reported hand hygiene. Intensity of activity in the nursing unit, rather than the TPB variables, predicted observed adherence to hand hygiene recommendations. The mean observed adherence was 70% (range 61%-74%) for 1246 hand hygiene indications. In contrast, the average self-reported rate of adherence was 82% (range 71% to 89%). The correlation between self-report and observed adherence to handwashing recommendations was low ($r = 0.21$) which the authors considered an enigma to be explained. They argue that actual hand hygiene behaviour may be more sensitive to the intensity of work activity in the clinical setting than to internal motivational factors.

Multi-Dimensional Strategies

Larson and Kretzer (1995) argue for interventions to improve hand hygiene adherence to be not only theoretically based, but also multi-dimensional. They base their point of view on the theoretical constructs of the PRECEDE model (Table 10) (an acronym for predisposing, reinforcing and enabling factors) (Green et al., 1980).

According to this, any single intervention focusing on only one of the three factors would be unlikely to be effective. For example, an educational programme would address only predisposing factors, and feedback would address only reinforcing factors. This model was used by Larson et al. (1991) to test the effect of a multifaceted intervention including focus group sessions, installation of automated sinks and feedback to staff on handwashing frequency.

Table 10 Components of the PRECEDE behavioural model (Green et al., 1980)

Factors which predispose to a behaviour	Factors which enable a behaviour	Factors which reinforce a behaviour
Knowledge	Skills training	Peer and supervisor support
Attitudes	Availability of adequate resources and supplies	Feedback
Beliefs		Mandates

Although there were some significant differences between the experimental and control units in handwashing during the study, these differences had returned to baseline within two months. Hence, this multi-modal intervention had a minimal long-term effect on handwashing frequency.

Summary And Implications For Research

There are a number of social cognition models that are used to explain behaviour change but very few researchers in the field of infection prevention and control have used them; Goldenberg and Laschinger (1991); O'Boyle Williams et al. (1994) and O'Boyle et al. (2001) being the exceptions. The recommendation to use a theoretical base when designing interventions has been noted (Larson and Kretzer, 1995). This programme of research begins therefore by using an extended theoretical framework based on the TPB in an endeavour to explain hand hygiene practice.

Conclusions

The Chief Medical Officer has issued guidance on how to tackle the growing problem of healthcare-associated infection (CMO, 2002; 2004). Given the relationship between handwashing and the prevention of cross-infection, finding ways to improve healthcare professionals' hand hygiene practice is one obvious solution because many observational studies have shown it to be suboptimal. This review of the literature has shown that there are many reasons why healthcare professionals' hand hygiene practice is suboptimal. These include inadequate education and training programmes, poor role models, ambiguous and confusing guidelines for hand hygiene and isolation nursing and posters that fail to convey persuasive messages. The meaning of optimal practice, however, is elusive.

Some of the many studies that have been undertaken in an attempt to improve healthcare professionals' hand hygiene practice have been considered. In so doing, light has been shed on aspects which have not hitherto been investigated and others that are worthy of further exploration. To begin with, no one seems to have determined the extent to which healthcare professionals understand the hand hygiene guidelines they are expected to follow. Knowledge and understanding of indications for hand hygiene are essential pre-requisites for the process of risk assessment. This is affected by the accuracy of perceived risk. The extent to which healthcare professionals risk assess the need for hand hygiene has not been determined. Risk perception may be biased by constructs such as optimism and the behaviour of role models. Optimism (about one's invulnerability to infection) could hinder the adoption and maintenance of preventative behaviours such as hand hygiene. If health risks such as cross-infection apply more to others than to oneself, there is no perceived need to take preventative action (i.e. wash hands). Determining healthcare professionals' perceptions of comparative risk and views of others' practice may enhance our understanding of factors that could improve or inhibit hand hygiene.

When healthcare professionals assess the health threat, they may not consider themselves or their patients to be at risk of cross-infection. Consequently, they may need to be persuaded why hand hygiene is in their best interests as well as their patients'. Hand hygiene posters are commonly used in the clinical setting for this intended purpose. However, the extent to which their messages are theoretically based has never been examined. Determining the extent to which they use principles of message-framing and fear appeals may provide useful information about how they help or hinder the improvement of hand hygiene practice.

Risk perception may be heightened by educational interventions designed in such a way as to *show* students the importance of hand hygiene practice. The effect that laboratory based practical demonstrations have on students' views of the importance of hand hygiene has not hitherto been reported in the literature.

Finally, the need to explore constructs that are predictive of hand hygiene behaviour has been highlighted by Kretzer and Larson (1998) and it was this observation that prompted the design of the first study presented in this thesis. A preliminary predictive model was devised based on the TPB (Ajzen, 1985). The study was undertaken around the same time as the one reported by O'Boyle et al. (2001).

Chapter 4

Study 1

Using A Theoretical Framework To Predict Healthcare Professionals' Hand Hygiene Practice

Introduction

The primary aim of this study was to develop a theoretical framework in order to identify perceived cognitive and physical factors that may explain the variance in healthcare professionals' hand hygiene behaviour. A secondary aim was to investigate whether, at a group level, the phenomenon of optimistic bias existed. It was postulated that the findings would provide direction for the design of theoretically driven interventions to improve adherence to hand hygiene guidelines.

The Theory of Planned Behaviour (TPB) (Ajzen, 1985) dictates that attitudes, subjective norms and perceived behavioural control are predictive of behavioural intention while behaviour is predicted by intentions and perceived behavioural control. However, given that the construct of perceived behavioural control would not identify *specific* obstacles that may hinder healthcare professionals' hand hygiene behaviour, the study model included the construct of barriers drawn from the Health Belief Model (HBM) (Rosenstock, 1966). These were based on existing literature related to poor hand hygiene adherence: acceptability of hand hygiene products (Zimakoff et al., 1992), time availability (Larson and Killien, 1982), satisfaction with paper towels (Heenan, 1992) and the number/location of sinks (Kaplan and McGuckin, 1986). It was postulated that these would impact upon intention and behaviour. The study model was extended further by the addition of the construct of 'personal responsibility' (Rothman et al., 1993) which was postulated to be a predictor of intention. This was included because, as highlighted in the literature review, healthcare professionals may perceive that the benefits of not washing their hands outweigh the costs to them personally. Hence, in order to improve hand hygiene practice, it is necessary to appeal to healthcare professionals' sense of altruism to do their patients no harm.

In addition to, but outside this postulated model, a measure of 'optimistic bias' was used to investigate whether this form of biased perception might be implicated in non-adherence. It was not entered into the model as a predictor because, at an individual level, a person may (perhaps because they regularly practise hand hygiene) quite realistically perceive their risk to be lower than that of other workers. Across a whole group however, if healthcare professionals on average consider their risk is lower than others, then there is evidence of bias in perception.

The proposed predictive model is shown in Figure 3.

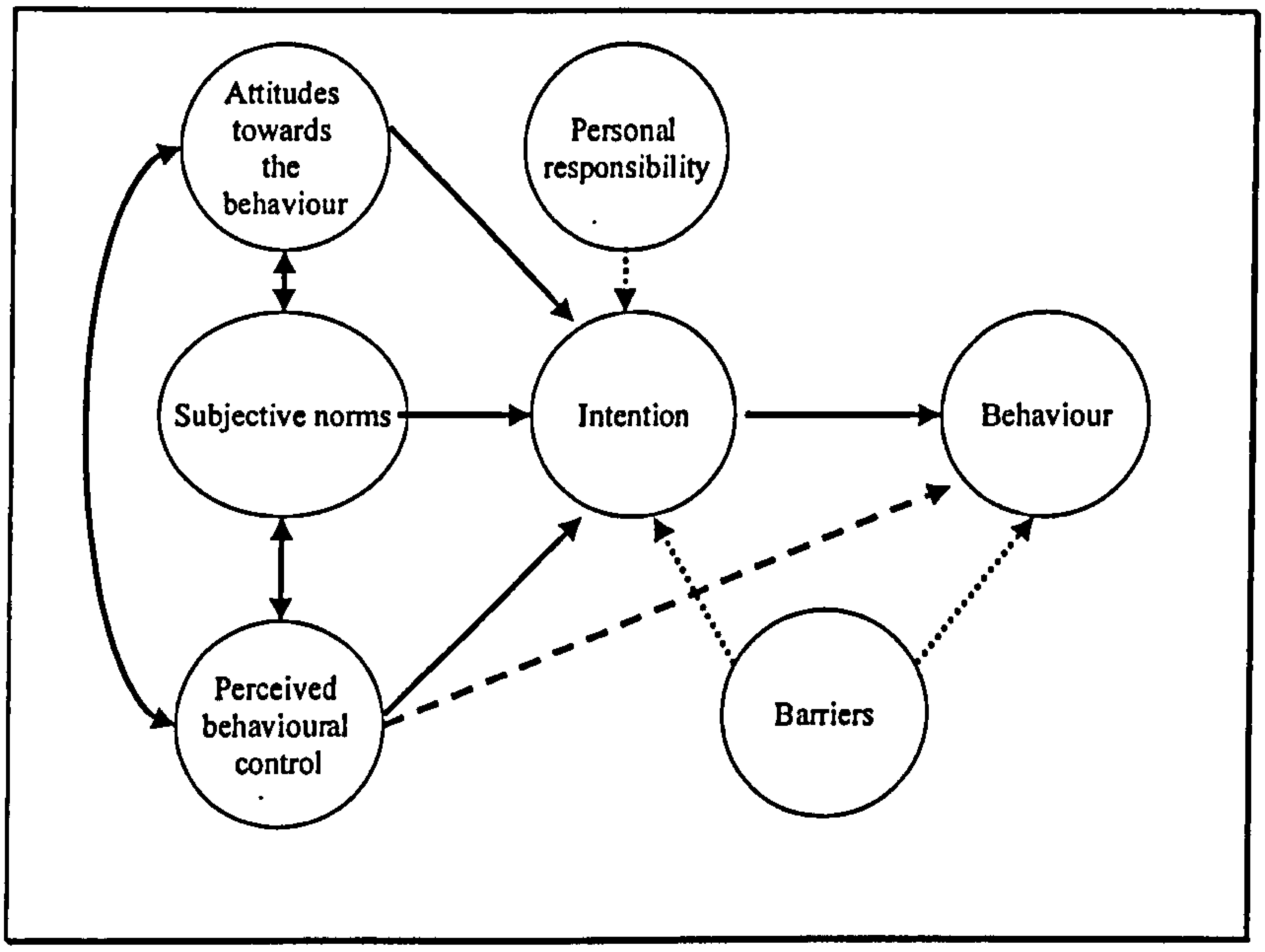

Figure 3 Proposed predictive model

Method

Design And Sample

A cross-sectional survey was used. A total of 304 questionnaires were given to the infection control nurse and senior nurse managers in a central London teaching hospital who agreed to distribute them to ward-based healthcare professionals. Anonymity and confidentiality were ensured in order to enhance the response rate (Oppenheim, 1992) and to overcome possible apprehensions which might affect the honesty of responses. Data collection took place during December 1999 through January 2000.

Table 11 gives the details of the potential and actual sample. One hundred and four questionnaires were returned via internal post to the Infection Control Nurse, representing a completed return rate of 34%. Eighty-eight (85%) of the respondents were female. Five participants did not indicate their gender.

Table 11 Potential and actual samples

Occupation	Potential sample	Actual sample	%
Registered Nurses	193	76	73
Therapists	47	17	16
Healthcare Assistants	43	4	4
Doctors	21	3	3
Occupation not disclosed		4	4
Total	304	104	100

Measures

The target behaviour of handwashing was defined in accordance with national guidelines (UK Health Departments, 1998). These specify that hands should be washed before and after contact with each patient and before putting on and removing gloves.

A 20 item[5] self-report questionnaire measuring attitudes, subjective norms, perceived behavioural control, intention, behaviour, personal responsibility, barriers and optimistic bias was constructed (Appendix 3, 4 & 5). With the exception of behaviour, the TPB constructs were measured using multiple items as recommended by Conner and Norman (1996) whereas personal responsibility, barriers and optimistic bias were measured by single items. The response format for all items was a seven point differential scale. Some response scales were reversed (and then reverse-scored) in order to reduce the probability of a positive response bias (Howell, 1992). In order to increase the appeal of the questionnaire, it was printed on pale blue coloured paper. Berdie and Anderson (1974) recommend that one should not feel restricted to the use of black ink and white paper. They also point out that pastel colours are easier to read than dark coloured papers. The questionnaire was piloted on 17 registered nurses and minor modifications were made. These nurses did not contribute to the final sample.

Attitudes were measured through four items and had an overall internal consistency value of 0.77 (Cronbach's Alpha) e.g. 'washing my hands before and after every patient contact is....', (1 = 'not important', 7 = 'very important'. *Subjective norms* were measured through two items (Cronbach's Alpha, 0.71), e.g. 'I feel under social pressure from the other staff on the ward to wash my hands before and after contact with each patient' (1 = 'strongly disagree', 7 = 'strongly agree').

[5] The open-ended question at the end of the questionnaire was only used in Study 6.

Perceived behavioural control was measured through two items (Cronbach's Alpha, 0.83) e.g. 'If I wanted to, I could easily wash my hands before and after contact with each patient' (1 = 'likely', 7 = 'unlikely'). The construct of *intention* was measured through four items (Cronbach's Alpha, 0.78) e.g. 'I always intend to wash my hands before and after contact with each patient' (1 = 'strongly agree', 7 = 'strongly disagree'). For all multiple item constructs, mean scores were calculated. The single item used to measure *behaviour* was 'I always wash my hands before and after contact with each patient' (1 = 'strongly agree', 7 ='strongly disagree'). The single item used to measure the construct of *personal responsibility* was 'I believe that I have a role to play in reducing the risk of cross-infection by washing my hands before and after every patient contact' (1 = 'strongly agree' and 7 = 'strongly disagree'). This construct was entered into the equation as a predictor of intention.

The five *barrier* items were all measured separately on seven-point scales ranging from 'strongly disagree' to 'strongly agree'. Scoring was reversed, where appropriate, so that a high value represented a highly rated barrier. For example, if an individual strongly agreed that a lack of time hindered their practice, a value of seven would be awarded.

As each barrier item represented a *separate* potential problem, it was not appropriate to calculate a collective barrier internal reliability value. The acceptability of hand hygiene products was measured by the item 'There is always a hand hygiene product available on the ward with which to wash my hands that will not cause damage my skin.' Time availability was measured by the item 'Sometimes I do not wash my hands before and after every patient contact because I do not have the time.' Satisfaction with paper towels was measured by the item 'I believe that the paper towels available are satisfactory for hand drying.'

Two of the barriers which were measured by the items 'The number of sinks available on the ward allows me to wash my hands with ease when I need to' and 'The location of sinks on the ward allows me to wash my hands with ease when I need to' were highly inter-correlated (Cronbach's Alpha 0.87). These were therefore combined to produce a composite score.

Optimistic bias was measured by the item 'I believe that, in comparison with the other staff I work with, I am at a lower/higher risk of acquiring an infection through my work.' The response format for this item was '1 = lower' and '7 = higher.'

Data Analysis

Data were analysed using the Statistical Package for Social Sciences (SPSS version 9.0). Non-parametric bivariate correlations were calculated in order to establish whether any of the predictive constructs were related to the dependent variables (intention and behaviour). When using the TPB as a theoretical framework, it is recommended that two separate analyses should be conducted to examine the extent to which the constructs predict variance in both behavioural intentions and actual behaviour (Hankins et al., 2000). Hence, two separate hierarchical logistic regression analyses were performed (Appendix 6). All of the independent predictors were added into the equations as categorical variables. In order to explain intention, constructs from the TPB were added into the equation on the first step followed by personal responsibility and barriers which were added on the second and third steps respectively. In order to explain hand hygiene behaviour, the construct of intention was added into the equation on the first step followed by perceived behavioural control and barriers on the second and third steps respectively.

Results

Descriptive Findings

Descriptive findings of the predictive constructs are presented in Table 12. The key points to note are that both the dependent variables (intention and behaviour) and several independent variables were positively skewed with relatively low variance. Therefore, appropriate categorisation processes were undertaken (for rationale see Table 13). The responses to subjective norms and the three remaining barriers did not warrant categorisation.

Table 12 Descriptive statistics

Predictors	Range (min)	Range (max)	Mean	SD
Intention	2.25	7.00	6.10	1.07
Behaviour	1.00	7.00	5.34	1.67
Attitude	4.25	7.00	6.59	0.69
Subjective norms	1.00	7.00	2.88	1.72
Perceived behavioural control	1.00	7.00	5.65	1.51
Barrier 1-Acceptability of hand hygiene products	1.00	7.00	2.87	2.02
Barrier 2-Time availability	1.00	7.00	3.17	2.03
Barrier 3-Satisfaction with paper towels	1.00	7.00	3.49	2.18
Barrier 4-Number/location of sinks	1.00	7.00	2.75	1.83
Personal responsibility	1.00	7.00	6.55	1.03

Notwithstanding the positive skew of the dependent variables, it should be noted that only a third of respondents (34/104) gave a composite score of seven in response to the items 'I *always* like/expect/intend/ want to wash my hands' and only a quarter (26/104) strongly agreed with the statement 'I *always* wash my hands before and after contact with each patient.'

Table 13 Categorisation of dependent and independent variables

Variable	Score	Label	Numbers in group (%)
Intention to wash hands	above 6	'high'	61
	6 and below	'low'	39
Behaviour	6 and above	'high'	63
	below 6	'low'	37
Attitudes	7	'high'	
	less than 7	'low'	
Perceived behavioural control	6.5-7	'high'	
	1-6	'low'	
Personal responsibility	7	'high'	
	less than 7	'low'	
Number/location of sinks	4-7	'high'	
	2-3.5	'medium'	
	1-1.5	'low'	

Correlation Analyses

Non-parametric bivariate correlations were calculated in order to establish whether any of the predictive constructs outlined in Figure 3 were related to the dependent variables (intention and behaviour). Table 14 shows that attitudes, personal responsibility and behaviour were all significantly correlated with intention. Attitudes, perceived behavioural control, intention, personal responsibility, time availability and number and location of sinks were all significantly correlated with behaviour. These two barriers were also significantly correlated with perceived behavioural control.

Table 14 Simple (Spearman's Rho) correlations between predictors (n =104)

	Attitude	Subjective norms	Perceived behavioural control	Intention	Barrier 1 Acceptability of hand hygiene products	Barrier 2 Time availability	Barrier 3 Satisfaction with paper towels	Barrier 4 Number/location of sinks	Personal responsibility
Attitude									
Subjective norms	-0.01								
Perceived behavioural control	0.16	-0.04							
Intention	0.30**	0.03	0.11						
Barrier 1	-0.09	0.09	0.06	0.00					
Barrier 2	-0.14	-0.09	-0.37**	-0.18	0.05				
Barrier 3	-0.04	0.16	-0.12	0.14	0.24*	-0.08			
Barrier 4	-0.17	-0.02	-0.24*	-0.11	0.28**	0.11	0.13		
Personal responsibility	0.41**	-0.02	0.22*	0.42**	0.02	-0.19*	0.01	-0.08	
Behaviour	0.25**	0.02	0.35**	0.55**	-0.01	-0.40**	0.03	-0.30**	0.36**

**p<0.01, * p<0.05

Logistic Regression Analyses

Following this, two separate logistic regression analyses were conducted in order to examine the extent to which these constructs predict variance in self-reported intention and self-reported behaviour of hand hygiene practice.

Explaining Intention

All of the independent predictors were added into the equation as categorical variables. The TPB predictors successfully produced a model explaining intention to perform hand hygiene with 70% of cases correctly classified. Personal responsibility contributed a further 2% to the correct classification and barriers a further 7% (Table 15). Correct classification rates were 71% for 'low' intenders and 84% for 'high' intenders. The overall correct classification rate was 79%, thus the model correctly predicted the majority of variance in intention to perform hand hygiene behaviour. Therefore, the overall predictive validity of the model was high (χ^2 57.95, df =35, $p<0.01$).

Table 15 Hierarchical logistic regression to predict intention

Predictors	χ^2	Correct classification (%)	Δ Classification (%)
TPB predictors	20.28	69.9	-
Personal responsibility	29.12	71.8	1.9
Barriers 1-4	57.95	78.6	6.8

Both attitudes ($p<0.05$) and personal responsibility ($p<0.01$) were significant predictors of intention. However, neither subjective norms nor perceived behavioural control significantly predicted intention (Table 16).

Table 16 Predictors of intention to perform hand hygiene

Predictors	B[1]	S.E[1]	Wald test statistic	Significance
Attitudes	-2.16	0.88	5.99	0.014*
Subjective norms	-	-	5.41	0.943
Perceived behavioural control	0.98	0.84	1.35	0.246
Personal responsibility	-2.65	0.95	7.76	0.005**
Acceptability of hand hygiene products	-	-	4.20	0.650
Time availability	-	-	8.33	0.215
Satisfaction with paper towels	-	-	9.57	0.144
Number/location of sinks	-	-	0.83	0.661

**p<0.01, *p<0.05

Note [1] Unstandardised beta (B) values and standard error values are not given when the predictors have a degree of freedom value of more than 1.

Explaining Behaviour

The predictors of self-report behaviour, namely intention, perceived behavioural control and 'barriers' were added into the equation as categorical variables. Intention was a strong predictor of behaviour with 79% of cases being correctly classified. Perceived behavioural control did not contribute further to the explanation of behaviour but 'barriers' contributed an additional 10% (Table 17). Correct classification rates were 79% for 'low' hand washers and 92% for 'high' hand washers. The overall correct classification rate was 87%, thus the model correctly predicted the majority of variance in performing hand hygiene behaviour. Therefore, the overall predictive validity of the model was high (χ^2 80.22, df=22, p<0.001).

Table 17 Hierarchical logistic regression to predict behaviour

Predictors	χ^2	Correct classification %	Δ Classification %
Intention	32.3	78.6	-
Perceived behavioural control	45.2	77.7	-
Barriers 1-4	80.2	87.4	9.7

Both intention (p<0.001) and perceived behavioural control (p<0.05) were significant predictors of self-reports of behaviour. Number and location of sinks approached significance (p=0.059) (Table 18).

Table 18 Predictors of hand hygiene behaviour

Predictors	B[1]	S.E[1]	Wald test statistic	Significance
Intention	-4.53	1.15	15.58	0.000**
Perceived behavioural control	-2.58	1.04	6.10	0.014*
Acceptability of hand hygiene products	-	-	4.89	0.558
Time availability	-	-	9.78	0.134
Satisfaction with paper towels	-	-	4.17	0.653
Number/location of sinks	-	-	5.65	0.059

** p<0.001, *p<0.05

Note [1] Unstandardised beta (B) values and standard error values are not given when the predictors have a degree of freedom value of more than 1.

A diagrammatic representation of the summative predictive model based on the findings is presented in Figure 4. This shows that self-reports of behaviour are predicted by intentions and perceived behavioural control, while intention is predicted by attitudes and personal responsibility but not subjective norms or perceived behavioural control as posited in the proposed predictive model.

The effect on behaviour of the two specific barriers, namely time and number and location of sinks, may be mediated by their effect on perceived behavioural control. As shown in Table 14, these barriers are correlated with both perceived behavioural control and behaviour but the relationship between these barriers and behaviour disappears when perceived behavioural control is added into the model.

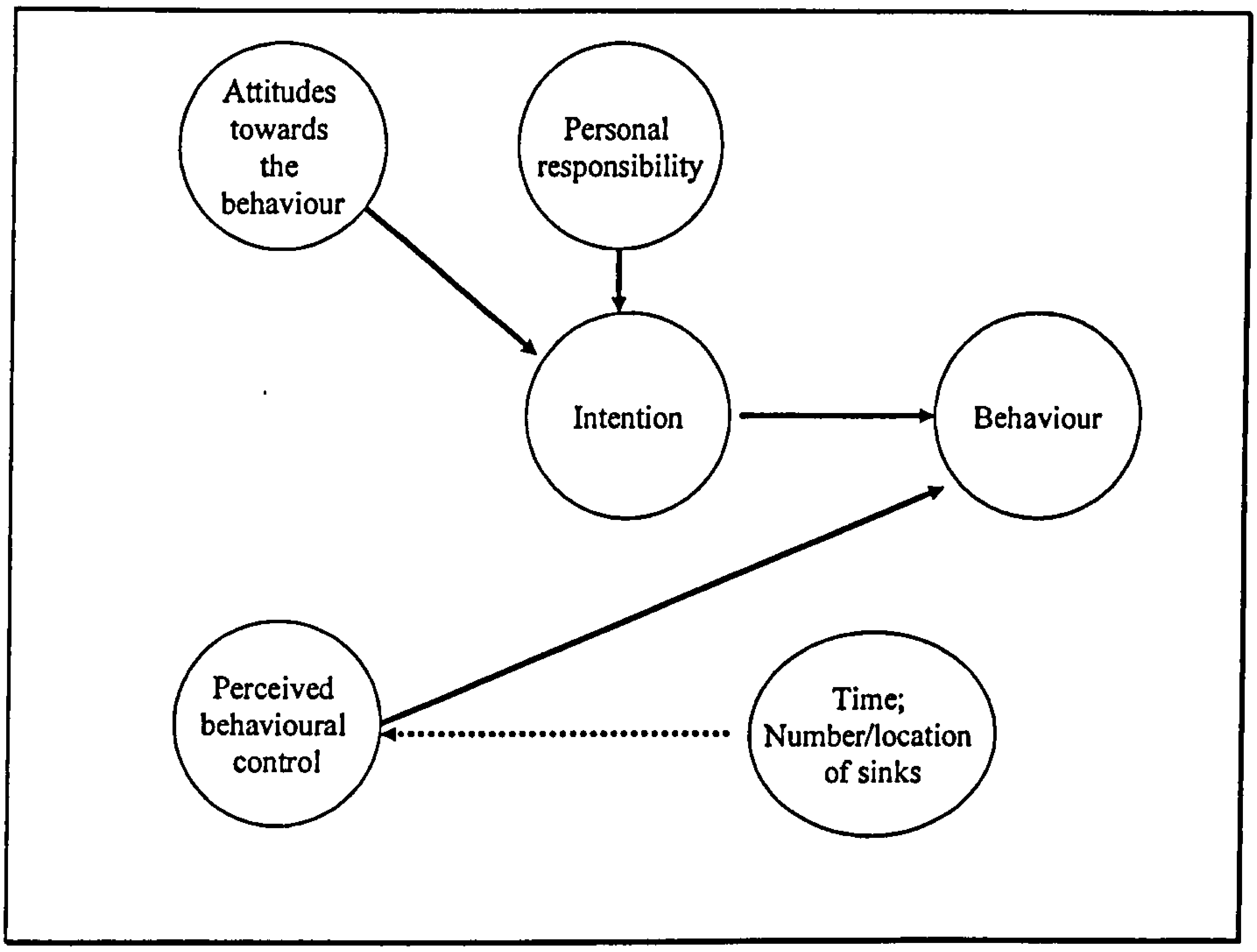

Figure 4 Summative predictive model

Optimistic Bias

A one sample t test showed that the responses to this construct were approximately equally distributed around the value of four i.e. the midpoint of the scale (neither at lower nor higher risk); mean = 4.17 (1.60), $t=1.05$, $df=102$, $p>0.05$. This shows that the group was not unrealistically optimistic regarding their risk of acquiring infection. A further analysis using a two sample t test explored the relationship of optimistic bias with the two dependent variables, intention and behaviour. This revealed that there was no significant difference in terms of risk perception between 'low' and 'high' handwashers ($t = 0.03$, $df = 101$, $p>0.05$; $t = -1.04$, $df = 100$, $p>0.05$ respectively).

Discussion

This study has demonstrated the value of using the TPB as a basis for modelling hand hygiene practice. However, the addition of the specific barriers and the construct of personal responsibility further enhanced the predictive validity of the model.

Attitudes were shown to be a significant predictor of intention to perform hand hygiene. Although the values attached to the construct were already high, only a third of respondents (34/104) said they *always* liked/expected/intended/ wanted to wash their hands before and after contact with each patient. Given this finding it is important to consider factors that can affect attitude formation. Fazio and Zanna (1981) have shown that attitudes formed through direct personal experience are better predictors of behaviour and later work by Fazio (1986; 1990) showed that direct personal experience results in the formation of attitudes which are not only more readily accessible but are also stronger. The strength of healthcare professionals' attitudes to hand hygiene may therefore be influenced by the fact that they do not see the *direct* effect of handwashing immediately, if at all. As Jenner et al. (1999, p.95) point out *"The interval between someone failing to wash their hands and a patient developing an infection makes it unlikely that the two events will be naturally associated."* Student nurses' attitudes towards hand hygiene are explored further in Study 2.

Contrary to predictions arising from the theory, however, neither subjective norms nor perceived behavioural control were found to predict hand hygiene intentions. The model hypothesised that specific barriers would be predictive of behavioural intentions. Although the addition of these contributed an extra 7% to the correct classification rate for intention, none were individually significantly correlated to or predictive of intention.

However, the additional construct of personal responsibility was shown to be a significant predictor of intention to perform hand hygiene practice. This construct added 2% to the correct classification rate over and above the 70% explained by the TPB constructs. Previous research has consistently shown that those who attribute their behaviour to internal causes are more inclined to adopt healthy behaviours (King, 1982). Other researchers have shown that those who attribute externally are poorer at adhering to recommendations (Davison and Valins, 1969; Storms and Nisbett, 1970). Clearly then, ways need to be found to enhance and maintain healthcare professionals' sense of personal responsibility regarding their role in the prevention of cross-infection through appropriate hand hygiene practice. In Study 7, the extent to which posters designed to promote the importance of hand hygiene use 'internal message framing' techniques as described by Rothman et al. (1993) is explored.

The significant predictors of hand hygiene behaviour were found to be intention and perceived behavioural control. Only a quarter (26/104) of those responding said that they *always* washed their hands before and after contact with each patient. The theoretical model used included four specific barriers to hand hygiene practice, which may impinge upon perceived behavioural control. Two of these, namely time availability and number and location of sinks, were significantly correlated with both behaviour and perceived behavioural control but were not directly associated with behaviour once perceived behavioural control was included as a predictor. This suggests that the effect of these barriers on behaviour is mediated by perceived behavioural control (Figure 4). The direction of the correlations means that increased time and sinks made it more likely that healthcare professionals would wash their hands. In the hospital in which this study was conducted, the infection control team had already attempted to address time constraints by ensuring that a bottle of alcohol hand gel was available on every bedside locker. This was in addition to liquid soap and two different kinds of antiseptics being available for handwashing at the sinks. Yet still it appears that perceptions about a lack of time persist even where attempts to remedy the problem have been made. As discussed in the literature review, Larson and Killien (1982) reported time availability to be highly ranked as a reason against handwashing. The introduction of new products in the clinical setting needs to be accompanied by demonstrations to show how easy, quick and effective it is to use alcohol-based products for hand hygiene. However, whilst some researchers have reported increased adherence rates when alcohol based products are introduced (Pittet et al., 2000) others have found this not to be the case (Muto et al., 2000).

As far as the number and location of sinks are concerned, researchers have reported that hand hygiene adherence was poor even where facilities for handwashing were more than satisfactory (Gould, 1994a; Tibballs, 1996). Indeed, whilst Preston et al. (1981) found no improvement in hand hygiene behaviour when a hospital moved to new premises with a sink provided at every bed space, Lankford et al. (2003) found that when staff moved to a new hospital with increased access to handwashing sinks, there was a highly significant *decrease* in their compliance rates with handwashing guidelines which fell from 53% in the old hospital to 23.3% in the new hospital ($p<0.001$).

Therefore, although the facilities for handwashing must obviously be provided, changing the design of the ward layout in relation to the number and location of sinks would probably have limited impact on changing behaviour.

As regards the other two predictors, neither hand hygiene products nor paper towels were perceived as barriers to the performance of the behaviour. The reason for this may be because there was not only a choice of hand hygiene products available but the paper towels provided at all sinks were of the very soft variety.

Conclusions

This study has explored a theoretical framework to determine factors that predict hand hygiene. Potential targets for changing hand hygiene behaviour have been identified so that interventions can be designed to increase healthcare professionals' adherence to hand hygiene guidelines. This is essential if the prevalence of hospital-acquired infections is to be reduced. Since it has been shown that the spread of hand-borne hospital pathogens which are present in endemic proportions can be brought under control by "*even small increases in the frequency of effective handwashes*" (Cooper et al., 1999, p.131), it is imperative that ways are found to increase adherence to this practice which is the cornerstone of any infection prevention programme.

It is clear, however, that the study has some limitations. While the current cross-sectional design does not allow causation to be determined, such exploratory work is nonetheless a necessary stage in identifying factors appropriate for study in follow-up longitudinal studies. The real value of this work lies in its ability to inform the design of more rigorous research. The work described here is useful in that it suggests areas, issues and measures that researchers may wish to explore in future longitudinal studies. It is particularly useful to have such exploratory data available as a basis for grant applications to fund such resource-intensive work.

Self-report measures could be a limitation as they may result in over-estimation of intention and behaviour and hence result in data being positively skewed (Abraham et al.,1999). Indeed, this is what Tibballs (1996) found. However, the study reported here showed that a majority of healthcare professionals admit to suboptimal levels of hand hygiene practice. Only a quarter of respondents said that they would *always* wash their hands before and after contact with each patient. It is likely that the reality is even worse. This finding also suggests that the sample was not biased towards more adherent healthcare professionals.

Notwithstanding attempts to recruit participants from other disciplines, i.e. medicine and therapy services, the composition of the sample consisted almost entirely of female registered nurses. The difficulty of recruiting doctors to participate in studies has been reported by others (Firth-Cozens, 2001). Two attempts were made to enhance the return rate of the questionnaire by re-distribution and extending the date for return. Although the sample size was suboptimal, it was within the expected range. In an analysis of nursing studies published between the 1950's and the 1980's, Brown et al. (1984) found that the average sample size was under 100 subjects in all four decades. This has been confirmed in a more recent analysis conducted by Moody et al. (1988).

Despite these limitations, this study has achieved its aims. Using an approach which integrates health behaviour theories and existing research findings, the study provides a framework which may be used as a building block for both theoretical developments and practical interventions. Specifically, it identifies three key targets: attitudes, perceived behavioural control and personal responsibility. Pointers for future research have been presented.

Chapter 5

Study 2

A Survey of Student Nurses' Attitudes Towards Hand Hygiene Practice: Poor Role Models And False Consensus Beliefs?

Introduction

In Study 1, possible psychological causes of poor hand hygiene practice were investigated using the framework of the Theory of Planned Behaviour (Ajzen, 1985). Strong support for aspects of the model were found: most notably, that the intention to perform hand hygiene was predicted by attitudes and personal responsibility and that hand hygiene practice was predicted by both intention and perceived behavioural control. This in turn was predicted by practical barriers to control (time and places to wash hands). One major question that follows from this research is: 'How does poor hand hygiene practice develop?' For example, are student nurses' very positive attitudes eroded as a result of exposure to poor role models (other doctors and nurses they encounter in the healthcare settings), or do they have unrealistic beliefs about the consequences of poor healthcare behaviours? This study considers such issues empirically.

Larson and Larson (1983) have shown that when doctors act as role models, they can have a positive influence on junior doctors' hand hygiene behaviour. However, their suboptimal hand hygiene practice shows that they cannot be relied upon to serve as good role models for either junior doctors or nurses. Teaching nurses about hand hygiene during their training therefore assumes great importance. However, as has already been highlighted, there are serious curricular deficiencies in this regard.

The Handwashing Liaison Group (1999, p.689) has pointed out that *"the failure of healthcare workers to decontaminate their hands reflects fundamentals of attitudes, beliefs and behaviours."* The role of attitude formation towards the target behaviour of handwashing has been somewhat overlooked although, as shown in Study 1, attitudes were a strong predictor of an individual's intention to wash their hands. Hence, it is clearly important that teachers and others who are in a position to influence practice, help student nurses form positive attitudes towards handwashing. This study was designed to see if general handwashing training that is provided to student nurses undertaking the Diploma in Higher Education was related to attitudes (self and important others), if the timing of this training in a three-year course was important, and if exposure to role models in the clinical setting who fail to adhere to hand hygiene guidelines was a contributing factor in poor hand hygiene behaviours.

Method

This study compared attitudes towards hand hygiene in three cohorts of student nurses in their first, second and third years of training at a UK university. Students differed in terms of temporal proximity to training in hand hygiene (which took place in year 1 before the first clinical placement) and extent of exposure to other healthcare professionals' practice. First year students had experienced only one clinical placement. A between and within subjects, cross-sectional design was used. The following questions were addressed in the study:

1. What are student nurses' attitudes towards their own hand hygiene practice?
2. How do the views of student nurses compare with their views of other nurses' and doctors' attitudes towards hand hygiene?
3. Do student nurses' attitudes towards hand hygiene practice change as they progress through their clinical training?

Measurement Tool

A 33-item, self-report questionnaire was devised (Appendix 7) to measure student nurses' attitudes towards the importance of hand hygiene for 11 different clinical procedures (Table 19).

Table 19 Clinical procedures used as context for assessing attitudes

The importance of washing hands:
1. Before coming on duty/starting the shift
2. Before putting gloves on
3. After taking gloves off
4. Before giving an injection
5. After giving an injection
6. Before removing a wound dressing
7. After handling contaminated equipment
8. Before entering an isolation room
9. Before leaving an isolation room
10. Before administration of medicines
11. Before going for a meal break

These procedures were selected from amongst those for which there is a consensus regarding the need to wash hands to ensure safe practice e.g. before performing an aseptic technique and after any possible microbial contamination (Infection Control Nurses' Association, 1999; Garner and Favero, 1985). The questionnaire was piloted on 25 student nurses in their second year and minor modifications were made. These nurses did not contribute to the final sample. The questionnaires for the three cohorts were printed on different pastel coloured paper to ease identification of cohorts and data processing.

For each procedure, nurses answered three questions to measure the attitudes they held about the importance of hand hygiene and the attitudes they believed are held by other nurses and doctors. Attitudes towards each clinical procedure were measured using a seven point differential scale which ranged from one, ('strongly disagree' or 'unimportant') to seven ('strongly agree' or 'very important'). For example, 'The nurses I work alongside believe that washing their hands before administering medicine is 1 = unimportant, 7 = very important;' 'I think that the doctors I work alongside regard washing their hands before removing a wound dressing as very important 1 = strongly disagree, 7 = strongly agree.' Some response scales were reversed (and then reverse-scored) in order to avoid a positive response bias (Howell, 1992). For example 'I believe that it is important to wash my hands before putting gloves on 1 = strongly agree, 7 = strongly disagree;' 'Before entering an isolation room, washing my hands is 1 = very important, 7 = unimportant.' The overall internal consistency values of the 11 items for self, 11 items for other nurses and 11 items for doctors were as follows: 0.807; 0.806; 0.913 (Cronbach's Alpha).

Participants

The questionnaire was distributed by the researcher and completed in class by a total of 386 out of 395 pre-registration nursing students (year 1, n = 141; year 2, n = 137; year 3, n = 108) undertaking a Diploma in Higher Education, a response rate of 98%. Of the 141 first-year students, 48 did not complete the section seeking their views on doctors' attitudes because, although they had undertaken their first clinical placement (and therefore met the inclusion criterion), this was of such a nature e.g. Learning Disabilities, that they had not worked with doctors and therefore felt they could not comment on doctors' attitudes. Nevertheless, 96 first-year students were able to give their views.

Prior to undertaking their first clinical placement, student nurses who participated in this study had been taught about the role of hand hygiene in the prevention of cross-infection. Lectures in the classroom had been supplemented by demonstrations in the clinical skills laboratory.

Students had been shown how to wash their hands and the results of poor hand hygiene technique had been illustrated through the application of a fluorescent cream and an ultraviolet light (the Glitter Bug technique, Brevis Corporation). Thus, their attitudes had been shaped regarding the importance of this simple measure to prevent cross-infection, both to themselves and their patients.

Data Analysis

The data were analysed using the Statistical Package for Social Sciences (SPSS version 9.0). Three types of analyses are reported. The first considers the differences, if any, between students' attitudes over the three years of the course. Due to large numbers of respondents and low frequencies in some cells, p value was calculated using the Monte Carlo option in SPSS.

The second considers the influence of student nurses' own attitudes towards hand hygiene. To examine this, the group of participants is split into two because the ratings used by student nurses were not normally distributed: there was a large degree of skew towards the 7 ('very important') end of the scale. It was, therefore, seen as more reasonable to treat the responses in terms of the very important/less important dichotomy: Group 1 consists of those who rated handwashing as 'very important' (i.e. 7 on the 7-point scale). Group 2, roughly equal in size, consists of those who rated handwashing as 'not very important' (i.e. 6 and below). Data were, therefore, analysed using the binomial test, rather than parametric tests which would require more normally distributed responses.

The third aspect of data analysis examined student nurses' ratings of other nurses' and doctors' hand hygiene behaviour and attitudes (referred to as 'others' throughout). It also examined if these attitudes differed according to whether the student nurses considered handwashing to be 'very important' or 'not very important'. These comparisons were analysed using χ^2 in SPSS.

Results

Comparison Between Attitudes Of First-, Second-And Third-Year Student Nurses

Table 20 presents student nurses' attitudes towards hand hygiene practice in year 1, year 2 and year 3. This shows how positive attitudes towards the importance of hand hygiene are eroded quite dramatically over the three years of student training. Across all procedures, an average of 81% of first-year student nurses thought handwashing to be 'very important'. Only for the procedure of 'putting gloves on' did relatively few (47%) consider handwashing to be 'very important' (i.e. a rating of 7).

Table 20 Student nurses' self attitudes towards hand hygiene practice

Procedures	1st year (%)[1]	2nd year (%)[1]	3rd year (%)[1]	All years (%)[2]	LL statistic value[3,4]	p value[4]
1.Before coming on duty/starting the shift	72.1	59.6	41.0	59.1	19.8	**0.00**
2. Before putting gloves on	47.1	37.5	34.3	40.1	6.4	**0.01**
3. After taking gloves off	70.7	60.3	61.0	64.0	1.06	0.33
4. Before giving an injection	91.3	64.7	51.9	70.7	40.8	**0.00**
5. After giving an injection	88.3	65.7	66.4	74.0	9.8	**0.02**
6. Before removing a wound dressing	94.3	86.9	85.2	89.1	2.65	0.10
7. After handling contaminated equipment	98.6	93.4	94.3	95.5	.16	0.72
8. Before entering an isolation room	77.9	72.1	65.7	72.4	.95	0.33
9. Before leaving an isolation room	85.8	88.2	90.7	88.0	2.9	0.09
10. Before administration of medicines	75.0	63.7	53.3	65.0	12.5	**0.00**
11. Before going for a meal break	95.0	90.4	88.0	91.4	1.4	0.27
Mean	81.46	71.1	66.52	73.57		

Note [1]. The percentage (%) of participants, by year, who believed handwashing to be 'very important' for each of the clinical procedures specified.
[2] The percentage (%) of participants across all years who rated handwashing as 'very important' for each clinical procedure.
[3] df 1 in all cases.
[4] The linear by linear (LL) test for trend over time was used; 2-tailed Monte Carlo significance value.

By the second year, the table shows a decrease in the percentage rating handwashing as 'very important' for 10 of the 11 procedures. By the third year, there is a further decrease in the percentage rating handwashing as 'very important' for seven of these procedures. This decrease is statistically significant at the $p<0.05$ level for five of the 11 clinical procedures: before coming on duty; before putting gloves on; before and after giving an injection and before administration of medicines. The differences in attitudes for the different procedures are noteworthy. Whilst 64% of nurses, irrespective of year, thought it 'very important' to wash hands after removing gloves, only 40% thought it 'very important' to wash hands before putting gloves on, yet 71% thought it 'very important' to wash hands before giving an injection, a procedure for which gloves should be worn. Ninety one per cent of all nurses thought it 'very important' to wash their hands before going for their meal break whereas only 65% thought it 'very important' to wash their hands before administering medicines to patients, a procedure which often results in handling the pills - either to dispense them or to put them into the patient's mouth.

Table 21 shows what the respondents believed were the attitudes towards hand hygiene held by 'other nurses'. A comparison with Table 20 shows that, for all procedures, these scores are very much lower even from the first year (46% as compared with 81% in Table 20). This suggests that student nurses view their own attitudes to hand hygiene as being far more positive and preventative than those of others.

Table 21 Student nurses' views of other nurses' attitudes towards hand hygiene practice

Procedures	1st year (%)[1]	2nd year (%)[1]	3rd year (%)[1]	All years (%)[2]	LL statistic value[3,4]	p value[4]
1.Before coming on duty/starting the shift	23.4	13.9	8.3	15.8	4.1	**0.04**
2. Before putting gloves on	25.4	14.8	12.1	17.9	6.1	**0.02**
3. After taking gloves off	36.0	25.7	25.9	29.5	.77	0.38
4. Before giving an injection	51.1	30.9	25.0	36.5	13	**0.00**
5. After giving an injection	48.9	27.2	28.0	35.3	12.2	**0.00**
6. Before removing a wound dressing	54.6	58.4	38.0	51.3	2.7	0.10
7. After handling contaminated equipment	79.9	75.7	74.5	76.9	.16	0.70
8. Before entering an isolation room	43.0	39.0	25.2	36.5	2.4	0.12
9. Before leaving an isolation room	64.9	56.6	58.9	60.2	.3	0.60
10. Before administration of medicines	26.2	17.5	10.2	18.7	3.06	0.08
11. Before going for a meal break	55.8	40.4	38.9	45.5	4.8	**0.03**
Mean	46.29	36.37	31.36	38.55		

Note [1]. The percentage (%) of participants, by year, who believed that other nurses would consider handwashing to be 'very important' for each of the clinical procedures specified.
[2] The percentage (%) of participants across all years who rated handwashing as 'very important'.
[3] df 1 in all cases.
[4] The linear by linear (LL) test for trend over time was used; 2-tailed Monte Carlo significance value.

Table 21 also shows that there is a worsening of attitudes over the three years for all 11 clinical procedures which reaches statistical significance for five of the procedures: before coming on duty, putting gloves on, going for a meal break, and before and after giving an injection. Of particular interest, washing hands before putting gloves on and before starting work both received very low estimates of importance: less than 18% of all respondents believed that other nurses thought washing hands before putting gloves on was very important and less than 16% of all respondents believed that other nurses thought handwashing before starting work was very important.

Table 22 shows the student nurses' views of doctors' attitudes to hand hygiene practice. Even first year students have low opinions and these show significant deterioration even further between years for 10 of the 11 clinical procedures (the exception, 'handwashing after handling contaminated equipment' is itself significant at the 10% level of probability). The total percentage of student nurses who think that doctors believe handwashing is 'very important' ranged from 10% for washing hands before putting gloves on, to 38% for washing hands after handling contaminated equipment. Only 14% thought doctors considered it 'very important' to wash hands before removing a wound dressing, a procedure which requires an aseptic technique.

Table 22 Student nurses' views of doctors' attitudes towards hand hygiene practice

Procedures	1st year (%)[1]	2nd year (%)[1]	3rd year (%)[1]	All years (%)[2]	LL statistic value[3,4]	p value[4]
1. Before coming on duty/starting the shift	20.5	10.4	6.2	11.9	11.5	**0.00**
2. Before putting gloves on	13.8	11.3	5.7	10.2	21.5	**0.00**
3. After taking gloves off	27.4	12.8	7.5	15.3	6.9	**0.01**
4. Before giving an injection	26.3	11.9	9.6	15.3	21.5	**0.00**
5. After giving an injection	30.9	11.9	10.4	16.9	20.9	**0.00**
6. Before removing a wound dressing	14.2	15.3	11.1	13.7	19.4	**0.00**
7. After handling contaminated equipment	46.3	31.3	40.0	38.3	2.9	0.09
8. Before entering an isolation room	25.3	16.5	13.3	17.9	14.6	**0.00**
9. Before leaving an isolation room	25.5	20.1	16.0	20.4	13.5	**0.00**
10. Before administration of medicines	20.7	8.4	6.7	11.3	21.0	**0.00**
11. Before going for a meal break	41.8	23.2	19.6	27.5	15.2	**0.00**
Mean	26.6	15.73	13.28	18.06		

Note [1]. The percentage (%) of participants, by year, who believed that doctors would consider handwashing to be 'very important' for each of the clinical procedures specified.
[2] The percentage (%) of participants across all years who rated handwashing as 'very important'.
[3] df 1 in all cases.
[4] The linear by linear (LL) test for trend over time was used; 2-tailed Monte Carlo significance value.

The Influence Of The Student Nurses' Ratings Of Themselves In Terms Of How They View Significant Others

The mean scores for respondents' attitudes towards the importance of hand hygiene were as follows: self = 6.539, other nurses = 5.4140, doctors = 4.1798. Paired sample t tests showed that these differences were statistically significant (Table 23). Student nurses not only believe that they themselves value the importance of hand hygiene more than other nurses and doctors, but they have a much lower view of doctors' practices.

Table 23 Differences between respondents' mean scores for self, other nurses and doctors

Paired sample	Mean	t	df	Significance (two tailed)
Self-other nurses	1.1255	24.257	385	.000
Self-other doctors	2.3481	31.5558	342	.000
Other nurses-doctors	1.2272	17.176	342	.000

Table 24 shows, for each of the clinical procedures, the percentage of student nurses who rated their own attitudes to hand hygiene practice as being superior to that of both other nurses and doctors (i.e. instead of relying on the mean differences across the sample reported above, this analysis looks at each student nurse's attitudes to self and others in turn). Irrespective of year of training, the great majority of student nurses believed that they held a superior level of attitude towards hand hygiene practice in comparison with other nurses and doctors. For example, 87% of first year students believed that their attitude towards hand hygiene before removing a wound dressing was superior to that of other nurses and doctors. Similarly, only nine out of a total of 101 (9%) third-year students did not believe their own attitudes towards handwashing before the administration of medicines were more positive than those of other nurses and doctors.

The results for first-year student nurses show that they rated their own attitudes more highly than those of other nurses and doctors for every procedure except one, washing hands after handling contaminated equipment. The results for second-and third-year student nurses show that they rated their attitudes more highly than those of other nurses and doctors for all clinical procedures measured. These results indicate that student nurses believe that their attitudes are superior to those of other nurses and doctors suggesting that they witness poor hand hygiene practice on a regular basis.

Table 24 The percentage of student nurses, by year, whose attitudes towards their own practice was greater than that of other nurses and doctors, for each clinical procedure

Procedures	1st year %	p value [1]	2nd year %	p value [1]	3rd year %	p value [1]
1. Before coming on duty/starting the shift	86	0.00	90	0.00	88	0. 00
2. Before putting gloves on	70	0.00	73	0.00	77	0.00
3. After taking gloves off	73	0.00	85	0.00	87	0.00
4. Before giving an injection	77	0.00	84	0.00	86	0.00
5. After giving an injection	76	0.00	85	0.00	90	0.00
6. Before removing a wound dressing	87	0.00	81	0.00	89	0.00
7. After handling contaminated equipment	55	0.35	67	0.00	62	0.21
8. Before entering an isolation room	76	0.00	83	0.00	83	0.00
9. Before leaving an isolation room	85	0.00	79	0.00	87	0.00
10. Before administration of medicines	83	0.00	87	0.00	91	0.00
11. Before going for a meal break	65	0.00	78	0.00	84	0.00

Note [1] p values calculated using the binomial test in SPSS.

Exact p value for the binomial test used to compare proportions to 0.5.

Figure 5 presents the attitudes of student nurses to their own hand hygiene compared with their views of other nurses and doctors, for each of the 11 clinical procedures. There is a clear tendency to rate others' attitudes more negatively than one's own which is statistically highly significant. This could be an interesting manifestation of the psychological phenomenon of 'unrealistic optimism' (Weinstein, 1984; Harris and Middleton, 1994). This refers to the bias people exhibit for a wide range of health indices and related outcomes whereby they consider themselves to be in a better or less risky position than they really are.

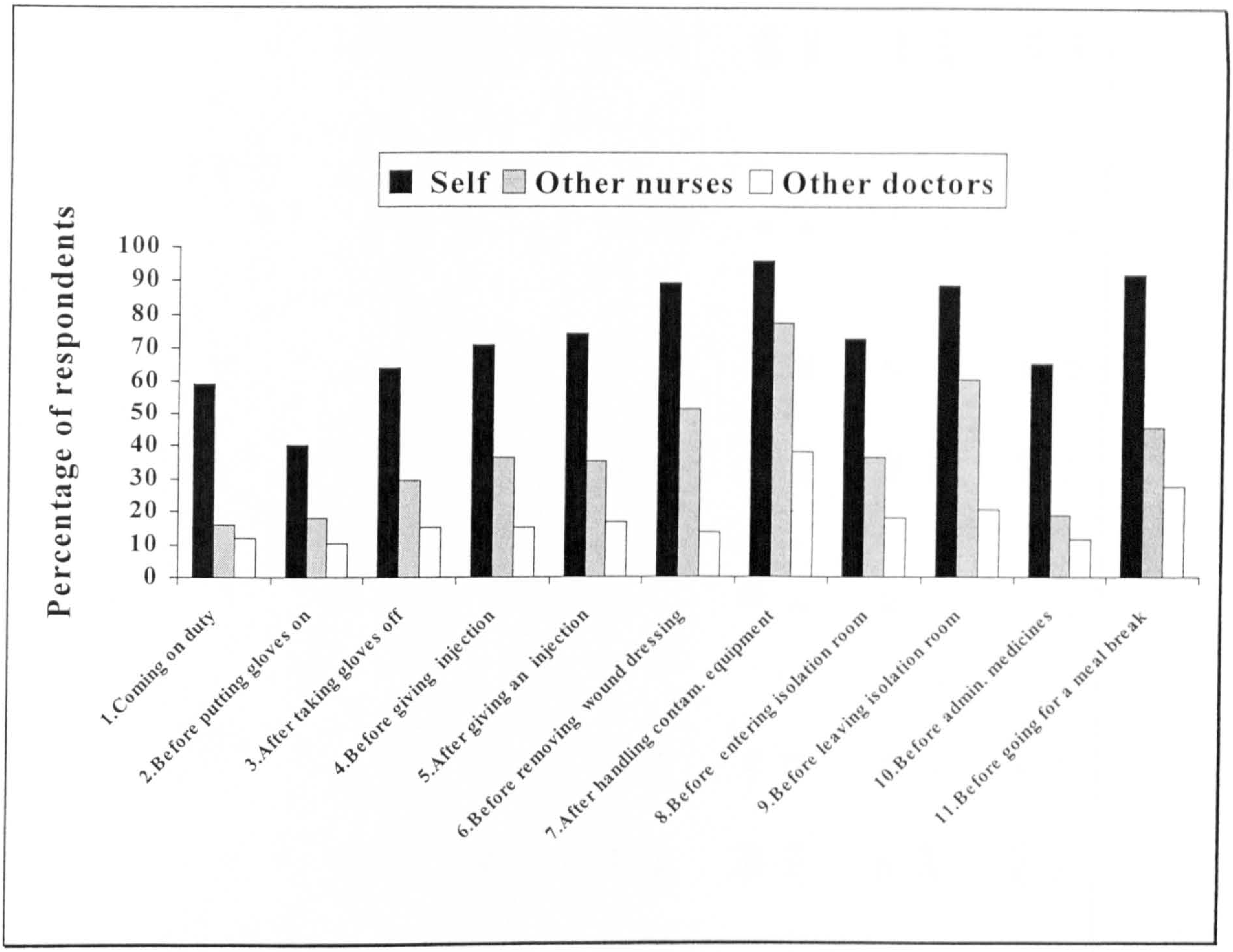

Figure 5 Within subjects analysis. The percentage of respondents who rated hand hygiene as 'very important' compared with their ratings of other nurses' and doctors' views of the importance of hand hygiene with respect to the various clinical procedures

Table 25 shows the possible influence of other nurses' and doctors' attitudes to hand hygiene on the attitudes of student nurses' views themselves. Student nurses' ratings of other nurses' and doctors' attitudes were split according to whether they themselves considered handwashing to be 'very important' (score of 7) or 'not very important' (score of 6 or below) for each of the questions. For clarity, only the percentage of other nurses and doctors who are considered by student nurses to believe handwashing to be 'very important' are shown. The percentages of those who are believed to consider handwashing 'not very important' is the number shown subtracted from 100.

First, looking at the influence of other nurses, Table 25 shows that there is a statistically significant influence in first-year student nurses' attitudes if other nurses are perceived as seeing hand hygiene as being 'very important' as opposed to 'not very important'. Compare, for example, 31% with 8% for the first procedure. The difference is significant at the 5% level for nine of the 11 procedures measured and was better than 10% for the other two procedures.

Table 25 The percentage of student nurses, by year, who believe other nurses and doctors consider hand hygiene to be 'very important' according to whether they themselves consider it to be 'very important' or 'not very important'

Own view:		Year 1			Year 2			Year 3		
% who believe other nurses and doctors consider hand hygiene to be 'very important'		Very important	Not very important	p value	Very important	Not very important	p value	Very important	Not very important	p value
Procedure										
Before coming on duty/starting the shift										
	Other nurses	31	8	.007	23	2	.001	21	0	.000
	Doctors	25	8	.083	17	2	.007	15	0	.005
Before putting gloves on										
	Other nurses	47	8	.000	26	8	.007	27	4	.001
	Doctors	21	8	.131	25	4	.000	14	1	.019
After taking gloves off										
	Other nurses	47	7	.000	40	6	.000	38	5	.000
	Doctors	33	8	.017	17	8	.186	9	5	.487
Before giving an injection										
	Other nurses	55	25	.068	43	10	.000	46	2	.000
	Doctors	29	0	.184	18	2	.010	18	0	.002
After giving an injection										
	Other nurses	53	25	.060	36	11	.002	37	11	.006
	Doctors	33	11	.268	17	2	.010	16	0	.034
Before removing a wound dressing										
	Other nurses	59	13	.022	66	6	.000	44	6	.004
	Doctors	21	17	1.00	17	6	.305	12	6	.688

Results were analysed using Pearson's χ^2 test.

Table 25[6] (continued). The percentage of student nurses, by year, who believe other nurses and doctors consider hand hygiene to be 'very important' according to whether they themselves consider it to be 'very important' or 'not very important'

Own view:		Year 1			Year 2			Year 3		
% who believe other nurses and doctors consider hand hygiene to be 'very important'		Very important	Not very important	p value	Very important	Not very important	p value	Very important	Not very important	p value
Procedure										
After handling contaminated equipment										
	Other nurses	82	0[1]	.037	78	44	.039	78	17	.004
	Doctors	46	100[1]	.468	33	11	.271	43	0	.079
Before entering an isolation room										
	Other nurses	54	3	.000	53	5	.000	37	3	.000
	Doctors	31	9	.050	20	8	.123	21	0	.005
Before leaving an isolation room										
	Other nurses	73	20	.000	61	19	.001	65	10	.001
	Doctors	28	9	.279	21	6	.195	18	0	.211
Before administration of medicines										
	Other nurses	34	6	.002	26	4	.002	16	2	.019
	Doctors	25	5	.062	13	0	.007	13	0	.015
Before going for a meal break										
	Other nurses	58	14	.044	44	8	.015	44	0	.001
	Doctors	42	50	1.00	25	8	.291	23	0	.066

Results were analysed using Pearson's χ^2 test.

[6] Note [1] 0 n=2. Only 2 nurses thought that hand hygiene after handling contaminated equipment was 'not very important' and neither of these participants thought other nurses thought it was 'very important', hence a zero return. On the other hand, the one nurse who did not consider hand hygiene 'very important' was of the opinion that other doctors do rate hand hygiene as 'very important', hence 100%.

In contrast to these findings for other nurses, the influence of doctors seemed less important for first year students: only two procedures produced significant differences at the 5% level: 'after taking gloves off' and 'before entering an isolation room.'

The weakening of student nurses' attitudes to good hand hygiene practice as they progress through their second and third years has been reported earlier. Table 25 shows that the congruence of self attitudes with other nurses' attitudes also differs according to year and that by year 2 there is a significant effect on hand hygiene attitudes for all 11 procedures. The influence of doctors is less pronounced, but present at the 5% level for five of the procedures in year 2 and six in year 3.

It is also noteworthy that this greater congruence of view is mainly a result of the worsening of student nurses' attitudes to hand hygiene generally: fewer of them see hand hygiene as 'very important' for themselves or for significant others although, if they do, they are much less likely to rate significant others as not seeing hand hygiene as important.

Table 26 presents the odds ratios (OR) and related statistics to show the chances of the respondents believing that hand hygiene is not very important for others if it is not very important for themselves. To project the differences for each clinical procedure, year 1 is compared with year 2 and year 3 in turn.

Several key findings presented in Table 26 are highlighted. First, those nurses who do not believe hand hygiene is very important before entering an isolation room are 24 times more likely to say that other nurses do not think it very important either and third-year nurses are twice as likely to say this than first-year nurses. Secondly, those nurses who do not believe hand hygiene is very important before giving an injection are 23 times more likely to say that doctors do not think it very important either and third-year nurses are twice as likely to say this than first-year nurses. Thirdly, at the other extreme, nurses who do not consider that hand hygiene is very important before performing a wound dressing are only twice as likely to say doctors do not think it very important either. Third-year nurses are twice as likely to say this than first-year nurses. These projections highlight how imperative it is for nurses to value the importance of hand hygiene, not just at the start of their training, but throughout their career.

Table 26 Own view and odds ratios of predictions of year 2 against year 1, and year 3 against year 1 for importance of hand hygiene for various clinical procedures

Clinical Procedure	View	Beta Parameter and Standard Error	Wald statistic and significance	Odds Ratio	Confidence Interval	
					Lower	Upper
Before coming on duty/	Self vs Other nurses	2.45 (.53)	21.06 (1) p = .000	11.60	4.07	33.04
starting shift	Year 2 to Year 1	.51 (.33)	2.38 (1) p = .123	1.67	.87	3.20
	Year 3 to Year 1	.73 (.42)	2.98 (1) p = .084	2.08	.91	4.76
	Self vs Doctors	2.20 (.62)	12.61 (1) p = .000	9.03	2.68	30.40
	Year 2 to Year 1	.61 (.41)	2.27 (1) p = .132	1.85	.83	4.11
	Year 3 to Year 1	.92 (.52)	3.20 (1) p = .074	2.51	.92	6.90
Before putting gloves on	Self vs Other nurses	1.92 (.31)	37.48 (1) p = .000	6.81	3.69	12.59
	Year 2 to Year 1	.61 (.33)	3.37 (1) p = .066	1.84	.96	3.54
	Year 3 to Year 1	.82 (.38)	4.71 (1) p = .030	2.27	1.08	4.74
	Self vs Doctors	1.81 (.43)	18.02 (1) p = .000	6.08	2.64	14.00
	Year 2 to Year 1	.10 (.42)	.06 (1) p = .808	1.11	.48	2.55
	Year 3 to Year 1	.88 (.53)	2.75 (1) p = .097	2.41	.85	6.83
After taking gloves off	Self vs Other nurses	2.43 (.39)	39.34 (1) p = .000	11.37	5.32	24.30
	Year 2 to Year 1	.32 (.29)	1.24 (1) p = .266	1.38	.78	2.42
	Year 3 to Year 1	.41 (.31)	1.75 (1) p = .186	1.51	.82	2.77
	Self vs Doctors	1.13 (.41)	7.54 (1) p = .006	3.09	1.38	6.90
	Year 2 to Year 1	.79 (.36)	4.96 (1) p = .026	2.21	1.10	4.43
	Year 3 to Year 1	1.39 (.44)	9.92 (1) p = .002	4.00	1.69	9.50

Table 26 (continued). Own view and odds ratios of predictions of year 2 against year 1, and year 3 against year 1 for importance of hand hygiene for various clinical procedures

Clinical Procedure	View	Beta Parameter and Standard Error	Wald statistic and significance	Odds Ratio	Confidence Interval	
					Lower	Upper
Before giving an injection	Self vs Other nurses	2.21 (.38)	34.34 (1) p = .000	9.16	4.37	19.20
	Year 2 to Year 1	.49 (.27)	3.30 (1) p = .069	1.64	.96	2.78
	Year 3 to Year 1	.59 (.31)	3.70 (1) p = .055	1.80	.99	3.29
	Self vs Doctors	3.14 (1.0)	9.42 (1) p = .002	23.20	3.12	172.82
	Year 2 to Year 1	.58 (.36)	2.55 (1) p = .110	1.79	.88	3.66
	Year 3 to Year 1	.66 (.42)	2.48 (1) p = .115	1.94	.85	4.43
After giving an injection	Self vs Other nurses	1.45 (.33)	19.71 (1) p = .000	4.27	2.25	8.10
	Year 2 to Year 1	.74 (.27)	7.48 (1) p = .006	2.09	1.23	3.54
	Year 3 to Year 1	.70 (.29)	6.02 (1) p = .014	2.02	1.15	3.54
	Self vs Doctors	2.27 (.74)	9.491 (1) p = .002	9.71	2.29	41.24
	Year 2 to Year 1	.87 (.36)	5.927 (1) p = .015	2.38	1.19	4.80
	Year 3 to Year 1	1.06 (.40)	7.133 (1) p = .008	2.89	1.33	6.29
Before removing a wound dressing	Self vs Other nurses	2.89 (.62)	22.115 (1) p = .000	18.00	5.40	60.04
	Year 2 to Year 1	-.30 (.26)	1.326 (1) p = .249	.74	.45	1.23
	Year 3 to Year 1	.58 (.27)	4.566 (1) p = .033	1.79	1.05	3.06
	Self vs Doctors	.84 (.62)	1.811 (1) p = .178	2.32	.68	7.86
	Year 2 to Year 1	.30 (.35)	.754 (1) p = .385	1.35	.68	2.67
	Year 3 to Year 1	.67 (.40)	2.817 (1) p = .093	1.95	.89	4.26

Table 26 (continued). Own view and odds ratios of predictions of year 2 against year 1, and year 3 against year 1 for importance of hand hygiene for various clinical procedures

Clinical Procedure	View	Beta Parameter and Standard Error	Wald statistic and significance	Odds Ratio	Confidence Interval	
					Lower	Upper
After handling	Self vs Other nurses	2.18 (.55)	15.652 (1) p = .000	8.88	3.01	26.19
contaminated equipment	Year 2 to Year 1	.14 (.30)	.224 (1) p = .636	1.15	.64	2.09
	Year 3 to Year 1	.21 (.32)	.444 (1) p = .505	1.24	.66	2.32
	Self vs Doctors	1.43 (.77)	3.480 (1) p = .062	4.19	.93	18.91
	Year 2 to Year 1	.59 (.28)	4.405 (1) p = .036	1.80	1.04	3.12
	Year 3 to Year 1	.22 (.29)	.550 (1) p = .458	1.24	.70	2.20
Before entering an	Self vs Other nurses	3.16 (.53)	36.116 (1) p = .000	23.53	8.40	65.91
isolation room	Year 2 to Year 1	.02 (.28)	.008 (1) p = .929	1.03	.60	1.76
	Year 3 to Year 1	.67 (.31)	4.689 (1) p = .030	1.96	1.07	3.61
	Self vs Doctors	1.69 (.49)	12.147 (1) p = .000	5.45	2.10	14.13
	Year 2 to Year 1	.52 (.34)	2.252 (1) p = .133	1.68	.85	3.29
	Year 3 to Year 1	.66 (.39)	2.962 (1) p = .085	1.94	.91	4.12
Before leaving an	Self vs Other nurses	2.29 (.41)	31.243 (1) p = .000	9.92	4.44	22.16
isolation room	Year 2 to Year 1	.49 (.27)	3.271 (1) p = .071	1.63	.96	2.76
	Year 3 to Year 1	.40 (.29)	1.930 (1) p = .165	1.49	.85	2.61
	Self vs Doctors	1.63 (.74)	4.800 (1) p = .028	5.08	1.19	21.72
	Year 2 to Year 1	.35 (.33)	1.143 (1) p = .285	1.42	.75	2.68
	Year 3 to Year 1	.61 (.36)	2.866 (1) p = .090	1.83	.91	3.70

Table 26 (continued). Own view and odds ratios of predictions of year 2 against year 1, and year 3 against year 1 for importance of hand hygiene for various clinical procedures

Clinical Procedure	View	Beta Parameter and Standard Error	Wald statistic and significance	Odds Ratio	Confidence Interval	
					Lower	Upper
Before administration of medicines	Self vs Other nurses	2.14 (.48)	19.881 (1) p = .000	8.53	3.33	21.89
	Year 2 to Year 1	.40 (.31)	1.662 (1) p = .197	1.49	.81	2.73
	Year 3 to Year 1	1.00 (.40)	6.459 (1) p = .011	2.74	1.26	5.97
	Self vs Doctors	3.03 (1.02)	8.750 (1) p = .003	20.65	2.78	153.45
	Year 2 to Year 1	.87 (.42)	4.305 (1) p = .038	2.38	1.05	5.41
	Year 3 to Year 1	.94 (.48)	3.819 (1) p = .051	2.57	1.00	6.62
Before going for a meal break	Self vs Other nurses	2.65 (.74)	12.836 (1) p = .000	14.13	3.32	60.13
	Year 2 to Year 1	.56 (.25)	4.873 (1) p = .027	1.74	1.06	2.85
	Year 3 to Year 1	.60 (.27)	4.900 (1) p = .027	1.82	1.07	3.08
	Self vs Doctors	1.43 (.75)	3.602 (1) p = .058	4.17	.95	18.22
	Year 2 to Year 1	.79 (.30)	6.737 (1) p = .009	2.19	1.21	3.97
	Year 3 to Year 1	.98 (.34)	8.463 (1) p = .004	2.66	1.38	5.14

Discussion

Comparison Between Attitudes Of First-, Second-And Third-Year Student Nurses

The positive attitudes held by first-year student nurses towards the value of hand hygiene may be due, at least in part, to the recency of lectures and practical demonstrations that they attended prior to their first clinical placement. If this is so, the differences in students' attitudes as they progress throughout the three years of their training programme may be explained, to some extent, by the fact that they receive no further lectures or practical demonstrations on hand hygiene. Reliance is placed on classroom teaching on the role of hand hygiene in the prevention of infection being reinforced in the clinical setting by practice link tutors and practitioners. This highlights the importance of role models. If students see other nurses and doctors washing their hands in accordance with what they have been taught to believe is 'good practice', then they will form the opinion that these practitioners think that the practice is very important, which in turn is likely to reinforce their attitudes positively. This is important because, as shown in Study 1, attitudes predict intention to perform a behaviour. However, this study shows that student nurses do not believe that other practitioners, be they nurses or doctors, place as much value on the importance of hand hygiene as they do. This suggests that the practice of others is suboptimal.

Although it is very important for others to set a good example by adhering to hand hygiene policies, the findings of this study suggest that other nurses rather than doctors have a greater influence on student nurses' attitudes. This may be due to the composition of the workforce on the wards as nurses outnumber doctors. Furthermore, student nurses work alongside other nurses more often than doctors and therefore have a greater number of opportunities to observe their hand hygiene practice.

What is less easy to explain is why student nurses' views of doctors' attitudes towards hand hygiene were already very low in the first year, when they had had very limited time to work alongside them and observe their behaviour. Perhaps they had been guided to read the literature on doctors' poor adherence to hand hygiene policies. Considering that doctors are eminently placed to act as role models, it is imperative that they are taught to value the importance of this simple hygiene measure when they are medical students. However, whilst some physicians incorporate this into their teaching, Griffiths and Bradley (2001, p.479) claim that many clinical teachers *"do not encourage this practice by example and even complain when it (i.e. hand hygiene) features in clinical examinations."*

It is crucial that *all* staff on the wards, but especially other nurses, act as good role models to student nurses. Indeed, if all staff acted as role models by practising appropriate hand hygiene, the behaviour of the critical mass would probably influence an individual's behaviour.

Comparison Between Ratings Of Own Attitudes And That Of Other Nurses And Doctors

Irrespective of year of training, student nurses considered that they valued the importance of hand hygiene practice more than other nurses and doctors they work alongside. There is a considerable margin between self-evaluated attitudinal beliefs and that of other nurses and doctors. Their low opinions of doctors' attitudes towards hand hygiene may reflect a self-serving bias rather than reflect actual behaviour. However, the literature does support the fact that doctors do not wash their hands very often (Tibballs, 1996), and student nurses would probably know this.

This finding reinforces the notion that student nurses are reporting that practice around them is poor, and this appears to be strongly influencing their own attitudes over time and, thus, practice of appropriate hand hygiene. Student nurses appear to be influenced by poor practices they observe as they progress throughout the training and clinical placements, even though when they begin their training they hold quite positive attitudes towards good hand hygiene practices.

The findings reported in Table 25 shed new light on how student nurses' attitudes towards those of other nurses and doctors may be shaped. Student nurses' beliefs about doctors' attitudes towards the importance of hand hygiene decrease over time for both those who consider hand hygiene to be 'very important' and those who 'do not consider hand hygiene to be very important'. The views of those who 'do not consider hand hygiene to be very important' decline most markedly. This suggests that student nurses' initial attitudes as well as the workplace culture both play an important part in the extent to which they continue to value hand hygiene throughout their training. It seems that student nurses begin their training with positive attitudes that are eroded partly as a result of poor role modelling they experience. If their medical seniors do not show good hand hygiene practice, why should they continue to do so?

Powerful psychological processes are likely to be operating here. A well-researched phenomenon in the psychological literature is that of 'false consensus bias' (Marks and Miller, 1987; Alicke and Largo, 1995; Harris et al., 2000). This is the systematic over-estimation of people who believe others have the same view as themselves. It is an alternative explanation for the findings in this study: the student nurses' views about hand hygiene tend to be congruent with their views of significant others, despite the fact that they report their own attitudes to be more positive. It seems unlikely, however, that false consensus bias provides the basis for change: it may help explain these findings but it does not offer help about how to improve hand hygiene.

Specific Practice Issues

When examining the actual value placed on hand hygiene practice for specific procedures some interesting findings emerge. In their first year of training, student nurses believed that handwashing was 'very important' for each of the 11 clinical procedures specified except one, i.e. handwashing *before* putting gloves on. By the third year, the percentage of nurses who thought it 'very important' to wash hands *before* putting on gloves had fallen from 47% in year one to 34%, a significant decline in attitudes. However, irrespective of year, 71% of the nurses thought it 'very important' to wash hands before giving an injection; a procedure for which gloves should be worn. These findings could mean that a large proportion of nurses are not wearing gloves to protect themselves from blood-borne pathogens whilst giving injections, a finding reported in a study by Watson and Myers (2001). The findings may also suggest that most nurses believe that gloves are an impermeable barrier and that handwashing is not necessary if gloves are worn. However, clinical gloves are not impermeable. In one study, up to 84% of polyvinyl chloride and 22% of latex gloves tested had holes in them prior to use (Daschner and Habel, 1988). Therefore, as Larson (1989) states, hands must be washed irrespective of whether gloves are worn.

Considering these views were expressed by first-year students (with second-and third-year students reporting similar values), it would appear that the reasons for the importance of this procedure are not explained to students sufficiently, if at all, during their training and this is clearly an issue which needs to be addressed in the classroom and reinforced in practice.

Gloves may be worn either to protect the healthcare professional from the patient's pathogenic micro-organisms (as in Universal Precautions) or to reduce the risk of transfer of transient micro-organisms on healthcare professionals' hands to the patient (as in aseptic technique) or both, for example, changing a wound dressing. Gloves are bound to become contaminated during any patient care procedure and, as they are not impervious, it is likely that healthcare professionals' hands also become contaminated. It is therefore essential to wash hands *after* removing them yet, irrespective of year, only 64% of nurses thought that this was 'very important.'

It appears that nurses believe that washing their own hands after taking gloves off is more important than washing hands before putting gloves on, suggesting an elevated interest in their own protection against infection. Indeed, this notion is reinforced by the fact that over 90% of the participants thought it 'very important' to wash their hands before going for a meal break, whilst less than two thirds considered it very important to wash their hands before administering medicines to patients. This demonstrates the value they place on protecting themselves from the ingestion of micro-organisms. It seems therefore that nurses think more of protecting their own health than that of their patients. This raises interesting issues around risk and 'self-protection.'

Suggestions For Improving And Maintaining Positive Attitudes To Hand Hygiene

The results strongly support the idea that hand hygiene training needs to be implemented to counteract both the erosion of student nurses' positive attitudes and the poor practices they must observe during their training. Given that student nurses' attitudes had significantly deteriorated by the end of their second year, hand hygiene training will have to be continuously and repeatedly reinforced in clinical settings as well as in the classroom if the prevention of infection is to be enhanced and cross-infection is to be minimised. There are various ways in which this could be done.

Training which demonstrates the effectiveness of handwashing and the importance of their own hand hygiene could be demonstrated through a microbiology laboratory practical exercise. If student nurses see for themselves (rather than just being told) that unwashed hands have real cross-contamination potential, then this might reinforce longer-term attitude and behaviour change to hand hygiene. This may be more effective than the Glitter Bug demonstration conducted in a clinical skills laboratory. These teaching strategies are investigated further in Studies 3, 4 and 5.

A second approach is to influence practice through better role modelling in the clinical settings. This might itself be done in a number of ways. However, this study has shown that students do have a poor view of the hygiene practices of significant others. There would be a need to change these attitudes. Nonetheless, this study has also shown how important the views of other nurses' and doctors' might be in influencing student nurses' attitudes directly. This could be tackled as the means for improvement at a systemic level, but it is equally clear that this is a major training need for the great majority of healthcare professionals.

Summary Of Key Findings

- In their first year of training, student nurses have positive attitudes towards the value of hand hygiene, but these decline as they progress throughout their three-year training programme.
- The strength of their attitudes is related to the extent to which they believe other nurses and doctors value the importance of hand hygiene.
- Student nurses consider that they value the importance of hand hygiene more than other nurses and doctors they work alongside.

Conclusions

The cross-sectional design of this study using three cohorts of students imposes some limitations on the findings. Future research could follow-up a single cohort of students throughout their three-year training. Nevertheless, the study has provided valuable insights into student nurses' attitudes towards hand hygiene. First-year student nurses have generally positive attitudes towards hand hygiene. This suggests that the methods used to teach them about the principles of hand hygiene are effective, save that further educational efforts need to be directed towards teaching all nurses (and doctors) the importance of washing hands before certain procedures: putting gloves on and taking them off and before the administration of medicines.

However, the results also suggest that, with increasing number of clinical placements undertaken, student nurses' attitudes towards the importance of hand hygiene become less positive. The difference is particularly marked by the end of the second year. It would therefore seem wise for educationalists and practitioners to reinforce the principles of hand hygiene before this stage of their training. It is not entirely clear why student nurses' attitudes continue to deteriorate over the course of their three-year training. It may be caused by exposure to other healthcare professionals' poor attitudes towards this simple behaviour but the fact that there is an increasing length of time from the initial training may also play a part. This raises two crucial issues. First, there is a discrepancy between the principles taught during nurse training and the reality of clinical practice. This reflects the 'theory-practice' gap (Rafferty et al., 1996). Secondly, doubt is cast on student nurses' ability to be good role models when they qualify. A vicious cycle is created whereby novices exposed to poor role models in turn become poor role models themselves. There is clearly a need to bring about a cultural change in the clinical setting with regard to the value placed on hand hygiene. According to the TPB, subjective norms should be such that they predict intention to perform a behaviour, but results reported in Study 1 found this not to be the case. This situation needs to be changed.

Chapter 6

Study 3

Healthcare Students' Attitudes Towards Hand Hygiene: The Effect Of A Microbiology Laboratory Practical Educational Intervention

Introduction

Study 1 showed that attitudes are a significant predictor of healthcare professionals' intention to wash their hands. Study 2 showed how student nurses' attitudes towards the importance of hand hygiene decline significantly throughout their three-year training, but especially at the beginning of their second year. Hence, the aim of this study was to determine whether this decline in attitudes could be halted by the administration of a laboratory-based educational intervention.

It was obviously desirable to recruit the participants who were first year students when Study 2 was conducted and who were just entering their second year of the Diploma in Higher Education (Nursing). However, whereas the biosciences curriculum for student nurses studying for a degree includes a microbiology practical session (as detailed later), which they are obliged to attend, the curriculum for diploma students does not. Hence, recruitment of diploma students would require voluntary attendance at the laboratory practical *in their own time.* The likelihood of this happening was not great, so it was decided to conduct a pilot study to determine whether sufficient numbers of students would volunteer for the study. Unfortunately, they did not. Only 16 responded to the invitation to take part in the optional laboratory study that would help the researcher to design further experimental studies. The process of recruiting students to participate in the pilot study is described to highlight some of the inherent problems (Appendix 8).

The effect of the microbiology laboratory practical was therefore tested instead on undergraduate student nurses and paramedic science students who are required to attend a microbiology laboratory practical to enhance the theoretical principles taught in the classroom. This practical exercise formed the basis of the study reported here.

Aim

To determine the effect of an educational intervention on undergraduate healthcare students' attitudes towards the importance of hand hygiene.

Research Questions

1. To what extent does a microbiology laboratory practical impact on student nurses' and paramedic science students' views on the importance of hand hygiene as a means of preventing cross-infection generally and *before* or *after* a range of clinical procedures?

2. Do their attitudes towards the importance of hand hygiene change after the first clinical placement?

3. Do student nurses and paramedic science students hold different views about the importance of hand hygiene?

4. Is gender a factor in explaining differences in attitudes between student nurses and paramedic science students?

Hypothesis

Students' views towards the importance of hand hygiene will improve following the laboratory practical exercise.

Negotiating Access

The co-operation of the Scheme Tutors and the Associate Head of Microbiology was sought. The researcher was granted access to the students at the end of various classes to explain the aim of the study to them. They were told that the aim of the study was to investigate whether different teaching styles impacted upon views around hand hygiene. Students were given the opportunity to ask questions about the study in which they were being invited to participate. The students were given an information sheet to read (Appendix 1) and told that if they were willing to participate in the study, they would be required to sign a consent form immediately prior to performing the microbiology practical exercise (Appendix 2).

Method

Design

Quasi-experimental, longitudinal, self-report, repeated measures.

Participants

Students on the programmes leading to BSc (Hons) with Registered Nurse or BSc (Hons) Paramedic Sciences engage in shared learning for the biosciences module. The microbiology component consists of four lead lectures each lasting one hour and a three-hour microbiology laboratory practical followed by a 30-minute follow-up session two days later. Whilst attendance at these sessions is compulsory, participation in the study was voluntary. However, all those who attended agreed to take part.

There were potentially 116 participants (88 nurses and 28 paramedics). Of these, 84 actually attended the laboratory demonstration (63 nurses and 21 paramedics) and completed the baseline questionnaire (a loss of 32). Of these, 70 (51 nurses and 19 paramedics) attended the follow-up session in the laboratory and completed the first follow-up questionnaire (a further loss of 14). Of these 70, 56 (41 nurses and 15 paramedics) completed the second follow-up questionnaire (a further loss of 14). Hence, those participants who did not complete all three stages of the investigation were removed from the analysis, leaving 56 participants. However, two of these were extreme outliers, leaving a final sample size of 54 (39 nurses and 15 paramedics) (Table 27).

Table 27 Potential and actual samples

		Nurses	Paramedics
Potential sample	116	88	28
Actual sample			
Baseline	84	63	21
1st follow-up	70	51	19
2nd follow-up	54[1]	39	15

Note [1] Two outliers removed

Intervention

The microbiology laboratory practical consisted of a three-hour exercise and a 30-minute follow-up session two days later. Students were given a method sheet to follow (Appendix 9). In order to demonstrate the effectiveness of handwashing, students divided a malt extract plate and a nutrient agar plate into two sectors by drawing a line across the back of the plate and labelled one side 'washed' and the other 'unwashed.' They then made a set of fingerprints from one hand onto the 'unwashed' side of both the malt and nutrient plates. After washing their hands with either chlorhexidine gluconate or soap, they repeated the exercise using the 'washed' side of the plates. Plates were incubated at 30°C. At the follow-up session two days later, numbers and types of colonies were compared and discussed with the demonstrators who moved between groups of students on each bench (see Figure 6). The impediments to effective handwashing of wearing a wrist watch (Hartley et al., 1999) and finger rings (Hoffman et al., 1985) were stressed and the importance of decontaminating hands both before and after wearing gloves stressed.

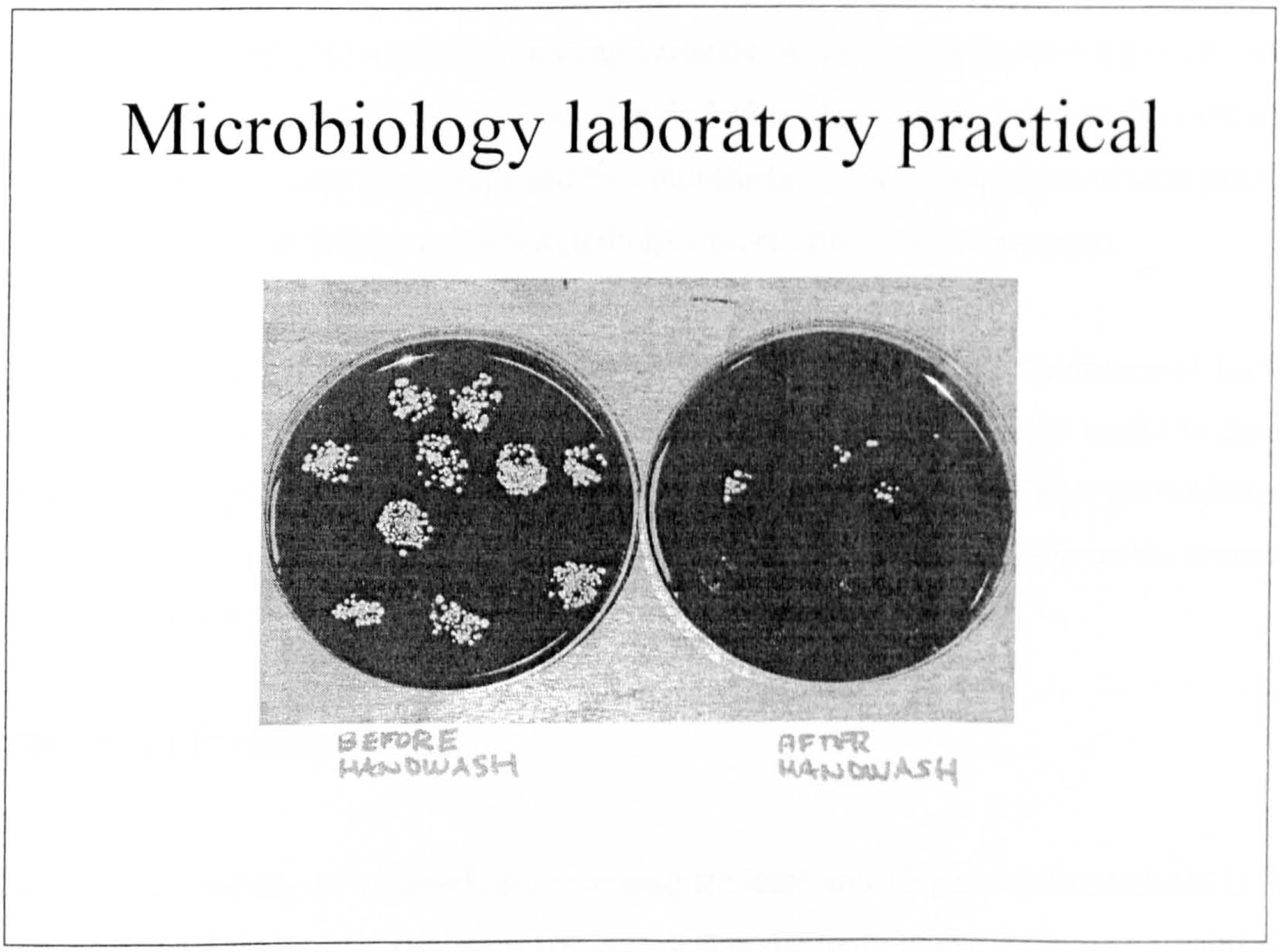

Figure 6 Agar plate showing microbial growth before and after handwashing

Measurement Tool

A 28-item, self-report questionnaire was devised with three sections (Appendix 10). The first section consisted of eight questions which sought views on the value of hand hygiene as a means of preventing cross-infection. They had an overall internal consistency value of 0.7378 (Cronbach's Alpha). For example 'In my view, hand decontamination is one of the most important factors in the prevention of cross-infection 1 = strongly disagree, 9 = strongly agree.' Three of the questions sought views on potential impediments to effective hand hygiene such as wearing a wrist watch (Hartley et al., 1999), finger rings (Hoffman et al., 1985) and gloves (Larson, 1989). For example 'Wearing rings on my fingers prevents adequate hand decontamination 1 = strongly disagree, 9 = strongly agree.' Section two consisted of 10 questions seeking views on the importance of hand hygiene *before* various clinical procedures (Cronbach's Alpha, 0.7803). For example 'I believe that decontaminating my hands before feeding a patient is 1 = not at all important, 9 = very important.' Section three consisted of 10 questions seeking views on the importance of hand hygiene *after* various clinical procedures (Cronbach's Alpha, 0.7710). For example 'I believe that decontaminating my hands after putting a dressing on a wound is 1 = not at all important, 9 = very important.' A nine point differential scale was used with the aim of optimising variance. A high score denoted a positive view.
The questionnaire was distributed immediately before the intervention (baseline score), two days after the practical (first follow-up) and five months later after completion of first year clinical placements (second follow-up) when participants returned to the classroom.

Given that findings from Study 2 showed that attitudes towards the importance of hand hygiene declined after the first clinical placement, it was decided that it would be useful to determine the nature and duration of the clinical placements undertaken by students after participating in the laboratory exercise. They were therefore asked to record this information on the second follow-up questionnaire.

Pilot Study Of Questionnaire

A pilot questionnaire was tested on 12 nursing students and 12 paramedic students in their second year of training. These were not included in the main study. Although a preliminary test on the data showed a ceiling effect, it was decided not to change the scale. Findings suggested that paramedics held slightly lower views towards hand hygiene than nurses did.

Unsolicited written comments from the paramedics included reports that they did not feed patients or remove wound dressings. Several also said that they had to wear a wrist watch. Consideration was given to modifying the questionnaire to take these issues into account, in particular whether to limit these questions to 'nurses only.' However, after consultation with the tutor in charge of the paramedics' course, it was decided not to confine these questions to 'nurses only' as it was considered unwise to discourage individuals from answering. (Analysis later showed that all 15 paramedics included in the study answered all questions).

Several paramedics also reported that hand decontamination was not always necessary as they wore gloves to perform all procedures. Therefore, a new item was constructed (which was included in section one) i.e. 'I believe that wearing gloves is an adequate substitute for decontaminating hands before and after each patient contact.' This question was reverse scored because a high scoring response indicated a poor attitude, i.e. 1 = strongly disagree; 9 = strongly agree.

Data Analysis

Data were analysed by a repeated measures ANOVA with post hoc t tests. Mean total scores are expressed out of a possible 252. Where applicable, mean question scores out of a maximum score of nine are given. For all multiple comparisons, a Bonferroni correction was used (p=0.0167), in order to control for type 1 error.

Results

Overall Effect Of The Intervention On All Participants

Repeated measures Analysis of Variance (ANOVA) showed a significant increase in scores overall $F_{(2,106)} = 24.2$, $p = <.001$. Paired t tests with Bonferroni correction showed a significant increase from baseline to first follow-up, $t_{(53)} = -8.430$, $p = <0.001$(two-tailed), a significant decrease from first follow-up to second follow-up, $t_{(53)} = 4.071$, $p = <0.001$(two-tailed), but no significant increase from baseline to second follow-up $t_{(53)} = -2.255$, $p = <0.028$ (two-tailed). Therefore the improvement in attitudes that had occurred after the laboratory practical was not sustained during the following five months (Figure 7).

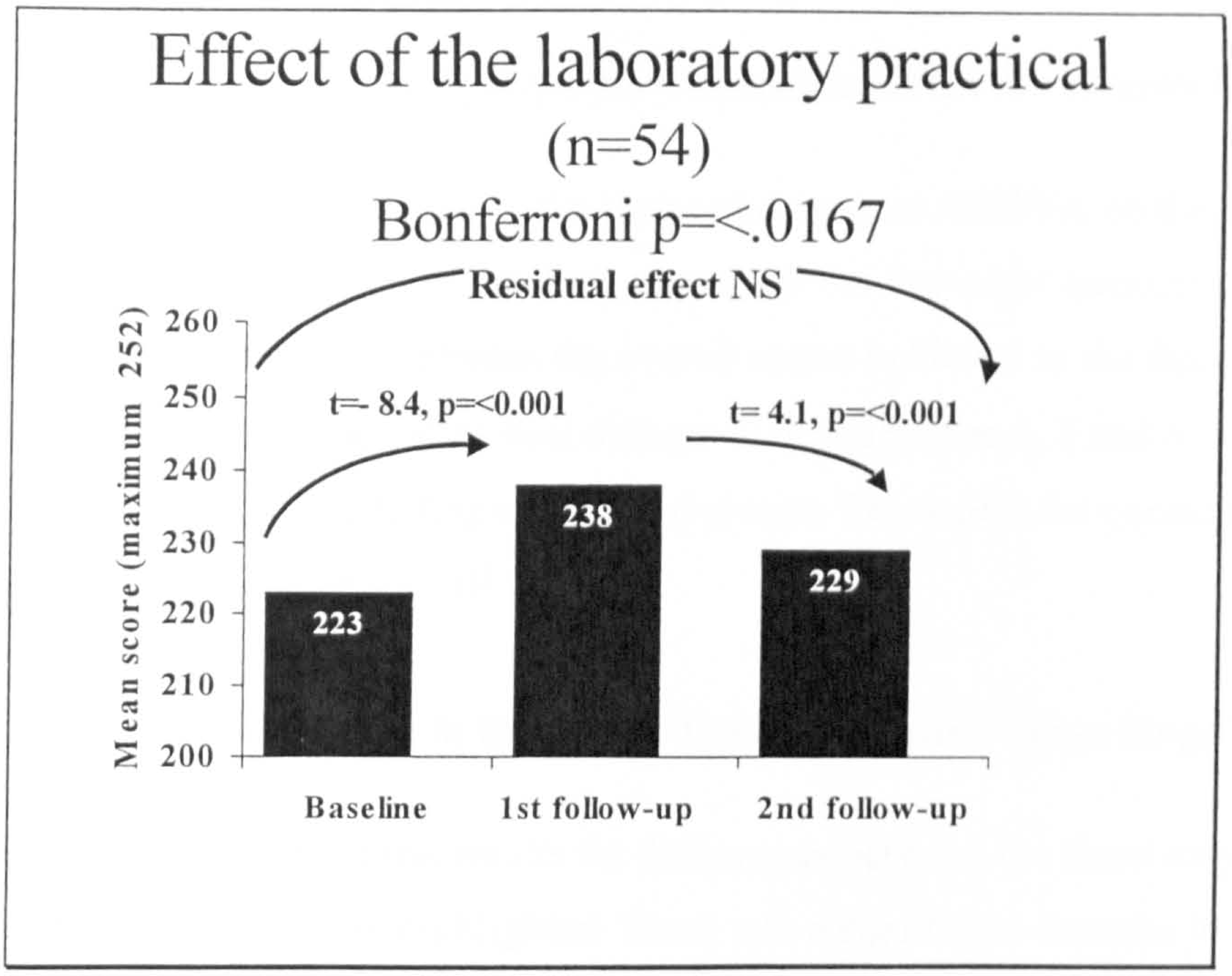

Figure 7 Changes in mean scores after the microbiology laboratory practical and clinical practice and significance levels of differences between them

Views On The Value Of Hand Hygiene As A Means Of Preventing Cross-Infection

Questions 1 To 8: Mean Sum Scores

Figure 8 shows the mean sum scores achieved by all 54 participants in each of the three stages, for the eight questions which focussed on attitudes towards the value of hand hygiene as a means of preventing cross-infection. Details of this set of questions may be found in Table 28, p.102.

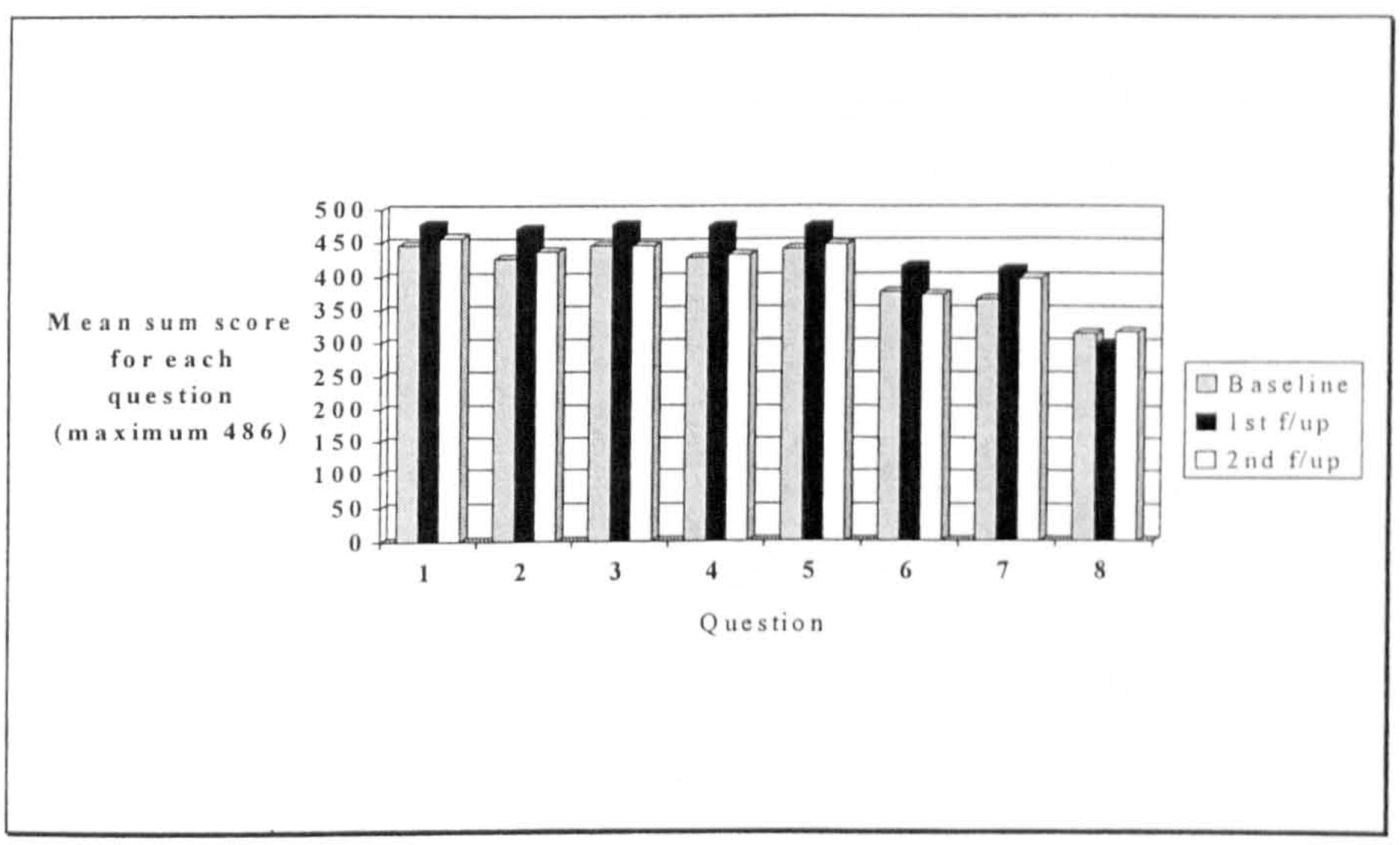

Figure 8 Views on the value of hand hygiene as a means of preventing cross-infection. Mean sum scores for questions 1-8, all three stages.

Questions 1 To 8: Repeated-Measures ANOVA - Overall Effect

Table 28 shows the results of the repeated measures ANOVA on the total scores achieved by all 54 participants in each of the three stages, for the first eight questions. There is a statistically significant difference between the overall scores achieved in the three different stages for questions 1-5, but no significant difference for questions 6, 7 and 8. These sought views on wearing a wrist watch, finger rings and gloves. The scores for question 8, which was reverse-scored, are the lowest of all.

Questions 1 To 8: Effects Of The Intervention From Stage To Stage

Table 29 shows the t test results for differences between the three stages for questions 1 to 8. Significant results are highlighted. There was a significant increase in scores after the laboratory practical for questions 1 to 6, but not for questions 7 or 8. However, there was a significant decrease, at second follow-up, after participants had undertaken clinical placements, for questions 2, 3, 4 and 5. None of the t tests between baseline and second follow-up scores achieve significance. This suggests that the enhancement of attitudes resulting from the laboratory practical was eroded after the first practice placement.

Table 28 Sum of all responses to questions 1 to 8, all participants over the three stages

Views on the importance of hand decontamination	Mean sum scores				
Question	Baseline	1st follow-up	2nd follow-up	Within-subjects F value[1]	η^2
1. Reducing hospital-acquired infections	446	479	458	**$F_{(2,106)} = 7.861$, $p = .001$**	.129
2. Preventing cross-infection	426	472	437	**$F_{(2,106)} = 13.074$, $p = <.001$**	.198
3. I have a significant role to play	446	479	447	**$F_{(2,106)} = 7.134$, $p = .001$**	.119
4. Preventing self-infection	430	476	434	**$F_{(2,106)} = 10.452$, $p = <.001$**	.165
5. Before and after contact with each patient	442	476	449	**$F_{(2,106)} = 6.497$, $p = .002$**	.109
6. Not wearing a wrist watch on duty	378	416	374	$F_{(2,106)} = 2.908$, $p = .059$ NS	.052
7. Removal of finger rings	366	412	398	$F_{(2,106)} = 1.515$, $p = .225$ NS	.029
8. Whether wearing gloves is an adequate substitute for hand hygiene	315	301	318	$F_{(2,106)} = .407$, $p = .667$ NS	.008

Note [1] Repeated-measures ANOVA (one way)

Table 29 t tests showing the differences between the stages for questions 1 to 8

	Stage		
Question	Baseline to 1st follow-up	1st follow-up to 2nd follow-up	Baseline to 2nd follow-up
1. Reducing hospital-acquired infections	**$t_{(53)} = -4.995$, $p = <.001$**	$t_{(53)} = 2.233$, $p = .03$	$t_{(53)} = -1.335$, $p = .188$
2. Preventing cross-infection	**$t_{(53)} = -6.155$, $p = <.001$**	**$t_{(53)} = 3.776$, $p = <.001$**	$t_{(53)} = -.992$, $p = .326$
3. I have a significant role to play	**$t_{(53)} = -4.777$, $p = <.001$**	**$t_{(53)} = 3.093$, $p = .003$**	$t_{(53)} = -.084$, $p = .933$
4. Preventing self-infection	**$t_{(53)} = -5.942$, $p = <.001$**	**$t_{(53)} = 3.5$, $p = .001$**	$t_{(53)} = -.308$, $p = .759$
5. Before and after contact with each patient	**$t_{(53)} = -4.645$, $p = <.001$**	**$t_{(53)} = 2.796$, $p = .007$**	$t_{(53)} = -.570$, $p = .571$
6. Not wearing a wrist watch on duty	**$t_{(53)} = -2.694$, $p = .009$**	$t_{(53)} = 1.885$, $p = .065$	$t_{(53)} = .197$, $p = .845$
7. Removal of finger rings	$t_{(53)} = -2.070$, $p = .044$	$t_{(53)} = .685$, $p = .497$	$t_{(53)} = -1.075$, $p = .287$
8. Whether wearing gloves is an adequate substitute for hand hygiene	$t_{(53)} = .727$, $p = .471$	$t_{(53)} = -.726$, $p = .471$	$t_{(53)} = -.175$, $p = .862$

Note [1] Bonferroni correction for multiple comparisons p= <.0167, in order to control for type 1 error.

Views On The Value Of Hand Hygiene *Before* Procedures

Questions 9 To 18: Mean Sum Scores

Figure 9 shows the mean sum scores achieved by all 54 participants in each of the three stages, for questions 9 to18 which focussed on attitudes towards the importance of hand hygiene *before* performing various procedures. Details of this set of questions may be found in Table 30, p.104.

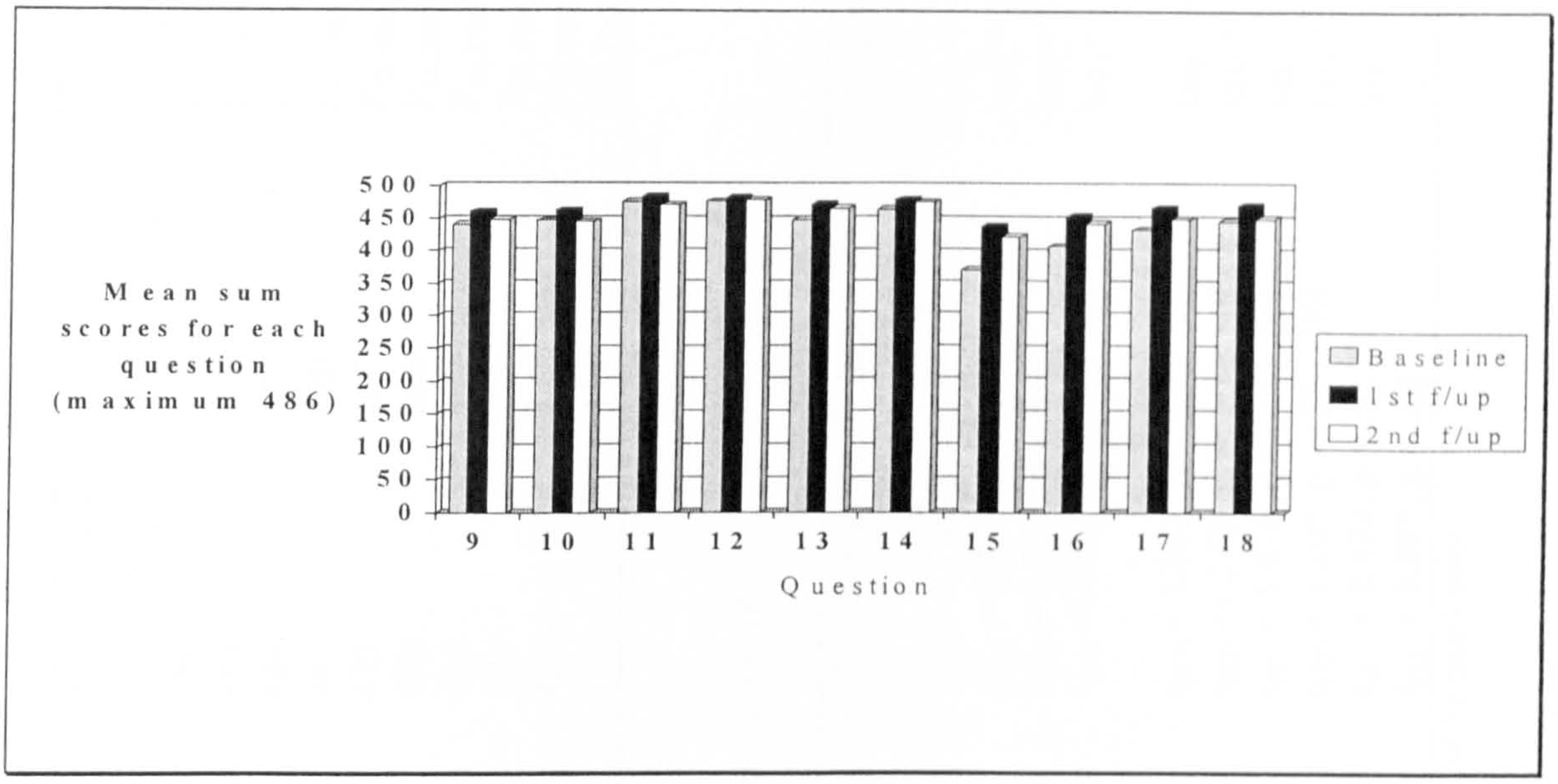

Figure 9 Views on the value of hand hygiene *before* procedures.
Mean sum scores for questions 9 to18, all three stages.

Questions 9 To 18: Repeated-Measures ANOVA - Overall Effect

Table 30 shows the results of the repeated-measures ANOVA on the total scores achieved by all 54 participants in each of the three stages, for questions 9-18. There is a statistically significant difference between the scores achieved in the different stages for all the questions except for question 12 which refers to hand decontamination before 'attending to an immuno-compromised patient.' The results demonstrate that the students are aware of the importance of protecting especially vulnerable patients; the scores increase only very slightly after the laboratory practical and decrease only very slightly after five months in clinical practice. The greatest increase in scores after the intervention occurs in question 15, which concerns decontaminating hands *before* 'putting gloves on.' The students' awareness about the importance of decontaminating hands before putting gloves on increased significantly after the intervention, and although there is a decrease in scores after five months in clinical practice, this was not significant.

Table 30 Sum of all responses to questions 9 to 18, all participants over the three stages

Question	Mean sum score				
Hand hygiene *before* procedures	Baseline	1st follow-up	2nd follow-up	Within-subjects F value[1]	η^2
9. Giving an injection	441	462	449	**$F_{(2,106)} = 3.69$, $p = .028$**	.065
10. Feeding a patient	448	464	446	**$F_{(2,106)} = 3.89$, $p = .023$**	.068
11. Putting a dressing on a wound	477	484	472	**$F_{(2,106)} = 3.82$, $p = .025$**	.067
12. Attending to an immuno-compromised patient	478	483	480	$F_{(2,106)} = .95$, $p = .390$ NS	.018
13. Eating food	449	473	467	**$F_{(2,106)} = 9.13$, $p = <.001$**	.147
14. Caring for an infected patient	465	480	476	**$F_{(2,106)} = 3.98$, $p = .022$**	.070
15. Putting gloves on	372	439	423	**$F_{(2,106)} = 17.25$, $p = <.001$**	.246
16. Coming on duty	408	455	443	**$F_{(2,106)} = 10.04$, $p = <.001$**	.159
17. Administration of oral medicines	434	468	450	**$F_{(2,106)} = 9.80$, $p = <.001$**	.156
18. Contact with each patient	447	472	451	**$F_{(2,106)} = 7.08$, $p = <.001$**	.118

Note [1] Repeated-measures ANOVA (one way)

Table 31 t tests showing the differences between the stages for questions 9 to18

Question Hand hygiene *before* procedures	Baseline to 1st follow-up	1st follow-up to 2nd follow-up	Baseline to 2nd follow-up
9. Giving an injection	**$t_{(53)} = -2.667$, $p = .010$**	$t_{(53)} = 1.788$, $p = .079$ NS	$t_{(53)} = -.970$, $p = .337$ NS
10. Feeding a patient	**$t_{(53)} = -2.530$, $p = .014$**	**$t_{(53)} = 2.574$, $p = .013$**	$t_{(53)} = .256$, $p = .799$ NS
11. Putting a dressing on a wound	$t_{(53)} = -1.630$, $p = .109$ NS	**$t_{(53)} = 2.704$, $p = .009$**	$t_{(53)} = 1.151$, $p = .255$ NS
12. Attending to an immuno-compromised patient	$t_{(53)} = -1.937$, $p = .058$ NS	$t_{(53)} = .772$, $p = .444$ NS	$t_{(53)} = -.468$, $p = .642$ NS
13. Eating food	**$t_{(53)} = -3.612$, $p = .001$**	$t_{(53)} = 1.062$, $p = .293$ NS	**$t_{(53)} = -3.497$, $p = .001$**
14. Caring for an infected patient	$t_{(53)} = 2.385$, $p = .021$ NS	$t_{(53)} = 1.272$, $p = .209$ NS	$t_{(53)} = -1.707$, $p = .094$ NS
15. Putting gloves on	**$t_{(53)} = -6.166$, $p = <.001$**	$t_{(53)} = 1.476$, $p = .146$ NS	**$t_{(53)} = -3.696$, $p = .001$**
16. Coming on duty	**$t_{(53)} = -4.8$, $p = <.001$**	$t_{(53)} = 1.205$, $p = .234$ NS	**$t_{(53)} = -2.756$, $p = .008$**
17. Administration of oral medicines	**$t_{(53)} = -4.832$, $p = <.001$**	**$t_{(53)} = 2.473$, $p = .017$**	$t_{(53)} = -1.852$, $p = .070$ NS
18. Contact with each patient	**$t_{(53)} = 3.388$, $p = .001$**	**$t_{(53)} = 3.107$, $p = .003$**	$t_{(53)} = -.551$, $p = .584$ NS

Note [1] Bonferroni correction for multiple comparisons p= <.0167, in order to control for type 1 error.

Questions 9 To 18: Effects Of The Intervention From Stage To Stage

To determine exactly where the significant effects lay t tests were carried out between the stages (Table 31). There was a significant increase in scores after the laboratory practical *before*: 'giving an injection,' 'feeding a patient,' 'eating food,' 'putting gloves on,' 'coming on duty,' 'giving oral medication' and 'patient contact.' This increase was then eroded after their clinical placements for 'feeding a patient,' 'giving oral medication,' and 'patient contact.' The increase was retained for 'eating food,' 'putting gloves' on and 'coming on duty.'

The laboratory practical had no significant effect on enhancing students' views towards the importance of hand hygiene *before*: 'dressing a wound,' 'caring for an immuno-compromised patient' and 'infected patient;' the students were already aware of the importance of hand hygiene prior to performing these procedures. The increase in scores after the intervention was maintained after five months in clinical practice for only three of the *before* items: 'eating food,' 'putting gloves on' and 'coming on duty.'

The results for 'giving an injection' are anomalous. The scores increased significantly after the intervention (Table 30). They then decreased after clinical practice but this was not a significant decrease ($p = 0.079$) (Table 31). However, the decrease was enough to render the comparison between baseline and second follow-up insignificant, so the increase afforded by the intervention was not maintained at the end of the clinical placement. This finding should be contrasted with the other three items, namely 'eating food,' 'putting gloves on' and 'coming on duty' which also showed a non-significant decrease at first follow-up to second follow-up but still showed a significant residual between baseline and second follow-up (Table 31).

This can be seen more clearly when looking at the total scores for each question at every stage (Table 32). For 'giving an injection' the increase after the intervention is less than for 'eating food,' 'putting gloves on' and 'coming on duty,' but the decrease at second follow-up is high at -13. It can be seen that the residual difference between baseline and second follow-up is very much smaller for 'giving an injection' than for the other three activities, hence the result.

Table 32 Comparison between scores for injection and the three other items that showed a significant increase after the intervention and a non-significant decrease after the clinical placement, yet resulted in different outcomes

Question Hand hygiene *before* procedures	Baseline	1st follow-up	(Increase)	2nd follow-up	(Decrease)	Difference from Baseline to 2nd follow-up (Residual increase)
9. Giving an injection	**441**	**462**	**+21**	**449**	**-13**	**8**
10. Feeding a patient	448	464		446		
11. Putting a dressing on a wound	477	484		472		
12. Attending to an immuno-compromised patient	478	483		480		
13. Eating food	**449**	**473**	**+24**	**467**	**-6**	**18**
14. Caring for an infected patient	465	480		476		
15. Putting gloves on	**372**	**439**	**+67**	**423**	**-16**	**51**
16. Coming on duty	**408**	**455**	**+47**	**443**	**-12**	**35**
17. Administration of oral medicines	434	468		450		
18. Contact with each patient	447	472		451		

Views On The Value Of Hand Hygiene *After* Procedures

Questions 19 To 28: Mean Sum Scores

Figure 10 shows the mean sum scores achieved by all 54 participants in each of the three stages, for questions 19 to 28 which focussed on attitudes towards the importance of hand hygiene *after* performing various procedures. Details of this set of questions may be found in Table 33, p.108.

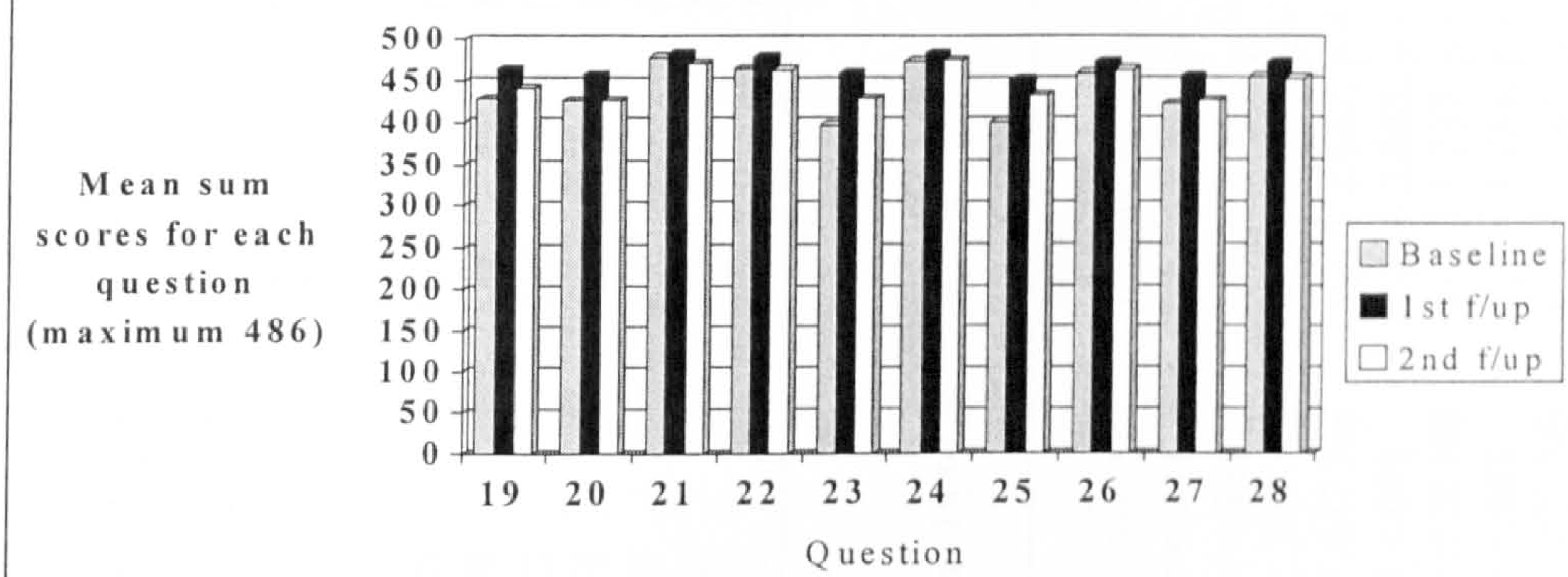

Figure 10 Views on the value of hand hygiene *after* procedures.
Mean sum scores for questions 19 to 28, all three stages.

Questions 19 To 28: Repeated-Measures ANOVA - Overall Effect

Table 33 shows the results of the repeated-measures ANOVA on the total scores achieved by all 54 participants in each of the three stages, for questions 19 to 28. There is a significant difference over the three stages for all the questions except *after*: 'putting a dressing on a wound,' 'attending to an immuno-compromised patient,' 'caring for an infected patient' and 'coming off duty.' Question 21 ('putting a dressing on a wound') just misses achieving significance. This question achieved the highest baseline score out of all the *after* procedures and indicates that the students are well aware of the importance of hand hygiene after this procedure.

Table 33 Sum of all responses to questions 19 to 28, all participants over the three stages

Question	Total score				
Hand hygiene *after* procedures	Baseline	1st follow-up	2nd follow-up	Within-subjects F value[1]	η^2
19. Feeding a patient	429	464	441	**$F_{(2,106)} = 7.734$, $p = .001$**	.127
20. Giving an injection	426	458	426	**$F_{(2,106)} = 8.169$, $p = .001$**	.134
21. Putting a dressing on a wound	478	482	470	$F_{(2,106)} = 3.06$, $p = .051$ NS	.055
22. Attending to an immuno-compromised patient	464	478	463	$F_{(2,106)} = 2.463$, $p = .090$ NS	.044
23. Eating food	396	459	428	**$F_{(2,106)} = 14.124$, $p = <.001$**	.210
24. Caring for an infected patient	474	483	475	$F_{(2,106)} = 2.010$, $p = .139$ NS	.037
25. Taking gloves off	400	451	433	**$F_{(2,106)} = 11.267$, $p = <.001$**	.175
26. Coming off duty	459	473	463	$F_{(2,106)} = 2.635$, $p = .076$ NS	.047
27. Administration of oral medicines	422	456	426	**$F_{(2,106)} = 7.542$, $p = .001$**	.125
28. Contact with each patient	455	472	453	**$F_{(2,106)} = 4.724$, $p = .011$**	.082

Note [1] Repeated-measures ANOVA (one way)

Table 34 t tests showing the differences between the stages for questions 19 to 28

Question	Stage		
Hand hygiene *after* procedures	Baseline to 1st follow-up	1st follow-up to 2nd follow-up	Baseline to 2nd follow-up
19. Feeding a patient	**$t_{(53)} = -4.135$, $p = <.001$**	$t_{(53)} = 2.360$, $p = .022$ NS	$t_{(53)} = -1.352$, $p = .182$ NS
20. Giving an injection	**$t_{(53)} = -4.724$, $p = <.001$**	**$t_{(53)} = 3.218$, $p = .002$**	$t_{(53)} = .000$, $p = 1.000$ NS
21. Putting a dressing on a wound	$t_{(53)} = -1.272$, $p = .209$ NS	$t_{(53)} = 2.000$, $p = .051$ NS	$t_{(53)} = 1.531$, $p = .132$ NS
22. Attending to an immuno-compromised patient	$t_{(53)} = -2.037$, $p = .047$ NS	$t_{(53)} = 2.127$, $p = .038$ NS	$t_{(53)} = .116$, $p = .908$ NS
23. Eating food	**$t_{(53)} = -5.323$, $p = <.001$**	**$t_{(53)} = 2.603$, $p = .012$**	$t_{(53)} = -2.708$, $p = .009$
24. Caring for an infected patient	$t_{(53)} = -2.265$, $p = .028$ NS	$t_{(53)} = 1.737$, $p = .088$ NS	$t_{(53)} = -.168$, $p = .868$ NS
25. Taking gloves off	**$t_{(53)} = -4.319$, $p = <.001$**	$t_{(53)} = 1.783$, $p = .080$ NS	$t_{(53)} = -3.078$, $p = .003$
26. Coming off duty	$t_{(53)} = -2.239$, $p = .029$ NS	$t_{(53)} = 1.747$, $p = .086$ NS	$t_{(53)} = -.586$, $p = .560$ NS
27. Administration of oral medicines	$t_{(53)} = -4.009$, $p <.001$	**$t_{(53)} = 2.952$, $p = .005$**	$t_{(53)} = -.401$, p .690 NS
28. Contact with each patient	**$t_{(53)} = -2.903$, $p = .005$**	**$t_{(53)} = 2.766$, $p = .008$**	$t_{(53)} = .265$, $p = .792$ NS

Note [1] Bonferroni correction for multiple comparisons p=0.0167, in order to control for type 1 error

Questions 19 To 28: Effects Of The Intervention From Stage To Stage

To determine exactly where the significant effects lay t tests were carried out between the stages (Table 34). There was a significant increase in scores after the laboratory practical *after*: 'feeding a patient,' 'giving an injection,' 'eating food,' 'removing gloves,' 'giving oral medication' and 'patient contact.' The increase was eroded after participants' clinical placements for *after*: 'giving an injection,' 'eating food,' 'giving oral medication' and 'patient contact;' and retained for 'feeding a patient' and 'taking gloves off.' There was no significant increase obtained *after*: 'dressing a wound,' 'caring for an immuno-compromised patient,' 'infected patient' and 'coming off duty.' The students were already aware of the importance of hand hygiene for these procedures. However, of the six questions where a significant increase was obtained after the intervention, only 'eating food' and 'taking gloves off' retained a significant difference between baseline and second follow-up.

The scores for question 21 ('putting a dressing on a wound') did not increase significantly after the intervention, although there was an almost significant decrease (to lower than baseline) after five months in clinical practice. The intervention had no significant effect on students' attitudes towards the importance of hand hygiene for 'after contact with an immuno-compromised patient' suggesting that they were already aware of the importance of this. Scores increased slightly after the laboratory practical and, although they fell to base line score, it was still a high score in comparison with the other procedures. Scores for hand hygiene after caring for an infected patient (question 24) show a similar pattern.

Scores regarding views on importance of performing hand hygiene 'after contact with each patient' were high before the laboratory practical and although they were further enhanced by the practical, they decreased after five months in clinical placement.

Differences In Students' Views As To Whether They Consider Hand Hygiene More Important Before Or After A Range Of Clinical Procedures

Table 35 shows the difference in students' attitudes as to whether they consider it is more important to wash hands *before* or *after* the specified clinical procedure. To enhance presentation, the items have been grouped according to the nature of the clinical procedure rather than in the same order as per the questionnaire.

Table 35 Comparison of mean scores for *before* and *after* questions

Questions	Stage	*Before* mean score (Maximum 9)	*After* mean score (Maximum 9)	t test (two-tailed)	
Coming on duty/coming off duty	Baseline	7.56	8.50	$t_{(53)} = -4.757$,	$p = .000$
	1st follow-up	8.43	8.76	$t_{(53)} = -2.342$,	$p = .023$
	2nd follow-up	8.20	8.57	$t_{(53)} = -2.682$,	$p = .010$
Eating food	Baseline	8.31	7.33	$t_{(53)} = 4.774$,	$p = .000$
	1st follow-up	8.76	8.50	$t_{(53)} = 2.517$,	$p = .015$
	2nd follow-up	8.65	7.93	$t_{(53)} = 3.606$,	$p = .001$
Feeding a patient	Baseline	8.3	7.94	$t_{(53)} = 1.918$,	$p = .061$
	1st follow-up	8.59	8.59	$t_{(53)} = .000$,	$p = 1.000$
	2nd follow-up	8.26	8.17	$t_{(53)} = .798$,	$p = .428$
Administration of oral medications	Baseline	8.04	7.81	$t_{(53)} = 1.766$,	$p = .083$
	1st follow-up	8.67	8.44	$t_{(53)} = 1.946$,	$p = .057$
	2nd follow-up	8.33	7.89	$t_{(53)} = 2.410$,	$p = .019$
Contact with each patient	Baseline	8.28	8.43	$t_{(53)} = -1.659$,	$p = .103$
	1st follow-up	8.74	8.74	$t_{(53)} = .000$,	$p = 1.000$
	2nd follow-up	8.35	8.39	$t_{(53)} = -.275$,	$p = .784$
Attending to an immuno-compromised patient	Baseline	8.85	8.59	$t_{(53)} = 2.037$,	$p = .047$
	1st follow-up	8.94	8.85	$t_{(53)} = .2451$,	$p = .229$
	2nd follow-up	8.89	8.57	$t_{(53)} = 3.203$,	$p = .002$
Caring for an infected patient	Baseline	8.61	8.78	$t_{(53)} = -1.267$,	$p = .211$
	1st follow-up	8.89	8.94	$t_{(53)} = -1.352$,	$p = .182$
	2nd follow-up	8.81	8.80	$t_{(53)} = .184$,	$p = .855$
Putting a dressing on a wound	Baseline	8.83	8.85	$t_{(53)} = -.207$,	$p = .837$
	1st follow-up	8.96	8.93	$t_{(53)} = 1.000$,	$p = .322$
	2nd follow-up	8.74	8.70	$t_{(53)} = .340$,	$p = .735$
Giving an injection	Baseline	8.17	7.89	$t_{(53)} = 1.846$,	$p = .071$
	1st follow-up	8.56	8.48	$t_{(53)} = .851$,	$p = .399$
	2nd follow-up	8.31	7.89	$t_{(53)} = 2.020$,	$p = .048$
Putting gloves on/taking gloves off	Baseline	6.89	7.41	$t_{(53)} = -2.349$,	$p = .023$
	1st follow-up	8.13	8.35	$t_{(53)} = -1.570$,	$p = .122$
	2nd follow-up	7.83	8.02	$t_{(53)} = -1.166$,	$p = .249$

Coming On And Off Duty

Students thought it was more important to wash hands after coming off duty as opposed to before starting a shift. All comparisons are significant.

Eating Food

Students thought it was more important to wash their hands *before* rather than *after* eating food. All comparisons are significant.

Feeding A Patient

There was no significant difference in the levels of importance of hand hygiene attached to *before* or *after* feeding a patient.

Administering Oral Medications

Students thought it was more important to wash their hands *before* rather than *after* administering oral medications. Scores were always higher for the *before* condition but were significant only at second follow-up.

Contact With Each Patient

Students thought that hand hygiene was equally important *before* and *after* having contact with each patient. Scores were the same, or higher, for the *after* condition but no comparisons were significant.

Attending To An Immuno-Compromised Patient

The mean score indicates that students considered hand hygiene was more important *before* attending to an immuno-compromised patient than *after*. The difference was significant at baseline and second follow-up.

Caring For An Infected Patient

Students thought that hand hygiene was equally important *before* and *after* attending to an infected patient.

Dressing A Wound

Students thought that hand hygiene was equally important *before* and *after* dressing a wound.

Giving An Injection

Students thought it was more important to wash their hands *before* rather than *after* giving an injection. However, the difference is only significant at second follow-up.

Putting Gloves On And Taking Them Off

Students thought that hand hygiene was more important *after* removing gloves than *before* putting them on. However, there was only a significant difference in the scores at baseline.

Effect Of Occupation

A repeated-measures ANOVA with status (nurses and paramedics) as the between-groups factor and the three stages as the within-groups factor showed a significant difference between nurses' and paramedics' mean scores for all questions: $F_{(1,52)} = 5.2$, $p =.027$. There was also a significant quadratic interaction between status and stage (F=8.63, df = 1, p=0.005). In order to pinpoint where the significant differences occurred, ANOVAs were carried out at each of the three stages. There was a significant difference between nurses' and paramedics' scores at baseline: $F_{(1,52)} = 4.03$, $p = .050$ and at the second follow-up: $F_{(1,52)} = 7.82$, $p = .007$ although comparison after the laboratory practical (first follow-up) showed no significant difference between them (Table 36).

Table 36 Differences between nurses' and paramedics' mean scores at each stage

Stage	Mean Scores				Results of ANOVA for the paired comparison
	Nurses	SD	Paramedics	SD	
Baseline	226	13.89	217.1	16.64	$F_{(1,52)} = 4.031$, $p = .050$
1st follow-up	238.8	13.24	236.9	11.53	$F_{(1,52)} = .229$, $p = .634$
2nd follow-up	233.1	17.46	217.3	21.33	$F_{(1,52)} = 7.825$, $p = .007$

Therefore, although the scores were similar *before* their clinical placements, the paramedics' views on the importance of hand hygiene declined more than the nurses' *after* their clinical placements.

Further analysis considered nurses and paramedics separately at each stage of the investigation, baseline, first follow-up and second follow-up.

Nurses

Nurses' mean baseline score was 226. This increased to 238.8 at first follow-up showing a significant enhancement of views towards the importance of hand hygiene after the intervention. However, at the second follow-up, after five to six months in clinical practice, they had a mean score of 233.1. While their scores had declined, they were still significantly higher than at baseline, $t_{(38)} = -2.9$, $p = .006$ (Table 37).

Table 37 Changes in nurses' scores between all stages (Within-group, repeated measures) effects for nurses

Paired Comparisons	Results of the t test
Baseline and 1st follow-up	$t_{(38)} = -8.037$, $p = <.001$
1st follow-up and 2nd follow-up	$t_{(38)} = 2.226$, $p = .032$
Baseline and 2nd follow-up	$t_{(38)} = -2.905$, $p = .006$

Therefore, the effect of the laboratory practical was still apparent after their first clinical placement (Figure 11).

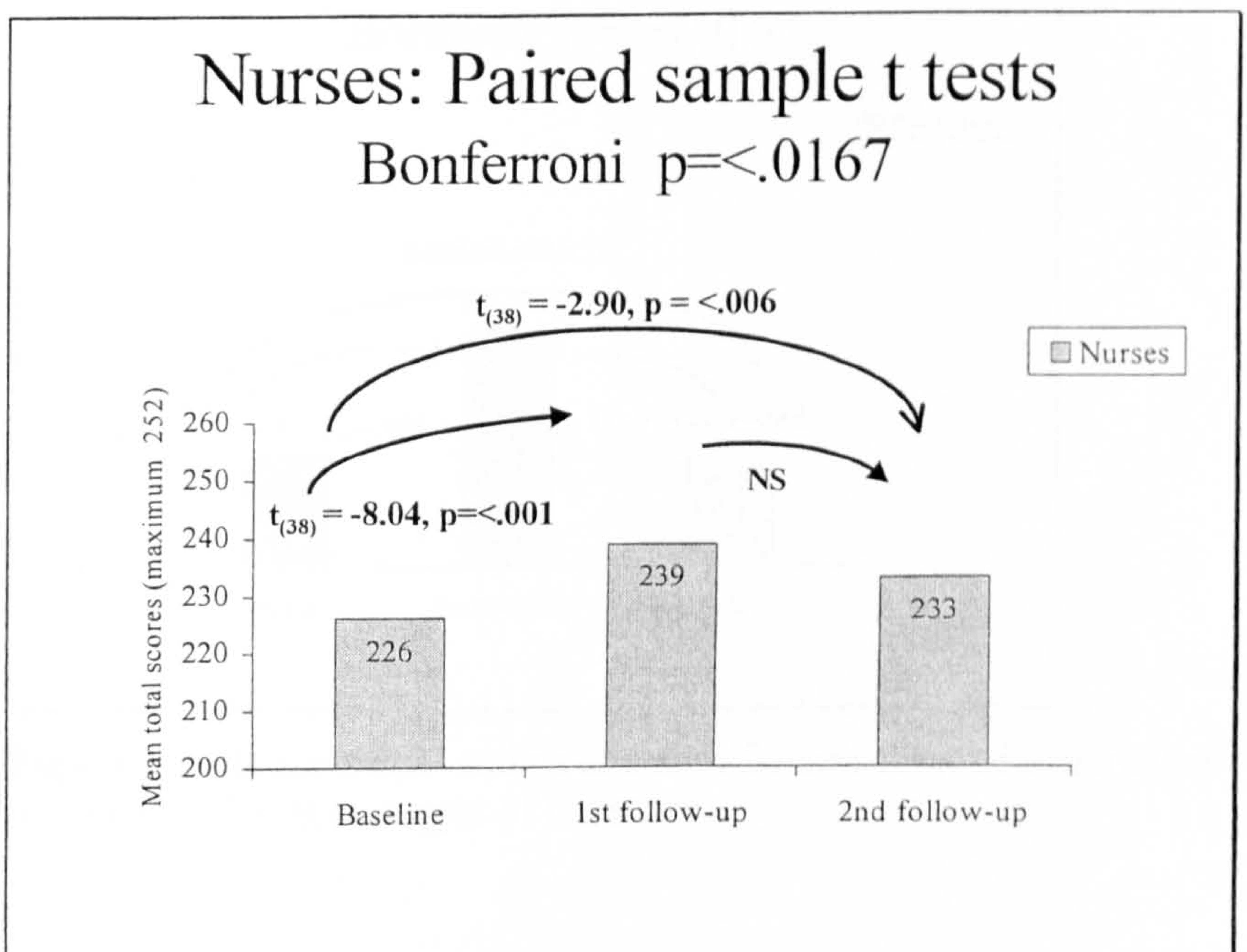

Figure 11 Nurses' scores and significance level of differences in scores at the three stages of the study

Paramedics

Paramedics' mean baseline score was 217.1. This increased to 236.9 after the laboratory practical showing a significant enhancement of views. However, after five to six months clinical experience the score had dropped to 217.3 showing a significant decrease which was almost back to baseline level (Table 38). Even after applying the Bonferroni correction the results are still significant. Therefore, the effect of the intervention was completely lost by the time the paramedics had finished their first placement (Figure 12).

Table 38 Changes in paramedics' scores between all stages (Within-group, repeated measures)

Paired Comparisons	Results of the t test
Baseline and 1st follow-up	$t_{(14)} = -4.309$ $p = .001$
1st follow-up and 2nd follow-up	$t_{(14)} = 4.490$ $p = .001$
Baseline and 2nd follow-up	$t_{(14)} = -.050$ $p = .961$

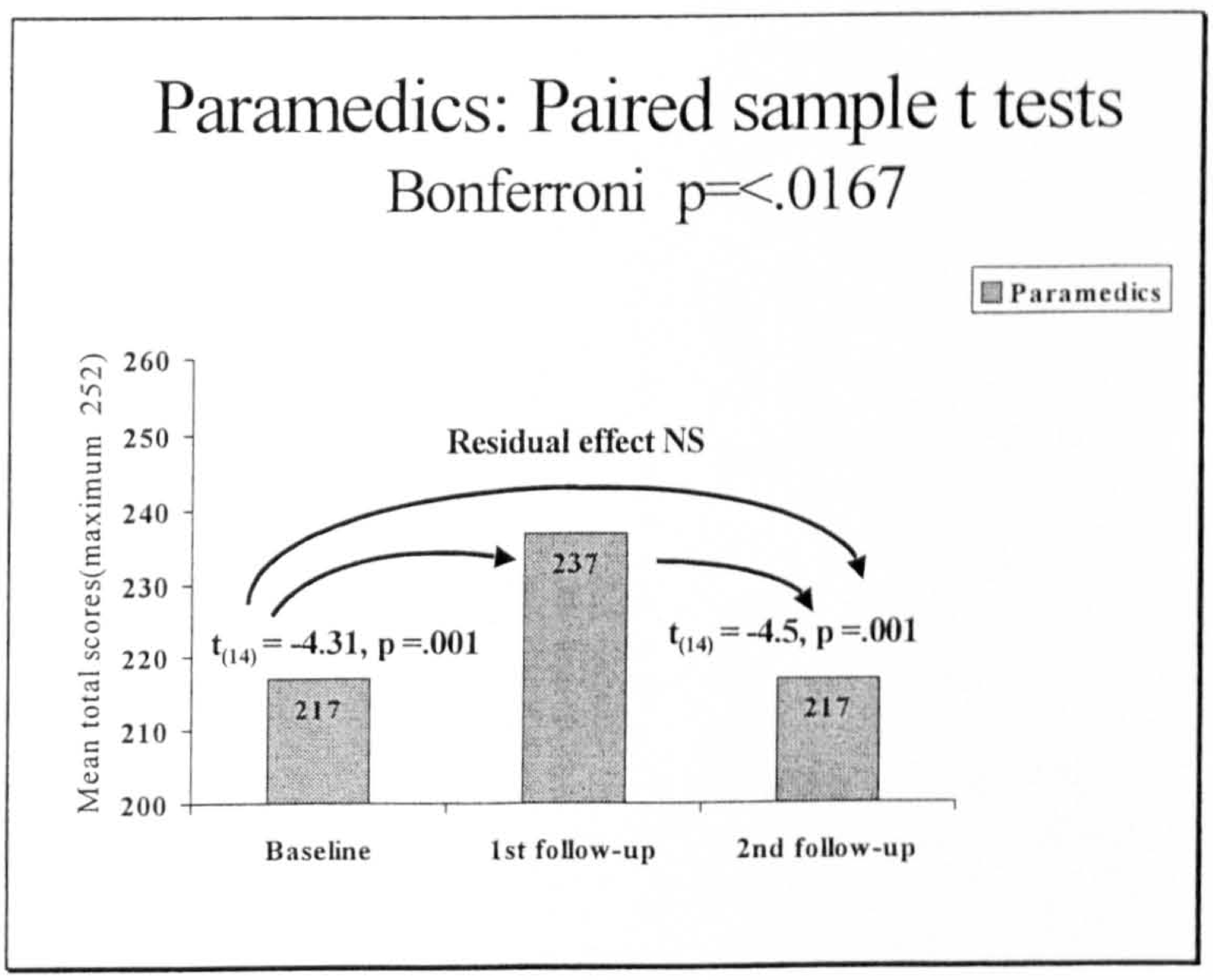

Figure 12 Paramedics' scores and significance level of differences in scores at the three stages of the study

Differences In Responses Between Nurses And Paramedics

There was a significant difference between nurses' and paramedics' responses at various stages for 13 questions (Table 39). However, as Table 40 shows, there were only significant differences overall for the following five items: 'not wearing a wrist watch whilst on duty,' $F_{(1,52)} = 39.15$, df = 1, p = .000; the importance of hand hygiene before: 'feeding a patient,' $F_{(1,52)} = 4.92$, df = 1, p = .031, 'putting a dressing on a wound,' $F_{(1,52)} = 16.58$, df = 1, p = .000 and 'caring for an immuno-compromised patient,' $F_{(1,52)} = 8.26$, df = 1, p = .006; 'after eating food,' $F_{(1,52)} = 4.19$, df = 1, p=.046.

Table 39 Nurses' and paramedics' mean scores and ANOVAs for each individual question; significant values only

Question	Baseline				1st follow-up				2nd follow-up			
	Mean scores				Mean scores				Mean scores			
	Nurses	Paramedics	ANOVA	η^2	Nurses	Paramedics	ANOVA	η^2	Nurses	Paramedics	ANOVA	η^2
6. Watch	7.8205	4.8667	**F=22.8,p =.000**	.305	8.1538	6.5333	**F=6.19,p=.016**	**.106**	8.0256	4.0667	**F=38.74,p=.000**	**.427**
9. Before injection	8.2308	8.000	F=.371,p=.545	.007	8.5128	8.6667	F=.36,p=.551	.007	8.5128	7.8000	**F=5.49, p=.023**	**.095**
10. Before feeding	8.4359	7.9333	F=3.06,p=.086	.056	8.6154	8.5333	F=.12,p=.728	.002	8.5128	7.6000	**F=8.8,p=.005**	**.145**
11. Before wound	8.9487	8.5333	**F=5.51,p=.023**	**.096**	8.9744	8.9333	F=.49,p=.484	.009	8.9744	8.1333	**F=27.1,p=.000**	**.343**
12. Before immuno	8.9231	8.6667	F=3.67,p=.061	.066	8.9744	8.8667	F=1.39,p=.244	.026	8.9744	8.6667	**F=6.42, p=.014**	**.110**
15. Before gloves	7.2308	6.000	**F=6.23,p=.016**	**.107**	8.1282	8.1333	F=.00,p=.988	.000	7.9487	7.5333	F=1.02,p=.318	.019
16. Before duty	7.7436	7.0667	F=1.95,p=.169	.036	8.4103	8.4667	F=.02,p=.879	.000	8.4615	7.5333	**F=6.99, p=.011**	**.119**
17. Before oral med	8.1282	7.8000	F=.81,p=.372	.015	8.6410	8.7333	F=.16,p=.690	.003	8.5128	7.8667	**F=5.41, p=.024**	**.094**
18. Before contact	8.2821	8.2667	F=.003,p=.957	.000	8.8205	8.8000	F=.017,p=.897	.000	8.5385	7.8667	**F=5.76,p=.034**	**.084**
22. After immuno	8.5641	8.6667	F=.18,p=.673	.003	8.8718	8.8000	F=.23,p=.635	.004	8.7179	8.2000	**F=4.16, p=.046**	**.074**
23. After eating	7.7179	6.3333	**F=9.54,p=.003**	**.155**	8.5385	8.4000	F=.25,p=.62	.005	8.0000	7.7333	F=.35,p=.557	.007
25. After gloves	7.7436	6.5333	**F=7.99,p=.007**	**.133**	8.2308	8.6667	F=2.13,p=.150	.039	7.9744	8.1333	F=.16,p=.687	.003
26. After duty	8.5897	8.2667	F=1.62,p=.209	.030	8.7436	8.8000	F=.11,p=.738	.002	8.7179	8.2000	F=3.95, p=.052	.071

df =1,52 in each case

Table 40 Questions where there are significant differences between nurses' and paramedics' scores

Question	Mean Scores		η^2 [1]	Mean Scores		η^2 [1]	Mean Scores		η^2 [1]
	Baseline			1st follow-up			2nd follow-up		
	Nurses	Paramedics		Nurses	Paramedics		Nurses	Paramedics	
Not wearing a watch	7.82	4.87	.305	8.15	6.53	.106	8.03	4.07	.427
Before feeding a patient	8.44	7.93	.056	8.61	8.53	.002	8.51	7.60	.145
Before putting on a wound dressing	8.95	8.53	.096	8.97	8.93	.009	8.97	8.13	.343
Before caring for an immuno-compromised patient	8.92	8.67	.066	8.97	8.87	.026	8.97	8.67	.110
After eating	7.72	6.33	.155	8.54	8.40	.005	8.00	7.73	.007

Note [1] Effect size is η^2 squared using ANOVA. Values of .01, .06. and .14 represent small medium and large effect sizes respectively. df = 1,52 in each case.

Clinical Placements

Nurses

Figure 13 shows the different types of clinical experience that the nurses had had in between the first and second follow-up measurements. They all did more than one clinical placement; one did two, 36 did three, one did four, one did five. The length of time of the practice placements ranged from eight to 17 weeks and the mode was 12 weeks.

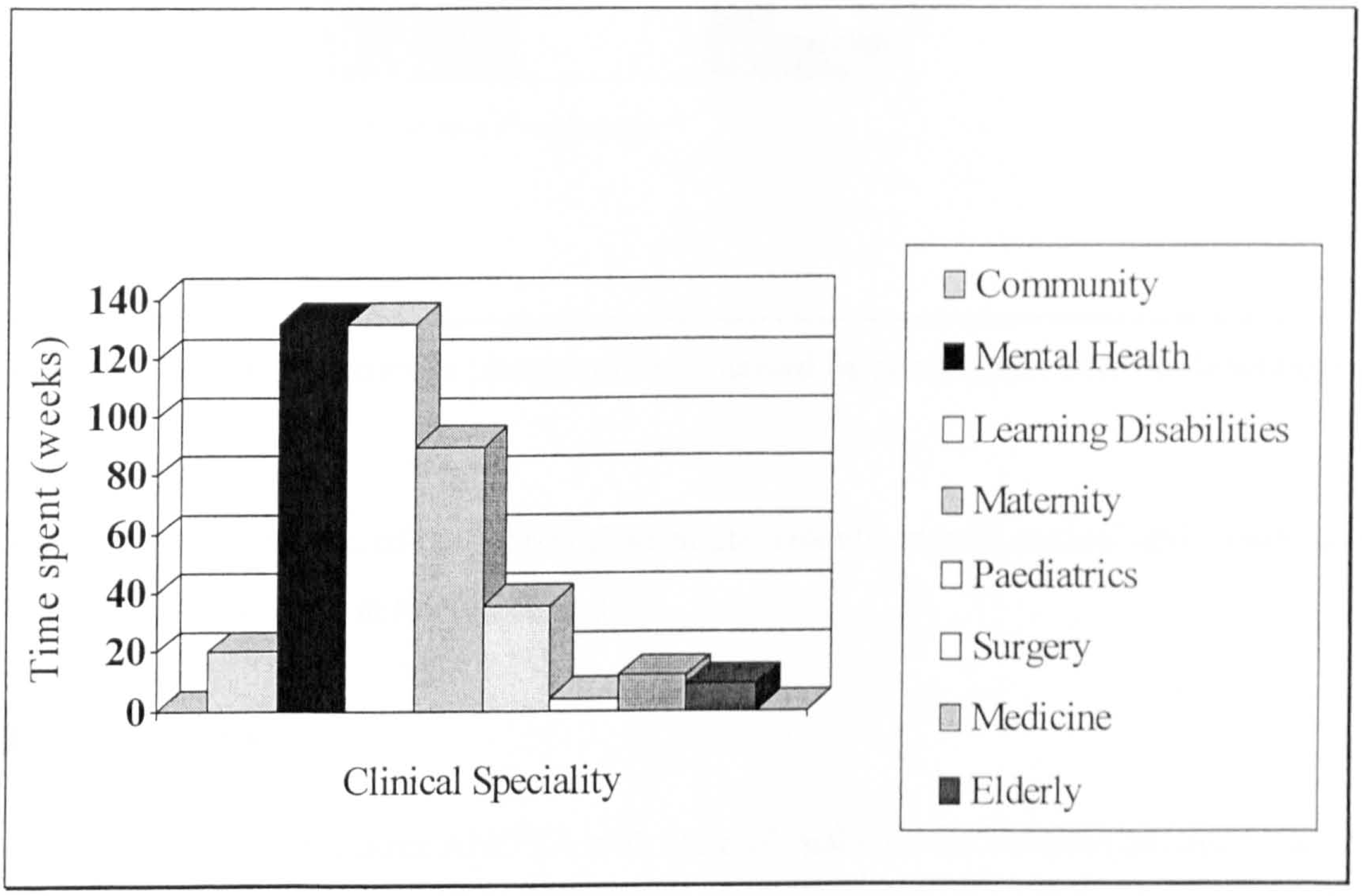

Figure 13 Types of practice placement experienced by nurses after the laboratory practical

Paramedics

Figure 14 shows the different types of clinical experience that the paramedics had had in between the first and second follow-up measurements.

Of the 15 paramedics, seven undertook both the technician course which is solely classroom-based and a period of operational training at the ambulance station, whilst eight did only the operational training at the ambulance station.

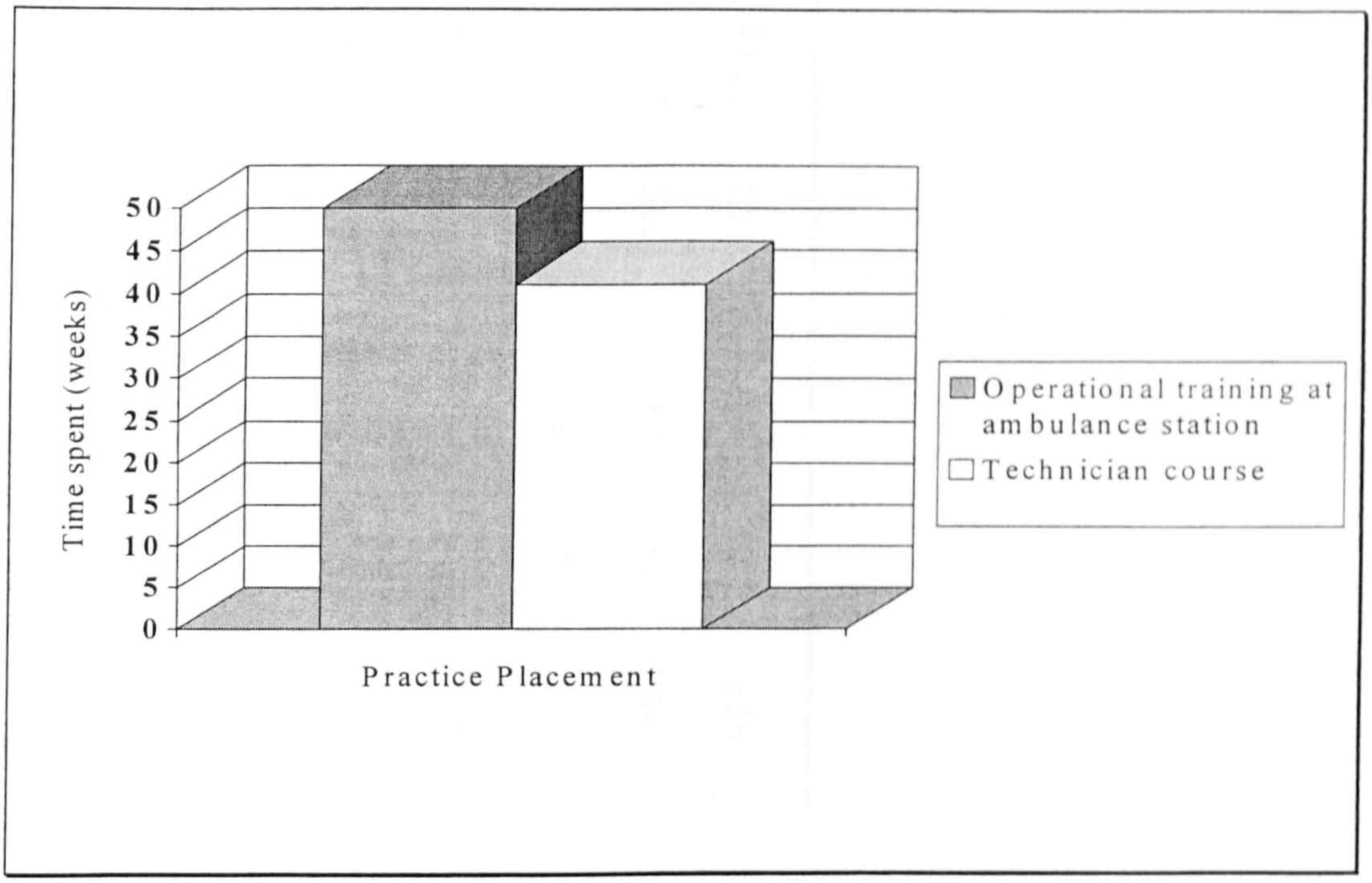

Figure 14 Types of practice placement experienced by paramedics after the laboratory practical

The potential relevance of the type of clinical placements on both nurses' and paramedics' attitudes is considered in the discussion.

Effect Of Gender

A 2-way repeated-measures ANOVA with males/females as the between-groups factor and the three stages as the within-subjects factor shows a significant effect of gender over the three stages, $F_{(1,52)} = 4.405$, $p = .041$. Females ($n = 48$) scored higher than males ($n = 6$) at all times, but post hoc tests indicated this arose mainly at second follow up, $F_{(1,52)} = 5.2$, $p = .026$ (Table 41). The significant difference between males and females at second follow-up appears to be due to the unusually low score by male paramedics. These data should be interpreted with caution given the low number of men in the sample.

The ANOVA also shows a significant within-subjects difference in the scores over the three trials: $F_{(2,104)} = 10.421$ $p = < .001$, $\eta^2 = .167$.

Table 41 Effect of gender

Stage	Mean overall scores for males	Mean overall scores for females	F value	η^2	Nurses		Paramedics	
					Male n = 1	Female n = 38	Male n= 5	Female n = 10
Baseline	217.5	224.3	$F_{(1,52)} = 1.080, p = .303$	.02	238	225.7	213.4	218.9
1st follow-up	229.8	239.3	$F_{(1,52)} = 3.095, p = .084$	.056	244	238.7	227	241.9
2nd follow-up	212	230.8	$F_{(1,52)} = 5.241$, **$p = .026$**	.092	243	232.9	205.8	223.1
Overall	219.8	231.5	$F_{(1,52)} = 4.405$, **$p = .041$**	.078	241.7	232.4	215.4	230.6

Discussion

The microbiology laboratory practical was successful in enhancing attitudes of both student nurses and paramedics as shown by the significant increase in baseline scores at first follow-up. The practical is very resource-intensive both in terms of the laboratory equipment that has to be provided and the staff, both academic and technical, so it was important to show its efficacy. This is believed to be the first time that the value of this method of teaching has been demonstrated in this way. It is also believed that this is the first study to explore paramedics' attitudes towards hand hygiene as no other such studies could be found in the literature. Given that the laboratory practical is the only session where the effectiveness of hand hygiene is demonstrated and its role in the prevention of cross-infection emphasised, it is a matter of concern that so many students failed to attend the laboratory practical and follow-up session (Table 27).

One of the key findings of this study is that there was no difference in the value students attached to the importance of hand hygiene 'before and after contact with each patient.' This suggests that the students subscribe to the recommendations of official guidelines which state that "*hands should be washed before and after contact with each patient.*" (UK Health Departments, 1998, p.9). Whether or not they actually do this is another matter and observation of practice, as reported in Study 8, shows that this is not the case. These guidelines also extol the need to wash hands before putting on and removing gloves. The results of this study show that students' appreciation of the need to wash hands after taking gloves off is greater than the need to wash them before putting gloves on. This misapprehension clearly needs to be rectified.

The low scores for question 8 ('I believe that wearing gloves is an adequate substitute for decontaminating hands before and after each patient contact'), which fell even further *after* the laboratory practical (Table 28), may be due to the layout of the question which was reverse-scored. On the other hand, the scores may demonstrate the misconception among students that wearing gloves is an adequate substitute for decontaminating hands. However, as Larson (1989) states, hands must be washed irrespective of whether gloves are worn.

The comparisons of mean scores for *before* and *after* questions (Table 35) show that students think it more important to wash hands *before* rather than *after*: 'eating food,' 'feeding a patient' and 'giving oral medicines.' This result reflects a common-sense view as the main aim of hand hygiene in these circumstances is to prevent the spread of organisms via the faecal-oral route.

Students thought it more important to wash hands '*after* coming off duty' as opposed to '*before* going on duty.' Given that they will be attending to patients as soon as they set foot on the ward, it could be argued that there should be no difference in the amount of importance attached to these situations. Perhaps students do not appreciate the cross-infection risk that their own flora poses to patients.

Table 31 shows that the laboratory practical enhanced attitudes towards the importance of hand hygiene *before* all procedures measured *except*: 'dressing a wound,' 'attending to an immuno-compromised patient' and 'caring for an infected patient.' The high scores at baseline indicate that the students were already aware of the importance of hand hygiene for these procedures.

Nurses' and paramedics' scores differed significantly for five questions (Table 40). With regard to the importance of hand hygiene 'before feeding a patient,' one possible explanation as to why nurses' scores stayed high, but paramedics' scores decreased after clinical practice may be because paramedics rarely, if ever, feed patients.

A similar picture emerged regarding the importance of hand hygiene 'before caring for an immuno-compromised patient.' Paramedics' scores for this item reverted to baseline at second follow-up; this may be due to the fact that the vulnerability of these patients to infection was not highlighted during the clinical training period.

Whilst nurses recognised that it was important not to wear a wrist watch whilst on duty, paramedics did not. There is a significant difference between them at every stage. It appears that rather than considering whether or not wearing a wrist watch impedes proper hand disinfection, paramedics simply stated that they *had* to wear a wrist watch. Given that nurses wear a fob watch instead of a wrist watch, perhaps paramedics could do likewise. They would then be able to use the correct technique to decontaminate their hands with an alcohol hand rub.
In contrast, there was no significant difference between the responses of nurses and paramedics to the question regarding the importance of not wearing finger rings whilst on duty. The information given during the laboratory practical about Gram negative organisms being harboured under rings (Hoffman et al., 1985) clearly had a positive impact on attitudes much of

which lasted throughout the first clinical placement (Table 28). Indeed, the enhancement of attitudes has been retained better for this question (question 7) than for any other in this section.

Unfortunately, like so many other educational interventions that have been tried with the aim of enhancing attitudes towards or knowledge about this fundamental behaviour (Dubbert et al., 1990; Conly et al., 1989) the effect of the laboratory practical was short-lived. Attitude scores measured at second follow-up, five to six months later after their first clinical placement, showed that paramedics' scores had reverted almost to baseline; virtually all of the increase that had occurred following the microbiology laboratory practical had been lost. Nurses' attitudes had also declined, although not significantly so.

The erosion of positive attitudes towards the importance of hand hygiene during the first experience of clinical practice mirrors one of the findings reported in Study 2. There are two possible explanations for this. Firstly, the majority of students were working in non-clinical areas for much or all of the duration of their first placement so there were few, if any clinical indications for hand hygiene. This was particularly the case for the paramedics most of whom spent a number of weeks on a training course which was classroom, as opposed to clinically based (Figure14). Similarly, a considerable number of the student nurses were working in mental health or learning disabilities settings (Figure 13) where the need for hand hygiene would not be as frequent as in an acute clinical setting, e.g. maternity.

The second explanation for the decline in attitudes may be that the students who were caring for patients were working alongside other healthcare professionals whose hand hygiene practice was lax. If students are witnessing poor practice on a regular basis, their attitudes regarding its importance are likely to be adversely affected. In both cases, there would not have been positive reinforcement of the lessons learnt from the practical.

The absence of a control group might be seen as a limitation of this study but it was not ethical to deprive some students of the laboratory practical component of the biosciences module which was a compulsory element of the course. However, in the curriculum changes that came about in response to national directives (DOH, 1999a,b; UKCC, 1999), this practical has since been removed from the biosciences module at the university where the study was conducted.

Hence, the following year there was an opportunity to enhance the validity of this study by recruiting a control group who had not done the microbiology laboratory practical. The findings of this study are reported next, in Study 4.

Conclusions

This study demonstrates that both nurses' and paramedics' attitudes towards hand hygiene can be significantly improved by a laboratory-based practical demonstration. However, the effectiveness of this method of teaching is quickly eroded by students' experience in clinical practice. The short-lived effect of the practical should not be used as a reason for abandoning this method of teaching. Indeed, the findings of this study may be used to support an argument for its re-instatement. Rather, attention should be focused on addressing how to reinforce the lessons learnt in the practical whilst the students are working in clinical practice. A culture of 'clean hands' needs to prevail in every clinical practice setting.

Chapter 7

Study 4

Healthcare Students' Attitudes Towards Hand Hygiene: The Effect Of Removing A Microbiology Laboratory Practical From The Curriculum

Introduction

As shown in Study 3, students' attitudes towards the importance of hand hygiene were enhanced by participation in a microbiology laboratory practical which was a compulsory part of the undergraduate curriculum. At the time, a control group could not be recruited owing to ethical considerations. However, the year after the aforementioned study was completed, the curriculum for the undergraduate nursing programmes was changed in line with national policy (DOH, 1999 a,b; UKCC, 1999). The Common Foundation Programme was shortened and one change to the biosciences module resulted in the microbiology laboratory practical being discontinued (although, for nurses, this was later replaced with a different type of practical demonstration in the clinical skills laboratory which is the focus of Study 5). This fortuitously presented an opportunity to enhance the validity of Study 3 by recruiting a control group who had not done the microbiology laboratory practical.

Aim

To determine whether there is a difference in attitudes towards the importance of hand hygiene between nurses and paramedic science students who participate in a microbiology laboratory practical exercise (experimental group, Cohort 2000) and those who do not (control group, Cohort 2001).

Hypothesis

Students who have participated in a microbiology laboratory practical exercise (experimental group) will have significantly higher scores towards the importance of hand hygiene than those who have not (control group).

Method

Design

Quasi-experimental, longitudinal, self-report, repeated measures.

Participants – Control Group

There was a potential sample of 97, first-year undergraduates in Cohort 2001 (nurses n =66 and paramedics n = 31). Of these, a total of 66 (nurses n = 42; female n = 38, male n = 4 and paramedic sciences students n = 24; female n = 9, male n = 15) were recruited to the study.

One student declined to take part in the study; the remaining 30 were not present in class when the baseline and follow-up questionnaires were administered. All participants were half way through their first year and had not yet undertaken any clinical placements.

Measurement Tool

This was the same 28-item self-report questionnaire that was used for the experimental group in Study 3 (Appendix 10).

Administering The Questionnaire

Baseline and first follow-up questionnaires were administered to correspond as closely as possible to the times when they were administered to the experimental group. At baseline, the questionnaire was administered to the nurses and paramedics separately as they were in different classes. The follow-up questionnaire was administered to all participants a week later when they were all together for shared learning in the biosciences module. Those who did not attend this lecture (n=18) completed the questionnaire the following week. A second follow-up questionnaire was not administered because shortly after the first follow-up questionnaire had been completed by the nurses, they attended a demonstration on hand hygiene in the clinical skills laboratory.

Data Analysis

Data were analysed using one way ANOVA between the experimental group and control group and t tests within the groups.

Results

The mean score at baseline 228.53 (SD 16.74) increased by 3.21 points to 231.82 (SD 17.40) at follow-up. Paired sample t tests between the stages showed that the increase from baseline to follow-up, $t_{(65)} = -2.547$, $p = .013$ was significant (see Figure 15).

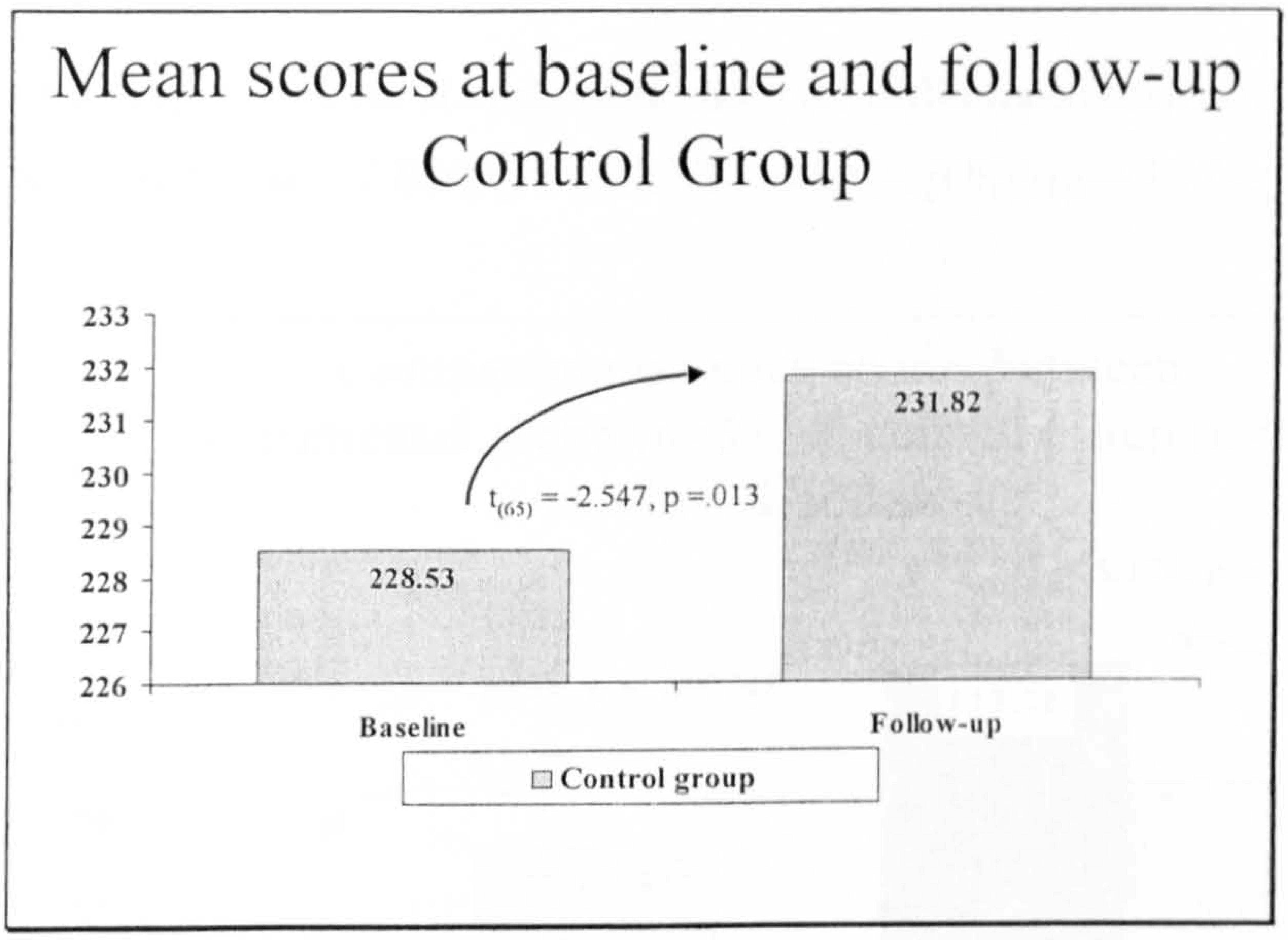

Figure 15 Scores of the control group at both stages and the significance level of the difference between them

Effect Of Occupation

The mean scores of the nurses and paramedics in the control group are shown in Table 42.

Table 42 Mean scores of control group (nurses and paramedics) at baseline and follow-up

Control Group	Baseline	SD	Follow-up	SD
Nurses	231.36	12.46	233.64	14.63
Paramedics	223.58	21.79	228.63	21.38

ANOVAs were carried out at each stage in order to see whether there were any significant differences between the above two groups. Although nurses' attitude scores were higher than paramedics' at both stages, the differences are not significant: baseline $F_{(1,64)} = 3.417$, $p = .069$;

follow-up: $F_{(1,64)} = 1.3$, $p = .276$.The attitude scores of the control group were then compared with those of the experimental group (Table 43).

Table 43 Mean scores of control group and experimental group at baseline and follow-up

Mean Scores	Baseline	SD	Follow-up	SD
Control group	228.53	16.74	231.82	17.40
Experimental group	223.54	15.10	238.28	12.72

One-way ANOVAs at each stage show the differences between the two groups: baseline $F_{(1,118)} = 2.884$, $p = .092$ NS; follow-up $F_{(1,118)} = 5.178$, $p = .025$ (see Figure 16).

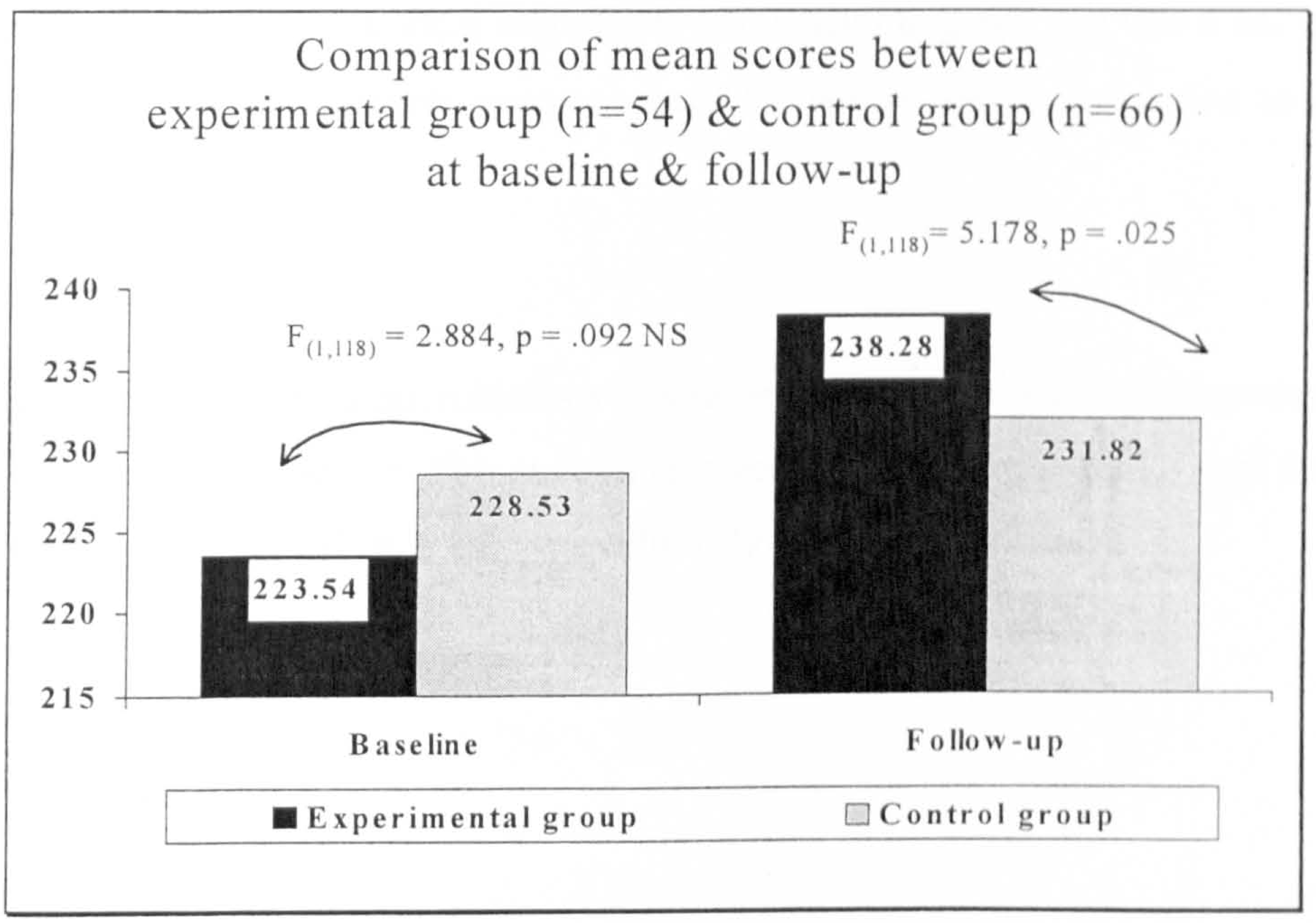

Figure 16 Mean scores of experimental and control groups at both stages and the significance levels of the differences between them

As hypothesised, the experimental group had significantly higher scores than the control group at follow-up: $F_{(1,118)} = 5.178$, $p = .025$. However, it should be noted that the control group had higher scores than the experimental group at baseline although the difference was not significant: $F_{(1,118)} = 2.884$, $p = .092$.

Discussion

In the control group, the significant increase in attitude scores from baseline to follow-up may be explained by the fact that although these students had not participated in any practical demonstration of hand hygiene, their programme of lectures as part of the microbiology component of the biosciences module commenced in the week between baseline and first-follow-up. The programme consisted of four hours of lectures on microbiology and immunology and a one hour lecture on nursing infected patients. The importance of handwashing as an effective measure to prevent infection would be stressed during some of these sessions.

Notwithstanding, the attitudes of the experimental group were significantly higher than the attitudes of the control group at follow-up. This demonstrates that the microbiology laboratory practical not only enhances attitudes towards hand hygiene, but that it has an additive effect on attitudes that have already been enhanced by lectures on the prevention and control of infection.

Conclusion

The value of using a microbiology laboratory practical to teach the importance of hand hygiene has been demonstrated. This study therefore suggests that the removal of the microbiology laboratory practical from the curriculum should be re-considered.

Chapter 8

Study 5

Student Nurses' Attitudes Towards Hand Hygiene: The Effect Of A Practical Exercise In The Clinical Skills Laboratory In Comparison With A Microbiology Laboratory Practical

Introduction

Study 3 has shown that students' attitudes towards the importance of hand hygiene were enhanced by participating in a microbiology laboratory practical which was a compulsory part of the undergraduate curriculum. However, the following year, there were changes to both the theoretical and practical components of the biosciences module. The content of the lectures on microbiology was changed and delivered by a different lecturer. The microbiology laboratory practical was discontinued and, for undergraduate nursing students (but not for paramedic science students), it was replaced with a different type of practical to demonstrate correct handwashing technique conducted in the clinical skills laboratory. This involved the application of a fluorescent cream known as 'Glitter Bug' (Brevis Corporation) and an ultraviolet (UV) light hand inspection cabinet. Like the microbiology practical demonstration, it enables students to visualise the effect of handwashing, albeit in a rather different way. It instantly highlights any defects in handwashing technique and raises awareness of potential hand hygiene problems. The cabinet demonstrates the importance of hands being washed often and well, requiring the right technique and friction. This practical exercise formed the basis of the study reported here.

Aims

To determine whether using a 'Glitter Bug' practical:-

1. Enhances student nurses' attitudes towards the importance of hand hygiene.
2. Is as effective as the microbiology laboratory practical in enhancing student nurses' attitudes towards the importance of hand hygiene.

Hypotheses

1. Student nurses' attitudes towards the importance of hand hygiene will show a significant improvement following the 'Glitter Bug' practical exercise.

2. The 'Glitter Bug' practical exercise will be as effective as the microbiology laboratory practical at enhancing student nurses' attitudes towards the importance of hand hygiene.

Negotiating Access

The co-operation of the Scheme Tutor and module leader was sought. The aim of the study was explained to all students at the end of various classes. Potential participants were given an information sheet to read (Appendix 1) and an opportunity to ask questions about the study in which they were being invited to participate. Two weeks before performing the practical exercise, all potential participants agreed to sign a consent form (Appendix 2) and then complete the questionnaire for base-line measurements (Appendix 10).

Method

Design

Quasi-experimental, longitudinal, self-report, repeated measures.

Participants – Glitter Bug Group

Participants were first year undergraduate nurses. There were 84 in the cohort which was divided into five groups for the purposes of teaching in the clinical skills laboratory. Although attendance at lectures and practicals is compulsory, not all attended. Furthermore, the practical demonstration for one of the five groups was postponed until the following semester and these students could therefore not be recruited to this study. Of the 35 who attended the practical exercise, only 29 of these were amongst those who completed the second follow-up questionnaire when it was administered in class five months later. Therefore, the final sample was n=29 (see Table 44).

Table 44 Sample loss over the three stages

Stage	Nurses
Baseline	66
Practical demonstration and 1st follow-up	35
2nd follow-up	45
Completed all three stages	29

Intervention

The microbiology component of the re-designed biosciences module consisted of four hours of lectures on microbiology and immunology, one lecture on nursing infected patients and a session on handwashing lasting 2.5 hours in the clinical skills laboratory. For this session, students were taught separately in five groups of about 16. This session included a lecture and a practical exercise to demonstrate the importance of hand hygiene, followed by a quiz (Appendix 11). The lecture addressed all aspects of hand hygiene including cleansing products and drying techniques. The main points were reinforced with handouts; one reiterated the consequences of non-adherence to hand hygiene procedures while the second illustrated an effective hand washing technique (Ayliffe et al., 1978).

In the practical, students applied a fluorescent cream, known as 'Glitter Bug' (Brevis Corporation) to their hands with handwashing movements. They were encouraged to rub it well in. They then placed their hands under the ultraviolet light of a hand inspection cabinet (Wedeco UV Systems, plc) to see the effect. The illuminator showed the extent to which the cream had covered the skin, nails and cuticles.

After this, they then washed their hands clean of the solution under the supervision of the lecturer. They were instructed to wet their hands before applying liquid soap or chlorhexidine gluconate. The choice of washing product was arbitrary. The purpose was to familiarise the students with the available products. Their attention was drawn to the handout on handwashing and the correct sequence for washing was emphasised and demonstrated by the lecturer. Particular mention was made of knuckles and around cuticles as being traps for bacteria. They then viewed their hands once more under the ultraviolet light. This showed that the fluorescent cream had not been entirely removed thus demonstrating flaws in the handwashing technique. The importance of paying particular attention to certain areas of the hands when washing such as cuticles, knuckles, finger tips and palmar creases was clearly demonstrated (Figure 17).

All participants were astonished by their poor handwashing technique. One student who was wearing nail varnish was particularly appalled by the debris she could see around her nails. Some students washed their hands again while others then used an alcohol rub as an extra cleansing agent. The effects of the alcohol and the friction of the rubbing action removed a substantial part of the remaining 'Glitter Bug' illuminator. This was a very effective demonstration of the usefulness of the alcohol rub as a cleansing agent. Finally the students completed a quiz on handwashing to reinforce the lessons learnt during the practical (Appendix 11).

Figure 17 Glitter Bug demonstration

Apparatus

'Glitter Bug' ultraviolet illumination lotion (Brevis Corporation, 3310 S 2700 E, Salt Lake City, UT 84109).
Ultraviolet light hand inspection cabinet (Wedeco UV Systems, plc).
Handwashing agents: liquid soap and chlorhexidine gluconate; alcohol hand rub.

Measurement Tool

Students' views on the importance of hand hygiene before and after various clinical procedures were measured using the same 28-item self-report questionnaire that was used in Study 3, the microbiology laboratory practical (see Appendix 10). This was arranged in three sections. The first section consisted of eight questions which sought views on the value of hand hygiene as a means of preventing cross-infection. For example 'In my view, hand decontamination is one of the most important factors in the prevention of cross-infection 1 = strongly disagree, 9 = strongly agree' (Cronbach's Alpha, 0.7378). Three of these questions addressed potential barriers to hand hygiene such as wearing a wrist watch (Hartley et al., 1999), finger rings (Hoffman et al., 1985) and gloves (Larson, 1989). For example 'Wearing rings on my fingers prevents adequate hand decontamination 1 = strongly disagree, 9 = strongly agree.' Section two consisted of 10 questions seeking views on the importance of hand hygiene *before* various clinical procedures (Cronbach's Alpha, 0.7803). For example 'I believe that decontaminating my hands before feeding a patient is

1 = not at all important, 9 = very important' Section three consisted of 10 questions seeking views on the importance of hand hygiene *after* various clinical procedures (Cronbach's Alpha 0.7710). For example 'I believe that decontaminating my hands after putting a dressing on a wound is 1 = not at all important, 9 = very important.' A nine point differential scale was used with the aim of optimising variance. A high score denoted a positive view.

The questionnaire was administered two weeks before the intervention (baseline score), immediately after the practical (first follow-up) and five months later after completion of first year clinical placements (second follow-up) when participants returned to the classroom. The baseline questionnaire had to be administered two weeks before the practical because this was the only time when it could be administered to the students in class who by this time had been divided into two groups for teaching purposes. Thus the baseline questionnaire was administered over two successive days.

Administering the questionnaire at second follow-up posed greater challenges. At the commencement of their second year, the undergraduate nurses had been channelled into their chosen 'branches' of specialisation, e.g. learning disabilities, mental health, child branch, so they were now being taught separately from each other. In addition, they were now participating in shared learning with diploma students who had also been channelled into their chosen branches. This posed several problems. First, negotiating access to administer the questionnaire at the end of a class necessitated liaising with a variety of lecturers. Second, not only were there diploma students in class who had not participated in the study to date, but some undergraduates had not actually taken part in the 'Glitter Bug' demonstration. Therefore, great care had to be taken to ensure that those who had not completed all stages of the study were excluded from the repeated-measures analyses.

Data Analysis

Data were analysed by a repeated-measures ANOVA with post hoc t tests. Mean total scores are expressed out of a possible 252. Where applicable, mean question scores out of a maximum score of nine are given. For all multiple comparisons, a Bonferroni correction was used (p=0.0167), in order to control for type 1 error.

Results

Overall Effect Of The Glitter Bug Practical

A repeated-measures ANOVA showed a significant effect of stage overall, $F_{(2,56)} = 3.726$, $p = .030$. Paired-sample t tests showed that there was a significant increase from baseline to first follow-up, $t_{(28)} = -3.003$, $p = .006$. None of the other comparisons showed a significant change (Table 45).

Table 45 Paired sample t tests between stages

Baseline to 1st follow-up	SD	1st follow-up to 2nd follow-up	SD	Baseline to 2nd follow-up	SD
$t_{(28)} = -3.003$, $p = .006$	12.49	$t_{(28)} = 1.277$, $p = .212$	12.22	$t_{(28)} = -1.342$, $p = .190$	16.32

The mean attitude scores obtained by the Glitter Bug group at every stage are shown Table 46.

Table 46 Mean attitude scores at every stage for Glitter Bug group

	Baseline	SD	1st follow-up	SD	2nd follow-up	SD
Mean score	232.69	12.74	239.66	12.22	236.76	14.66

The improvement in attitudes that had occurred after the practical was only partially sustained. After five months in clinical practice, their scores had declined and although they were still higher than at baseline, they were not significantly higher (Figure 18). Given the final sample size, this finding may be due to lack of power.

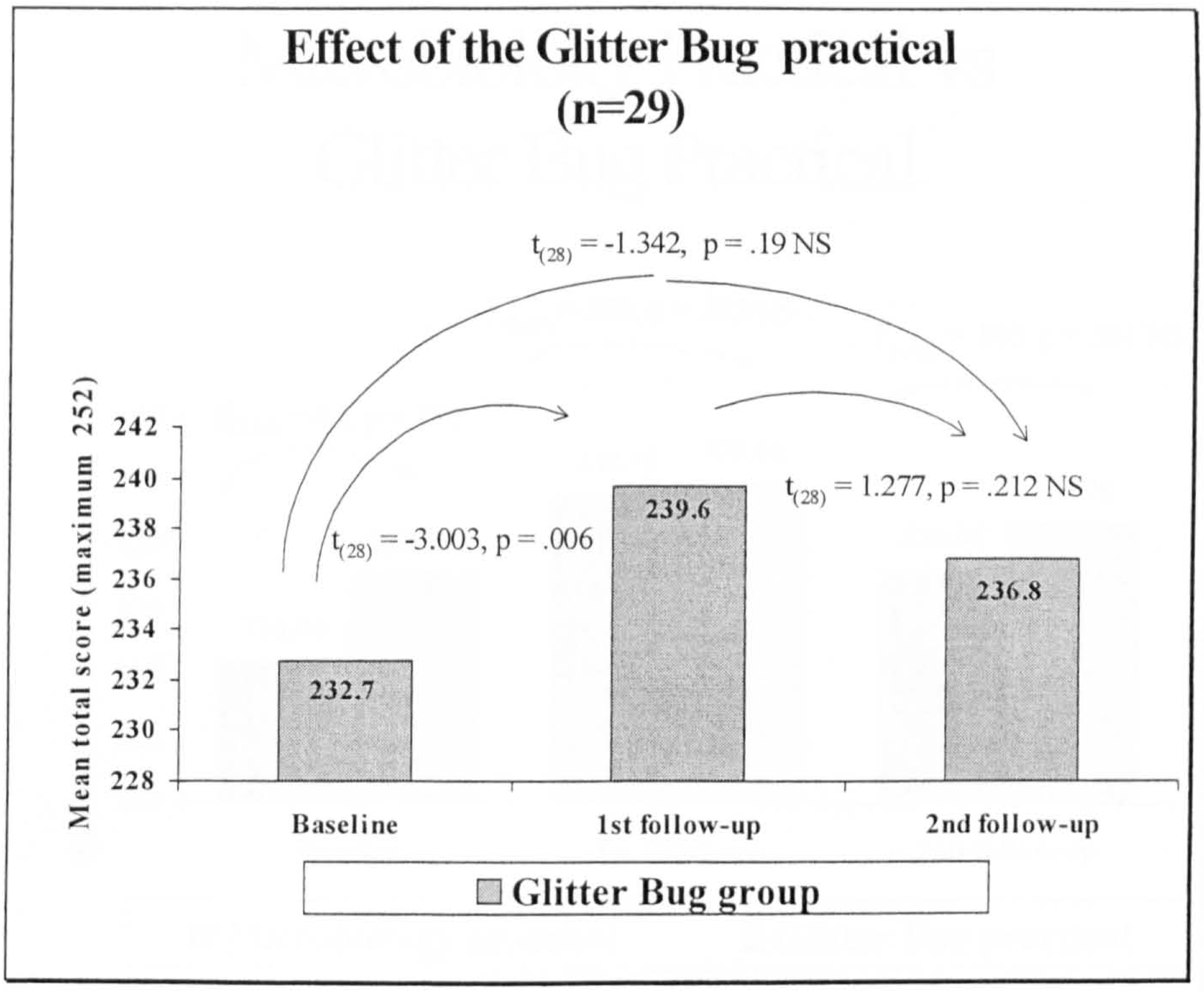

Figure 18 Changes in mean scores after the Glitter Bug practical and clinical practice and signficance levels of differences between them

Comparison Of Effects Of The Microbiology Laboratory Practical With The Glitter Bug Practical

An Analysis of Covariance (ANCOVA) was performed to compare the attitude scores of the nurses in the microbiology laboratory practical group (n=39) with the Glitter Bug practical group (n=29) at first and second follow-up (see Figure 19) . This tests whether the means, adjusted for differences on the covariate (in this case the baseline), vary significantly between the two groups at first and second follow-up. In other words it effectively equalises the scores at baseline and looks at the resulting differences. However, it should be noted that because the participants were not randomly assigned to the groups, nor were they assigned to their groups *because* of their scores at baseline, the differences between them may be due to unknown variables.

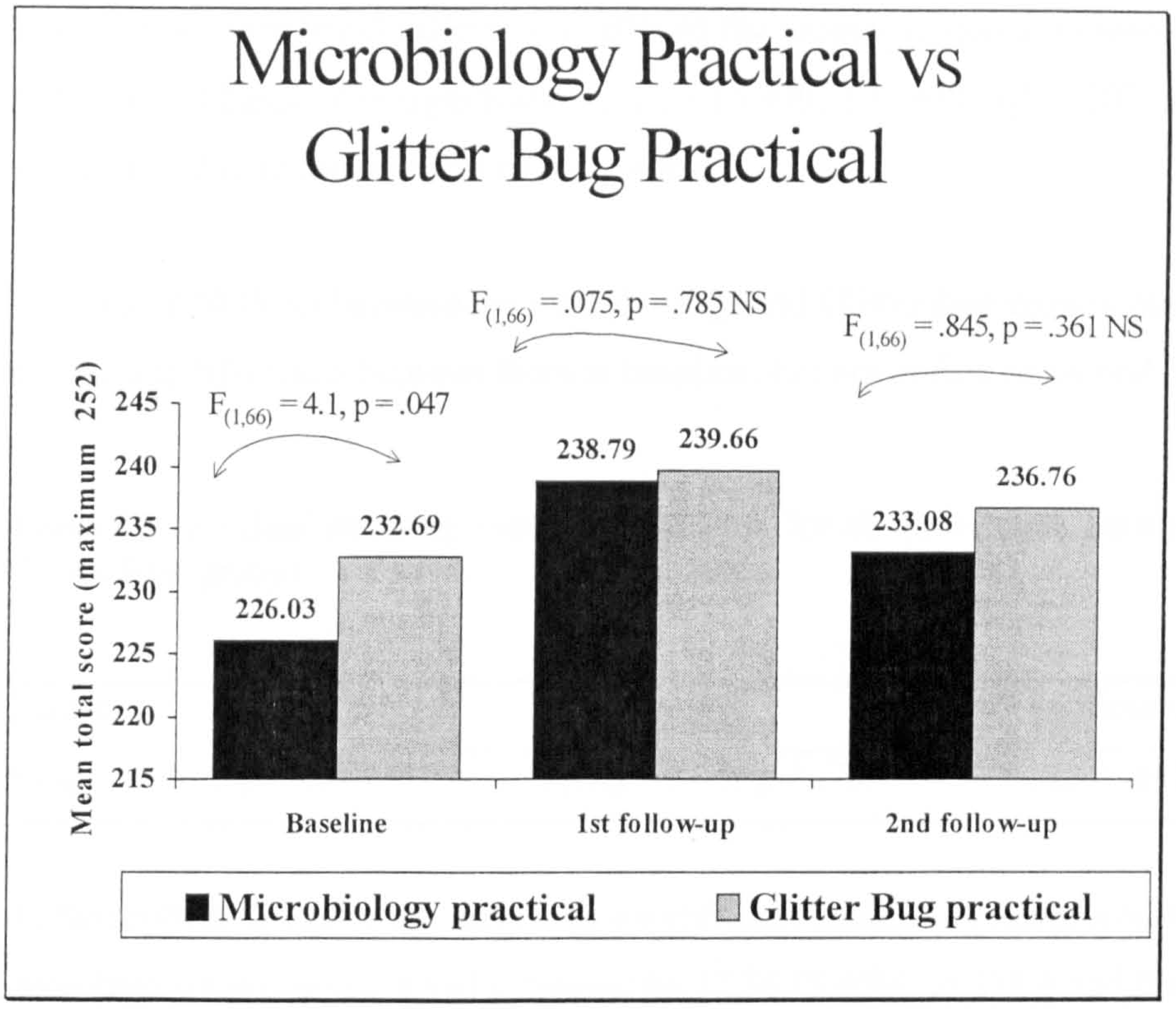

Figure 19 Differences in attitude scores between the microbiology practical group and Glitter Bug practical group at each stage

ANCOVA Between Microbiology Group And Glitter Bug Group At First Follow-Up

Levine's test is not significant, therefore the variances can be taken as equal. The homogeneity-of-slopes test shows that there is no significant interaction between the covariate (baseline) and the factor (group), therefore the ANCOVA can proceed.

There are no significant differences between the microbiology group and the Glitter Bug group at first follow-up, controlling for baseline score: $F_{(1,65)} = 1.682$, $p = .199$. However, there is a significant difference between the groups at baseline, $F(_{1,65}) = 46.03$, $p = .000$, $\eta^2 = .415$. This means that 41% of the variance is due to differences at baseline.

ANCOVA Between Microbiology Group And Glitter Bug Group At Second Follow-Up

Levine's test and the homogeneity-of-slopes tests are not significant, so the ANCOVA can proceed.

There are no significant differences between the groups at second follow-up. However, the difference at baseline is significant: $F_{(1,65)} = 16.999$, $p = .000$, $\eta^2 = .207$. Therefore 20% of the variance is due to the differences at baseline.

One-way ANOVAs between the microbiology and Glitter Bug groups, at each stage, showed a significant difference between them at baseline, but not at first or second follow-up (Table 47).

Table 47 F values showing overall significance for all three stages between microbiology and Glitter Bug groups

Baseline	1st follow-up	2nd follow-up
$F_{(1,66)} = 4.102$, $p = .047$	$F_{(1,66)} = .075$, $p = .785$	$F_{(1,66)} = .845$, $p = .361$

At first follow-up, although there was a significant increase in mean scores for both groups (the microbiology group score had increased by 12.76 (5.66%) to 238.8 and the Glitter Bug group score had increased by 6.97 (1.58%) to 239.66), there is no significant difference between the two groups (Figure 19). This suggests that the microbiology practical and the Glitter Bug practical appear to be equally effective at improving attitudes.

At second follow-up, whilst scores for both groups had decreased (although not significantly so), there was not a significant difference between the scores for the two groups (Figure 19). This suggests that the microbiology practical and the Glitter Bug practical appear to be equally effective at maintaining the improvement in attitudes during the participants' first clinical placement.

Differences Between Individual Questions

Tables 48, 49 and 50 show that there were statistically significant differences in the way in which three questions were answered: question 7: removing finger rings; question 12: hand hygiene before caring for an immuno-compromised patient and question 25: hand hygiene after taking gloves off. The Glitter Bug group had higher scores (Table 50). The repeated-measures ANOVA had *stage* as the within-groups factor and *cohort* (or group) as the between-groups factor. Only the between-groups F value is shown in Table 49.

Table 48 Comparisons between microbiology group and Glitter Bug group for questions 7, 12 and 25

Question	F value	Effect size η^2
7. Wearing rings on my fingers prevents adequate hand decontamination.	$F_{(1,66)} = 7.736$, $p = .007$	.108
12. Decontaminating my hands before attending to an immuno-compromised patient is very important/not important.	$F_{(1,66)} = 4.195$, $p = .045$	.060
25. In my opinion, decontaminating my hands after taking gloves off is very important/not important.	$F_{(1,66)} = 5.244$, $p = .025$	.074

One way ANOVAs were carried out on questions 7,12 and 25 to see whether the differences occurred at baseline, first follow-up or second follow-up (Table 49).

Table 49 Differences between microbiology group and Glitter Bug group at each stage for questions 7, 12 and 25

Q	Baseline		1st follow-up		2nd follow-up	
	F value	Effect size η^2	F value	Effect size η^2	F value	Effect size η^2
7	**$F_{(1,66)} = 6.689$, $p=.012$**	.095	$F_{(1,66)} = 2.758$, $p = .101$	.040	$F_{(1,66)} = 3.579$, $p = .063$	.051
12	$F_{(1,66)} = 2.983$, $p = .089$	.043	$F_{(1,66)} = 1.814$, $p = .183$	.027	$F_{(1,66)} = 3.130$, $p = .081$	.045
25	$F_{(1,66)} = 1.543$, $p = .219$	.023	**$F_{(1,66)} = 4.351$, $p=.041$**	.062	**$F_{(1,66)} = 4.245$, $p = .043$**	.060

The differences in the mean scores between the two groups, at each stage, for these three questions are shown in Table 50.

Table 50 Mean scores for questions 7, 12 and 25 showing differences between nurses in microbiology group and Glitter Bug group

	Baseline		1st follow-up		2nd follow-up	
Question	Microbiology group	Glitter Bug group	Microbiology group	Glitter Bug group	Microbiology group	Glitter Bug group
7	7.16	**8.34**	7.87	8.62	7.67	8.52
12	8.92	8.72	8.97	8.90	8.97	8.86
25	7.74	**8.10**	8.23	**8.69**	7.97	**8.52**

Discussion

The higher scores of the Glitter Bug group at baseline could just be due to chance. On the other hand, this finding could be due to the different programme of lectures on microbiology and infection prevention and control that the two groups had. The microbiology group had four one-hour lectures delivered by a bioscientist in addition to the three-hour microbiology laboratory practical and follow-up. The Glitter Bug group had different lectures as specified in the methods section and these had been delivered by nurses, one of whom was a former Infection Control Nurse and had a degree in Infection Control. Thus the emphasis on hand hygiene may have been more pronounced. Whatever the reason, the Glitter Bug group had better attitudes towards hand hygiene than the microbiology group, before the start of the investigation.

For question 7 the nurses in the Glitter Bug group had higher attitudes at baseline than the nurses in the microbiology group suggesting that they had already been taught about the importance of not wearing finger rings whilst on duty as they impede effective hand hygiene. For question 12, although the ANOVA showed a significant difference overall, there was no significant difference identified at any of the individual stages. This may be due to the fact that the difference overall was only just significant ($p = .045$). For question 25, there was no significant difference at baseline between the Glitter Bug and the microbiology group but there was a significant difference at both first and second follow-up. This enhancement may be due to the intervention *per se* or the importance of hand hygiene after glove removal being emphasised more strongly during lectures or clinical practice.

Conclusion

Student nurses' attitudes towards the importance of hand hygiene improved following the Glitter Bug practical exercise, hence the first hypothesis is supported. Although Glitter Bug and similar aids are commonly used to demonstrate the effectiveness of hand hygiene (Elston, 1998), it is believed that this is the first time that its effect on enhancing attitudes has ever been demonstrated. Its use should therefore be encouraged.

The extent to which attitudes were enhanced following the Glitter Bug practical was not significantly different from the enhancement that occurred following the microbiology practical. Hence, the second hypothesis is also supported. However, it may be that the high score of the

Glitter Bug group at baseline limited the likelihood of much improvement. The small sample size not only poses limitations on the study's findings, but raises issues about the fact that only 53% of the students who should have attended this practical exercise did so. Given the constraints of the timetable, it is believed that those who missed the session would not be able to make good this defecit before going into clinical practice for the first time.

The lessons to be learnt from the use of 'Glitter Bug' are different from those ensuing from the microbiology laboratory practical. So although both appear to be equally effective at enhancing attitudes towards hand hygiene, one should not be substituted for the other.

In keeping with findings reported in Studies 2 and 3, this study has also produced results which show that attitudes towards the importance of hand hygiene decline during the first clinical placement. Students therefore need to be taught about hand hygiene not only early on in training but also at the beginning of the second year. Further, given the finding from Study 2 that this decline continues during their three-year training, there is a need for hand hygiene to be reinforced thereafter.

Moreover, there is also a need to consider factors in the clinical practice setting which may be having an adverse effect on students' attitudes towards hand hygiene. Perhaps the healthcare professionals, working alongside the students, are not adhering to hand hygiene policies because they do not understand them. This issue is explored next.

Chapter 9

Study 6

Hand Hygiene Policies: Rule Set Or Risk Assessment?

Foreword

"When I use a word, Humpty Dumpty said in a rather scornful tone, it means just what I choose it to mean - neither more nor less." (Carroll, 1899, p.123)

Introduction

This study is concerned with the potential confusion caused by hand hygiene policies and the effect it might have on hand hygiene behaviour. A hand hygiene policy, approved by each Trust's Infection Control Committee, is considered a key requirement to fulfil criterion 6 in the recently published Infection Control Standard produced by the Department of Health (DOH, 2003). This states that *"Written policies, procedures and guidance for the prevention and control of infection are implemented and reflect relevant legislation and published professional guidance."* (p.20).

Effective implementation of policies requires them to be clear and consistent. Yet, as has been argued in the literature review, published and other professional guidance shows ambiguities, incompleteness, contradictions and changes over time, albeit to accommodate new microbiological problems and alterations in practice. Hand hygiene policies may therefore be poorly understood or viewed as unworkable or unnecessary. This may partly explain why Infection Control Teams continue to be challenged by healthcare professionals' poor hand hygiene practice. Rello et al. (2002) reported that physicians' reasons for non-adherence to evidence-based guidelines for ventilator-associated pneumonia included: disagreement with interpretation of clinical trials, unavailability of resources and costs. Cabana et al. (1999) showed in their study of physicians' adherence to clinical practice guidelines that lack of agreement with the policy is an attitude barrier. As shown in Study 1, attitudes are a significant predictor of intention to perform hand hygiene, hence it is clearly crucial that barriers to positive attitudes are overcome. If policy makers do not take sufficient account of the psychology of healthcare professionals, how can hand hygiene policies be successfully implemented and hand hygiene practice be improved?

As discussed in the literature review, guidelines on hand hygiene may promulgate *rule set* which refers to *lists* of tasks meriting hand hygiene, or *risk assessment* which requires the healthcare professional to engage in informed decision-making as to when hand hygiene is necessary. For example, a policy that states '*hands should be washed before and after every significant patient contact*' requires the healthcare professional to decide the meaning of 'significant.' This requires an assessment of risks of cross-infection both to the index patient, other patients and self.

The aim of this study was to determine healthcare professionals' understanding of this critical term used in their hand hygiene policy. Evidence was sought for the risk assessment strategies used in determining what they considered a significant contact to be.

Method

Design

Self-report, interpretive.

Participants

Two hundred and seventeen clinical healthcare professionals working in two teaching hospitals consented to take part in the study. Of these, 201 (93%) answered one open-ended question which asked them to explain what they understood by the statement '*Hands should be washed before and after every significant patient contact.*' The hand hygiene policy was applicable to staff in both hospitals as they were governed by the same Acute Trust and Infection Control Committee. Of the 201 participants 126 (63%) were qualified nurses; 29 (14%) were therapists; 17 (8%) were healthcare assistants; two (1%) were midwives; 21 (10%) were doctors of whom one was a consultant. Six (3%) did not disclose their occupation. One hundred and fifty-seven (78%) of the sample were female. It will be noted that it proved very difficult to recruit doctors to the study and it was even harder to recruit medical consultants to participate.

Measurement Tool

Participants wrote down their interpretation of the open-ended question at the end of the self-report questionnaire which had been administered for Studies 1 and 8 (Appendix 5).

Data Analysis

Category And Thematic Formation

Initially, it was intended to analyse the data in accordance with the risk assessment approach suggested by Pratt et al. (2001) by way of the four key factors that should be considered prior to hand hygiene, i.e. *"The level of the anticipated contact with patients or objects; the extent of the contamination that may occur with that contact; the patient care activities being performed and the susceptibility of the patient."* (p.23).The guideline was discussed at length with an expert Infection Control Nurse. It was agreed that there was no clear understanding of what was meant by *"The level of the anticipated contact."* Consideration was given to using Larson's (1995) risk assessment approach viz *"The decision regarding when handwashing should occur depends on 1) the intensity of contact with patients or fomites* (items), *2) the degree of contamination that is likely to occur with that contact, 3) the susceptibility of patients to infection and 4) the procedure to be performed.."* (Larson, 1995, p.253). However, the meaning of the term *"intensity of contact"* was as unclear as the term "*The level of the anticipated contact.*" It was concluded that neither of these frameworks could be used in their entirety for the purpose of category generation although the one by Pratt et al. (2001) did inform the analysis process.

The data were content-analysed for both categories and themes along the lines recommended by Atkins (1984) and Burnard (1991). For each response a category and theme were identified and the response allocated to these groupings. Categories drawn up were designed to be exhaustive and mutually exclusive at the same level of analysis. The data were independently analysed and assigned to the categories and themes by two investigators to reduce researcher bias (Atkins, 1984). There was complete agreement for assignment of responses to categories but there were nine instances where attributions to the themes had not been made. These were agreed through discussion and rectified.

Results

The responses fell into four distinct categories: those which offered an explanation as to what they considered a 'significant patient contact' to be (n=99, 49%); those which offered an explanation as to what they considered a 'significant patient' to be (n=31, 15%) those which offered other answers (n=64, 32%) and those which were non-answers (n=7, 3%) Themes emerged from the first, second and third categories only. Table 51 presents an overview of the categories and themes that emerged.

Table 51 Overview of categories and themes

Category 1 Significant Patient Contact Explanations n=99 (49%)	Category 2 Significant Patient Explanations n=31 (15%)	Category 3 Other Answers n=64 (32%)	Category 4 Non-Answers n=7 (3%)
Themes	Themes	Themes	No Themes
Task specification: n=99 (100%)	Infectious status of patient n=28 (90%)	Reasons for handwashing: n=63 (98%)	
Extent of patient contact or contamination: n=60 (60%)	Other responses: n= 3 (10%)	Products used to decontaminate hands: n=22 (34%)	
• Discriminators n=19 (19%)			
• Non-discriminators n=41 (41%)			
Susceptibility of the patient to infection: n=2 (2%)		How to wash hands: n=18 (28%)	
Timing of handwash: n=90 (91%)		Barriers to the behaviour: n=18 (28%)	

Category 1: Significant Patient Contact Explanations

From the 99 participants who attempted to explain what they considered a *'significant patient contact'* to be, the following themes emerged (Table 51):

- task specification, i.e. listing patient care activities that would necessitate handwashing;
- the extent of patient contact or contamination; responses fell into two sub-themes: those who discriminated and those who did not;
- susceptibility of the patient to infection;
- timing of handwash.

Theme: Task Specification

The tasks specified by respondents are shown in Table 52. All the participants who explained what they considered a significant contact mentioned 'physical contact' which was taken to mean 'touching' in one form or other such as skin-to-skin, pat on shoulder, handling etc.

Although less than a quarter mentioned body fluids, they were often cited as examples along with physical contact by the same person, suggesting that they were considered of equal significance. Forty-three per cent of this sample (n=43) mentioned equipment, bedclothes or personal items. Less than a quarter mentioned aseptic technique. Only three per cent mentioned suctioning yet Pittet et al. (1999a) demonstrated that respiratory care was associated with particularly high levels of hand contamination.

Table 52 Tasks specified by respondents

Task	n	sample n=99 %	total n=201 %
Physical contact	99	100	49
Handling patients' clothes, bedclothes or equipment	43	43	21
Aseptic techniques i.e. wound dressings	23	23	11
Exposure to body fluids	22	22	11
Performing personal hygiene for the patient	14	14	7
Before giving food or oral medicines	10	10	5
Clinical procedures e.g. IV drugs; suctioning	3	3	1

The following quotes illustrate some of the responses:

"Every significant = intimate contact (skin) and body fluids." (Staff Nurse)

"I assume significant patient contact means skin to skin contact with any bodily fluids." (Senior House Officer)

"Significant patient contact is: Examination of the patient; clinical procedures e.g. IV drugs, dressings, washing patients." (Qualified Nurse)

"If I have physical contact with the patient or their bedclothes, personal items, I wash my hands." (Senior Staff Nurse)

"Significant implies exposure to patient via hand-hand/skin contact or exposure to any body fluid." (Specialist Registrar)

Theme: Extent Of Patient Contact Or Contamination

Several factors influence the extent of patient contact or contamination e.g. the amount of time spent in direct contact with the patient; the degree of physical closeness; whether the patient is infected or colonised with an antibiotic-resistant organism such as MRSA. For example, spending an hour or two with a patient dressing their infected burn wounds poses a different risk of cross-infection from touching a patient's skin to take their pulse. Responses were analysed on the basis of either extent of patient contact or whether the patient was infected or colonised. Analysis showed that there were those who did consider these risk factors, i.e. the discriminators, and those who did not, i.e. the non-discriminators.

Discriminators

Only a few respondents (n =19) discriminated between the extent of the patient contact or contamination, suggesting that they risk assessed for this factor in order to determine whether a handwash was required (Table 53).

Table 53 Reasons given by those who discriminated between the extent of the patient contact/ contamination

Discriminators	n	sample n=99 %	total n=201 %
Caring for an infected patient or leaving an isolation cubicle	13	13	6
Length of time spent in contact with patient	6	6	3

The following quotes illustrate the views of the discriminators:

"That handwashing should be undertaken prior to and after prolonged contact with patient. "Qualified Nurse

"That significant patient contact means doing dressing, remove drains.....etc. excluding observations. Taking, helping patient move from bed to chair & vice versa etc......little tasks are excluded. Also it means with self-caring, independent patients, who only need minimal assistance hands don't have to be washed before and after contact." (Staff Nurse)

"With MRSA patients you should wash your hands after any form of contact e.g. bedlinen." (Healthcare Assistant)

"Ideally after all contact with a patient, but one tends to think it less important if holding a patient's hand (not isolated)." (Staff Nurse)

Non-Discriminators

In contrast, 41% of this sample (n=41) and 20% of the whole sample, did not discriminate between the amount of contamination. They considered that handwashing should take place before and after *any* patient contact suggesting that they considered *all* contact, no matter how fleeting, to be 'significant'. Two actually described handwashing as being a 'Universal Precaution' (Table 54).

Table 54 Those who did not discriminate between the extent of the contact/contamination

Non-discriminators	n	sample n=99 %	total n=201 %
Any or all patient contacts	39	39	19
Universal Precautions	2	2	1

This suggests that they are adopting the precautionary principle and are not performing a risk assessment. The following quotes illustrate this:-

"Hands should be washed before and after any direct physical contact with a patient." (Staff Nurse)

"I believe that this statement ranges from touching a patient's locker to changing the sheets of an incontinent patient." (Staff Nurse-Specialist)

"Strict handwashing is a must to decrease the risk of infection and is a universal precaution." (Staff Nurse on adaptation)

"You should always wash your hands before and after dealing with any patient however small the job is." (Healthcare Assistant)

"All the contacts are significant as you can't see the bacteria." (Qualified Nurse)

"Significant patient contact - every hands on contact?" (Therapist)

"Any nursing which is not merely a normal social interaction but which involves physical contact with patients skin, food, body fluids or invasive devices." (Qualified Nurse)

"My interpretation is that significant patient contact means anything major done to the patient. I disagree because whether the contact is significant or not, handwashing is important as long as there is patient contact." (Qualified Nurse)

Theme: Susceptibility Of Patient To Infection

Only two respondents mentioned patient susceptibility to infection. One mentioned the immuno-compromised patient and one the very ill. No one mentioned surgical patients or newborns (as specified in the guidelines by Steere and Mallison, 1975), even though many of the respondents worked on surgical wards and a couple of the respondents were midwives. Catheters such as intravenous cannulae were mentioned but these were categorised under the theme of task specification in order to maintain exclusivity of themes. Urinary catheters were not specified by anyone even though their insertion and manipulation are risk factors for urinary tract infection (Emmerson et al., 1996).

Theme: Timing Of Handwash

Table 55 shows that 92% (91/99) of the respondents in this sample offered views about the timing of the handwash. Over half of these (n=51) stated that hands should be washed *before and after* performing specified tasks. Less than a third (n=27) mentioned washing hands *after* performing certain tasks and only 3% mentioned washing hands *before* performing tasks. Nine per cent referred to handwashing between patient contacts. One mentioned handwashing before going off duty.

Table 55 Timing of handwash

Timing of handwash	n	sample n=99 %	total n=201 %
Before and after patient contact	51	52	25
After patient contact	27	27	13
Between patient care activities	9	9	4
Before patient contact	3	3	1
Before going off duty	1	1	.5

Category 2: Significant Patient Explanations

Fifteen per cent (n=31) of the total respondents offered their views on the meaning of a '*significant patient*' rather than '*significant patient contact.*' One theme emerged, namely the infectious status of the patient. There were three other responses which could not be construed as a theme.

Theme: Infectious Status Of The Patient

Twenty-eight (90%) of the responses in this category referred to the infectious status of the patient. For example:

"Significant patient could mean infectious." (Staff Nurse)

"Significant in the sentence implies that only some patients are an infection risk." (Senior Staff Nurse)

"The statement is ambiguous as it could mean 'significant contact' or 'significant patient' the latter being interpreted as only referring to patients with infections." (Speech Therapist)

"Washing before and after contact with all patients. But some staff could take this to mean infection control patients e.g. source isolation. However, I take this to mean all patients as you do not always know what infections they have - all patients & staff are a potential source of cross-infection." (Qualified Nurse)

Other Responses

One respondent implied that significance is an important factor but failed to disclose what they viewed as significant:

"You don't have to wash your hands each time, only with significant patients." (Qualified Nurse)

Whilst another wrote that *"Every patient is significant." (Staff Nurse)* which does not illuminate their views on hand hygiene issues.

The third response was as follows:

"I have never heard this statement before, but I should imagine 'significant patient' means touching the patient's body, clothes or personal possessions." (Speech Therapist)

Category 3: Other Answers

Theme: Reasons For Handwashing

Almost all the respondents in this category (n=63) specified reasons for hand hygiene. Forty-three per cent of those who gave a reason for handwashing (27/63) stated it was important to reduce cross-infection. Twenty nine per cent of this sample (18/63) reported that hand hygiene was important to reduce cross-infection from themselves to the patient whilst 17% (11/63) reported that hand hygiene was important to reduce cross-infection from the patient to themselves. The following quotes illustrate these replies:-

"Hand washing has been proven time and time again as reducing infection." (Staff Nurse)

"Before to prevent infections being brought into contact with the patient. After so that any infections picked up from the patient just treated are not passed on to other hospital areas or patients." (Therapist)

"All patients and staff are a potential source of cross-infection." (Qualified Nurse)

"I don't believe handwashing has anything to do with education or culture on a ward. It has to do with one's personal belief system and concept of risk. For example, my husband is much more conscious about hand hygiene than I am. I rarely wash my hands before and after each patient contact, but the time I ALWAYS do, is when I have certified a patient dead. At least, that was the case when I was a junior house officer. It is an emotional thing. The other time when I ALWAYS wash my hands is after examining a patient's sweaty feet, neuro obs, reflexes in Outpatients Department. I don't suppose you can catch anything from feet except perhaps athlete's foot." (Medical Consultant)

Theme: Products Used To Decontaminate Hands

Just over a third of the respondents in this category (22/64) specified the product to use to decontaminate hands (Table 56). Forty-five per cent of the sample (10/22) referred to soap and water, 41% (9/22) mentioned alcohol hand rub, nine per cent (2/22) mentioned Hibiscrub (chlorhexidine gluconate) and one person referred to a cleaning agent. Two respondents mentioned paper towels.

Table 56 Products used to decontaminate hands

Products used to decontaminate hands	n	n=22 %	n=201 %
Soap and water	10	45	5
Alcohol hand rub	9	41	4
Hibiscrub	2	9	1
Cleaning agent	1	4	.5
Paper towels	2	9	1

The following quotes illustrate this theme:

"If doing observation hand-rub between patients is sufficient." Qualified Nurse

"If I come into contact with any body fluids or MRSA infected patients I will wash my hands - otherwise I will use an alcohol based hand rub as this is effective and readily available."(Qualified Nurse)

"That prior to having physical contact with a patient and immediately after hands and wrists should be washed with water and soap and dried thoroughly towels (paper)." (Therapist)

"Before I start patient contact wash (after then social contact e.g. shaking hands on new introduction) I wash my hands with Hibiscrub. After each patient contact (other than social contact). Before procedures medication administration, food dispersion or nasogastric administration I wash my hands with Hibiscrub. Before I leave I do likewise. My knuckles commonly bleed." (Charge Nurse)

Theme: How To Wash Hands

Twenty-eight per cent (18/64) of the respondents in this category gave their views on how hands should be washed. A third (6/18) specifically said that technique was important; 22% (4/18) mentioned washing the wrists as well as hands and 28% (5/18) mentioned the importance of thorough drying. Only one person mentioned the importance of removing rings and watches. Examples are as follows:-

"Hands and wrists should be washed with water and soap & dried thoroughly with towels (paper)." (Therapist)

"Each patient contact hands should be washed + the use of alcohol gel. Rings & watches should always be removed." (Staff Nurse)

Theme: Barriers To The Behaviour

Twenty-eight per cent of responses in this category (18/64) mentioned various barriers to hand hygiene. These included the time factor involved (7/18), a lack of sinks (2/18), wrong water temperature (2/18) and the products provided caused skin damage (2/18). Two participants said there was a lack of peer pressure.

"There is more (doctor level) peer pressure to go round with the group of doctors than to stop and wash hands unless the consultant washes their hands and this is unlikely unless they have seen a patient who is isolated, smelly or where they have had to handle anything gungy or grungy. It is practically unheard of for doctors to make a pause between the bedside & their discussions for themselves + students to wash their hands. In Out Patient Dept. the pressure to go swiftly can distract one from handwashing." (Registrar)

"In the practical situation, washing my hands after every single contact with each patient is unrealistic." (Qualified Nurse)

"Washing your hands regularly reduces the chances of infection, but washing them every single time you come in contact with each patient is not practical, and would ruin your skin."(Qualified Nurse)

"Contact means touching in any form - direct or indirect e.g. passing a cup involves patient contact. Hence to wash hands before and after every significant patient contact would require that we spend possibly 25-30% of our time handwashing or going between handwashing. This is clearly unrealistic. Perhaps 'significant' patient contact needs defining more specifically." (Qualified Nurse)

"Things that inhibit this activity – lack of mixer taps, taps set at wrong temperature, not enough blue roll (paper towels)." (Qualified Nurse)

"If sinks are not clean & welcoming (site, soap, water temp.) they won't get used." (Registrar)

Category 4: Non-Answers

Replies in this category failed to offer any insight into what the respondents considered a 'significant patient contact' to be. For example:

"As it says."(Specialist Registrar)

"Hands should be washed before and after every significant patient contact." (Doctor)

"Common sense!"(Healthcare Assistant)

"I strongly agree with this statement." (Qualified Nurse)

"I find this question insulting to my intelligence." (Qualified Nurse)

Discussion

This study has exposed the lack of clarity and understanding of quite simple statements that are used in hand hygiene policies and guidelines. This has serious implications for the prevention of infection and cross-infection. Just over half of all respondents failed to explain what they understood a *significant patient contact* to be. The few who gave 'non-answers' might not have wanted to co-operate. The other respondents might not have been taught about the factors informing the risk assessment process for hand hygiene or they may not have understood them (Larson, 1995; Pratt et al., 2001). As previously discussed, neither the researcher nor the independent judge (who are both experienced Infection Control Nurses) had a clear understanding of what was meant by one risk assessment criterion suggested by Pratt et al. (2001, p.23) i.e. *"the level of anticipated contact"* and one risk assessment criterion suggested by Larson (1995, p.253), i.e. the *"intensity of contact."* Hence, if infection control 'experts' do not have a clear understanding of what this means, how can other healthcare professionals be expected to? Such ambiguity suggests that authors of guidelines need to test the comprehensibility of any guidance they produce before it is published. Furthermore, the usefulness of the risk assessment models advocated by Larson (1995) and Pratt et al. (2001) needs to be tested empirically.

As regards those respondents who did explain what they considered a *significant patient contact* to be, it is not clear to what extent their answers were based on risk assessment or rule set. On the one hand, not one respondent actually stated that their interpretation was determined by an assessment of risk based on the four factors specified by Larson (1995) or Pratt et al. (2001). However, it would seem that, although not articulated as such, some of the factors were considered to a greater or lesser extent. For example, all of them mentioned 'physical contact' with the patient and many others specified a variety of tasks. Thus, by specifying various tasks which would require a handwash, all these respondents could be said to be considering one of the risk factors specified by Pratt et al. (2001, p.23) i.e. *"the patient care activities being performed."* On the other hand, it could be argued that this type of response reflects a 'rule set' approach to learning and that the respondents do not actually have an understanding as to why the activity presents a risk of cross-infection if hands are not washed. After all, the risk assessment process assumes that healthcare professionals have the knowledge of what might cause contamination but Prieto (2003) has shown that this is not necessarily the case.

In terms of the other risk factors proposed by Pratt et al. (2001) these did not feature very much in healthcare professionals' minds. Only 19 respondents considered *"the extent of the* *contamination that may occur with that contact"* and only two respondents mentioned *"the susceptibility of the patient"* (to infection). There was therefore no evidence of a systematic evaluation of risk by respondents but rather a partial consideration of some risk factors. This incompleteness could mean that these healthcare professionals perceive risk assessment as a passive process rather than one which requires active engagement.

One of the coincidental findings of this study was that a few respondents indicated their opinion that it was unrealistic or not practical to perform hand hygiene every single time they had contact with a patient. It would be interesting to know how many others would have offered this view had they been asked. Such replies indicate an implicit acceptance of the need for risk assessment to determine when hand hygiene is essential, even though these respondents did not specify what they considered a *significant patient contact* to be.

The fact that over half of all respondents did not specify what they considered a *significant patient contact* to be may suggest that there is considerable uncertainty in the healthcare professional's mind. On the one hand, clinical risk management, of which risk assessment is an integral component, is one of the currently prevailing philosophies in the National Health Service. On the other hand, the principle of Universal Precautions also prevails where everyone is treated as if they are potentially infected with a blood-borne virus. The rationality of this philosophy is clearly questionable given that in the UK the lifetime risk of hepatitis B is five per cent, the prevalence of hepatitis C is 1:1400 (Mandal et al., 1996) and the prevalence of HIV is 0.09% although this does vary between regions (Communicable Disease Report, 1998). Furthermore, the principle of risk assessment is at odds with the precautionary principle. This probably adds to the confusion in the healthcare professional's mind and clouds their decision-making process.

The respondents who offered their views on the meaning of a *significant patient* rather than *significant patient contact* clearly misinterpreted the policy. If the study were to be repeated, this problem might be overcome by breaking the question down into elements, e.g. what is a significant contact? With which patients? Some or all? Or asking additional questions to pursue perceptions of risk e.g. what factors would influence your decision as to whether an activity was likely to put you at risk? What factors would influence your decision as to whether an activity was likely to put the patient at risk?

Those whose responses were categorised under 'other answers' might have deliberately chosen not to interpret the policy correctly because they had other views on hand hygiene they wanted to share. Those who gave 'non-answers' indicated their unwillingness to explain their thought processes and it is surprising that they completed the questionnaire at all.

Conclusion

This study has shown that healthcare professionals have difficulty determining what constitutes a '*significant patient contact*'. There are several possible reasons for this. First, the policy is not clear. Secondly, healthcare professionals are inculcated with the philosophy of Universal Precautions which is at variance with the principles of risk assessment. Hence, they may be more used to following 'rule set' without necessarily understanding the underpinning rationale. Thirdly, they have not been taught how to actively engage in risk assessment so a passive approach is adopted resulting in an incomplete consideration of all the risk factors. There is clearly a need for a risk assessment tool to enable healthcare professionals to determine the need for hand hygiene. A Dynamic Assessment Strategy for Hand Hygiene (DASHH) has been developed by the researcher and this is discussed further in the final chapter.

Chapter 10

Study 7

Hand Hygiene Posters: Motivators Or Mixed Messages?

Introduction

Study 6 highlighted problems which can arise when healthcare professionals are required to make an individual interpretation of the meaning of the hand hygiene policy they are expected to follow. If hand hygiene practice is to be improved, policies must be crystal clear, simple and unambiguous. The same principles should be applied to any other vehicle which transmits messages about hand hygiene, such as posters. Although poster campaigns on hand hygiene are commonly used by Infection Control Teams to improve practice (Storr and Brind, 2003), the evidence base for their efficacy is weak (Williams, 1987; Pittet et al., 2000). Reasons for this are unclear but it may be because their messages are not based on established theory or research. The relevance of utilising key theoretical principles of message-framing and various other constructs has already been discussed in the review of the literature on hand hygiene posters.

Aim

The aim of this study was to explore and evaluate the extent to which a random selection of hand hygiene posters utilised the theoretical constructs advocated. The following research questions were formulated:

1. Did the posters use a message-framing approach?
2. Were the messages persuasive?
3. Was the information given correct and consistent?
4. To what extent were fear appeals used?
5. What was the presentation style of the posters?

Method

A notice was placed in the Hospital Infection Society newsletter inviting infection control personnel to submit examples of the posters they use to be displayed at the Federation of Infection Societies Meeting, November 1996.

Sample

Eighty-six posters were donated from 70 respondents. Two posters were sent by an Infection Control Doctor in Belgium; the rest were sent by Infection Control Teams from all over Britain. Four British teams sent more than one poster; one sent six; one sent four, two sent two. Eight different posters commissioned by the Infection Control Nurses' Association of Great Britain were received from different sources. Seventeen of the posters received were duplicated leaving a final sample size of 69.

Data Analysis

The posters were analysed in two stages: message-framing and message categorisation. They were also examined to assess whether the information given was correct and consistent. The presentation style of the posters was also noted.

Message-Framing

The 69 posters were analysed for the number of messages they contained, with a message being defined as a brief communication, either explicit or implicit. They were then analysed to determine the extent to which the messages were underpinned by theoretical principles of message-framing (Tversky and Kahneman, 1981,1992). This included whether the messages were framed in terms of losses or gains (Rothman and Salovey, 1997; Detweiler et al., 1999) the use of threats or fear appeals (Rogers, 1975,1983; Self and Rogers, 1990; Janis and Fesbach, 1953; Kirscht and Haefner, 1973) and the extent to which constructs such as personal responsibility as well as attitudes and perceived behavioural control (Ajzen, 1985) were targeted.

Category Formulation

Message(s) conveyed by the posters both in writing and pictorially were then analysed to determine emergent categories. As a category became apparent, a file was created and then all posters relevant to that category were filed under it and coded accordingly.

Categories drawn up were designed to be exhaustive and mutually exclusive at the same level of analysis (Atkins, 1984). Four categories emerged: instructional which simply told (i.e. instructed) the viewer to wash their hands; informational which provided some reason to support the instruction for hand washing; training which showed viewers how to wash their hands and conscience raising which attempted to heighten viewers' sense of responsibility for handwashing albeit through the use of different strategies.

Independent Judge

In order to enhance the objectivity of the analysis, the data were also analysed by an independent judge. Atkins (1984) considers that a sample selected at random by the judge would suffice. However, in this study, all 69 posters were analysed by the researcher and an independent judge, thereby increasing the trustworthiness through triangulation. The two judges then met to discuss their respective analyses. There was 100% agreement as regards the message-framing. There was 88% agreement (61/69) as regards the categorisation of the posters. Disagreements were discussed, posters re-examined and then assigned to the category in which the message was considered to be most salient by both judges.

Results And Discussion

Message-Framing

The 69 hand hygiene posters analysed in this study exhibited an impressive range of ideas. There were 75 messages; 73 were in English, one was in French and one was in Flemish, translated by a Belgian colleague. Those who designed them presumably thought that they would motivate healthcare professionals to wash their hands. However, as Table 57 shows, only 41% (31/75) of the messages which they conveyed were gain-framed which, according to Rothman and Salovey (1997), is how health promotion messages should be framed.

Table 57 How the messages were framed (n=75)

Gain-framed messages n=31		Loss-framed messages n=8		Neither n=36
Attaining a desirable outcome	Avoiding an undesirable outcome	Attaining an undesirable outcome	Avoiding a desirable outcome	
19[1,2] (5 implied)	12[1,2] (5 implied)	7[1,3]	1[3]	

Notes [1] Two posters had both a both a gain-framed and a loss-framed message.
[2] One poster had two gain-framed messages.
[3] One poster had two loss-framed messages.

Examples of these are shown in Figure 20 which aims to 'attain a desirable outcome' whilst the message in Figure 21 aims to 'avoid an undesirable outcome'. One poster carried two gain-framed messages.

Figure 20 Gain-framed message: attaining a desirable outcome

Figure 21 Gain-framed message: avoiding an undesirable outcome

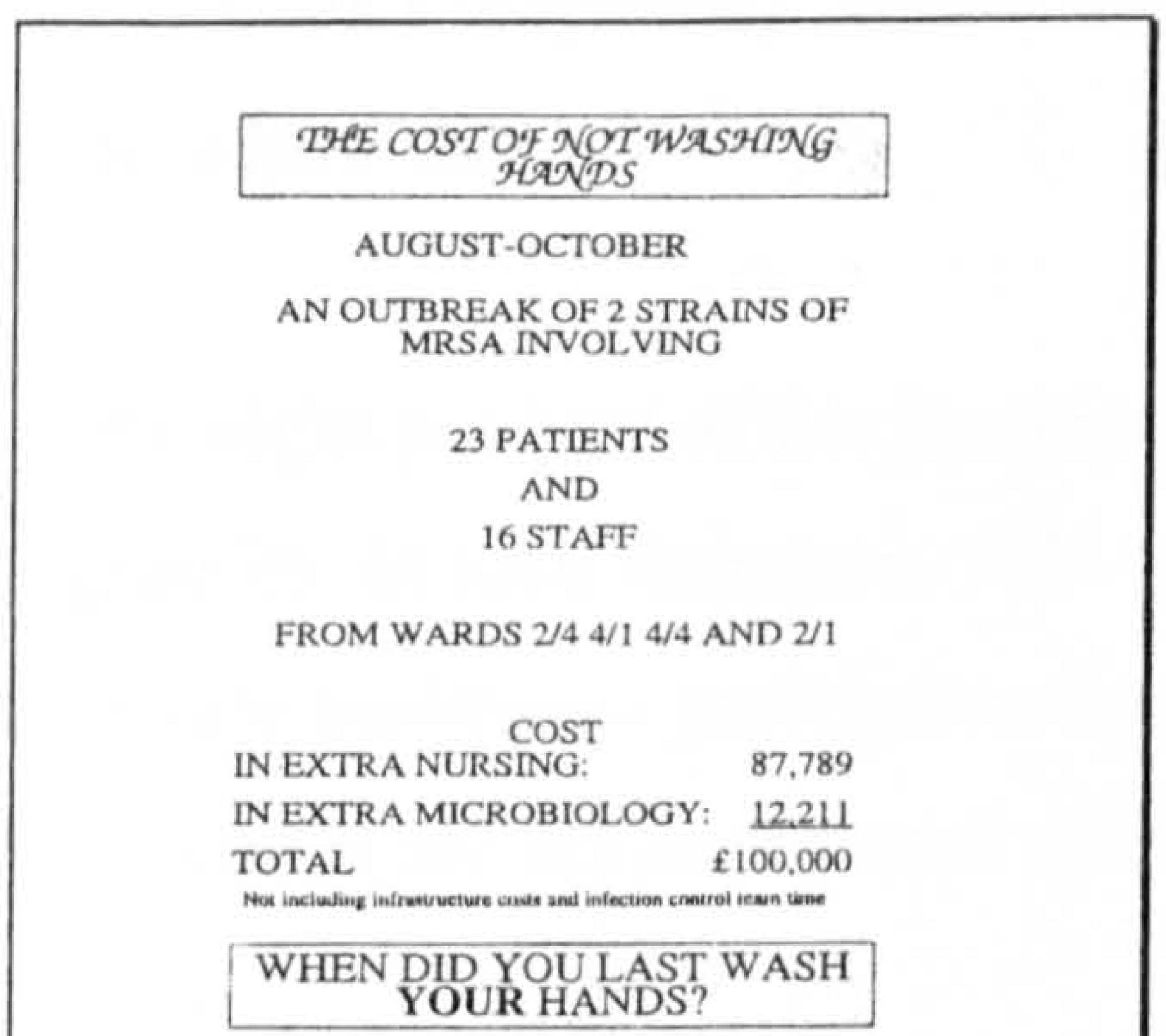

Figure 22 Loss-framed message: attaining an undesirable outcome

Figure 23 Gain-framed and loss-framed messages

Eleven per cent (8/75) of the messages were framed in terms of losses, which Rothman and Salovey (1997) have shown to be more appropriate for illness detection behaviours. These can be exemplified by Figure 22 which carries a loss-framed message: 'attainment of an undesirable outcome'. Two posters carried both a gain-framed and a loss-framed message e.g. Figure 23 'attaining a desirable outcome' and 'attaining an undesirable outcome' respectively. Such mixed messages may confuse rather than motivate. Some of the messages were implicit rather than explicit. For example, Figure 24 shows hands contaminated by sneezing and implies that others can be prevented from catching the germs if hands are washed, thereby 'avoiding an undesirable outcome'. Figure 25 shows a sketch of sheriffs shooting 'germs' dead with the message *"There's only one law in this town – wash your hands!"* and tombstones engraved *"R.I.P. A. Germ"* indicating that a desirable outcome has been obtained by killing the germs through handwashing.

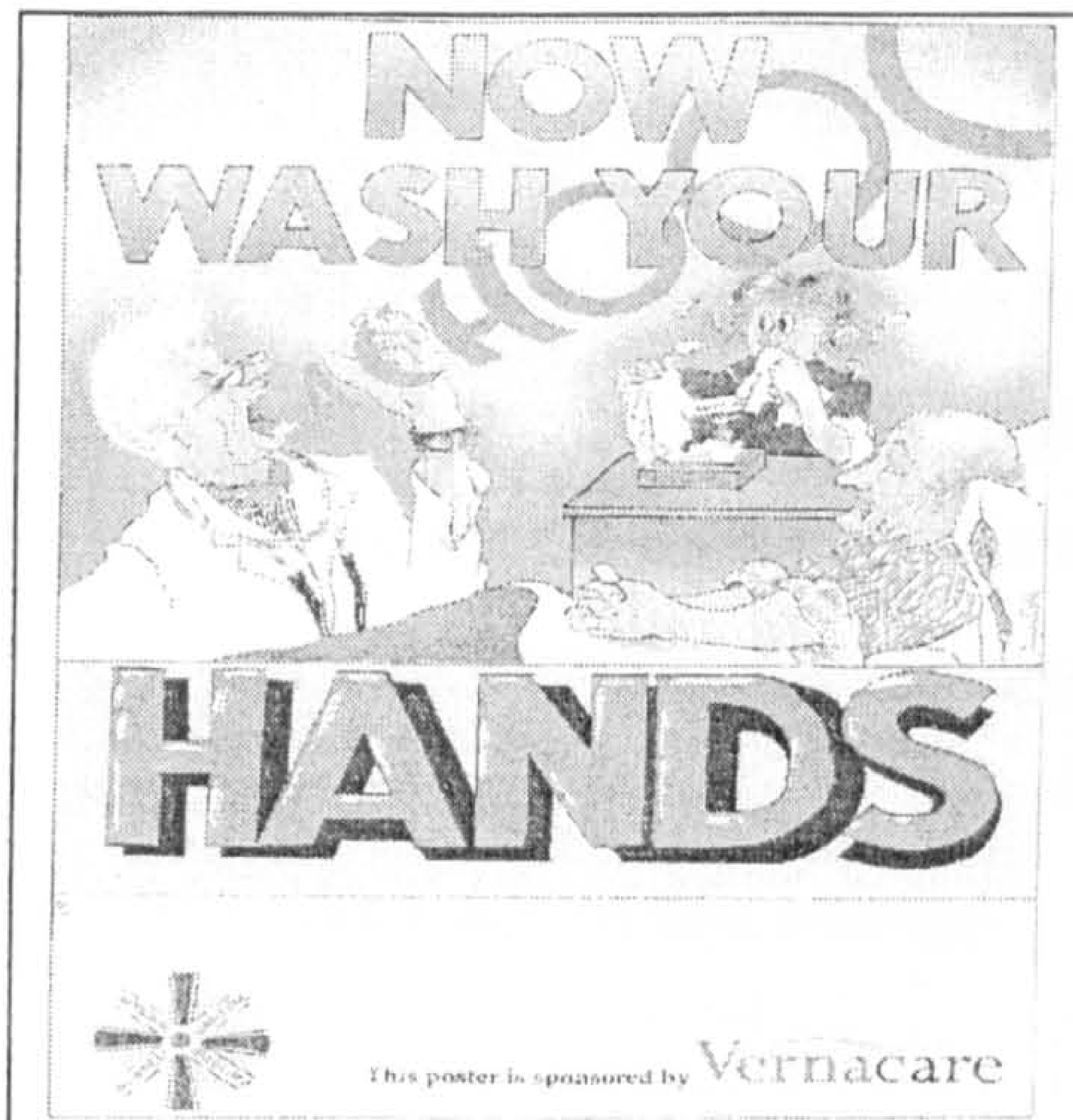

Figure 24 IMPLIED Gain-framed: avoiding an undesirable outcome

Figure 25 IMPLIED Gain-framed: attaining a desirable outcome

However, according to Gould and Brooker (2000, p.112) *"The aim of ward hand hygiene is to **remove** transient micro-organisms before their transfer to susceptible patients,"* not to kill them (researcher's emphasis). Whilst hidden meanings may have a certain intellectual appeal, they must not mislead.

Forty-eight per cent of the messages (36/75) were neither gain-framed nor loss-framed e.g. Figure 26. In total therefore, 59% (44/75) of the messages were not framed in such a way as to motivate healthcare professionals to wash their hands. This is a big lost opportunity and shows that posters are not being used as effectively as they could be.

Figure 26 Message neither gain- nor loss-framed

Figure 27 Loss- framed message: attaining an undesirable outcome; Fear appeal

The use of *threats* or *fear appeals* was evident in only two posters. One was loss-framed: avoiding an undesirable outcome (see Figure 1, p.43). The coffin reminds people that 10% of patients die as a result of healthcare-associated infections (Plowman et al., 1999) but that washing hands helps to prevent this outcome. The other was loss-framed: attaining an undesirable outcome (see Figure 27). This illustrates the protective clothing and 'plague mask' worn by old women who performed the gruesome task of 'searchers' during the Great Plague of London in 1665 which killed more than a fifth of the inhabitants (Guthrie, 1945). It reminds the healthcare professional about the high mortality rate resulting from the Black Death and is used as an analogy for the potential seriousness of the current outbreak referred to. Considering that every year over 100 000 patients acquire an infection whilst in hospital and 5 000 people die as a result of healthcare-associated infections (Plowman et al., 1999), it is perhaps surprising that so little use was made of this strategy.

Three posters carried messages which emphasised the fact that hand washing was the *personal responsibility* of each individual (e.g. Figure 28), yet the messages were neither gain nor loss-framed.Messages on posters should target this construct for, as shown in Study 1, it is a significant predictor of intention to practise appropriate hand hygiene behaviour.

Only one poster (Figure 23) highlighted that handwashing prevents self-infection as well as cross-infection of patients. Protection Motivation Theory (Rogers, 1975; 1983) would suggest that posters should endeavour to emphasise the benefits to self in addition to gains for patients.

One poster was designed to target *attitudes* (Figure 29). This illustrates the painting of St.Thomas by Batista and conveys a message to convince doubting Thomas. The poster shown in Figure 30 was interpreted as an attempt to target the construct of *perceived behavioural control*; it promotes alcohol hand rub between each patient contact as opposed to handwashing, which takes longer to perform.

Figure 28 Message targeting 'personal responsibility'

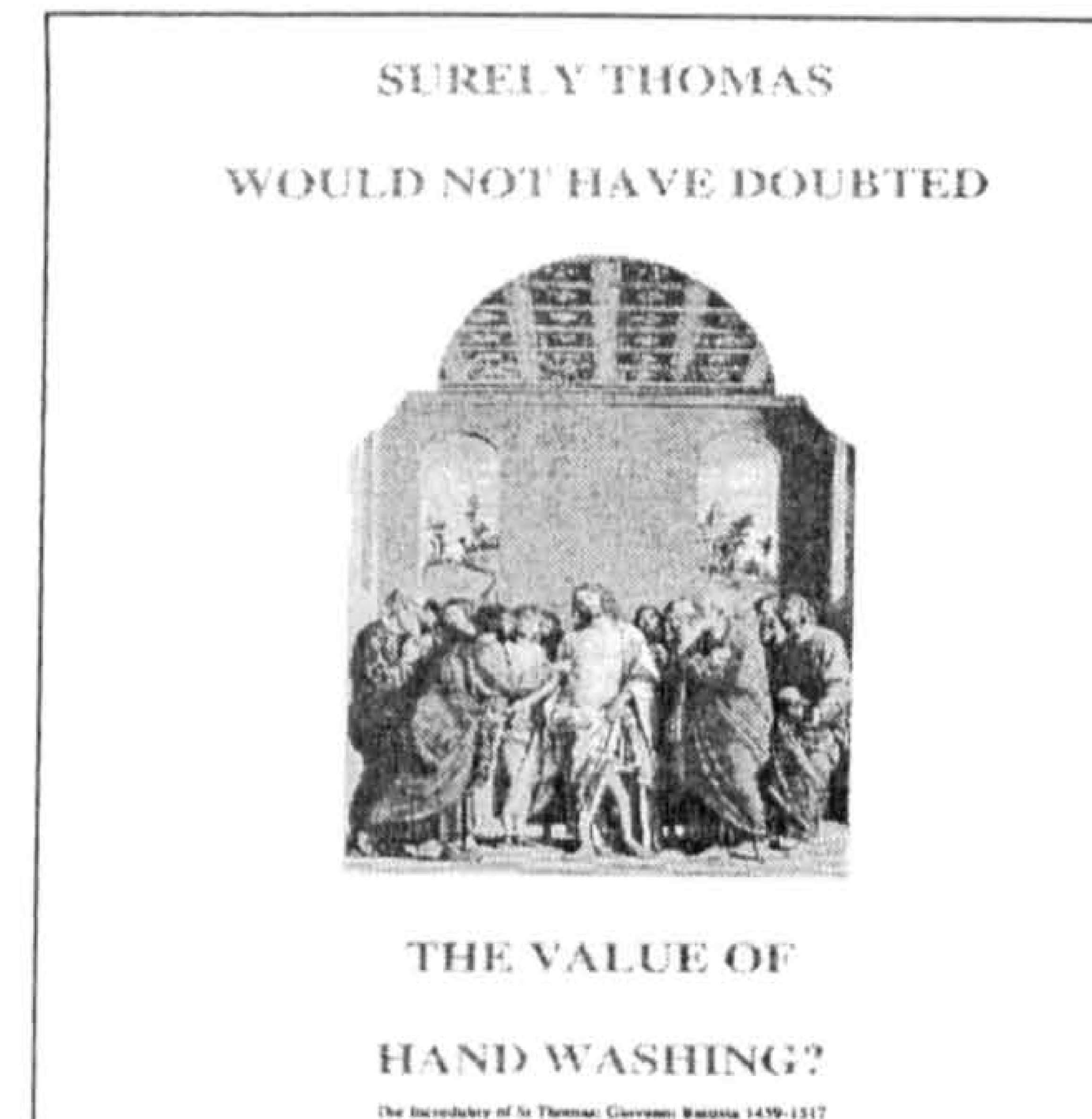

Figure 29 Message targeting 'attitudes'

Figure 30 Message targeting 'perceived behavioural control'

Figure 31 Micro-organisms portrayed as 'creatures'

Some posters used cartoons to depict micro-organisms as creatures with hands, legs and faces (Figures 21, 31, 32). Courtenay (1998) has described nurses' ill-conceived understanding of the motility of micro-organisms. These posters certainly reinforce such unrealistic perceptions and may well be the origin of them. Some Infection Control Teams have launched a counter-offensive to disabuse the viewer of such misunderstandings. For example, the message in Figure 33 explains that *"This virus doesn't walk or fly."* However, this would not be necessary if messages were framed in such a way as to respect healthcare professionals' intelligence.

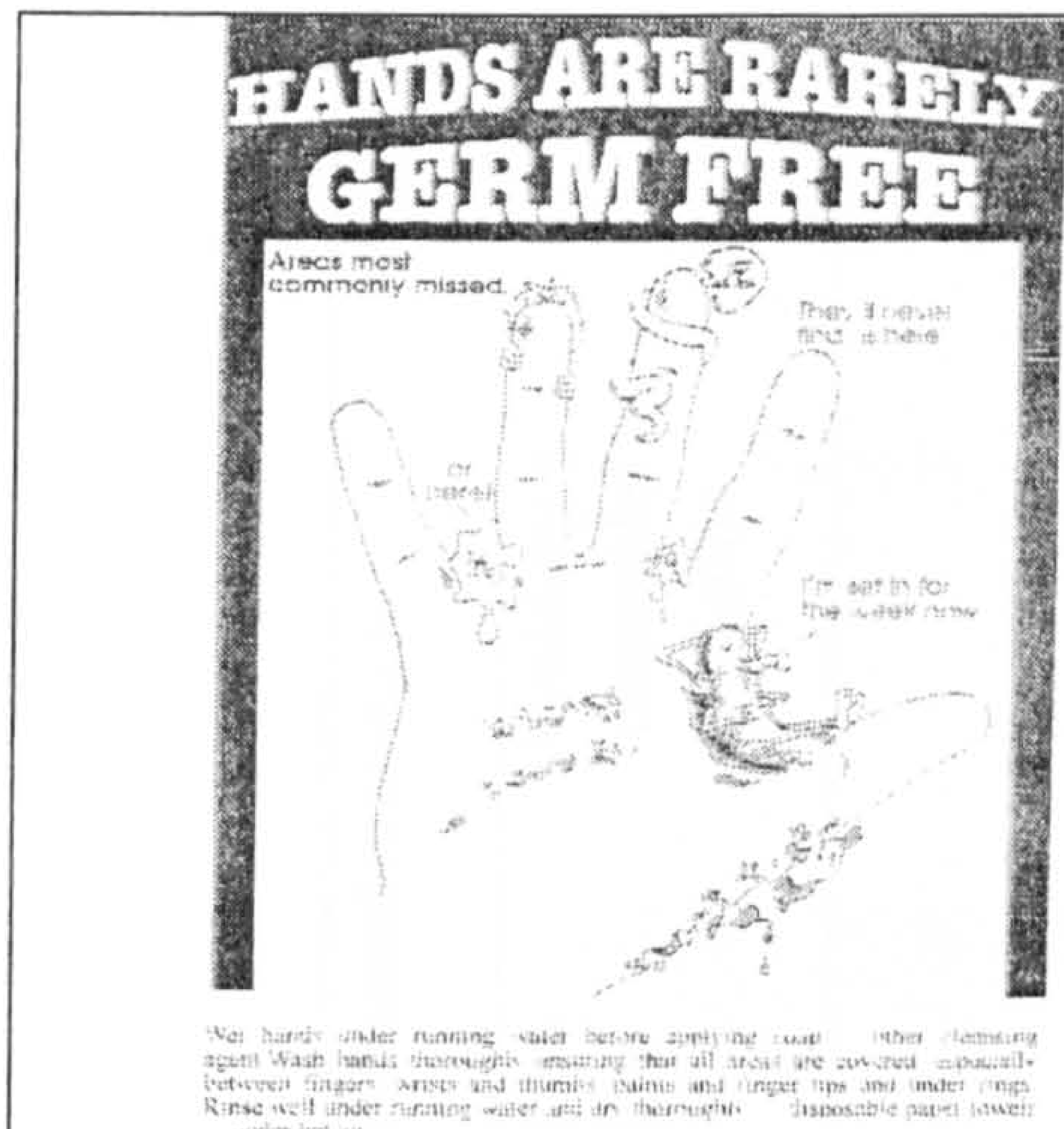

Figure 32 Micro-organisms portrayed as 'creatures'; Training category

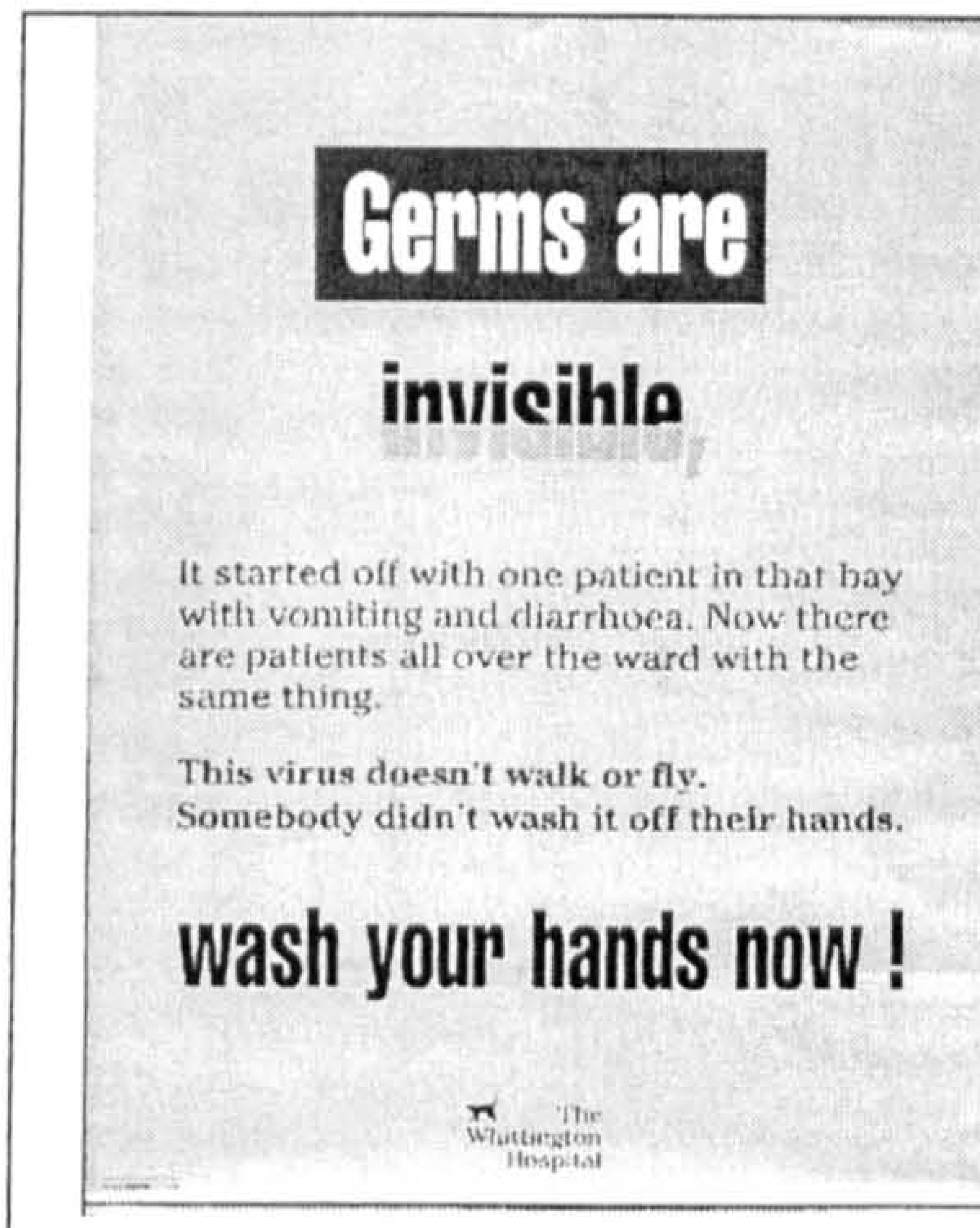

Figure 33 "This virus doesn't walk or fly"

Poster Categories

The extent to which the gain-or loss-framed messages were represented in each of the categories is shown in Table 58.

Table 58 How the messages were framed (n=75) according to category

	Gain-framed messages		Loss-framed messages		Neither
Category	Attaining a desirable outcome	Avoiding an undesirable outcome	Attaining an undesirable outcome	Avoiding a desirable outcome	
Instructional – humorous	1 (implied)	1 (implied)			8
Instructional – non-humorous	5 (2 of which implied)	3 (2 of which implied)			7
Informational	8[1] (1 of which implied)	3 (1 of which implied)	4[1,2]	1[1]	3
Training	3[3]	1[3]			12
Conscience raising	2 (1 of which implied)	4[1] (1of which implied)	3[1]		6
Total messages (n=75)	19	12	7	1	36

Notes [1] Two posters had both a both a gain-framed and a loss-framed message.
[2] One poster had two loss-framed messages.
[3] One poster had two gain-framed messages.

Category 1: Instructional

There were 25 posters in this category which constituted 36% of the total. They were subdivided into humorous n=10 (14%) (see Figure 24) and non-humorous n=15 (22%) (see Figure 26). Despite the lack of literature to support the use of humour, it featured strongly in messages on posters in this category. Given the diverse ethnic groups of staff who work in the health service in this country, it is important to remember that humour is not necessarily transcultural and may be misunderstood.

Of the 52% of the posters (36/69) that carried messages which were neither gain-nor loss-framed, 41% (15/36) of them were in this category (Table 58). Whilst there is no doubt that healthcare professionals do need to increase the number of times they wash their hands (Pittet, 2000; Tibballs, 1996) simply *telling* them is not the most effective way to get them to do it (Alvaran et al., 1994). People need to be *persuaded* to wash their hands.This may be accomplished if they can be convinced that the behaviour change is in their best interests, but the self-interest needs to be made clear to them (Bennis et al., 1985).

Category 2: Informational

Just under a quarter (16/69) of the posters aimed to inform. These conveyed messages about the effectiveness of handwashing in the prevention of healthcare-associated infections; warnings about infection hazards of wearing a wrist watch; the costs of outbreaks of infection and the role of alcohol hand rub in preventing the spread of various organisms. This category had the greatest number of gain-framed messages 35% (11/31) (see Figure 34) but it also had the greatest number that were loss-framed (5/8) e.g. Figure 22.

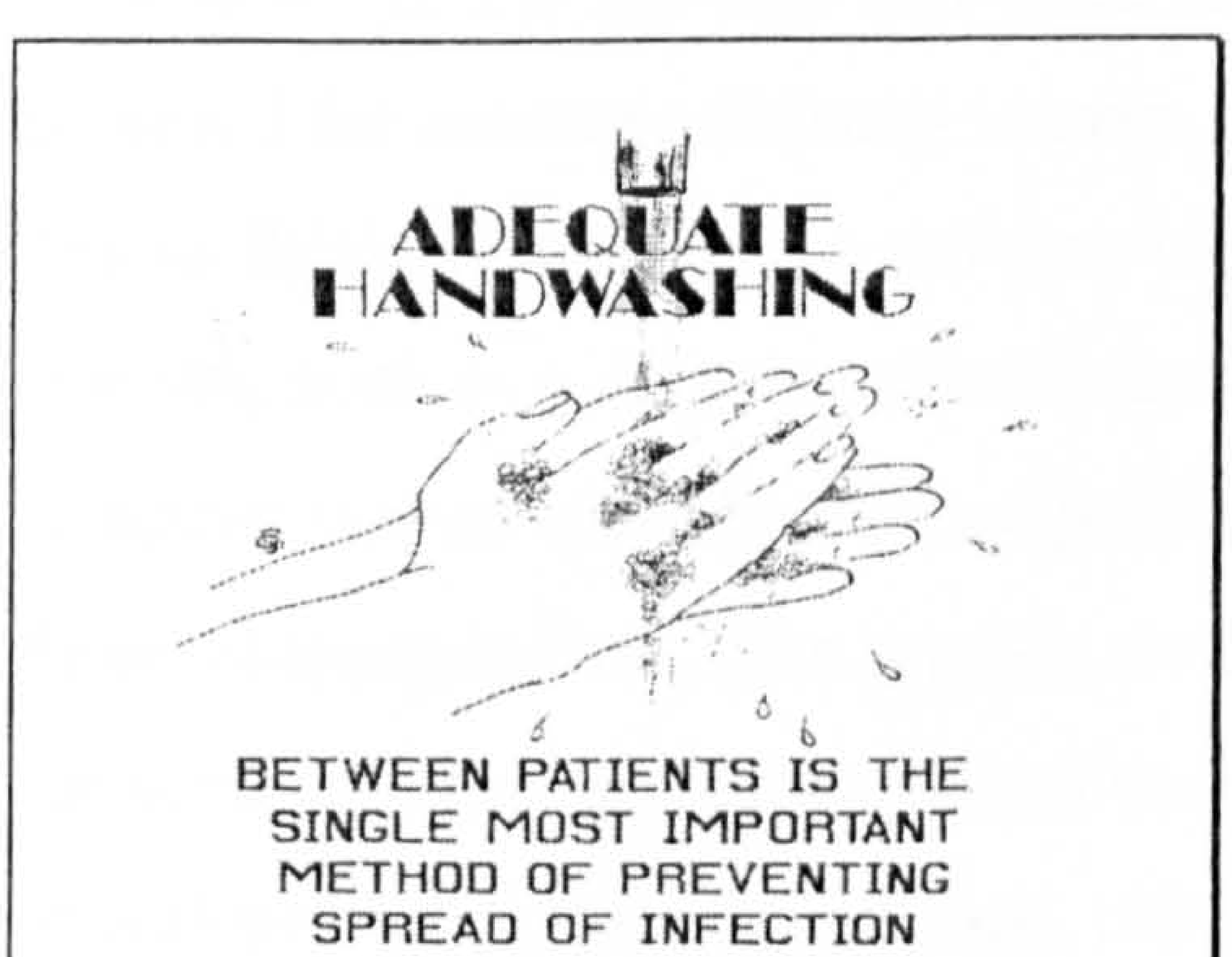

Figure 34 Informational category

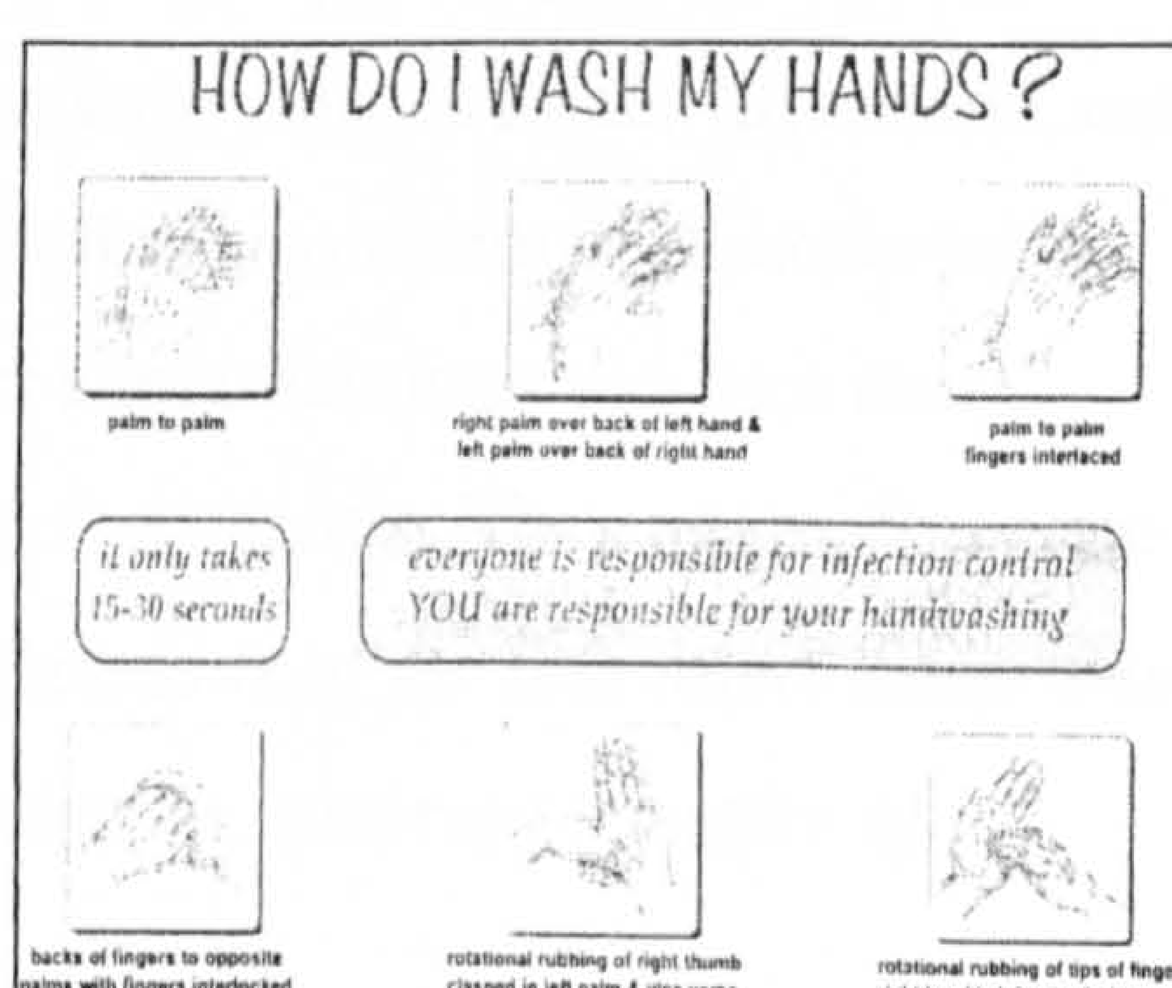

Figure 35 Training category. Message targeting 'personal responsibility'

Category 3: Training

Fifteen posters (22% of the total) were designed to explain the procedure for handwashing (Figure 32) or show the technique. A third of the posters (12/36) which carried neither gain-nor loss-framed messages were in this category and 12 of the 15 posters illustrated the 'six step technique' (Ayliffe et al., 1978) (Figure 35) or variations on this theme. The number of steps varied according to whether or not the poster was endorsed commercially and, if so, by which company. For example, a poster endorsed by a company that makes alcohol hand rub promotes an eight step technique (Figure 36) whereas a poster endorsed by a company that makes hand towels illustrates a 10 step technique (Figure 37). This emphasises the importance of hand-drying which has been shown to be a vital conclusion to the handwashing procedure (Marples and Towers, 1979; Gould, 1994b). Such inconsistency of messages may encourage people to ignore them altogether. Posters which illustrate the 'six step technique' represented 17% of the total (12/69).

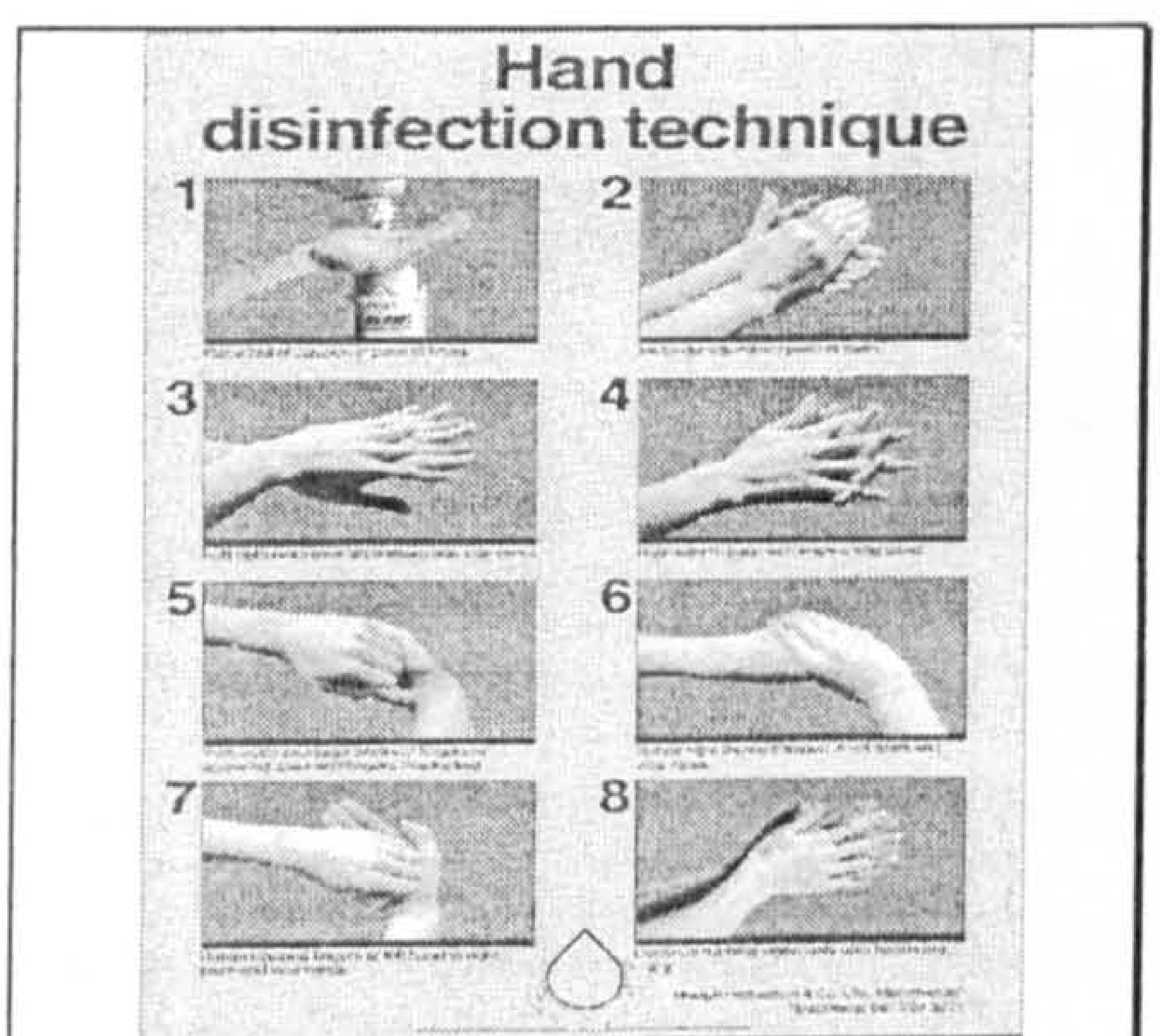

Figure 36 'Eight step technique'

Figure 37 'Ten step technique'

However, in a survey conducted more recently, Storr and Brind (2003) reported that 54% of the Infection Control Teams said that they based their poster campaigns around the 'six step technique'. If it is the case that more use is now being made of this type of poster, then the lost potential for message-framing is even greater, which is most worrying. Why do Infection Control Teams think posters are a good way to teach a behaviour? Perhaps some form of experiential learning such as a demonstration followed by practice under supervision would be a more effective way to teach healthcare professionals how to wash their hands. Then again, there are those who argue that *"The specific technique used to wash hands is of far less importance than the occurrence of any type of hand wash at an appropriate time to interrupt transfer of infection."* (Hoffman and Wilson, 1995, p.211).

This begs the question as to what represents an 'appropriate time'? Posters conveying messages about *when* hands should be washed were also inconsistent. For example, some posters (e.g. Figures 30, 34) refer to hand washing/rub *between* patients, whereas others (e.g. Figure 38) bid the healthcare professional to wash hands "*before and after* having patient contact" (researcher's emphasis). Furthermore, the term 'patient contact' lacks clarification and is therefore subject to individual interpretation.

Figure 38 Timing of handwash

Posters in the training category not only give conflicting messages regarding the timing of the handwash and the technique that should be employed, but also the *duration* of the handwash. Some posters advocate 60 seconds (Figure 37) which accords with the test procedure described by Ayliffe et al. (1978) whilst others promote one lasting 15-30 seconds (Figure 35) which accords with the guidelines produced by the Infection Control Nurses' Association of Great Britain (1999). This may partly explain why the amount of time that nurses actually spend on each handwash has fallen from a mean of 21 seconds (Taylor, 1978b) to 6.5 seconds (Gould, 1994a). However, pressures of work and time constraints are reasons staff commonly give for failing to wash their hands (Larson and Killien, 1982) but even when they do, the technique is poor (Taylor, 1978a). In an attempt to address this perceived barrier, alcohol-based products such as hand rubs (see Figure 30) are now commonly used as they can disinfect hands that are not visibly soiled more quickly than a handwash (Mackintosh and Hoffman, 1984). Nevertheless, they are intended to be an adjunct to, not a substitute for, handwashing and it will be important that messages on posters make this distinction.

Furthermore, time is only one factor affecting the response efficacy. As with detergent-based hand cleaning products, alcohol-based products also cause skin problems (Kownatzki, 2003). So, if healthcare professionals are to be persuaded to improve their hand hygiene practice, other response costs must also be minimised. Hence alternative products, such as non-detergent emulsion cleansers that will not damage the skin, need to be promoted (Kownatzki, 2003).

Category 4: Conscience Raising

Thirteen posters (19% of the total) used messages to heighten healthcare professionals' recognition of the value of handwashing. Strategies included the use of fear appeals (Figure 27), appeals to healthcare professionals' sense of personal responsibility (Figure 28, 35) and enhancement of attitudes (Figure 29). As shown in Study 1, greater use needs to be made of messages that target the constructs of personal responsibility and attitudes as well as fear appeals (Janis and Fesbach, 1953; Kirscht and Haefner, 1973).

Production Style Of Posters

The posters analysed in this study were a mixture of amateur, semi-professional and professional productions (see Table 59). Fifty-eight per cent of the posters (40/69) were produced in an amateur style e.g. Figure 25. Twenty-eight per cent (19/69) were classified as semi-professional e.g. Figure 33. Fourteen per cent (10/69) were produced professionally and funded by companies that made hand hygiene products or antibiotics or published journals carrying an infection control supplement (Figures 24, 26, 36, 37).

Of those that were produced professionally, 90% (9/10) carried messages that were neither gain- nor loss-framed. Only one, in the instructional non-humorous category, carried a gain-framed message. Considering that most of the professionally produced posters were designed to market the use of products, it is surprising that they were so poor at utilising the correct principles of message-framing. Brown (1969) argued that graphic designers should be employed in the preparation of posters. However, whilst a professionally produced, glossy, coloured poster may look better than one designed and produced in-house, if the message is not framed appropriately, it may not be so successful in motivating healthcare professionals to wash their hands.

Table 59 The style of the production of the posters (n = 69)

Category	Style of production		
	Amateur	Semi-professional	Professional/ Commercial
Instructional – humorous (n=10)	2	8	
Instructional non-humorous (n=15)	10	3	2
Informational (n=16)	15	1	
Training (n=15)	6	1	8
Conscience Raising (n=13)	7	6	
Total	40	19	10

Contrary to Brown's (1969) recommendation that *"posters should not be confused with teaching charts"* (p.316), just under a quarter were categorised as training posters. Infection Control Teams may consider it necessary to use posters designed in this way because, as discussed in the literature review, hand hygiene training receives scant attention in pre-registration curricula (Courtenay, 1998; Emmerson and Ridgway, 1980) and its practice is positively discouraged in post-graduate examinations (Darley et al., 2000). However, there are those who are now calling for this state of affairs to be addressed (Feather et al., 2000). Perhaps then the aim of hand hygiene posters should be to motivate or remind staff to wash their hands, for some do simply forget (Michiels et al., 2000), especially those in whom the habit has not been embedded.

In addition to the use of posters, perhaps Infection Control Teams should make greater use of today's information technology. Hospitals' intranet systems and e-mail (Dibb, 2004) could be explored as a medium for communicating handwashing messages.

Conclusion

An impressive collection of hand hygiene posters was received from generous donors. Analysis of the messages revealed that most were not framed in the most effective way to motivate healthcare professionals to decontaminate their hands. Indeed, many posters conveyed mixed messages as well as inconsistent ones. This is probably adding to the confusion in the healthcare professional's mind regarding hand hygiene. This commonly used communication medium is therefore not being used to its best advantage.

Posters will no doubt continue to be used in an attempt to improve healthcare professionals' hand hygiene practice. If they are to be cost effective, it is essential that theoretical principles of message-framing be used. More use could be made of repeated minimal fear appeals, but they too should be gain-framed. It would seem fitting for posters to target the personal responsibility which healthcare professionals need to exercise as part of their accountability for patient care as well as the other relevant constructs of the TPB. Messages should be readily understood by healthcare professionals from diverse ethnic groups with various health beliefs.

Suggestions for gain-framed messages to promote hand hygiene are offered in Table 60. A direction for future research would be to test the effect of these in the clinical setting.

Table 60 Suggested ways to gain-frame hand hygiene messages

Attaining a desirable outcome	Avoiding an undesirable outcome
Wash your hands to protect yourself and others from infection.	Don't forget to wash your hands or you will expose yourself and others to infection.
If you wash your hands, you increase your chances of preventing self-and cross-infection.	If you wash your hands, you decrease your chances of getting infected and of cross-infecting others.
Washing your hands increases your chances of staying infection free.	Washing your hands decreases your risk of self-infection.
The more you wash your hands, the more you will be protected from catching a healthcare-associated infection.	Not forgetting to wash your hands is the surest way to reduce your risk of catching a healthcare-associated infection.
Protecting yourself by handwashing is the surest way to prevent healthcare-associated infections.	Washing your hands is the surest way to protect yourself and others from infection.
You are caring for patients right now – have you washed your hands to ensure that you stay infection free?	You are caring for patients right now – have you washed your hands to protect yourself and others from infection?

Chapter 11

Study 8

Healthcare Professionals' Hand Hygiene Behaviour

Introduction

The studies reported hitherto have utilised self-report measures. One of the limitations of this method is that it may result in over-estimation of intention and behaviour (Abraham et al., 1999). In Study 1, only a quarter of respondents said that they would *always* wash their hands before and after contact with each patient. While this might in itself be viewed as a worringly small proportion, given the discrepancy between what people say they do and what they actually do in practice, the reality is likely to be even worse. This study was therefore designed to determine the extent of the relationship between intentions and behaviours.

Aims

The study had five aims.

1. To determine the extent to which the TPB constructs predict self-report hand hygiene behaviour.

2. To determine whether there is a correlation between self-report hand hygiene behaviour and actual hand hygiene behaviour.

3. To determine the extent to which healthcare professionals adhere to hand hygiene guidelines.

4. To determine whether their hand hygiene behaviour is influenced by the nature of the risk of the care activity performed, including those performed on patients with MRSA.

5. To determine which products are used for hand hygiene.

Method

Design

Non-participant observation by two observers of healthcare professionals' hand hygiene practice and a cross-sectional survey of their self-report hand hygiene behaviour.

Participants

All healthcare professionals (i.e. doctors, qualified nurses including 'permanent' agency/bank nurses, therapists and healthcare assistants) working dayshifts on four wards (two neurology and two neurosurgery) in a teaching hospital were invited to participate in the study (Appendix 1). The total number of staff who gave informed, written consent (Appendix 2) was 133 out of a possible 135.

One hundred and thirteen questionnaires were completed by those who had consented to participate (85%) of which 55 were from the two surgical wards and 58 from the two medical wards. However, due to staff movements, not all these were available when the observation phase began. The number of participants who had both completed a questionnaire and who were observed was 71. This sample included 42 registered nurses (59%); 5 therapists (7%); 14 healthcare assistants (20%); and 10 doctors (14%). Forty-eight (68%) of the respondents were female. Seventy-two per cent of those who had completed a questionnaire (51/71) were observed four or more times. Table 61 summarises the sizes of the samples used for different analyses.

Table 61 Summary of samples used for different analyses

Participants	Sample size	Use
Those completing questionnaires	113	Correlations between TPB predictors
Those who were observed	81	Analyses of observed behaviour
Those who were observed at least once and who completed a questionnaire	71	Correlations between self-report behaviour and observed behaviour
Those who were observed on four or more occasions and who completed a questionnaire	51	Sub-set used for correlations between self-report behaviour and observed behaviour

Setting

The wards were chosen on the basis of their layouts which were very similar and facilitated observation. There were four bays, each with six beds, plus two side rooms and all were alike in terms of the number and location of sinks which were readily accessible at the entrance to each bay/side room. The sinks were therefore easy to observe which Kaplan and McGuckin (1986) have shown to be of critical importance.

Measures

Definition Of A Handwashing Opportunity

The target behaviour of handwashing was defined in accordance with national guidelines (UK Health Departments, 1998). These state that hands should be washed *"before and after contact with each patient, and before putting on and after removing gloves."* (p.9). Hence, an observation opportunity was defined as 'any occasion when a participant performed any activity which merited hand hygiene.' This included direct physical contact with a patient, their equipment, medication, food or prior to going on their break (see Appendix 12). It excluded non-patient care activities such as answering the telephone, writing up case notes etc. whilst sitting at the nurses' station. 'Handwashing' was understood variously as cleansing the hands with water alone, with water and one of the available handwashing products or with alcohol hand rub. No judgement was made about the duration or efficacy of the handwashing technique.

Observation Of Practice

The hand hygiene practice of consenting participants was observed by the researcher and an assistant. Inter-rater reliability was established at the outset by both researchers observing the same practices for two days on each of the four wards, kappa 0.90; range 0.75-1.0. In order to minimise the observer effect, the researchers 'hung out' on the wards and conducted preliminary observational sessions to reduce gradually the healthcare professionals' awareness of their presence. Practices were observed at different times on different days to limit selective bias. The research assistant, who was not a nurse, was not granted permission to observe patient care activities of a personal nature. Patients' informed oral consent was obtained as appropriate. Observation of both care activities and participants was opportunistic. On entering the wards, the observers individually 'shadowed' the first healthcare professionals they encountered who performed a patient care activity. These individuals were observed until they had ceased to perform patient care activities. On any occasion, a participant may have been observed performing a discrete care activity on one individual patient, or sequential care activities on the same patient, or care activities on sequential patients. Examples of these are presented as cameos. Observations ranged from the performance of simple, non-invasive care activities such as taking and recording vital signs which took a few minutes, to invasive procedures such as bladder catheterization which took over 45 minutes to perform. Observations of hand hygiene practice took place in the sluice and treatment rooms as well as the wards and involved going behind bed curtains and into side rooms which were usually occupied by patients with MRSA.

Observation took place on weekdays from 9am to 7pm after which time there were very few patient care activities performed. Observation periods were never longer than two hours as it was found during the pilot phase that longer sessions were tiring and resulted in loss of information. Coffee, lunch and tea breaks were taken off the wards at appropriate intervals.

Eighty-one participants and a total of 142.6 hours of healthcare professionals' work was observed. The total number of observations recorded was n=644 which constituted n=1288 hand hygiene opportunities (before and after performing the care activity) (see Table 62).

Table 62 Number of observations and total observation time for all four wards combined, by professional group

Professional group	n	Number of observations	Total observation time Hours (decimal) Minutes in brackets
Staff Nurses	42	359	80.28 (4817)
Enrolled Nurses	5	32	6.58 (395)
Sisters and Charge nurses	4	26	5.91 (355)
Doctors	12	22	5.02 (301)
Therapists	3	11	2.58 (155)
Healthcare Assistants	15	194	42.28 (2537)
Total	81	644	142.65 (8560)

Observation Schedule

An observation schedule was devised and piloted (Appendix 13). To maintain anonymity, individual identities were not recorded. Information about participants was recorded using coded numbers. Data recorded included: type of care activity performed; whether hands were cleaned[7] before and/or after the activity; type of hand cleansing product used. There were four different products available at every sink: chlorhexidine gluconate (Hibiscrub); povidone iodine (Betadine); liquid soap and alcohol gel. Alcohol gel was also available on every patient's bedside locker. Relevant contextual information was also recorded and these qualitative data were used for cameo illustrations of care activities observed. These included patient or equipment contact, glove use and whether isolation precaution notices were posted on side room doors. Scores for observed behaviour were based on the mean per cent of occasions participants washed their hands before, after and both before and after care activities.

Risk Scoring Protocol For Care Activities

A protocol was devised to assess the nature of risk of cross-infection to the index patient, other patients and self from the care activities performed. Activities were assigned a score where 1 = none to low risk e.g. taking observations; 2 = medium risk, e.g. administration of medicines via a percutaneous endo-gastrostomy tube and 3 = high risk of cross-infection, e.g. contact with blood. It was adapted from that developed by Ayliffe et al. (1993) to assess cross-infection risks to patients from equipment and the environment.

Two key factors were taken into consideration: the inherent nature of the activity itself (e.g. invasive versus non-invasive procedures; clean versus dirty procedures) and the status of the individual (i.e. patient versus healthcare professional). In order to be able to determine whether hand hygiene behaviour before and after patient care was influenced by the nature of the risk of the care activity performed, the scoring also had to take account of whether the activity posed a risk of infection *to* the index patient or *from* the index patient to other patients and staff. In the former case, hand hygiene *before* is paramount, whereas in the latter case, hand hygiene *after* is paramount. However, in the healthcare professional's mind, hand hygiene performed *after* a care activity may be viewed as hand hygiene *before* the next activity, especially if care activities are sequential. In practice, however, care activities are frequently subject to interruptions. This

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[7] The term 'cleaned' is used to embrace all hand hygiene activities such as washing with liquid soap or a detergent disinfectant, and hand rub with an alcohol-based gel.

highlights the importance of healthcare professionals basing their hand hygiene practice on risk assessment. An iterative approach was used to develop the protocol which was sent to two infection control experts on two occasions for critical comment. The final version of the protocol is shown at Appendix 14.

Questionnaire

A 13-item, self-report questionnaire was adapted from the one designed for Study 1 (Appendix 5). For this study, only the constructs of the Theory of Planned Behaviour (TPB) (Ajzen, 1985; 1991) were measured viz attitudes, subjective norms, perceived behavioural control, intention and behaviour. With the exception of behaviour, the TPB constructs were measured using multiple items as recommended by Conner and Norman (1996). The response format for all items was a seven point differential scale. Some items were reversed (and then reverse-scored) in order to reduce the probability of a positive response bias (Howell, 1992).

Attitudes were measured through four items and had an overall internal consistency value of 0.77 (Cronbach's Alpha) e.g. 'washing my hands before and after every patient contact is....', (1 = 'not important', 7 = 'very important'). *Subjective norms* were measured through two items (Cronbach's Alpha, 0.71), e.g. 'I feel under social pressure from the other staff on the ward to wash my hands before and after contact with each patient' (1 = 'strongly disagree', 7 = 'strongly agree'). *Perceived behavioural control* was measured through two items (Cronbach's Alpha, 0.83) e.g. 'If I wanted to, I could easily wash my hands before and after contact with each patient' (1 = 'likely', 7 = 'unlikely'). The construct of *intention* was measured through four items (Cronbach's Alpha, 0.78) e.g. 'I always intend to wash my hands before and after contact with each patient' (1 = 'strongly agree', 7 = 'strongly disagree'). For all multiple item constructs, mean scores were calculated. The single item used to measure self-report *behaviour* was 'I always wash my hands before and after contact with each patient' (1 = 'strongly agree', 7 ='strongly disagree').

The questionnaire was administered to all those who consented to participate in the study before the observation phase began, through a variety of means. This included giving them personally to participants face-to-face on the wards and at the end of induction sessions; leaving them with the Ward Sister and asking her to follow-up named individuals who had consented to participate and sending personalised mail shots through the internal post. Anonymity and confidentiality were ensured in order to enhance the response rate (Oppenheim, 1992) and to overcome possible apprehensions which might affect the honesty of responses. Data collection took place from May through to September 2000.

Data Analysis

Data were entered and analysed using SPSS v 11.0. The self-report questionnaires were analysed first to determine whether data from the two surgical wards and the two medical wards differed significantly in any way that would require their separate analysis, or whether they could be combined. The mean sum scores for the individual TPB constructs were calculated. A univariate Analysis of Variance showed that there were no significant differences (Table 63). Therefore, the responses from the participants on the four wards were combined (n=113).

Table 63 Sum of responses to TPB constructs by participants on surgical and medical wards

	Surgical wards		Medical wards		
Construct (No. of items)	Mean sum scores	SD	Mean sum scores	SD	Between groups F value
Attitudes (4)	26.127	2.308	25.490	3.428	F1.157,df 1, p=0.285
Subjective norms (2)	6.407	3.400	5.684	3.449	F1.236,df 1, p=0.269
Perceived behavioural control (2)	10.92	2.940	10.767	3.219	F.070,df 1, p=0.792
Intention (4)	23.769	5.554	23.750	5.110	F.000,df 1, p=0.985
Self report behaviour (1)	5.220	1.525	5.361	1.662	F.214,df 1, p=0.644

After the data were checked for outliers, correlation analyses were performed to determine the relationship between intention and self-report behaviour with observed hand hygiene practice. The Pearson product moment correlation test was used. This is an appropriate test to use when both variables are measured on an interval or ratio scale (Colman, 1995) and when data are normally distributed.

Observations of hand hygiene practice were analysed according to whether the behaviour had been performed before, after or before and after a care activity. Contingency tables were set up to determine how many participants washed their hands more or less often than 33%, 50% and 66% of the time before and after patient contact. As the observations before and after patient contact refer to the same person, and therefore the observations are not independent, χ^2 cannot be used. Therefore, a paired t test was used to compare the mean percentage of times that staff clean their hands before and after patient contact.

The care activities were scored according to whether they posed a low, medium or high risk of infection to the index patient, other patients or self. Contingency tables were set up using cross-tabs to explore whether hand hygiene behaviour before and after care differs according to the nature of the cross-infection risk posed by the healthcare activity performed. As the observations are independent, χ^2 was used as appropriate to determine whether the difference was significant.

Results

The TPB Constructs Predicting Self-Report Behaviour

In accordance with the TPB (Ajzen, 1985; 1991), attitudes and intention were significant predictors of self-report behaviour and attitudes were also a significant predictor of intention to perform hand hygiene (Table 64). Contrary to predictions arising from the theory, however, and in keeping with findings reported in Study 1, subjective norms were not found to be predictors of intention. However, the Pearson's product moment correlation indicated that they approached close to a conventional level of significance (p=.057) as predictors of self-report behaviour. Perceived behavioural control was also a significant predictor of intention and behaviour. However, it should be noted that only 23% (26/113) of participants reported that they "always washed their hands before and after each patient contact" (i.e. they answered this question with a score of 7). This is even lower than the finding of 25% reported in Study 1.

Table 64 Pearson's product-moment correlation co-efficients between TPB constructs (n=113)

	Attitude	p	Subjective Norms	p	Perceived Behavioural Control	p	Intention	p
Attitude								
Subjective Norms	.109	.285						
Perceived Behavioural Control	.169	.094	-.083	.395				
Intention	.485**	.000	.132	.179	.281**	.004		
Self-Report Behaviour	.324**	.001	.181	.057	.364**	.000	.644**	.000

** Correlation is significant at the 0.01 level (2 tailed)

The Relationship Between Intention And Observed Hand Hygiene Practice

Table 65 shows that there is no correlation between intention and actual hand hygiene practice either before *or* after care activities or before *and* after care activities.

Table 65 Pearsons's product-moment correlation co-efficients between intention and actual hand hygiene practice of those observed at least once (n=71)

	Intention	p
Observed adherence: those who washed their hands BEFORE the care activity	.099	.545
Observed adherence: those who washed their hands AFTER the care activity	-.165	.308
Observed adherence: those who washed their hands both BEFORE & AFTER the care activity	.063	.700

The Relationship Between Self-Report Behaviour And Observed Hand Hygiene Practice

Table 66 shows that there is no correlation between self-report behaviour and actual behaviour either before *or* after care activities or before *and* after care activities. To enhance the reliability of the analysis, a subset of this group was selected who had completed a questionnaire and who had been observed on four or more occasions (n=51). The number of observations recorded on these participants was n=564. This sample was comprised as follows: Staff Nurses n=30; Enrolled Nurses n=1; Sister/Charge Nurse n=4; Doctor n=1; Therapists n=1; Healthcare Assistants n =14. Results are presented in Table 67 which also show that there is no correlation between the two variables: self-report behaviour and observed behaviour either before *or* after care activities or before *and* after care activities. However, this analysis reveals that there is a significant correlation between hand hygiene adherence before and after patient contact ($r = 0.36$, $p<0.011$). Hence, if a person cleans their hands before, they are more likely to clean their hands after patient contact. This effect probably applies to participants observed three times or less, but is obscured by the number of healthcare professionals who did not clean their hands before patient contact. The mean adherence rate for hand hygiene before patient contact is reliably less than the mean adherence rate after patient contact (13.1% versus 57.6%, $t_{(71)} = -9.87$, $p<0.01$).

Table 66 Pearson's product-moment correlation co-efficients between self-report behaviour and actual practice of those observed at least once (n=71)

	Self-Report Behaviour	p	Observed adherence BEFORE care activity	p	Observed adherence AFTER care activity	p
Self-Report Behaviour						
Observed adherence: those who washed their hands BEFORE the care activity	-.040	.742				
Observed adherence: those who washed their hands AFTER the care activity	.047	.698	-.063	.602		
Observed adherence: those who washed their hands both BEFORE & AFTER the care activity	.028	.814	.510**	.000	.580**	.000

** Correlation is significant at the 0.01 level (2 tailed)

Table 67 Pearson's product-moment correlation co-efficients between self-report behaviour and actual practice of those observed on four or more occasions (n=51)

	Self-Report Behaviour	p	Observed adherence BEFORE care activity	p	Observed adherence AFTER care activity	p
Self-Report Behaviour						
Observed adherence: those who washed their hands BEFORE the care activity	-.202	.155				
Observed adherence: those who washed their hands AFTER the care activity	.095	.506	.364**	.009		
Observed adherence: those who washed their hands both BEFORE & AFTER the care activity	.018	.898	.660**	.000	.652**	.000

** Correlation is significant at the 0.01 level (2-tailed)

What this comparison covers, however, is that 53% (38/71) of healthcare professionals were observed not to have cleaned their hands before patient contact. This effect can be demonstrated by using contingency tables (Tables 68, 69 and 70) in which the participants are divided on the basis of the percentage of times that they clean their hands. This enables us to see how many people clean their hands more or less often than 33%, 50% and 66% of the time before and after patient contact. The columns represent a division in the population based on the frequency with which they clean their hands, and the rows represent before and after. The percentage in the last column refers to the proportion of healthcare professionals who wash their hands less than x% before patient contact, and the proportion of healthcare professionals who wash their hands more than x% after patient contact.

Table 68 uses 33% as a cut-off point to demonstrate how little adherence there is to hand hygiene before patient contact. This shows that 92% (65/71) of healthcare professionals only cleaned their hands 33% of times or less frequently than this before patient contact and that 73% (52/71) cleaned their hands more than 33% of the time after patient contact. Alternatively, if the participants are divided by whether they clean their hands 66% of the time or more often, then, as Table 70 shows, only 48% of the healthcare professionals fall into this activity grouping.

Table 68 Contingency table using 33% as the cut-off point to show hand hygiene adherence before and after patient contact

		33% or less of occasions	More than 33% of occasions	
Adherence	Before	65	6	92%
	After	19	52	73%

Table 69 Contingency table using 50% as the cut-off point to show hand hygiene adherence before and after patient contact

		50% or less of occasions	More than 50% of occasions	
Adherence	Before	67	4	94%
	After	21	50	70%

Table 70 Contingency table using 66% as the cut-off point to show hand hygiene adherence before and after patient contact

		66% or less of occasions	More than 66% of occasions	
Adherence	Before	68	3	96%
	After	37	34	48%

The contingency tables show that healthcare professionals are more likely to clean their hands after patient contact than before. Fewer than half of them clean their hands a significant proportion of the time after patient contact. This raises the question 'why do healthcare professionals clean their hands more often after patient contact than before?' The answer may be partly explained by perceptions of risk. They may be more concerned with protecting others and themselves from acquiring an infection rather than the patient with whom they are about to have contact. Perhaps they do not perceive themselves as a source of risk to the patient. Or may be they do not perceive the tasks they perform in between washing hands after contact with the index patient and contact with next patient (e.g. answering the telephone, writing notes, *etc.*) as potential sources of contamination to themselves that may be transmitted to the patient.

Observed Hand Hygiene Practice And Associated Risks Of Cross-Infection To The Index Patient, Other Patients And Self

Figure 39 shows that most activities observed posed a low as opposed to medium or high risk of cross-infection. More of the low risk activities posed a risk to self (84%) as opposed to the index patient (77%) or 'other' patients (63%). However, 'other' patients, as opposed to the index patient or self, had a greater exposure to cross-infection from medium and high risk activities.

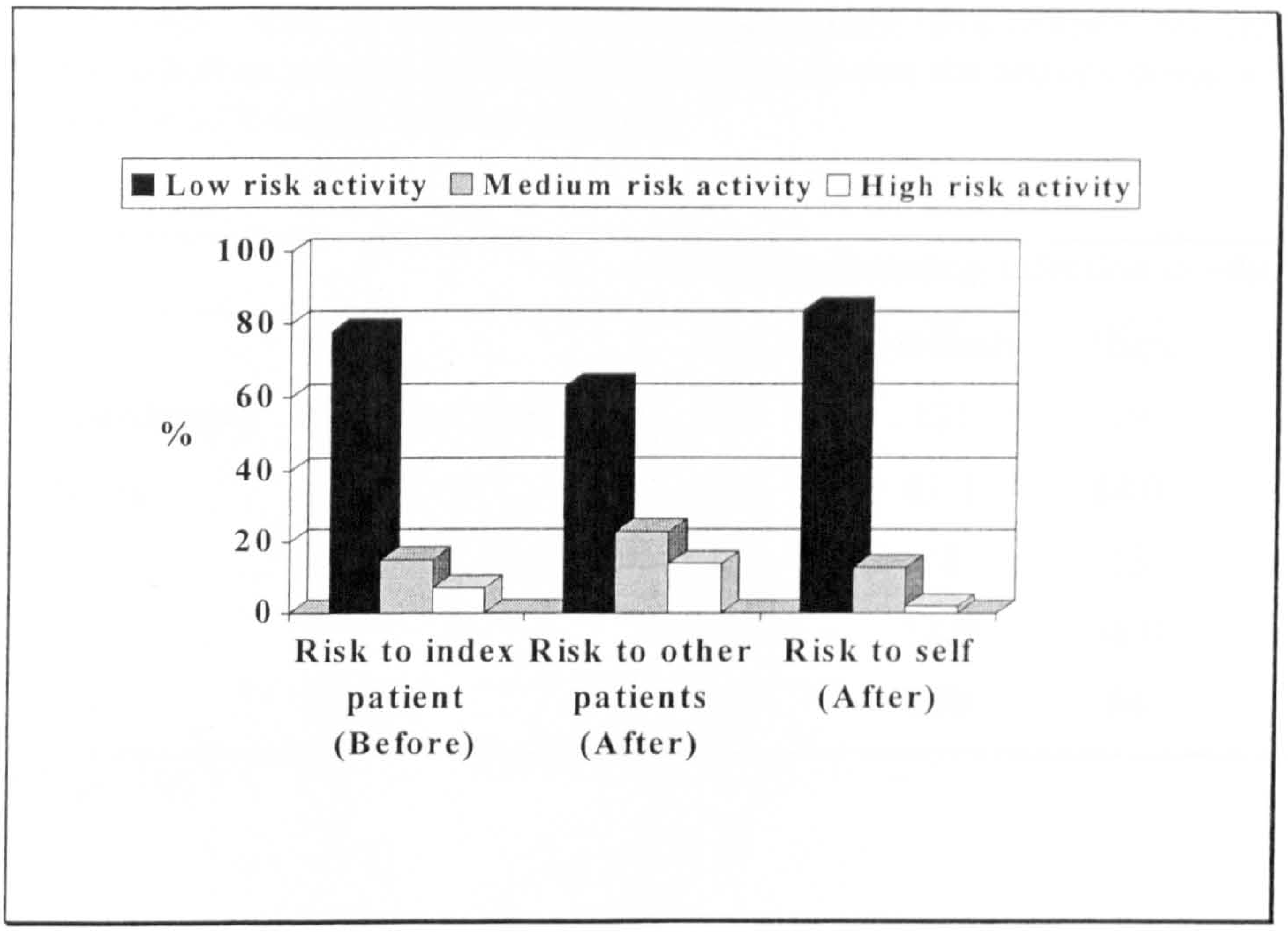

Figure 39 Nature of risk posed by patient care activities observed (n=644): to patient (before activity), other patients and self (after activity)

The results of the contingency tables set up to determine whether hand hygiene behaviour before *and* after patient care was influenced by the nature of the risk of the care activity performed are presented in Tables 71, 72 and 73.

Table 71 Contingency table to show the % of occasions when hand hygiene was performed before *and* after performing a care activity according to whether the activity posed a low, medium or high risk of infection to the patient

			Risk of introducing infection to the patient			
			Low	Medium	High	Total
Hand hygiene performed before *and* after an activity	No	Count	443	88	38	569
		%	88.2	91.7	80.9	88.2
	Yes	Count	59	8	9	76
		%	11.8	8.3	19.1	11.8
	Total		502	96	47	645

χ^2 3.553, df 2, p=.169

Table 72 Contingency table to show the % of occasions when hand hygiene was performed before *and* after performing a care activity according to whether the activity posed a low, medium or high risk of infection to other patients

			Risk of transferring infection to other patients			
			Low	Medium	High	Total
Hand hygiene performed before *and* after an activity	No	Count	369	121	79	569
		%	89.6	87.1	84.0	88.2
	Yes	Count	43	18	15	76
		%	10.4	12.9	16.0	11.8
	Total		412	139	94	645

χ^2 2.476, df 2, p=.290

Table 73 Contingency table to show the % of occasions when hand hygiene was performed before *and* after performing a care activity according to whether the activity posed a low, medium or high risk of infection to self

			Risk of transferring infection to self			
			Low	Medium	High	Total
Hand hygiene performed before *and* after an activity	No	Count	480	75	14	569
		%	88.6	86.2	87.5	88.2
	Yes	Count	62	12	2	76
		%	11.4	13.8	12.5	11.8
	Total		542	87	16	645

χ^2 .408, df 2, p=.816

These show that not only is there a very low level of adherence to the national guideline but that the level of adherence does not increase significantly with the level of risk of the care activity performed. It could be argued that the national guideline is an inappropriate 'gold standard' against which to measure hand hygiene practice and associated risks of cross-infection because it brooks no risk assessment. Therefore, as the care activities do pose different levels of risk in different situations, the level of adherence has also been analysed according to whether hand hygiene was performed before *or* after the care activity. These contingency tables are presented in Tables 74, 75 and 76.

Table 74 Contingency table to show the % of occasions when hand hygiene was performed *before* performing a care activity according to whether the activity posed a low, medium or high risk of infection to the patient

			Risk of introducing infection to the patient			
			Low	Medium	High	Total
Hand hygiene performed *before* an activity	No	Count	413	70	35	518
		%	82.3	72.9	74.5	80.3
	Yes	Count	89	26	12	127
		%	17.7	27.1	25.5	19.7
	Total		502	96	47	645

χ^2 5.554, df 2, p=.062

For the association shown in Table 74, the χ^2 statistic narrowly misses achieving a conventional level of significance (p=0.06). Nonetheless, this might be thought to indicate some trend in the expected direction that would probably reach significance if the number of observations were increased. Hands were cleaned on only just over 25% of occasions before performing a procedure on patients judged to pose a medium risk of infection, e.g. administration of medicines via percutaneous endo-gastrostomy (PEG) tube or a high risk of infection, e.g. administration of intravenous medications. Despite this poor level of adherence, there is clearly some appreciation of risk because for medium risk activities, the adjusted residual is >2 indicating that the proportion of times that healthcare professionals wash their hands under these circumstances is reliably greater than expected. The slightly lower rate of hand hygiene when high risk activities are performed may be due to a lack of power as the number of observations of high risk procedures was low.

Table 75 shows an overall trend of increased adherence according to increased risk. However, it is the performance of high risk activities as opposed to medium risk activities which determines a significant increase in rates of hand hygiene to prevent cross-infection to other patients. This is evidenced by an adjusted residual of 4.6. Nevertheless, hands were not cleaned on 17% of occasions after performing an activity which posed a high risk of cross-infection to other patients, e.g. contact with faeces.

Table 75 Contingency table to show the % of occasions when hand hygiene was performed *after* performing a care activity according to whether the activity posed a low, medium or high risk of infection to other patients

			Risk of transferring infection to other patients			
			Low	Medium	High	Total
Hand hygiene performed *after* an activity	No	Count	182	49	16	247
		%	44.2	35.5	17.0	38.4
	Yes	Count	230	89	78	397
		%	55.8	64.5	83.0	61.6
	Total		412	138	94	644

χ^2 24.470, df 2, p=.000

Table 76 Contingency table to show the % of occasions when hand hygiene was performed *after* performing a care activity according to whether the activity posed a low, medium or high risk of infection to self

			Risk of infection to self			
			Low	Medium	High	Total
Hand hygiene performed *after* an activity	No	Count	214	30	3	247
		%	39.6	34.5	18.8	38.4
	Yes	Count	327	57	13	397
		%	60.4	65.5	81.3	61.6
	Total		541	87	16	644

χ^2 3.483, df 2, p= .175

Table 76 demonstrates that hands were not cleaned on 19% of occasions after performing an activity which posed a high risk of cross-infection to self. However, there is a strong trend to clean hands more often after high risk procedures as opposed to medium risk or low risk procedures. This is evidenced by an adjusted residual of 1.6 for high risk situations. The reason that this does not reach significance may again be due to the relatively small numbers involved.

If data from Tables 75 and 76 are compared (which both examine hand hygiene adherence *after* care activities), the rates of adherence for low risk activities were 55.8% and 60.4% respectively, but these were not significantly different; χ^2 2.1, p>0.5 at the 5% level. The results show that the rates of hand hygiene adherence for medium and high risk of infection care activities are almost identical.

Although data from Tables 75 and 76 can be compared with each other, they cannot be compared with data from Table 74 (which examines hand hygiene adherence *before* care activities). This is because, as has already been reported, significantly more staff clean their hands after rather than before performing care activities, so it would be an artificial comparison.

Methicillin-Resistant *Staphylococcus aureus*

As has been shown in Tables 75 and 76, the adherence rate for hand hygiene after performing high risk activities falls well below 100%. This is worthy of further exploration with regard to one particular high risk activity: contact with a patient or equipment infected or colonised with methicillin-resistant *Staphylococcus aureus* (MRSA). In such cases, the infective status of the patient poses an added dimension to the risk assessment process. Whilst patient care activities such as 'taking observations/touching a patient' and 'handling/moving the patient' are classified as 'low' risk when caring for non-infected patients, when performed on a patient with MRSA, they pose a 'high' risk of cross-infection to other patients if hands are not cleaned afterwards. As Figure 40 shows, these were the most frequently performed care activities on patients with MRSA, along with tracheal suction, a procedure which has been shown to be associated with particularly high levels of hand contamination (Pittet et al., 1999b). Fifty patient care activities were observed performed by 27 healthcare professionals.

The question arises as to the extent to which healthcare professionals recognise the different cross-infection risks posed by similar activities performed on infected patients as opposed to non-infected patients. These patients were nursed in isolation and notices to this effect were posted on the door to the room.

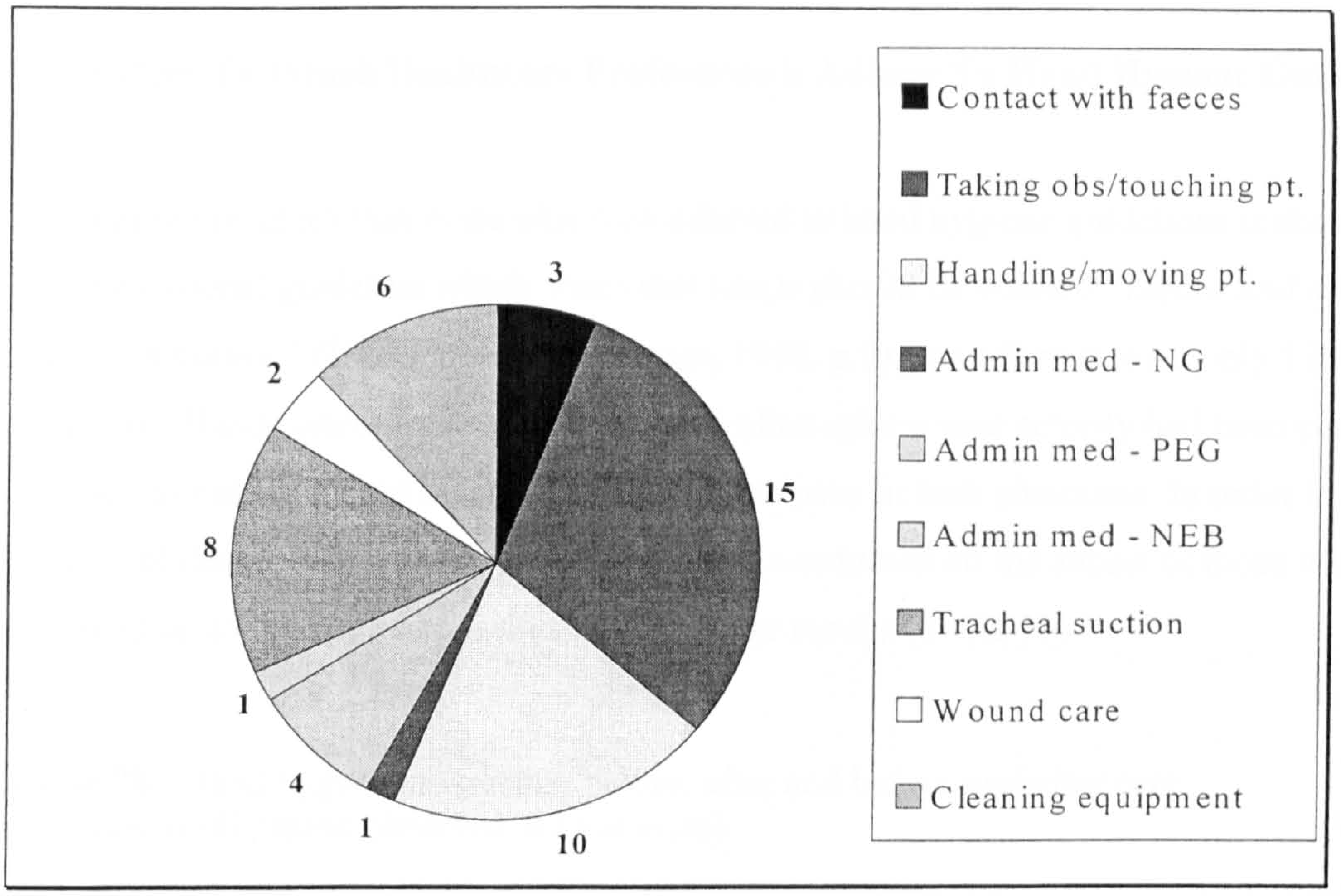

Figure 40 Numbers and types of activities performed on patients with MRSA

Table 77 shows that hand hygiene was performed on only 78% of available opportunities *after* patient care activities had been performed on patients with MRSA. This is in fact *lower* than the hand hygiene adherence rate for high risk activities overall as shown in Tables 75 and 76. The fact that hands were not cleaned on 22% of occasions following contact with a patient with MRSA sheds some light on why MRSA is endemic in our hospitals.

Table 77 Hand hygiene adherence before, after and before *and* after care activities performed on patients with MRSA

Hand hygiene adherence		No	Yes	Total
Before	Count	39	11	50
	%	78	22	100
After	Count	11	39	50
	%	22	78	100
Before *and* after	Count	42	8	50
	%	84	16	100

The Extent To Which Healthcare Professionals Adhere To Hand Hygiene Guidelines

The number of times that those observed adhered to hand hygiene guidelines is shown in Table 78. The national guideline which states that hands should be washed *"before and after contact with each patient"* (UK Health Departments, 1998. p.9) was adhered to on only 12% of occasions. Hands were washed three times as often *after* a care activity had been performed as opposed to *before* but the level of adherence was poor in both situations. In order to enhance the validity of these findings, this analysis was also conducted on the subset of those who had been observed on four or more occasions, with similar results (Table 79).

Table 78 Hand hygiene adherence before, after and before *and* after care activities n=81 (those observed at least once)

Hand hygiene adherence		No	Yes	Total
Before	Count	518	127	645
	%	80.1	19.6	100
After	Count	247	397	644
	%	38.2	61.4	100
Before *and* after	Count	569	76	645
	%	87.9	11.7	100

Table 79 Hand hygiene adherence before, after and before *and* after care activities n=51 (those observed on four or more occasions)

Hand hygiene adherence		No	Yes	Total
Before	Count	474	124	598
	%	79.3	20.7	100
After	Count	223	374	597
	%	37.3	62.5	100
Before *and* after	Count	522	76	598
	%	87.3	12.7	100

The number of times staff cleaned their hands before and after specific care activities[8] is shown in Figures 41 and 42 respectively. These are expressed as percentages of available opportunities. For some activities, the actual number of observations was very small.

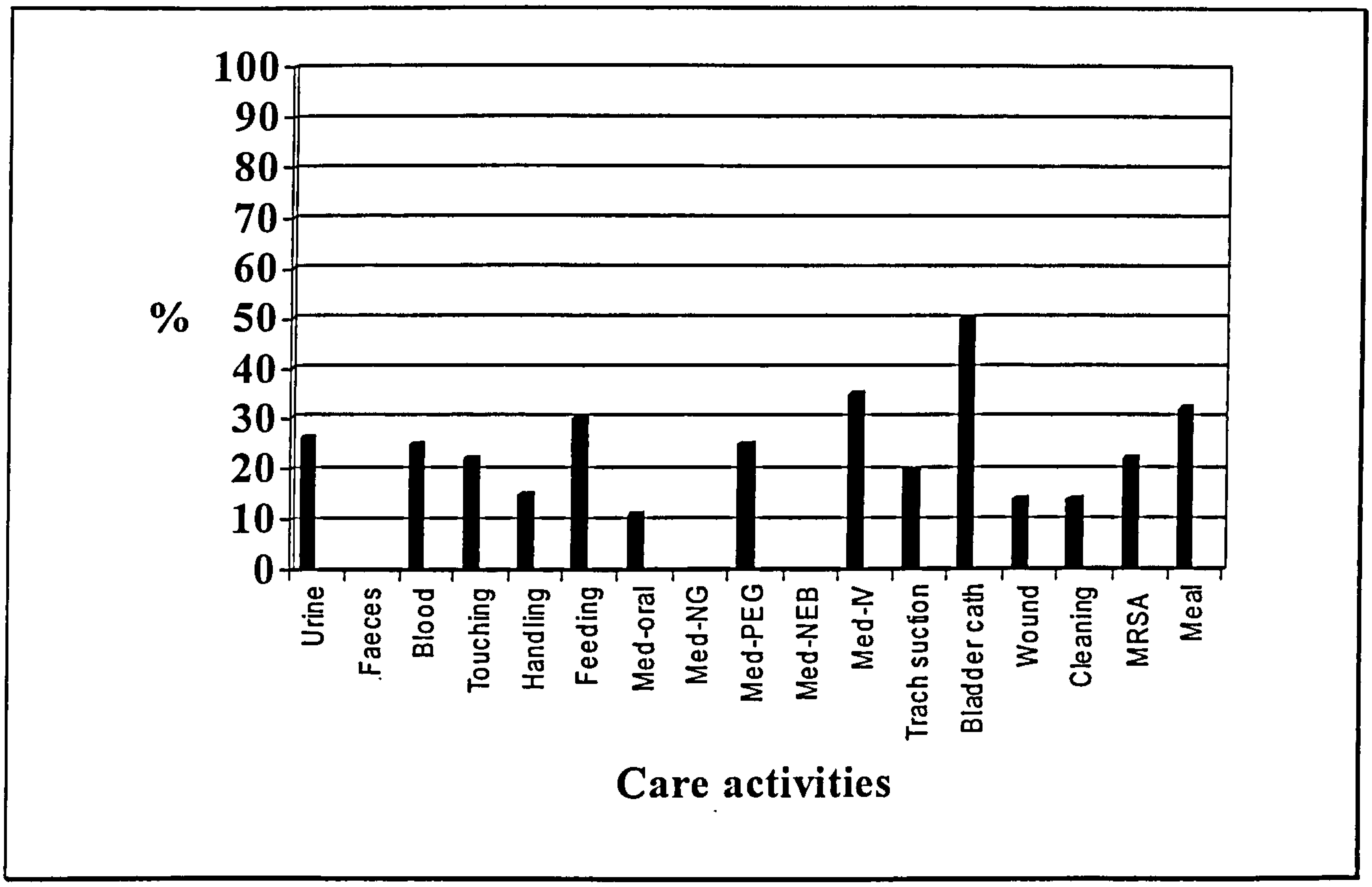

Figure 41 % occasions hand hygiene performed *before* specific care activities (n=644)

There are several key points to note in Figure 41. Firstly, the low rate of hand hygiene before performing *any* of the care activities. Secondly, the low rate of hand hygiene prior to handling food (feeding) and giving medicines by mouth (Admin med-oral) or via a percutaneous endo-gastrostomy tube (Admin med-PEG). Thirdly, the low rate of hand hygiene prior to performing procedures requiring aseptic techniques such as intravenous injections (Admin med-IV), tracheal suction, wound care and bladder catheterisation. Although gloves should be worn when performing these procedures, hands should be cleaned before putting them on.

[8] For explanation of abbreviations, see Appendix 11.

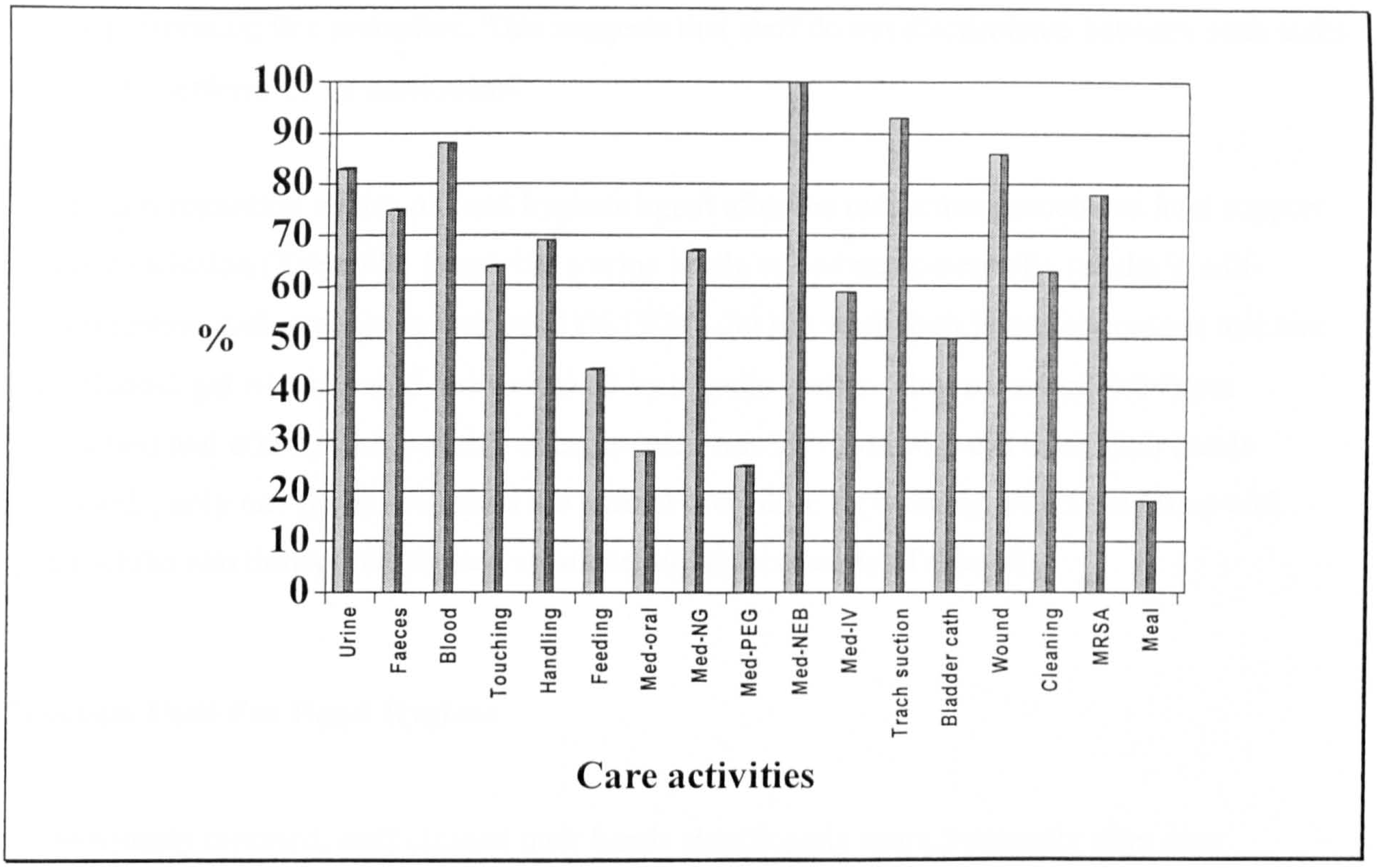

Figure 42 % occasions hand hygiene performed *after* specific care activities (n=644)

The key points to note in Figure 42 are as follows. Firstly, hand hygiene takes place more often after as opposed to before performing care activities. In some cases, the findings suggest that healthcare professionals' practice is not rational. For example, hands were cleaned on 86% of occasions after wound care had been performed (when the aim is to prevent cross-infection to other patients), but on only 14% of occasions before (when the aim is to prevent the index patient from developing an infection). Secondly, two healthcare professionals did not wash their hands after handling faeces. Given the low level of hand hygiene prior to handling food, as shown in Figure 41, and the fact that food poisoning is spread via the faecal-oral route, this lapse in basic hygiene is a matter for concern.

The data concerning 'contact with urine' were analysed further as two distinct procedures were involved: emptying a urine bottle or bedpan and emptying a urine drainage bag. These pose different risks of cross-infection. Emptying a urine bottle or bedpan poses no risk of cross-infection to the index patient so it is understandable that on 72% occasions (18/25), hands were not decontaminated beforehand. In contrast, emptying a catheter bag does pose a significant risk of cross-infection to the patient concerned and should be preceded by hand disinfection with an antiseptic, even if gloves are worn. Yet, 83% (5/6) of those observed did not wash their hands before performing this procedure. This suggests that staff do not discriminate between such tasks and fail to perform a risk assessment.

The results regarding choice of hand hygiene agent after the respective procedures lend support to this conclusion (Table 80). Emptying a urine bottle or bed pan potentially results in self-contamination with organic matter, yet 21% (5/24) did not wash their hands afterwards and one used alcohol gel which would be inactivated by organic matter. Thus a quarter (6/24) put themselves and other patients at risk of cross-infection. Of those who did wash their hands afterwards, only one person followed the correct procedure by washing with liquid soap and water whilst two thirds (16/24) used an antiseptic unnecessarily (Table 80).

Products Used For Hand Hygiene

As previously reported, staff cleaned their hands significantly more frequently after care activities than before. The results from the data on *all* those who were observed (n=81) on 1288 adherence opportunities (n=644 before and after) show that, on 80% of occasions, hands were not cleaned before care activities and, on 38% of occasions, hands were not cleaned after care activities. However, when they were cleaned, the proportions of use of each of the products both before and after performing the activity were very similar. Figure 43 shows the extent to which the various products were used for cleaning hands for both before and after care activities combined. Chlorhexidine gluconate was used almost half the time and all the disinfectants combined were used almost twice as often as liquid soap. Given that most of the care activities were classified as 'low' risk in terms of cross-infection, this suggests that healthcare professionals' choice of product is not based on informed decision making.

Table 80 Hand hygiene practice and choice of cleaning agent before and after contact with urine

	Hands cleaned before?					Hands cleaned after[1]?					
	No	Yes				No	Yes				
Contact with urine n=31		Chlorhexidine gluconate	Povidone iodine	Alcohol gel	Liquid soap		Chlorhexidine gluconate	Povidone iodine	Alcohol gel	Liquid soap	Water only
Empty urine bottle/bedpan n=25	18	5	1	1		5	15	1	1	1	1
Empty catheter bag n=6	5				1		4	1		1	

Note [1] 1 missing data

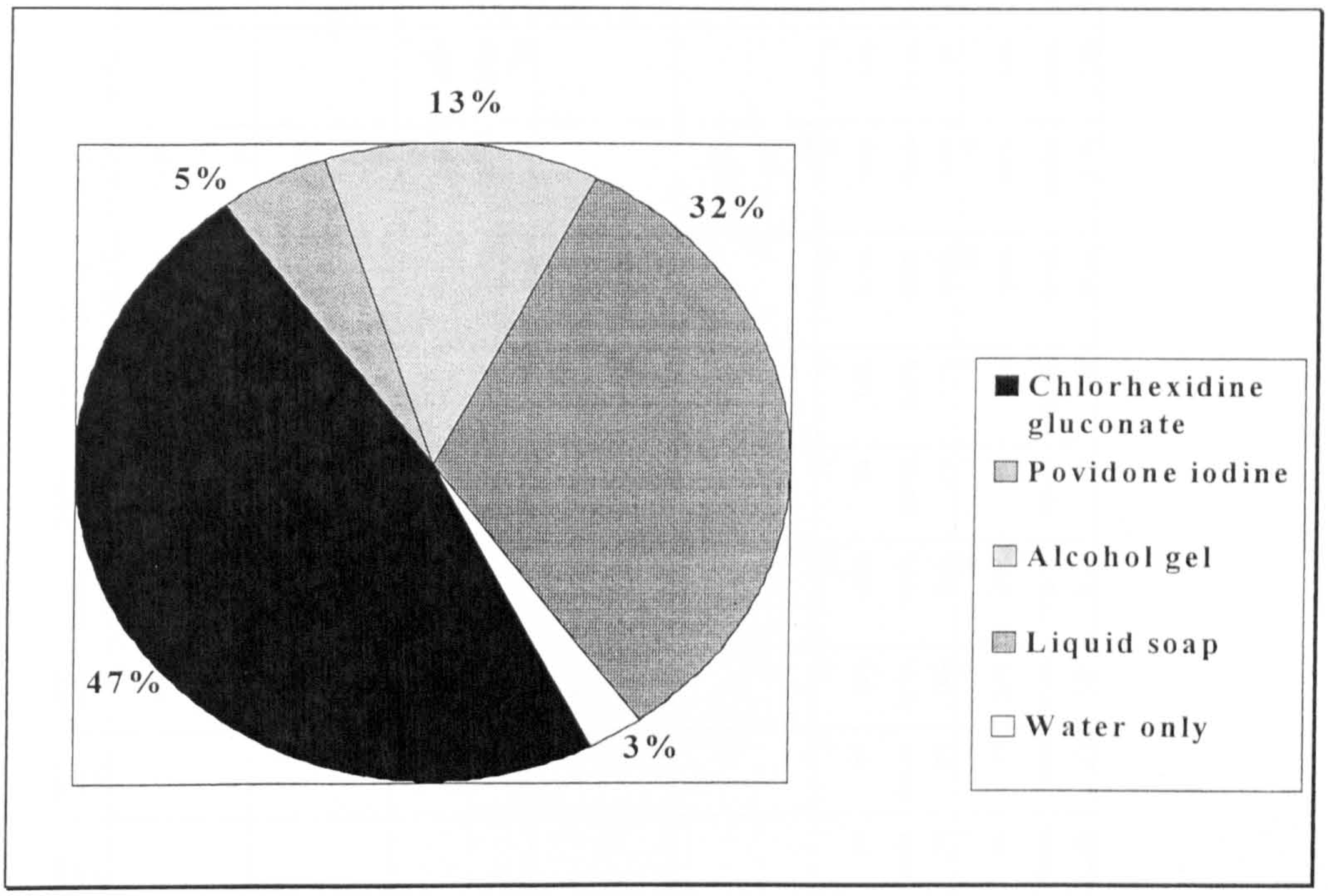

Figure 43 Products used to clean hands as a percentage of all before and after care activities (n=1287)

Table 81 Extent to which individual hand hygiene agents were used to clean hands *before* performing patient care activities

			Activity of Healthcare Professional																	
			Contact with urine	Contact with faeces	Contact with blood	Taking obs/touching patient	Handling/ moving the patient	Feeding patient/ serving food	Admin med - oral	Admin med - NG	Admin med - PEG	Admin med - NEB	Admin med - IV	Tracheal suction	Bladder catheter isation	Wound manage ment	Handling/ cleaning equipment	Contact with MRSA patient/ equipment	Taking meal break	Total
Agent used before Procedure	Hibiscrub	Count	3		1	6	7	5					1	2			2	3		30
		% within Agent used before Procedure	10.0%		3.3%	20.0%	23.3%	16.7%					3.3%	6.7%			6.7%	10.0%		100%
		% within Activity of Healthcare Worker	12.5%		20.0%	7.4%	7.5%	20.0%					11.1%	14.3%			3.6%	7.7%		7.8%
		% of Total	.8%		.3%	1.6%	1.8%	1.3%					.3%	.5%			.5%	.8%		7.8%
	Betadine	Count	1				1	1										3		6
		% within Agent used before Procedure	16.7%				16.7%	16.7%										50.0%		100%
		% within Activity of Healthcare Worker	4.2%				1.1%	4.0%										7.7%		1.6%
		% of Total	.3%				3%	.3%										8%		1.6%
	Liquid Soap	Count	1		1	10	3		2				1				4	1	1	24
		% within Agent used before Procedure	4.2%		4.2%	41.7%	12.5%		8.3%				4.2%				16.7%	4.2%	4.2%	100%
		% within Activity of Healthcare Worker	4.2%		20.0%	12.3%	3.2%		13.3%				11.1%				7.1%	2.6%	25.0%	6.2%
		% of Total	.3%		.3%	2.6%	.8%		.5%				.3%				1.0%	.3%	.3%	6.2%
	Alcohol Gel	Count	1			2	3	1					1	1		1	3			13
		% within Agent used before Procedure	7.7%			15.4%	23.1%	7.7%					7.7%	7.7%		7.7%	23.1%			100%
		% within Activity of Healthcare Worker	4.2%			2.5%	3.2%	4.0%					11.1%	7.1%		16.7%	5.4%			3.4%
		% of Total	.3%			.5%	.8%	.3%					.3%	.3%		.3%	.8%			3.4%
	Water Only	Count					1											1		2
		% within Agent used before Procedure					50.0%											50.0%		100%
		% within Activity of Healthcare Worker					1.1%											2.6%		.5%
		% of Total					.3%											.3%		.5%
	Nothing	Count	18	6	3	63	78	18	13	6	1	1	6	11	1	5	47	31	3	311
		% within Agent used before Procedure	5.8%	1.9%	1.0%	20.3%	25.1%	5.8%	4.2%	1.9%	.3%	.3%	1.9%	3.5%	.3%	1.6%	15.1%	10.0%	1.0%	100%
		% within Activity of Healthcare Worker	75.0%	100.0%	60.0%	77.8%	83.9%	72.0%	86.7%	100.0%	100.0%	100.0%	66.7%	78.6%	100.0%	83.3%	83.9%	79.5%	75.0%	80.6%
		% of Total	4.7%	1.6%	.8%	16.3%	20.2%	4.7%	3.4%	1.6%	.3%	.3%	1.6%	2.8%	3%	1.3%	12.2%	8.0%	8%	80.6%
Total		Count	24	6	5	81	93	25	15	6	1	1	9	14	1	6	58	39	4	386
		% within Agent used before Procedure	6.2%	1.6%	1.3%	21.0%	24.1%	6.5%	3.9%	1.6%	.3%	.3%	2.3%	3.6%	.3%	1.6%	14.5%	10.1%	1.0%	100%
		% within Activity of Healthcare Worker	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100%
		% of Total	6.2%	1.6%	1.3%	21.0%	24.1%	6.5%	3.9%	1.6%	.3%	3%	2.3%	3.6%	3%	1.6%	14.5%	10.1%	1.0%	100%

Table 82 Extent to which individual hand hygiene agents were used to clean hands *after* performing patient care activities

			Activity of Healthcare Professional																	
			Contact with urine	Contact with faeces	Contact with blood	Taking obs/ touching patient	Handling/ moving the patient	Feeding patient/ serving food	Admin med - oral	Admin med - NG	Admin med - PEG	Admin med - NEB	Admin med - IV	Tracheal suction	Bladder catheter isation	Wound manage ment	Handling/ cleaning equipment	Contact with MRSA patient/ equipment	Taking meal break	Total
Agent used after procedure	Hibiscrub	Count	19	3	5	28	50	12	2	2	1		4	6		4	31	17	2	186
		% within Agent used after procedure	10.2%	1.6%	2.7%	15 1%	26 9%	6.5%	1.1%	1.1%	.5%		2.2%	3.2%		2 2%	16.7%	9.1%	1.1%	100.0%
		% within Activity of Healthcare Worker	79.2%	50 0%	100.0%	34 6%	53 8%	48.0%	13.3%	33 3%	100 0%		44 4%	42.9%		66 7%	55.4%	43 6%	50.0%	48.2%
		% of Total	4 9%	8%	1 3%	7 3%	13 0%	3 1%	.5%	5%	.3%		1.0%	1 6%		1 0%	8 0%	4 4%	5%	48 2%
	Betadine	Count	2				2		2				1	3			4	7		21
		% within Agent used after procedure	9.5%				9.5%		9 5%				4 8%	14.3%			19 0%	33 3%		100.0%
		% within Activity of Healthcare Worker	8 3%				2.2%		13.3%				11.1%	21.4%			7.1%	17.9%		5 4%
		% of Total	5%				.5%		.5%				.3%	8%			1 0%	1 8%		5 4%
	Liquid Soap	Count	2	3		36	33	7	9	2		1	3	5	1	1	17	15	2	137
		% within Agent used after procedure	1.5%	2.2%		26.3%	24.1%	5.1%	6.6%	1.5%		.7%	2.2%	3 6%	.7%	.7%	12 4%	10 9%	1.5%	100.0%
		% within Activity of Healthcare Worker	8 3%	50.0%		44.4%	35.5%	28 0%	60 0%	33.3%		100.0%	33.3%	35 7%	100.0%	16.7%	30.4%	38.5%	50 0%	35.5%
		% of Total	5%	8%		9 3%	8 5%	1 8%	2 3%	.5%		.3%	.8%	1 3%	.3%	.3%	4 4%	3 9%	.5%	35 5%
	Alcohol Gel	Count	1			17	8	6	2	2			1			1	4			42
		% within Agent used after procedure	2.4%			40.5%	19 0%	14.3%	4 8%	4.8%			2.4%			2.4%	9 5%			100.0%
		% within Activity of Healthcare Worker	4 2%			21.0%	8 6%	24.0%	13 3%	33 3%			11 1%			16.7%	7.1%			10 9%
		% of Total	3%			4 4%	2 1%	1 6%	5%	.5%			3%			3%	1 0%			10 9%
Total		Count	24	6	5	81	93	25	15	6	1	1	9	14	1	6	56	39	4	386
		% within Agent used after procedure	6.2%	1 6%	1 3%	21 0%	24 1%	6 5%	3 9%	1 6%	.3%	.3%	2.3%	3 6%	.3%	1 6%	14 5%	10 1%	1.0%	100 0%
		% within Activity of Healthcare Worker	100 0%	100 0%	100.0%	100.0%	100 0%	100.0%	100 0%	100%	100.0%	100.0%	100 0%	100.0%	100 0%	100.0%	100 0%	100.0%	100 0%	100.0%
		% of Total	6 2%	1 6%	1 3%	21 0%	24 1%	6 5%	3 9%	1 6%	3%	3%	2 3%	3 6%	.3%	1 6%	14 5%	10 1%	1 0%	100 0%

This is supported by data in Tables 81 and 82 that show which products were used for hand cleaning before and after each patient care activity. Table 81 shows that chlorhexidine gluconate was used most often for hand hygiene *before* performing low risk activities such as: taking observations, handling/moving the patient and feeding patients/serving food. It was even used on 7% of occasions for hand hygiene prior to handling/cleaning equipment. Using chlorhexidine gluconate, a disinfectant detergent, prior to the performance of these activities is unwarranted; alcohol gel or, in some instances, liquid soap, should have been used instead. Liquid soap was most commonly used for a similar range of activities, but given that time constraints are the most commonly cited reason for non-adherence, it is very surprising that more use was not made of alcohol gel.

As regards the use of products *after* patient care activities, Table 82 shows that after contact with urine, hand hygiene was performed on 79% of occasions with chlorhexidine gluconate whereas liquid soap would have sufficed. Hands were washed with chlorhexidine gluconate or liquid soap rather than disinfected with alcohol rub after handling and moving patients and taking observations. Indeed, chlorhexidine gluconate was used four times as often as alcohol gel, even though alcohol gel was freely available, not just at the wash hand basins, but also on every patient's bedside locker.

Cameos To Illustrate Hand Hygiene Practice Within The Context Of Care Delivery

The design of this study allowed a greater understanding about hand hygiene practice in the context of care delivery to emerge. The following four cameos (Tables 83, 84, 85, 86) are presented to illustrate hand hygiene practice when nurses perform sequential activities on the same patient and sequential care activities on sequential patients. The risks that they take in relation to cross-infection from failure to adhere to hand hygiene guidelines are highlighted.

Table 83 Cameo 1. Sequential care activities on one individual patient

Patient severely neurologically impaired. In isolation in side room as tracheostomy infected with MRSA. Attended by participant and two other nurses.

Participant had used alcohol gel on her hands on conclusion of the activity preceding this one (cleaning MRSA equipment in sluice). She should have washed with Hibiscrub.

Activity	Protective clothing	Hand hygiene	Best practice
1. Used hoist to lift patient out of wheelchair into bed. Patient coughed stopper out of tracheostomy tube. Cleaned up expectorated sputum with blue hand towels.	Put on apron and unsterile latex gloves	None	Alcohol gel
2. Performed tracheostomy suction on patient.	Put sterile co-polymer glove on left hand *over* unsterile latex gloves Changed all three gloves		Wash with Hibiscrub. Put on pair of sterile co-polymer gloves (but not over existing ones)
3. Took patient's jogging trousers off. Anti-embolism stockings adjusted, but not correctly (on right leg, area intended to be put on inside of thigh was put on outside of leg). Pillows put under leg resulting in calf compression.	Put new pair of gloves on Gloves off	None	Wash with Hibiscrub
4. Gave PEG feed via bolus syringe push. Sucked up Ensure plus from carton. Rinsed water glass at wash hand basin. Filled glass with water from water glass. 50mls water pushed down tube. Syringe rinsed out at wash hand basin.	Put another pair of gloves on Gloves off	None	Alcohol gel
5. Recorded care in care plan.	Put another pair of gloves on Gloves off. Apron off	Washed hands with liquid soap followed by alcohol gel.	Wash with liquid soap

Comments

- A total of five pairs of gloves were used for this episode of total patient care.
- Hands were not decontaminated once during care when gloves were changed (x 4) even though alcohol gel was available on the bedside locker.
- Risk of cross-infection: high to patient (due to tracheostomy tube); high risk to other patients and medium risk to self (due to MRSA).
- Did not speak to patient whilst administering feed; only whilst putting him into bed.
- Incorrect application of anti-embolism stockings.
- On leaving isolation, this participant proceeded to set up an enteral feed for another patient in the ward, sitting on the bed to do so. She cleaned her hands with alcohol gel after this procedure, but not before.

Table 84 Cameo 2. Sequential care activities involving two patients

Participant arrived on duty. Did not wash hands.

Activity	Protective clothing	Hand hygiene	Best practice
1. Patient 1. Got patient out of bed with help of another nurse.		Before - water only After - chlorhexidine gluconate	Before - wash with liquid soap After - alcohol gel
2. Went over to fish tank and handled packet of fish feed.			
3. Went to Nurses' station to answer 'phone.			
4. Returned to patient 1 and held his hand.		Before - none After - none	Before - alcohol gel After - alcohol gel
5. Patient 2. Went to bed to get patient up to weigh him.	Put apron on	Before - none After - alcohol gel	Before - alcohol gel After - alcohol gel
6. Went back to desk.			

Comments

- Activity 1. Inappropriate choice of hand cleansing agents.
- Inadequate hand hygiene before and after activities.
- This participant proceeded to another patient to set up a steroid drip and washed her hands with chlorhexidine gluconate (Hibiscrub).

Table 85 Cameo 3. Sequential care activities involving three patients

Participant came back on ward from meal break.

Activity	**Protective clothing**	**Hand hygiene**	**Best practice**
1. Patient 1. Regulated intravenous fluid.	Gloves on		Before - alcohol gel
	Gloves off	After - water only	After - alcohol gel
2. Patient 2. Regulated intravenous fluid.		Before - none	Before - alcohol gel
		After - none	After - alcohol gel
3. Patient 3. In Source Isolation as PEG site infected with MRSA. Also had *Aspergillus* spp. infection in post fossa space and had lost sight in one eye. Had renal transplant 10/12 ago, i.e. Patient immunocompromised, therefore highly susceptible to infection.		Before - none	Before - chlorhexidine gluconate (Hibiscrub)
	Apron & gloves on		
Made patient comfortable. Checked catheter bag urometer.			
	Gloves off		
Recorded observations whilst holding gloves in hand.			
Hung new intravenous administration line.	New pair gloves on		Alcohol gel
Syringed water down PEG tube to keep patient hydrated.			
	Gloves and apron off	After - chlorhexidine gluconate	After - Hibiscrub

Comments

- Patients 1 & 2. No hand hygiene.
- Patient 3. Appropriate hand hygiene after care, but not before or during to protect patient from infection. Incorrect perception of risk of cross-infection.
- This participant then proceeded to the Sister's office to put X rays away.

Table 86 Cameo 4. Sequential care activities involving six patients

Participant had washed her hands with chlorhexidine gluconate after attending to preceding patient but had been filing notes in the interim.

Activity	Protective clothing	Hand hygiene	Best practice
1. Patient 1. Cleaned up patient who had been incontinent of faeces. Put brace on; put hoist on. Hoist became covered in faeces as did not protect with incontinence pad. Put patient in chair. To sluice to discard yellow bag.	Put gloves and apron on Gloves off Put new pair of gloves on Took gloves and apron off	Before - none After - none After - liquid soap	Before - alcohol gel After - liquid soap After - liquid soap
2. Patient 2. Gave oral medication.		Before - none After - none	Before - alcohol gel After - alcohol gel
3. Patient 3. Gave drink.		Before - none After - none	Before - alcohol gel After - alcohol gel
4. Patient 4. MRSA. Disconnected intravenous infusion in readiness for patient's transferral to another hospital. Put on bandage around IV. Bed stripped. Dirty linen thrown on floor. Took water jug to kitchen. Wiped over mattress and pillow covers with alcohol gel.	No gloves on Gloves and apron on Gloves and apron off	Before - none After - none	Before - alcohol gel After - chlorhexidine gluconate
5. Patient 5. Removal of redivac drain from brain. Blood dripped on nightshirt and pillow. Patient in pain – self-administered morphine pump. Put dressing on with ungloved hands. (Another nurse put bandage on head). To treatment room; cleaned trolley.	Gloves on Gloves off	Before - none After - water only	Before - chlorhexidine gluconate After - liquid soap
6. Patient 6. Took neurological observations, i.e. touching patient.		Before - povidone iodine After - none	Before - alcohol gel After - alcohol gel

Comments

- No hand hygiene after taking gloves off which were grossly soiled with faeces.
- No hand hygiene before or after care of patients 2 and 3 or prior to aseptic technique.
- No hand hygiene before or after care of a patient with MRSA.
- Incorrect use of alcohol gel to clean mattress.
- Incompetent practice.

Discussion

The results of this study confirmed relationships between the TPB variables in line with the findings reported in Study 1, thus re-affirming the reliability of the questionnaire. The self-reported behaviour correlated highly with intention ($r=0.644$, $p<.000$), which in turn correlated with attitudes ($r=0.485$, $p<.000$). If these results were considered in isolation, improving attitudes and intentions might be regarded as a useful way of changing hand hygiene practice. However, this study has also shown that not only did none of the measures of observed adherence correlate with the intention ratings, but there was no relationship between what healthcare professionals say they do regarding hand hygiene and what they actually do in practice. This finding should be compared to the American study which reported a correlation of only 0.21 between self-report behaviour and actual hand hygiene practice (O'Boyle et al., 2001). However, that study used a self-report averaging method likely to inflate correlations between self-report and observed practice.

This study also showed that healthcare professionals' self-report behaviour is an over-estimation of observed behaviour. This false belief poses tremendous challenges for those who try to improve adherence to hand hygiene policies. It also confirms one of the limitations of the self-report method of enquiry as highlighted by Abraham et al. (1999).

Observations of healthcare professionals' practice showed that a significant proportion of them failed to adhere to national recommendations (UK Health Departments, 1998). This has implications for the duty of care and principles of non-maleficence. It should be noted that level of adherence was poor even though they knew that their hand hygiene practice was being observed. Healthcare professionals' hand hygiene practice is not only very lax but also lacks consistency. It does not generally appear to be informed by an assessment of the infection risks posed. This is borne out by both the timing of their hand hygiene and the choice of hand cleaning product.

Regarding the timing, their hand hygiene practice would suggest that they think it more important to prevent cross-infection from one patient to another rather than preventing infection of the index patient. This may be because they do not appreciate that their hands are potential sources of infection as well as vehicles of infection. This view is supported by the prevailing philosophy which emphasises infection *control* rather than infection *prevention*. Perhaps the time has come for members of the Infection Control Team to re-think the aim of their role and indeed their job titles. Clearly, Infection Control Nurses and Infection Control Doctors need to emphasise prevention of infection. There may then be less infection to control.

Most of the healthcare professionals observed were nurses. This reflects the fact that they outnumber other types of healthcare professional on the ward. This in turn accounted for the type of activities observed, most of which presented a low risk of infection. However, when activities were performed which presented a medium or high risk of cross-infection, it was 'other patients' who were at the greatest risk of cross-infection. This may illuminate why hand hygiene was performed more often *after* care activities than *before*. This finding should be contrasted to that reported in Study 3 which showed that the participants considered it equally important to wash hands before and after care activities. This finding casts further doubt on the trustworthiness of self-report.

Healthcare professionals were clearly taking unnecessary risks. Hand hygiene was often not performed when the care activity posed a high risk of cross-infection both to other patients and self. This may be because they do not actually understand the factors that should guide their decision-making about hand hygiene at the cognitive level. This is borne out by findings reported in Study 6 which revealed that healthcare professionals have difficulty explaining their understanding of the hand hygiene policy they are expected to follow. It may also indicate that healthcare professionals do not believe that they are at risk of acquiring infection from their patients.

The role of hand hygiene in the prevention of cross-infection has a different significance when caring for a patient infected or colonised with an organism such as MRSA which is most commonly spread by direct contact. In this situation, healthcare professionals' hand hygiene practice would suggest that they focus on preventing cross-infection *from* the infected patient to others rather than on preventing the already infected patient developing another infection in a vulnerable site. This clearly needs to be explored further.

There was also a lack of hand hygiene prior to serving food or feeding patients and the administration of oral medicines which quite often involved nurses putting pills in patients' mouths. Equally worrying is the fact that on 38% of observed occasions, healthcare professionals did not wash their hands after having contact with urine and on 25% of occasions they did not wash their hands after having contact with faeces.

Regarding choice of hand hygiene product, when hands were cleaned either before or after the patient care activity, the hand cleansing agent used most often was chlorhexidine gluconate. As discussed in the literature review, and as shown in the cameos, the indications for the use of this product are limited to a few specific situations where patients are at high risk of infection. Yet, as previously highlighted, most care activities performed posed a low risk of infection so the use of this product would not be merited in those situations. This finding also suggests that the participants' choice of hand cleaning agent appears not to have been guided by knowledge of the various uses of the various products. Of course, it could be argued that it is better that they use antiseptic detergents rather than nothing. However, Reybrouck (1986) found that if a non-irritant soap is not used, skin damage, dermatitis or allergy may occur after frequent applications. Healthcare professionals with dermatitis will tend to avoid handwashing and have higher bacterial counts on damaged skin; they are, therefore, a greater potential source of infection (Steere and Mallison, 1975). Such a hazard was encountered during a prolonged field trial, in which 4% chlorhexidine gluconate detergent (Hibiscrub) proved to be highly irritant (Ojajärvi et al., 1977). Given that skin irritation and dryness caused by frequent handwashing is a reason commonly cited by healthcare professionals as a factor which deters them from handwashing (Larson and Killien, 1982; Zimakoff et al., 1992), it is important that antiseptic detergents are used only when clinically indicated. Teachers need to ensure that students are equipped with this knowledge and understanding before they go into clinical practice.

One of the challenges of the observational method of data collection is that the nature of much ward work is very complex and fast moving. Hence, it is possible that hand hygiene might have been performed but not observed by the researchers. With regard to handwashing, it is thought that the numbers would be small, especially in view of the fact that the wash hand basins at the end of the patient bed bays were highly visible. Alcohol gel, on the other hand, was available on bedside lockers as well as at wash hand basins and takes only seconds to apply. Such a reason for data loss has been reported by others (Gould, 1994a; Ojajärvi, 1991). It is also acknowledged that, in some instances, the frequency of specific care activities observed was small. There was only one observation of administration of medication via nebulisation (Admin-NEB) and bladder catheterisation.

Conclusion

This study was not undertaken merely to describe practice, as many others have done (see Table 6, p.28). It was also conducted to determine the extent to which measures of self-report behaviour were correlated with measures of observed behaviour. The findings of this study therefore go beyond those reported by Tibballs (1996) and O'Boyle et al. (2001). In addition to showing that there is no correlation between healthcare professionals' self-report behaviour and actual practice, this study has also shown that healthcare professionals over-estimate the number of times they wash their hands. As long as healthcare professionals carry on believing that they clean their hands more frequently than they really do, changing their behaviour will continue to pose an enormous challenge for those who try to improve adherence rates. Indeed, it could be argued that this mismatch between perceived behaviour and actual behaviour throws light on precisely why it is so difficult to bring about sustained improvements in adherence rates.

The findings of this study suggest that hand hygiene interventions that target changes in attitudes, intentions or self-reported practice (rather than behaviours) are likely to fail. Attempts must therefore be made to change practice, because this observation study has shown that healthcare professionals' hand hygiene practice is generally poor, often irrational and risky. Findings from both this study and Study 6 show quite clearly that healthcare professionals need to be better informed about how to assess risks of cross-infection to determine the need for hand hygiene. This issue is addressed further in the final chapter.

Chapter 12

Conclusions And Recommendations

Summary Of Findings

Findings from this programme of research strongly suggest that improving healthcare professionals' hand hygiene practice centres on three key issues. First, overcoming negative influences in the clinical practice setting. Second, enhancing educational and training programmes. Third, changing the way healthcare professionals think about hand hygiene with particular regard to risk assessment. The value of using a theoretical framework to predict healthcare professionals' hand hygiene practice was limited by the finding that self-report behaviour bore no relationship to actual practice.

The most important negative influence in the clinical practice setting has been shown to be healthcare professionals who students work alongside. Their hand hygiene practice was observed to be not only infrequent but also irrational and risk assessment was patchy. The behaviour of these poor role models strongly indicates that they think it more important to prevent cross-infection from one patient to another rather than preventing infection of the index patient.

Findings also show that working alongside poor role models has an adverse impact on students' attitudes towards the importance of hand hygiene throughout their three-year training. It also undermines the lessons learned from practical demonstrations of handwashing in the pre-clinical training period and contributes to theory-practice disintegration.

Hand hygiene posters which do not utilise message-framing theory and convey mixed messages about when, how and for how long hands should be washed are another negative influence in the clinical practice setting which add to the confusion in the healthcare professional's mind as to what constitutes 'best practice'.

Difficulties in risk assessing the need for hand hygiene was evidenced not only by observing healthcare professionals' practice and choice of hand cleansing agent but also by asking them to explain their understanding of the hand hygiene policy to which they were expected to adhere. These studies showed that risk assessment at the cognitive level was incomplete and appeared to be passive rather than active. Their practice is putting patients' lives at risk of cross-infection.

Introduction

In this concluding chapter, the three key issues that have emerged from this programme of research will be discussed in relation to the literature reviewed. Recommendations as to how hand hygiene practice might be improved are integrated throughout as are proposals for future research.

First, ways to neutralise negative influences in the clinical practice setting will be considered. This includes a discussion on role models with particular reference to the contribution that could be made by Infection Control Nurses (ICNs) and Infection Control Link Nurses (ICLNs). Ways in which they can use influencing tactics to enhance practice is considered. Suggestions are made for changing ward culture through the use of a group pledge and sanctions and rewards. The limitations of sanctions for non-adherence to hand hygiene guidelines are discussed in light of their limited evidence base. This section concludes with a recommendation that messages on hand hygiene posters should be theoretically based and that posters should be designed to persuade, rather than to teach healthcare professionals how to wash their hands.

The next section considers ways in which educational and training strategies could be enhanced. Clinical supervision could be improved and a strong recommendation is made to bring back the role of the Clinical Practice Teacher. The teaching of clinical skills could be extended by, for example, facilitating ICLNs to use Glitter Bug in the clinical practice setting to demonstrate hand hygiene on a repeated basis. The limitations of educational curricula are considered and recommendations made for the use of novel teaching strategies such as in-context learning at a 'virtual' hospital and learning games. The importance of habit formation and the need to teach children about hand hygiene from an early age is stressed.

The last section considers why it is necessary to change the way healthcare professionals think about hand hygiene in order to improve their hand hygiene practice. This centres on a discussion about how to enhance healthcare professionals' ability to risk assess the need for hand hygiene. A novel risk assessment tool known as A Dynamic Assessment Strategy For Hand Hygiene (DASHH), designed by the researcher, is presented.

The discussion begins by exploring the findings that emanated from the use of the extended theoretical model.

The Theoretical Model

One of the strengths of the TPB is that the constructs of subjective norms and perceived behavioural control place the target behaviour in a social context. This is particularly apposite for a study of ward-based, healthcare professionals' hand hygiene practice and it is surprising that this model has only been used by one other researcher in this field, namely O'Boyle et al. (2001). In Study 1, it was shown that the model correctly classified 79% of the variance in intention to perform appropriate hand hygiene and 87% of the variance in self-reported hand hygiene behaviour. Attitudes and personal responsibility were significant predictors of intention, whilst perceived behavioural control and intention were significant predictors of behaviour. However, when practice was observed, Study 8 showed that there was no correlation between healthcare professionals' actual hand hygiene behaviour and their self-report behaviour. Nor did any of the measures of observed adherence correlate with intention ratings. These findings highlight the limitation of self-report and raise uncertainty about the value of using a theoretical model to predict practice.

The question as to why self-report behaviour bore no relationship to observed practice needs to be considered. Ajzen's (1996) discourse on belief equivalence versus mode congruence offers an answer. He argues that, depending on motivation and ability, respondents may be either in a controlled, reasoned mode of operation or in an automatic, spontaneous mode.

> "*Mode congruence refers to the case in which the predictor variables and the criterion are assessed when the respondents are in the same mode of operation (i.e. both are assessed in a controlled mode or both are assessed in an automatic mode). Mode incongruence occurs if participants are in one mode of operation when the predictors are assessed and in the other mode when the criterion is measured.*" (p.393).

He posits that attitude-intention and attitude-behaviour relations will tend to be relatively weak under conditions of mode incongruence because different beliefs are likely to be salient in the automatic mode and in the controlled mode. However, he points out that a congruent mode of operation does not ensure equivalence of salient beliefs. This is especially true for congruence in the automatic or spontaneous mode. In this mode, people are highly susceptible to situational forces. Ajzen (1996, p.398) also posits that *"attitudes should predict behaviour better in the reasoned than in the spontaneous mode of action."*

This explanation is relevant to both the findings reported in Study 8 and the findings reported by O'Boyle et al. (2001). In Study 8, when healthcare professionals' practice was observed, they were invariably extremely busy and working in a fashion that could be likened to an automatic, spontaneous mode. In contrast, when participants completed the self-administered questionnaires, they were either off duty or 'on their break' on the ward. Both these situations would foster a controlled, reasoned mode of operation. There was therefore mode incongruence when attitudes were assessed and practice observed.

O'Boyle et al. (2001) found that there was a low significant correlation ($r = 0.21$) between self-report behaviour and observed adherence and consider this *"an enigma to be explained."* (p. 3522). This result may be an artefact due to the self-report averaging method they used which is likely to inflate correlations between self-report and observed practice. They also found that there was a significant and negative association between observed adherence to hand hygiene recommendations and intensity of activity in the unit at the time of observation ($r = -0.32$). Hence, hand hygiene adherence was lower when the unit was busier. Here again is evidence of hand hygiene practice being observed in conditions which are very different from those prevailing when the questionnaires were completed.

If Study 8 were to be repeated, attempts would have to be made to measure the theoretical constructs in the setting where hand hygiene practice was observed. The same beliefs would then be likely to be salient and there would be little chance that attitudes would have changed prior to observation of practice.

Notwithstanding the limitations discussed hitherto, the addition of the construct of 'personal responsibility' to the theoretical model has extended previous findings reported by others (O'Boyle et al. 2001). It would seem appropriate therefore to recommend that this construct should be included in future studies utilising the TPB to explore hand hygiene practice.

The hypothesis that specific barriers, such as time, would be predictive of behavioural intentions, was not supported. Hence, contrary to reports by others (Larson and Killien, 1982; Voss and Widmer, 1997; Weeks, 1999), it appears that these participants' intentions and hand hygiene practice were not constrained by a perceived lack of time. However, in Study 6, seven out of 18 participants who gave an opinion about barriers to hand hygiene practice did cite lack of time as a reason for not washing hands. Healthcare professionals' perceptions about time constraints therefore have to be taken seriously. However, alcohol hand rub, which was introduced in an endeavour to address this problem, would not appear to be the answer. Study 8 showed that this product was rarely used and chlorhexidine handwash was used almost four times as often. This finding is similar to that reported by Doebbeling et al. (1992).

Contrary to expectations, subjective norms, which are assumed to assess the social pressures individuals feel to perform or not to perform the behaviour, were not shown to be a determinant of intention to wash hands. Drawing on work by Trafimow and Finlay (1996), Sheeran et al. (1999, p.404) argue that *"people as well as behaviours determine whether intentions are attitudinally versus normatively controlled."* They then proceeded to prove that intentions based on attitudes better predict behaviour than intentions based on subjective norms. In Study 1, although findings showed that there was a significant correlation between attitudes and intention ($r = 0.30$, $p<0.01$), only a third of respondents said they always intended to wash their hands before and after contact with each patient. Study 8 showed that in fact only 12% did so demonstrating a very low level of adherence to the national guideline (UK Health Departments, 1998). It is believed that this is the first time that the level of adherence to these guidelines has been reported.

The lack of social pressure to wash hands raises questions about the extent to which healthcare professionals value and practise hand hygiene, their effect as role models and the ward culture. These issues are discussed next.

Overcoming Negative Influences In The Clinical Practice Setting

Role Models

Nursing is a complex social practice and the social reality for nurses is represented in the ....*"political and organizational factors that promote or constrain the development of nursing."* (Rafferty et al., 1996, p.685). Work by Melia (1982) points to the professional socialization of students as a basis for students' actions in practice settings. In other words, students' practice will be affected by both the way in which other healthcare professionals behave and the ward culture. More recently, Gerrish and Clayton's (2004) study on evidence-based practice has shown that nurses rely most heavily on experiential knowledge gained through interactions with nursing colleagues, medical staff and patients to inform their practice. The importance of good role models in the clinical practice setting is therefore self-evident. However, several of the studies conducted as part of this thesis lend support to the conclusion that healthcare professionals' hand hygiene practice is adversely affected by poor role models. In Study 8, overt observation of practice in the ward setting revealed not only suboptimal hand hygiene practice but also poor, and in some cases incompetent, episodes of practice. Students who work alongside these qualified healthcare professionals in the clinical practice setting witness this poor practice. These observations are likely to have an adverse effect on their practice and, in due course, they too will become poor role models.

Witnessing poor practice also has an adverse effect on students' attitudes. In Study 2, it was shown that although student nurses held positive attitudes towards the importance of hand hygiene at the beginning of their training, there was a downward trend over three years. This indicates that the more time students spend in clinical practice, the less value they place on hand hygiene. This is believed to be the first time that student nurses' attitudes towards hand hygiene have been studied in this way.

Findings from Studies 3 and 5 showed that student nurses' attitudes towards hand hygiene were enhanced by participation in two different laboratory based practical exercises in the pre-clinical period of training. However, this enhancement was short-lived. The improvement had declined by the end of the students' first clinical placement, providing further weight to the argument that students are witnessing poor hand hygiene practice by other healthcare professionals in the clinical practice setting. Not only does the experience of clinical practice fail to reinforce what has been taught in the university, but also it undermines it. This may well cause conflict in the student's mind as to the 'right way to do things'. It also exemplifies theory-practice disintegration which has long been a concern in nurse education (Hunt, 1974; Alexander, 1982; Elkan and Robinson, 1993).

Given the influence that role models exert on others' attitudes and practice, there is clearly a need for further research in this area. As discussed in the literature review, only three studies have been conducted to test the effect of good and bad role models (Larson and Larson, 1983; Larson et al., 1986; Lankford et al. 2003) and two of these focused exclusively on doctors. Lankford et al. (2003) have shown that hand hygiene practice can be improved when medical consultants set a good example to healthcare professionals. However, as shown in Study 2, student nurses' attitudes are influenced more by other nurses they work alongside than by doctors. It is therefore imperative that senior nurses act as good role models too.

Infection Control Nurses

The Infection Control Nurse (ICN) has a role to play here. The value of seconding an ICN to work as an integral member of the ward team with a view to implementing and monitoring policies was first described by Jenner (1981). More recently, Prieto (2003), a Clinical Nurse

Specialist in Infection Control, researched the effect of a supportive intervention by working alongside nurses on one ward to teach them about the implementation of Contact Precautions (a practice guideline for isolation nursing). This enabled her to challenge any misconceptions in order to promote the rationales for practices designed to prevent and control infection. She relied mainly upon her expertise as an infection control nurse specialist and role modelling to influence nurses' practice. She reports that misconceptions were not only prevalent but difficult to overcome despite intensive one-to-one practical instruction. She argues that the extent to which it is possible to influence nurses' infection control practice in relation to Contact Precautions is limited when they have strongly held irrational beliefs about the subject. The effectiveness of this teaching strategy was also determined to a great extent by nurses' willingness to exploit the support offered to them. Only two-thirds engaged fully in this invaluable opportunity. This seemed to be associated with their willingness to expose deficits in their knowledge and practice and to learn from the expert nurse researcher. Indeed, a proportion of participants found the researcher's expert knowledge off-putting. This should be contrasted with the custom and practice amongst doctors who commonly seek the specialist knowledge of colleagues by referring patients for a second opinion.

Prieto (2003) was ideally placed to show nurses the 'correct' way to do things and the majority of the participants relied heavily upon the researcher's function as an expert role model since this allowed them the opportunity to observe the way in which she practised the principles of Contact Precautions. She found that the key benefit of this teaching strategy was its applicability to practice, since as soon as questions arose, they were answered thus promoting learning to take place in its situational context. Although the findings of this study have clear implications for the role of the ICN in clinically based teaching, she concedes that a teaching strategy such as this is too resource intensive to be sustainable. ICNs are not only too few in number but teaching comprises only one element of their multi-faceted role.

Infection Control Link Nurses

In order to enhance the provision of the infection control service, some hospital Trusts in the UK have established Infection Control Link Nurse (ICLN) schemes (Horton, 1988; Charalambous, 1995; Teare and Peacock, 1996). These nurses are usually ward-based staff nurses with an interest in infection control, although in some Trusts other professionals allied to medicine take on the role too. Their responsibilities have been described by the DOH/PHLS (1995b) who emphasize that the role should not substitute that of the ICN. However, the effectiveness of these roles in UK hospitals has never been evaluated and this clearly needs to be done. Given appropriate training, described elsewhere (Jenner and Wilson, 2000), they should be well placed to act as role models for other healthcare professionals in the ward team.

Influencing Tactics

Raven and Haley (1982) sought to determine how hospital personnel could be influenced to engage in behaviours which tend to minimize the risks of nosocomial infections and to refrain from activities which tend to increase those risks. This led to the seminal survey conducted in 433 hospitals in America known as the Study On The Efficacy Of Nosocomial Infection Control (SENIC Project). As part of the study, a representative sample of ICNs and staff nurses were interviewed and completed a self-administered questionnaire. One key finding centred on the inter-relationship between the ICN and staff nurses. This revealed that staff nurses reported being especially likely to attribute their compliance with infection control practice to the expertise of the ICN, as defined by their superior knowledge or ability in infection control. However, ICNs did not rate expert power very highly reporting that they relied instead on informational power, defined by the persuasiveness of the information communicated by them. This highlights the importance of being able to present the evidence base for practice and policy.

Another way to address unsafe practice is to appoint one member of the team as a risk monitor. This is in fact an element of the role of members of the Infection Prevention and Control Team who are charged with pointing out deviations from recommended practice to the offenders. Raven and Haley (1982) studied the Infection Control Team's readiness to speak to violators of infection control policy. They found that although most ICNs said they would deal directly with violators, such direct action was less likely with physicians (65%) than with nurses (83%). On the other hand, whilst 86% of Infection Control Doctors said they would deal directly with the physicians who violated policy, only 40% said they would deal directly with nurses. The data suggest a greater tendency to deal directly with members of one's own profession.

Seto et al. (1989) studied the efficacy of various 'influencing tactics' for increasing adherence to infection control policies by means of an interview survey. They found that nurses most favoured professional-resources (providing specialized or expert help). This was followed in descending order by professional respect (esteeming others as fellow professionals); coalition (obtaining staff support); ingratiation (cultivating goodwill); hierarchical (exerting pressure derived from rank) and non-communicative (ignoring or disregarding other's point of view). This emphasizes the need for adequate communication and an understanding of healthcare professionals' points of view when a new policy is to be implemented. The generalisabilty of the findings of this study, which was conducted in Hong Kong, is unclear. However, it would be interesting to replicate this study in a British hospital.

Another strategy for improving poor hand hygiene practice is to change the culture on the ward so that hand hygiene becomes the norm rather than the exception. This might be achieved by a group pledge.

Changing The Culture On The Ward: Testing The Effect Of A Group Pledge

As Studies 2 and 8 have demonstrated, working in a clinical setting where hand hygiene is not part of the culture has an adverse effect on attitudes and behaviour. This creates a vicious cycle which is difficult to break. If hand hygiene practice is to be improved, the culture on the wards needs to be changed. However, changing group behaviour is far more difficult and takes longer than changing an individual's behaviour (Hersey and Blanchard, 1988).

One possible way to change the culture on the wards is to persuade all healthcare professionals to participate in a group pledge. This novel intervention takes account of individual factors as well as social and organisational influences which Kretzer and Larson (1998) argue must be considered when planning and executing a behavioural based intervention. The use of a group pledge is underexplored but the technique was successfully used by Groth-Marnat et al. (1996) to change smoking behaviour. The aim would be to enhance healthcare professionals' sense of personal responsibility for their hand hygiene practice which was shown in Study 1 to be a significant predictor of intention to wash hands. Cialdini (1987, p.171) advises that *"Commitment is likely to be maximally effective in producing consistent future behavior to the extent that it is active, effortful, public and viewed as internally motivated."* Hence, the participants would be invited to sign the group pledge in front of each other. The signatories would be pledging to practise hand hygiene themselves in accordance with the Trust policy and to remind fellow healthcare professionals to perform appropriate hand hygiene practice when they have neglected so to do.

The theoretical framework that underpins the group pledge is the Elaboration Likelihood Model of Persuasion (ELM) (Petty and Cacioppo, 1986). This argues that persuasive communication is determined by whether one is motivated to process the information e.g. personal relevance, personal responsibility. It is also cognisant of one's ability to process the information by lack of distraction, repetition, prior knowledge and message comprehensibility. The nature of the cognitive processing is also relevant, e.g. favourable/unfavourable thoughts and initial attitudes. As shown in several studies undertaken in this programme of research, healthcare professionals generally hold very positive attitudes towards hand hygiene. Thus, the idea of a group pledge is likely to be received favourably.

Two key principles which inform the conduct of the group pledge are 'The Commitment/Consistency Principle' and 'The Social Validation Principle' (Cialdini, 1987). The 'Social Validation Principle' draws on the need for an individual to be seen to be doing what others are doing, i.e. complying with the norm. Hence, it is essential to secure commitment from *all* concerned. This is particularly important given the findings from Study 2 which showed how nurses' attitudes towards hand hygiene decline during the course of their training when they see that those they work alongside do not place the same value on hand hygiene as they do themselves

A clinical team is a powerful influence in changing healthcare professionals' behaviour. Its power probably depends on the rewards it provides to those who keep its rules, and the potential threat of sanctions for those who do not. These are considered next.

Sanctions And Rewards

Non-compliance with hand hygiene is reported to be a disciplinary offence in some trusts (Comptroller and Auditor General, 2004). However, given the low level of adherence to the national guideline reported in Study 8, the feasibility of sanctioning staff in this way, is questionable. Rather, it is recommended that the focus should be on a system of rewards such as interest, participation, status, excitement, social support and praise which according to Firth-Cozens (1995) work better than punishments. Participating in the development and execution of a group pledge, as discussed above, may well serve as the reward that is needed to encourage healthcare professionals to improve their hand hygiene practice. However, Firth-Cozens (1995) advises that there should always be clearly understood punishments in the form of sanctions to be used as a last resort. If healthcare professionals are to be disciplined for non-compliance, policy makers and policy enforcers must be quite certain about what constitutes an adherence opportunity. This is quite a challenge given the limitations of hand hygiene guidelines.

Hand Hygiene Guidelines

Findings from Study 8 show that healthcare professionals rarely wash their hands in accordance with national guidelines. However, as acknowledged by CDCP (2002, p.4) *"Data are limited regarding the types of patient care activities that result in transmission of patient flora to the hands of personnel."* This lack of evidence undermines the credibility of guidelines and may partly explain why healthcare professionals do not adhere to them. Given that nurses are more likely to draw their knowledge from policy and procedure manuals than from research literature (Gerrish and Clayton, 2004), it is essential that such documents are research-based and easy to understand. As discussed in the literature review and as shown in Study 6, the meaning of words and phrases in guidelines and policies is not always clear. In his critique of the English language, Humphrys (2004) offers the following example of NHS management-speak found in an advertisement

> *"The job in question is 'Manual hygiene trainer'. The successful applicant will offer 'hands-on' advice to health workers with 'particular attention to cross-infection minimisation'. Could it mean 'teach them how to wash their hands'? The great skill of management-speak is its ability to state the obvious in such a way that normal human beings won't have a clue what it means. My own theory is that it's the lawyer syndrome: if we knew what they were talking about, we wouldn't need them."* (p.159-160).

Infection Control Personnel should therefore ensure that any policies they write would be clarity-approved by the Plain English Campaign and awarded the Crystal mark for clear English.

There is an urgent need for The Department of Health to commission research to generate comprehensive data about the types of patient care activities that result in transmission of patient flora to the hands of personnel. Evidence based guidelines could then be written which would stipulate when hand hygiene is an imperative for as Pittet et al. (1999a, p.128) argue *"Full compliance with handwashing guidelines may be unrealistic."* A similar view was expressed by a qualified nurse who participated in Study 6 "*washing hands every single time you come into contact with each patient is not practical, and would ruin your skin.*"

The definition of an adherence opportunity should be standardised so that the meaning of optimal and suboptimal practice is universally understood. This would enhance the rigour of audits of hand hygiene practice and enable meaningful comparisons between observation studies to be made. If it is proven that it is not always necessary to wash hands *"before and after each patient contact and before putting on and removing gloves"* (UK Health Departments, 1998, p.9), then the demands on healthcare professionals' time would be reduced.

Another source of confusion in the clinical setting in hand hygiene posters. These are considered next.

Hand Hygiene Posters

Although hand hygiene posters are intended to persuade healthcare professionals to wash their hands, Study 7 showed that they are not being used to maximum effect. This accords with the finding reported by Storr and Brind (2003). Indeed, they were found to be a source of mixed messages as well as inconsistent ones which could adversely affect attempts to improve hand hygiene practice. This is probably adding to the confusion in the healthcare professional's mind regarding hand hygiene.

One of the problems in persuading healthcare professionals to wash their hands is that this behaviour is primarily for the benefit of others. The construct of personal responsibility which was found in Study 1 to be a predictor of intention to perform hand hygiene, should be targeted to emphasise the responsibility which healthcare professionals need to exercise as part of their accountability for patient care.

If posters are to be cost effective, it is essential that theoretical principles of message-framing are used. Suggestions for gain-framed messages to promote hand hygiene have been offered (see Study 7). More use could be made of repeated minimal fear appeals, but they too should be framed in terms of gains rather than losses. It is not known whether the posters used by Williams (1987) and Pittet et al. (2000) in their multi-faceted studies utilised message-framing theory. Given that both studies report on the limited usefulness of posters at enhancing hand hygiene practice, it is doubtful. A research grant has recently been obtained from the Hospital Infection Society to test the effect of messages on hand hygiene posters which utilise the theoretical principles advocated.

Infection Control Teams should stop using posters as training charts. There are other, more effective ways to teach healthcare professionals how to wash their hands. The next section considers various education and training strategies which might enhance healthcare professionals' knowledge, understanding and practical skills concerning infection prevention and control in general and hand hygiene in particular.

Enhancing Educational And Training Strategies

Clinical Supervision

Healthcare professionals' hand hygiene practice could be improved if there was increased supervision of clinical practice, not only of students, but also of newly qualified staff. Although university tutors also act as Practice Link Tutors, they only spend one day per week in clinical practice supervising students. In view of the current situation in NHS wards of high bed occupancy rates (Taylor, 2004), high staff turnover and pronounced problems recruiting qualified nurses (Hutt and Buchan, 2005) this is clearly insufficient. Consideration should be given to re-instating the role of the Clinical Practice Teacher which was abolished when nurse training moved from Schools of Nursing into universities in order to raise the minimum education level of pre-registration nurses (DOH, 1989; UKCC, 1986).

Clinical Skills Teaching

The above radical change in nurse education necessitated the establishment of clinical skills laboratories to support and enhance the teaching and learning of psychomotor skills for pre-registration nursing students. Hilton (1996) was one of the first in the UK to pioneer these and since then, there has been a proliferation of such facilities across universities in the UK. However, a report by the Department of Health was critical of the fact that newly qualified nurses lacked the necessary skills to be *'Fit for practice and purpose'* (DOH, 1999b).

Findings from Study 8 give not only examples of staff who do not wash their hands or use gloves appropriately but who also lack clinical skills to perform procedures which a qualified nurse should be able to perform competently. For instance, application of compression stockings to prevent thrombo-embolism. Such findings are very disturbing. Clearly, there is an urgent need to change the way in which clinical competencies such as these are taught and assessed.

The 'added-value' of ICLNs teaching infection prevention and control practices at the bedside has been demonstrated by Ching and Seto (1990) in Hong Kong. In a controlled trial, they tested the effectiveness of using ICLNs to implement a new guideline for the prevention of catheter-associated urinary tract infections. They found that those nurses who attended ward-based demonstration tutorials given by the ICLNs in addition to an in-service lecture by the ICN, made significantly fewer incorrect practices than those nurses in the control group who had only attended the in-service lecture.

Studies 3 and 5 showed that the microbiology laboratory practical exercise was as effective as the Glitter Bug demonstration at enhancing attitudes towards hand hygiene. However, as there are different lessons to be learnt from each, both teaching strategies should be used. It is therefore recommended that the microbiology laboratory practical that used to be delivered in the first year of training should be re-instated in the curriculum, as part of the biosciences module. This should be supplemented by the Glitter Bug demonstration later on in the training programme. As shown in both these studies, as well in Study 2, there clearly needs to be reinforcement of the training messages in the clinical setting by repeating demonstrations of hand hygiene at regular intervals. This might limit the decline in attitudes seen in Studies 2, 3 and 5. The ICLNs could be taught how to assume this important job. The Glitter Bug cabinet is eminently portable and used to good effect by Elston (1998) to teach junior doctors about hand hygiene at their induction training day. It is recommended that hand hygiene techniques should be designated as competencies to be assessed and students' knowledge about indications for hand hygiene should be tested. Furthermore, all qualified nurses should be required to attend an in-service education day every year to update their knowledge on infection prevention and control.

Education Curricula

Several researchers have documented that qualified nurses' comprehension of basic microbiology and principles of infection prevention and control is woefully inadequate (Prieto, 2003; Courtenay, 1998; Elliott, 1996; Horton, 1992). Prieto (2003) found that *"registered nurses relied almost exclusively on their basic education to guide their infection control practice, even though the majority ranked their knowledge of applied microbiology as only fair or poor."* (p. 208). Further, they relied on this knowledge no matter how long ago they had qualified.

Clearly, there is an urgent need to undertake a review of pre-registration nursing curricula to address this serious short-coming. More time must be assigned to teaching both clinically applied microbiology and infection prevention and control. However, given that nurses have difficulty understanding the concepts that underlie the principles of infection prevention and control (Prieto, 2003; Courtenay 1998), the way in which the subject is taught is very important.

Courtenay (1998) suggests that nurse educators need to become more aware of learners' own understanding of microbiology and principles of infection prevention and control, so that they can challenge any misconceptions. This, she argues, may be accomplished by adopting teaching strategies based on learning theories such as constuctivism and situated cognition.

In-Context Learning At A 'Virtual' Hospital

The recent subject benchmarking exercise emphasised the need to locate theory development within the context of clinical practice (Quality Assurance Agency, 2001). The In-Context Project (www.in-context.info) addresses this challenge through re-integrating theory with practice by focusing upon the complex demands of patient care within the context of service delivery. Over 200 case studies have been collected with a view to using them as learning materials in support of nursing curricula. A sub-set of these has been used to populate Penfield, a 'virtual' hospital (www.penfieldvirtualhospital.info). The case-based learning materials will be available at minimal cost to Higher Education Funding Council for England institutions later this year. It is recommended that the case-based learning materials include records of patients who acquired an infection during their hospitalisation as a result of someone failing to wash their hands. This might bring home to students why appropriate hand hygiene is an essential part of caring.

Greater theory-practice integration can also be accomplished through the development and implementation of novel teaching methods (McCaugherty, 1991) such as learning games.

Learning Games

Some educationalists have incorporated a gaming approach into a teaching programme. Walljasper (1982) found that learning games encourage group interaction, stimulate interest in the subject, increase motivation and can signify a topic's relevance to real-life situations. Participants may then be able to apply the knowledge acquired through gaming experiences to their work situations. Within the field of infection prevention, gaming techniques have been developed and incorporated into teaching programmes by several practitioners (Resko and Chorba, 1992; Moralejo and Gaese, 1993; Nagy et al., 1993; Rowell and Spielvogle, 1996).

Kramer (1978) used a handwashing song to train 22 pre-school children, some of whom had learning disabilities, how to wash their hands. She based her study on the knowledge that *"for music to be effective in a maintenance procedure, it must first be effective in a training* *procedure."* (p. 138). It would be interesting to study the effect of using a song to teach students how to wash their hands.

Habit Formation

Hand hygiene needs to be embedded as a habit and early education is essential to instil good habits for life. This should begin in the home with parents teaching their children to wash their hands at a young age. It is particularly pleasing to note that the cookery programme for children on BBC 2, 'Big Cook, Little Cook' always emphasises the importance of hand hygiene before food preparation with the question *"Have you washed your hands?" "Yes, all clean and ready to cook."* Television is such a powerful communication medium, it is very disconcerting to note that similar programmes for the 'grown up helpers' do not do likewise. Study 8 showed that nurses washed their hands on only 30% of occasions before feeding or serving food to patients.

The importance of indoctrinating children with good hand hygiene cannot be overstated. Parents need to set a good example but, as reported by Hateley and Jumaa (1999), many adults, including healthcare professionals, do not wash their hands after using the toilet. Children who witness this disregard for personal hand hygiene are also likely to disregard their own. As shown in Study 8, qualified nurses did not wash their hands after handling urine and faeces on 17% and 25% of occasions respectively. The more systematic and automatic hand hygiene behaviour can become, the greater the chance of infection prevention. Practice should be rational but findings from Study 8 showed that this was not always the case. Healthcare professionals need to be taught how to risk assess the need for handwashing. The next section discusses how this might be done.

Changing The Way Healthcare Professionals Think About Hand Hygiene With Particular Regard To Risk Assessment

Healthcare professionals' should be enabled to risk assess the need for hand hygiene for three main reasons. Firstly, it may not actually be necessary for them to wash their hands *"before and after contact with each patient, and before putting on and after removing gloves"* (UK Health Departments, 1998, p.9). As CDCP (2002, p.4) acknowledge *"Data are limited regarding the types of patient care activities that result in transmission of patient flora to the hands of personnel."* They therefore recognise that *"it might be unrealistic to expect healthcare workers to clean their hands after every contact with the patient."* (p. 31). A similar view was expressed by Pittet et al. (1999a, p.128) who argued that *"Full compliance with handwashing guidelines* *may be unrealistic."* This may be because the guidelines themselves are unrealistic. As CDCP (2002, p.31) state *"there is a need to determine evidence-based indications for hand cleansing."*

The second reason is that healthcare professionals' thinking about hand hygiene is flawed. The third reason is that their hand hygiene practice is often irrational. As shown in Study 8, they rarely wash their hands before attending to a patient. This places patients at an increased risk of acquiring an infection from flora on the hands of healthcare professionals. Further, they sometimes do not wash their hands after procedures associated with a high risk of cross-infection, thereby putting other patients as well as themselves at risk of cross-infection. This disregard for personal safety is difficult to understand.

This section begins by discussing findings which show that healthcare professionals' perception of risk of cross-infection is impaired. Protection Motivation Theory may offer an explanation as to why they do not always consider themselves or their patients to be at risk of cross-infection. Then the challenge posed by failure to perceive risk is considered. Finally, discussion centres on explaining how healthcare professionals might be taught to engage actively in the risk assessment process using a novel tool designed by the researcher: A Dynamic Assessment Strategy For Hand Hygiene (DASHH).

Perceptions Of Risk

As shown in Study 6, healthcare professionals do not have a clear understanding as to when they should wash their hands and the decision-making process is not guided by a comprehensive assessment of the risks of infection. As a consequence, their hand hygiene practice is often irrational and unsafe as shown in Study 8. Nurses' irrational practice has been reported by others with regard to isolation nursing precautions (Prieto, 2003), and various infection control practices including handwashing (Macqueen, 1995). Curtis (2001), who studied peoples' hygiene behaviour, has shown that individuals have predispositions to behaviours and do not act purely on rationality.

The findings from Study 8 show that the observed adherence rate for hand hygiene both *before and after* a care activity was only 12%. When the data were analysed further, it was found that hand hygiene was performed significantly less often *before* as opposed to *after* any type of care activity (20% versus 61% of occasions). This finding is similar to those reported by others (Sproat and Inglis, 1994; Picheansatathian, 1995; Lankford et al., 2003) in so far as these studies also show that rates of hand hygiene are higher *after* care activities as opposed to *before*. However, there are quite substantial differences between these studies with regard to the actual percentages of occasions when hand hygiene was performed (see Table 6, p.27). Moreover, findings from all these studies differ from those reported by DeCarvalho et al. (1989) who showed higher rates of hand hygiene *before* care activities as opposed to *after* care activities. This difference is difficult to explain. Some experts now specify that hands should be washed *"between"* care activities (Cookson et al., 2001, p.153). This may be interpreted to mean that washing hands *after* a care activity effectively constitutes a wash *before* the next care activity. However, this change in emphasis would not help explain the rates reported in studies conducted in the 1990s.

Whatever the reason, washing hands more frequently after as opposed to before care activities suggests that practice is neither rational nor informed by an adequate assessment of the risks of infection. For example, hands were cleaned on 86% of occasions after wound care (when the aim is to prevent cross-infection to other patients), but on only 14% of occasions before (when the aim is to prevent the index patient from developing an infection). This suggests that healthcare professionals think it more important to prevent cross-infection from one patient to another than to prevent infection of the index patient. This may result from an emphasis on infection *control* rather than infection *prevention*. However, in Study 3 it was shown that students thought it was equally important to wash hands before and after dressing a wound.

Further analysis of the data in Study 8 showed that healthcare professionals often fail to wash their hands before and after performing procedures that carry a medium or high risk of cross-infection both to themselves and other patients. There was no evidence of much additional care being taken with patients who were infected with MRSA. Others have also reported that healthcare professionals frequently do not wash their hands even after caring for patients who are known to be infected (Donowitz, 1987; Korniewicz et al., 1990; Larson, 1980; Preston et al., 1981).

The lack of utilisation of risk assessment strategies to guide decisions about when to wash hands was evidenced further by findings from Study 6 which showed that healthcare professionals have difficulty determining what constitutes a *'significant patient contact'*. This may be because they are inculcated with the philosophy of Universal Precautions which is at variance with the principles of risk assessment. Indeed, two participants in Study 6 actually described handwashing as being a Universal Precaution. It appears their practice is guided by 'rules' without necessarily comprehending the underpinning rationale. Enhancing healthcare professionals' perception of risk is therefore very important because it appears to be a key determinant of whether or not they wash their hands.

In Study 1, it will be recalled that the participants were not unrealistically optimistic regarding their risk of acquiring infection. Further analysis which explored the relationship of optimistic bias with intention and self-report behaviour revealed that there was no significant difference in terms of risk perception between 'low' and 'high' handwashers.

Protection Motivation Theory

As discussed in the literature review, Protection Motivation Theory (Rogers, 1975; 1983) offers insights into why it is difficult to bring about a change in healthcare professionals' hand hygiene practice. When they assess the health threat, they may not consider themselves or their patients to be at risk of cross-infection. Indeed, healthcare professionals may not appreciate the cross-infection risk that their own flora poses to patients.

As shown in Study 2, it appears that nurses believe that washing their own hands after taking gloves off is more important than washing hands before putting gloves on, suggesting an elevated interest in their own protection against infection. Indeed, this notion is reinforced by the fact that over 90% of the participants thought it 'very important' to wash their hands before going for a meal break, whilst less than two thirds considered it very important to wash their hands before administering medicines to patients. This demonstrates the value they place on protecting themselves from the ingestion of micro-organisms. It seems therefore that nurses think more of protecting their own health than that of their patients. This raises interesting issues around risk and 'self-protection.'

Failure To Perceive Risk

Individuals vary in their propensity to risk. These differences stem from personality, past experience and from current psychological and physiological states. According to Firth-Cozens (1995), human efficiency is lowered considerably when people are asked to do two things at once, both of which require accuracy and attention, for example attending to clinical care and watching for risk. Multi-tasking, where healthcare professionals perform more than one task simultaneously, goes beyond the phenomenon of working 'on automatic pilot'. This was described by healthcare professionals in a study by Treloar et al. (1996) as 'thinking two miles ahead' whilst being engaged in a task. This construct, referred to as 'mindlessness' in the psychological literature, is a specific application of a general cognitive ability. It develops from a reliance on past behaviours, habits and established cognitive schema as a strategy to conserve cognitive capacity. Treloar et al. (1996) developed The Cognitive Conservation Model of Mindlessness as a theoretical framework for the evaluation of an intervention strategy to reduce the incidence of 'sharps' injuries. It provides a conceptualisation of the influence of mindlessness on the amount of attention directed toward behaviour under varying levels of competence or skill. The model also seeks to explain how this influence can be reduced and mindfulness encouraged by re-directing attention to achieve a state of 'mindful mastery' of a behaviour. Clearly, the effects of mindlessness, which Treloar et al. (1996) found was widespread amongst the participants in their study, may be far-reaching and should be considered further in studies of hand hygiene behaviour.

Willy et al. (1990) found that compliance with improved working practice guidelines increases only when education alters perception of risk, as opposed to simply increasing knowledge. A process is therefore proposed whereby healthcare professionals could be taught how to engage in active rather than passive risk assessment. This has been named a Dynamic Assessment Strategy for Hand Hygiene (DASHH).

A Dynamic Assessment Strategy For Hand Hygiene (DASHH)

DASHH involves assessment from two perspectives: risk to patients and risk to self. This requires a knowledge base which could be key 'rules'. Thus, it is an amalgamation of 'rule set' and 'risk assessment'. Two factors determine whether hand hygiene is necessary *before* patient contact. First, the susceptibility to infection of the site which is to be the focus of the care activity (e.g. manipulation of catheter entering a sterile cavity or taking a patient's pulse). Second, the patient's susceptibility to infection (e.g. very sick and immuno-compromised or convalescent) (see Figure 44). For example, a patient in intensive care who is given an intravenous medication is at greater risk of infection from transient organisms on the healthcare professional's hands than the convalescent who has his pulse taken. Handwashing *after* patient contact would be determined by the extent of hand contamination that has occurred as a result of the patient care activity performed (e.g. taking a pulse or changing a baby's nappy) (see Figure 45). Given the differences between the two perspectives, healthcare professionals should be taught to risk assess the need for handwashing in two separate stages, i.e. *before* patient contact and *after* patient contact. As Figure 44 shows, handwashing may not be required before a patient care activity is performed. However, if it is necessary, then it is essential that it is performed to protect the index patient.

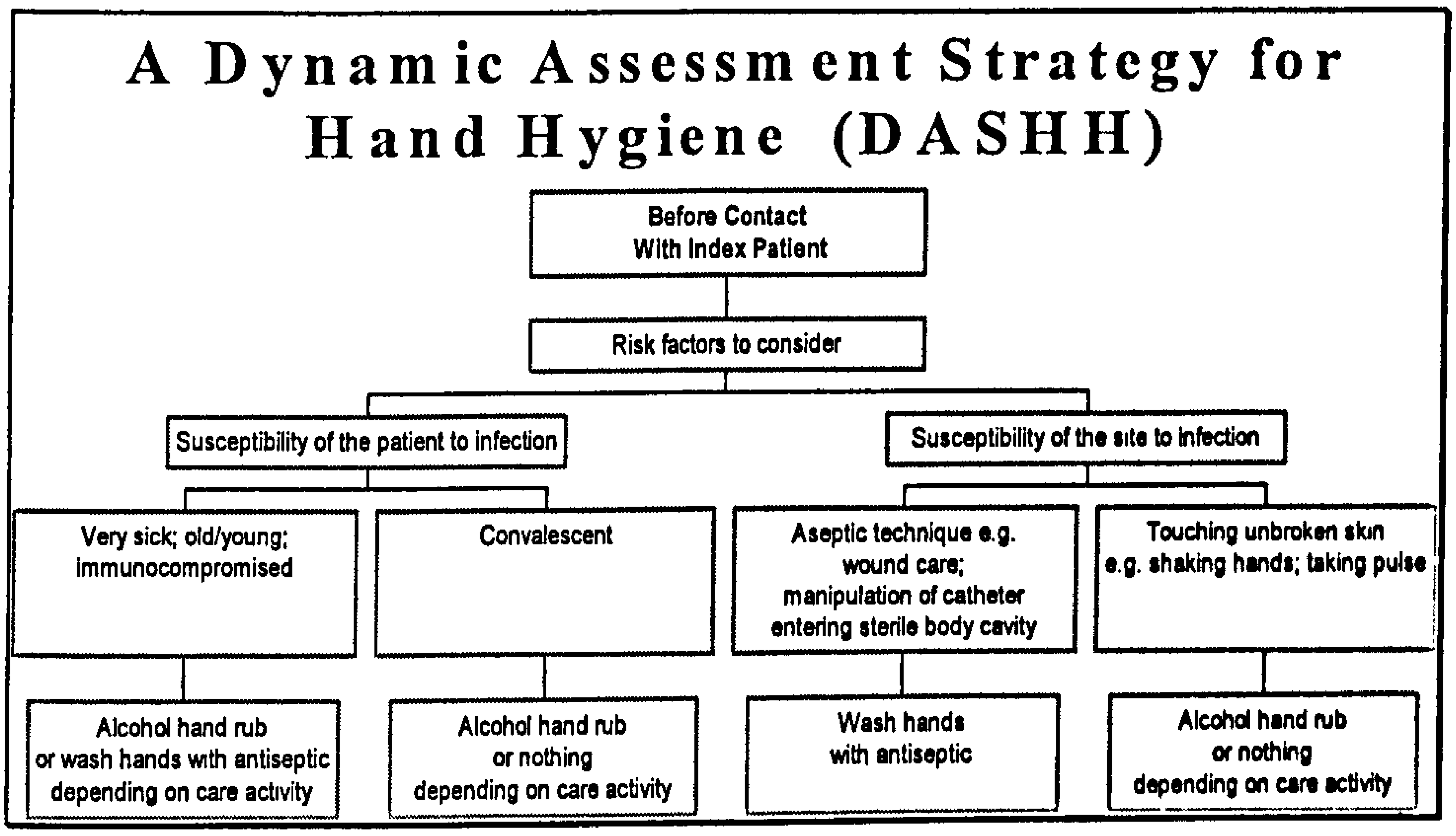

Figure 44 Risk assessment process *before* performing a patient care activity

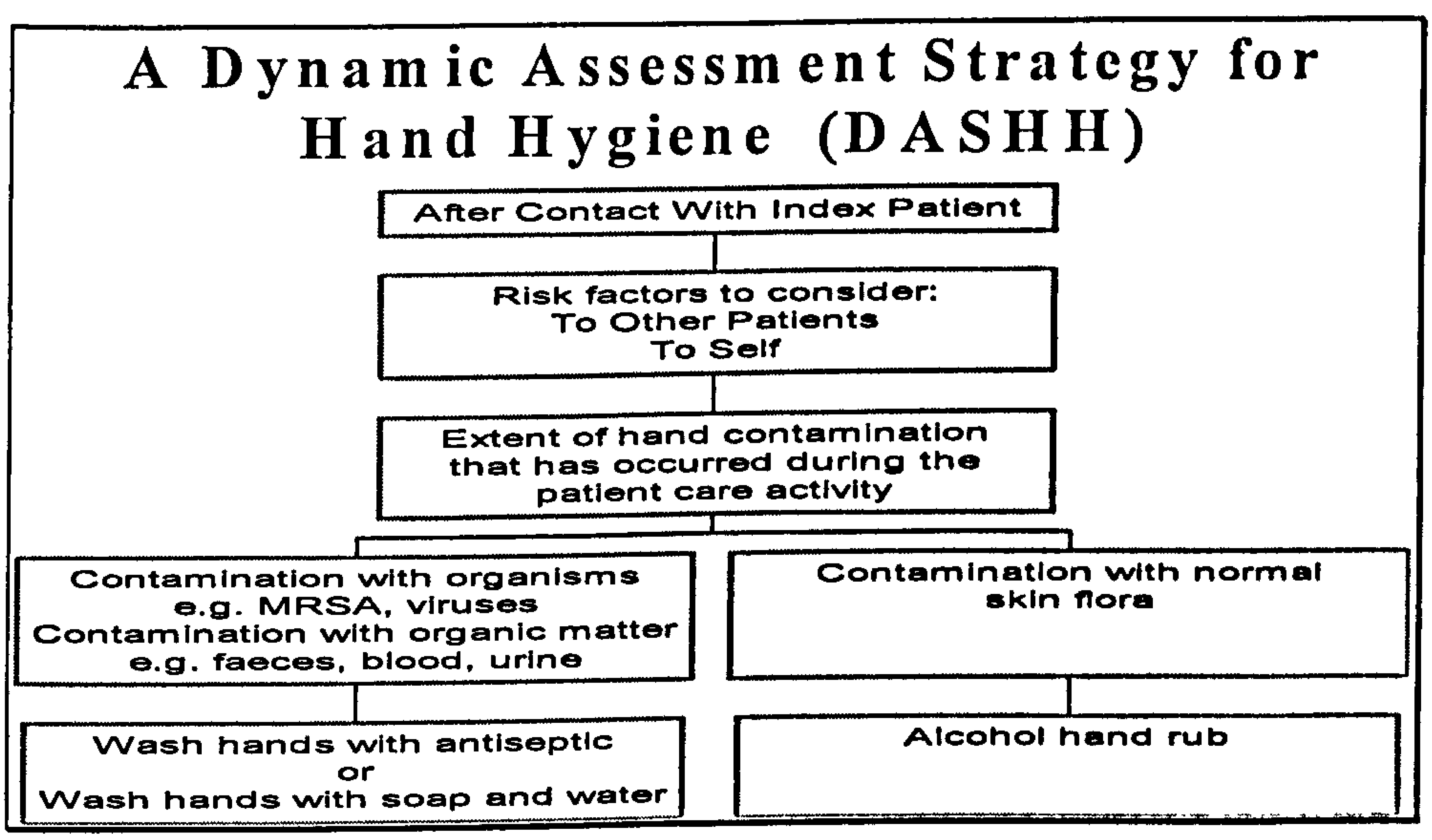

Figure 45 Risk assessment process *after* performing a patient care activity

The timing and number of handwashes would be determined by whether staff-patient interactions were sequential or were completely isolated from each other. Then again, it may well be necessary to wash hands *before and after* performing a *range* of procedures on the *same* patient, an issue that has been made explicit for the first time in the British guidelines (Pratt et al., 2001). However, it is not sufficient for guidelines merely to state that this is so. Prieto and Clark (1999) have shown that when carrying out a range of patient care activities on the same patient, nurses are very confused as to when they should wash their hands. The DASHH approach should serve to reduce the uncertainty in such a way as to decrease the risk of cross-infection.

Given that healthcare professionals work in a practice setting which is fast moving and where novel situations are inevitable, they need to be empowered to think intuitively, critically, laterally and contextually. DASHH is designed to provide them with the mental mind map to enable them to do this and may help to overcome the phenomenon of 'mindlessness' discussed earlier. By risk assessing the need for a handwash, or any other sort of hand cleansing, healthcare professionals would be enabled to make an informed decision as to whether and when hand hygiene is necessary. Teaching them how to engage actively in this process which combines knowledge of key rules as well as an understanding of risk factors determining the need for hand hygiene, is offered as a way forward. DASHH is structured to change the way healthcare professionals *think* about the behaviour. This would seem to be an essential precursor to improving their hand hygiene practice.

Testing, Implementation And Evaluation Of DASHH

This tool needs to be tested empirically and is viewed as an important area for future research. If it is found to be valid and reliable, then training programmes would need to be developed to facilitate its implementation in practice. As argued elsewhere personal explanation and accompanying persuasion of rules are key factors in their adoption (Jenner et al. 1999). Based on Prieto's experience (Prieto, 2003), its success would hinge on healthcare professionals' ability and willingness to comprehend the rules presented to them and to think about them at the right time. However, as discussed earlier, both Prieto (2003) and Courtenay (1998) have reported on nurses' struggle to make sense of infection control practice as a result of their poor understanding of basic microbiology. This in turn limits their ability to exercise clinical judgement. It is anticipated that a tool such as DASHH would enable this process. Implementation of DASHH would need to be followed by an assessment of learning which must cover verbal and, in particular, practical evidence that healthcare professionals are able to operationalise the risk assessment tool appropriately. Once it has been adopted, healthcare professionals' hand hygiene practice must then be monitored by audit and results fed back to the individuals concerned and their managers.

Improving healthcare professionals' hand hygiene practice is complex and challenging. This thesis has shown why it is necessary to draw on principles from the behavioural sciences when interventions and strategies to improve hand hygiene practice are implemented. Healthcare professionals must be trained how to risk assess the need for hand hygiene. This requires a sound knowledge base of microbiological principles and rational beliefs about the prevention and control of infection. These can be taught but more time must be devoted to this in the pre-qualifying curriculum. Research is urgently needed to enhance the evidence base for hand hygiene guidelines, and to gain a better understanding about healthcare professionals' perceptions of risk and risk taking behaviour with regard to hand hygiene.

Appendix 1 Information sheet for potential participants, modified as necessary for all studies

CONFIDENTIAL

INFORMATION SHEET FOR HEALTHCARE PROFESSIONALS

Title of study: Hand hygiene of healthcare professionals. A study to investigate attitudes and practice.

Investigators: Dr. Geoff Scott, Ms. Liz Jenner, Mr. Philip Watson.

This sheet describes a research project in which we are inviting you to take part. It explains why we are doing the research, and why we believe it is important. It also explains how we will need your help, if you choose to take part in the project.

You do not have to take part in this study if you do not want to. If you do decide to take part you may withdraw at any time without having to give a reason.

All proposals for research using human subjects are reviewed by an ethics committee before they can proceed. This proposal was reviewed by the joint UCL/UCLH Committees on Ethics of Human Research.

If there is anything that is not clear to you, or if you would like further information, please ask the person who gave you this form. You may also contact Dr. Geoff Scott, the principal investigator.

Purpose of study

The overall aim of the study is to evaluate the attitudes and behaviour of staff towards hand hygiene (HH) practice in a clinical setting. This is important as previous research has shown that adherence to HH standards is inadequate for a number of reasons, allowing opportunities for cross-infection.

What taking part will involve

Taking part will involve completing a short questionnaire which asks your views about hand hygiene practice, and returning it to the project leader, Liz Jenner, via internal mail.

Profile of investigators

The principal investigator of this study is Dr. Geoff Scott who is a consultant microbiologist at UCLH. The project leader is Liz Jenner who is an honorary appointee research Infection Control Nurse, UCLH and a post-graduate research student at the University of Hertfordshire currently registered for a PhD. Philip Watson is a Research Assistant.

Appendix 2 Consent form for all participants, modified as necessary for all studies

CONFIDENTIAL

CONSENT FORM FOR HEALTHCARE PROFESSIONALS

Title of study: Hand hygiene of healthcare professionals. A study to investigate attitudes and practice.

Investigators: Dr. Geoff Scott, Ms. Liz Jenner, Mr. Philip Watson.

Have you read the information sheet about this study? Yes ☐ No ☐

Have you had an opportunity to ask questions and discuss this study? Yes ☐ No ☐

Have you received satisfactory answers to all your questions? Yes ☐ No ☐

Have you received enough information about this study? Yes ☐ No ☐

Do you understand that you are free to withdraw from this study ?

- At any time
- Without giving a reason for withdrawing

Yes☐ No☐

Do you agree to take part in this study? Yes☐ No☐

Name of healthcare professional:..

Position:..

Signature of healthcare professional:.. Date:........

Appendix 3 Covering letter for questionnaire for Studies 1, 6 and 8

A study to investigate healthcare professionals' attitudes towards and practices of hand hygiene

Dear Healthcare Professional,

I am currently registered for a PhD at the University of Hertfordshire where I work as a principal lecturer in the Dept. of Post-Registration Nursing. Prior to this, I worked in the NHS as an Infection Control Nurse for several years and now hold an honorary appointment as a research nurse at UCLH working with the infection control team. As part of the PhD degree programme, I am carrying out a piece of research examining issues around hand hygiene in healthcare staff. In confirmation with my own personal experience, the body of evidence in the literature suggests that the recommendations concerning hand hygiene are not always followed for a number of reasons. One aspect of the study will explore factors that may be associated with non-compliance.

Attached to this cover sheet is a short questionnaire which you are invited to complete. Please be assured that the questionnaire is completely confidential and analysis of data will only be presented in group form. Hence, individuals will not be identifiable.

I realise that you are very busy, but your participation would be greatly appreciated. If you would like to complete the questionnaire, please first read carefully the information sheet attached. As a requirement of the ethics committee, a consent form has to be completed. However, in order to strictly preserve anonymity, I would ask you to return this separately from the questionnaire (also via internal mail) in the labelled envelope provided.

Please answer all the questions. Answer them by yourself, without help. It is **your own views** which interest me.

Dr. Geoff Scott (Consultant Microbiologist/Principal Investigator).
Ms. Liz Jenner (Project leader, PhD Student/Research Infection Control Nurse).
Mr. Philip Watson (Research Assistant).

Appendix 4 Cover sheet for questionnaire for Studies 1, 6 and 8

Hand Hygiene Questionnaire

CONFIDENTIAL

Name of ward:

Male or **Female:**
(Please circle your gender, as appropriate)

Occupation: Qualified nurse, doctor, therapist, healthcare assistant

(Please circle, as appropriate)

Appendix 5 Questionnaire for Studies 1, 6 and 8

Hand Hygiene Questionnaire

CONFIDENTIAL

Code number........................
For researcher's use only

Please answer ALL the questions.

Please **circle the one number** on the scale that best reflects your views.

HANDWASHING IN PRACTICE

The following questions seek your views about hand hygiene practice in general.

1. I always like to wash my hands before and after contact with each patient.

Definitely Yes 1 2 3 4 5 6 7 **Definitely No**

2. I always want to wash my hands before and after contact with each patient.

Strongly Agree 1 2 3 4 5 6 7 **Strongly Disagree**

3. I always intend to wash my hands before and after contact with each patient.

Strongly Agree 1 2 3 4 5 6 7 **Strongly Disagree**

4. I always expect to wash my hands before and after contact with each patient.

Likely 1 2 3 4 5 6 7 **Unlikely**

5. I always wash my hands before and after contact with each patient.

Strongly Agree 1 2 3 4 5 6 7 **Strongly Disagree**

RESOURCES AND OBSTRUCTIONS

The following questions assess whether you believe there are sufficient clinical resources available in your ward in order for you to carry out hand hygiene practices with ease. Some questions address possible obstacles to appropriate practice.

1. There is always a hand hygiene product available on the ward with which to wash my hands that will not cause damage to my skin.

   Strongly Disagree 1 2 3 4 5 6 7 **Strongly Agree**

2. The number of sinks available on the ward allows me to wash my hands with ease, when I need to.

   Strongly Agree 1 2 3 4 5 6 7 **Strongly Disagree**

3. Sometimes I do not wash my hands before and after every patient contact because I do not have the time.

   Strongly Disagree 1 2 3 4 5 6 7 **Strongly Agree**

4. The location of sinks on the ward allows me to wash my hands with ease when I need to.

   Strongly Agree 1 2 3 4 5 6 7 **Strongly Disagree**

5. I believe that the paper towels available are satisfactory for hand drying.

   Strongly Disagree 1 2 3 4 5 6 7 **Strongly Agree**

PERSONAL RESPONSIBILITY AND RISK

1. I believe that I have a role to play in reducing the risk of cross-infection, by washing my hands before and after every patient contact.

   Strongly Agree 1 2 3 4 5 6 7 **Strongly Disagree**

2. I believe that, in comparison with the other staff I work with, I am at a

Lower 1 2 3 4 5 6 7 **Higher**

risk of acquiring an infection through my work.

YOUR VIEWS ABOUT HANDWASHING

I would like to ask you about your personal views towards hand hygiene practice.

1. Washing my hands before and after contact with each patient would be beneficial as it would contribute to the reduction of hospital-acquired infection.

Strongly Agree 1 2 3 4 5 6 7 **Strongly Disagree**

2. Washing my hands before and after every patient contact is:-

Very Beneficial 1 2 3 4 5 6 7 **Not at all Beneficial**

Not Important 1 2 3 4 5 6 7 **Very Important**

3. I believe that cross-infection could be reduced if all healthcare professionals washed their hands before and after contact with each patient.

Strongly Agree 1 2 3 4 5 6 7 **Strongly Disagree**

4. I feel under social pressure from the other staff on the ward to wash my hands before and after contact with each patient.

Strongly Disagree 1 2 3 4 5 6 7 **Strongly Agree**

5. I believe that I should wash my hands before and after contact with each patient because my colleagues expect me to.

Strongly Disagree 1 2 3 4 5 6 7 **Strongly Agree**

6. If I wanted to, I could easily wash my hands before and after contact with each patient.

Likely 1 2 3 4 5 6 7 **Unlikely**

7. For me, washing my hands before and after contact with each patient is:-

Difficult 1 2 3 4 5 6 7 **Easy**

Finally, I am interested in finding out what you understand by the statement

'hands should be washed before and after every significant patient contact.'

Please write your interpretation below........

....
....
....
....
....
....
....
....
....

Thank you very much for taking the time to answer this questionnaire.

Please place it in the envelope provided which is addressed to Liz Jenner c/o Jacquie Murray-Leonard, Dept. Clinical Microbiology, Outpatient Wing, UCLH, and put it in the internal mail no later than - **31st January 2000.**

Please don't forget to sign the consent form and return it via internal mail in the separate envelope supplied.

Appendix 6 Note on data analysis, Study 1

A question arose as to whether the data should be analysed using multiple regression or logistic regression. Initially, the data were analysed using multiple regression. However, it was clear that the responses to the questions measuring the dependent variables were highly positively skewed. This is a common finding in self-report and one of the limitations of this methodology.

Acting on advice from a statistician, an attempt was made to transform the data to produce a normal distribution. However, the dependent variables remained skewed. This therefore constituted a violation of parametric assumptions and questioned the validity of the results. As Hankins et al. (2000, p.156) point out, "*the dependent variable should be normally distributed at all points along the regression line.*" Therefore the dependent variables were dichotomised and the data were re-analysed using logistic regression.

IMPORTANCE OF PRACTICES TO PREVENT CROSS-INFECTION

Situation: During a span of duty, there is a range of activities to be performed, some of which have particular implications for infection control.

In this section, I am interested in finding out how important you consider the following procedures to be.

Please respond to each statement by ringing a number.

1. Washing my hands before giving an injection is

   Very important 1 2 3 4 5 6 7 **Unimportant**

2. I believe that it is important to wash my hands before putting gloves on

   Strongly Agree 1 2 3 4 5 6 7 **Strongly Disagree**

3. After giving an injection, I believe it is very important to wash my hands

   Strongly Agree 1 2 3 4 5 6 7 **Strongly Disagree**

4. I would regard washing my hands before removing a wound dressing as

   Very Important 1 2 3 4 5 6 7 **Unimportant**

5. In my opinion it is very important to wash my hands before leaving an isolation room.

   Strongly Agree 1 2 3 4 5 6 7 **Strongly Disagree**

6. Before going for my meal break, I believe that it is very important to wash my hands

   Strongly Agree 1 2 3 4 5 6 7 **Strongly Disagree**

7. I believe that washing my hands after handling contaminated equipment is very important

Strongly Agree 1 2 3 4 5 6 7 **Strongly Disagree**

8. Before entering an isolation room, washing my hands is

Very Important 1 2 3 4 5 6 7 **Unimportant**

9. Washing my hands after taking gloves off is very important

Strongly Agree 1 2 3 4 5 6 7 **Strongly Disagree**

10. Before starting a shift I regard washing my hands as very important

Strongly Agree 1 2 3 4 5 6 7 **Strongly Disagree**

11. Washing my hands before the administration of medication is

Very Important 1 2 3 4 5 6 7 **Unimportant**

<u>In the next section, I am interested in finding out what you think the views of the nurses you work alongside would be.</u>

12. The nurses I work alongside believe that washing their hands before administering medicine is

Unimportant 1 2 3 4 5 6 7 **Very important**

13. Before starting a shift, the nurses that I work alongside believe that washing their hands is

Unimportant 1 2 3 4 5 6 7 **Very important**

14. I believe that the nurses I work alongside regard handwashing before entering an isolation room as

Very important 1 2 3 4 5 6 7 **Unimportant**

15. I believe that the nurses I work alongside consider it important to wash their hands after taking gloves off

Strongly Agree 1 2 3 4 5 6 7 **Strongly Disagree**

16. The nurses that I work with believe it is very important to wash their hands before giving an injection.

Strongly Agree 1 2 3 4 5 6 7 **Strongly Disagree**

17. The nurses I work alongside believe that washing their hands before going for a meal break is

Very Important 1 2 3 4 5 6 7 **Unimportant**

18. The nurses that I work alongside regard it as important to wash their hands before putting gloves on

Strongly Agree 1 2 3 4 5 6 7 **Strongly Disagree**

19. The nurses that I work alongside believe it is very important to wash their hands after handling contaminated equipment

Strongly Agree 1 2 3 4 5 6 7 **Strongly Disagree**

20. I believe that the nurses I work alongside regard washing their hands before removing a wound dressing as

Unimportant 1 2 3 4 5 6 7 **Very important**

21. I believe that the nurses I work with think that it is very important to wash their hands before leaving an isolation room.

Strongly Agree 1 2 3 4 5 6 7 **Strongly Disagree**

22. The nurses that I work alongside believe it is very important to wash their hands after giving an injection.

Strongly Agree 1 2 3 4 5 6 7 **Strongly Disagree**

In the next section, I am interested in finding out what you think the views of the doctors you work alongside would be.

23. The doctors that I work alongside believe it is very important to wash their hands after giving an injection.

Strongly Agree 1 2 3 4 5 6 7 **Strongly Disagree**

24. I think that the doctors I work alongside regard washing their hands before removing a wound dressing as very important

Strongly Disagree 1 2 3 4 5 6 7 **Strongly Agree**

25. I think that the doctors I work alongside believe it to be important to wash their hands before putting gloves on.

Strongly Agree 1 2 3 4 5 6 7 **Strongly Disagree**

26. I believe that the doctors I work alongside regard it as important to wash their hands after taking gloves off.

Strongly Agree 1 2 3 4 5 6 7 **Strongly Disagree**

27. The doctors I work alongside believe that washing their hands before giving an injection is

Very Important 1 2 3 4 5 6 7 **Unimportant**

28. The doctors I work alongside believe that washing their hands before going for a meal break is

Very Important 1 2 3 4 5 6 7 **Unimportant**

29. Doctors I work alongside regard it as very important to wash their hands before leaving an isolation room.

Strongly Agree 1 2 3 4 5 6 7 **Strongly Disagree**

30. After handling contaminated equipment, the doctors I work alongside believe it is important to wash their hands.

Strongly Agree 1 2 3 4 5 6 7 **Strongly Disagree**

31. The doctors I work alongside believe that it is very important to wash their hands before the administration of medication.

Strongly Agree 1 2 3 4 5 6 7 **Strongly Disagree**

32. Doctors that I work alongside regard handwashing before entering an isolation room as

Very important 1 2 3 4 5 6 7 **Unimportant**

33. In my view, the doctors I work alongside believe that it is very important to wash their hands before coming on duty

Strongly Agree 1 2 3 4 5 6 7 **Strongly Disagree**

Your help in completing this questionnaire is greatly appreciated. Thank you very much.

We hope to be able to present the findings of the study to you when these are available.

Appendix 8 Information on pilot conducted for Study 3

Pilot Study For Study 3

The aim of the study was to demonstrate the effectiveness of handwashing by means of a microbiology laboratory practical. This involved making fingertip impressions on culture plates before and after washing hands with soap or chlorhexidine gluconate (a disinfectant detergent). Two days later, numbers and types of colonies were compared and discussed. Students' views on the importance of hand hygiene before and after various clinical procedures were measured using a self-report questionnaire, immediately before the intervention (base-line score), seven days after the practical (first follow-up) and five months later after completion of first-year clinical placements (second follow-up).

Negotiating Access

Initial discussions about the laboratory practicals took place with the Scheme Tutor and Cohort Tutor, both of whom supported the research in principle. The Cohort Tutor provided all the necessary documentation regarding the timetable and the names of the 179 students who were split into six groups for teaching and administrative purposes. The Associate Head of Biosciences agreed to timetable and facilitate the laboratory practicals and provisional bookings were made according to availability of laboratories, lecturer, demonstrator and technician. Wednesday afternoons were booked as the laboratories were free then and students did not have timetabled sessions.

Recruitment Of Participants

The researcher arranged to speak to the students in their respective groups for 10 minutes at the end of a class to explain what the research was about and to get a show of hands as to how many students would be interested in participating. This was done for two reasons: firstly, in an endeavour to get commitment, and secondly for the purely practical reason of booking laboratory time and space.

Student Groups 1, 2, 3

6th October 2000. The researcher spoke to students who were fairly unreceptive to the idea of participating. They said they were not prepared to travel in as Wednesday afternoons were free periods; some were not prepared to stay in a laboratory in the late afternoon as the University bus was unreliable and they had to get home for child-minding responsibilities. Before they understood that participation was voluntary, some very vocal students mentioned getting the unions involved as the Student Officer had made it clear that Wednesday afternoons were meant to be kept free for sports activities. Bearing these objections in mind, the researcher re-visited the schedule and offered to start and therefore end the session half an hour earlier so that they could catch the bus home in time at 4.30pm.

Wednesday 11th October. The researcher returned to this group of students to inform them that she had changed the time of the laboratory sessions to accommodate their request. One student said she spoke on behalf of the class to thank the researcher for taking their social and personal needs into account. Approximately 15-20 students indicated by a show of hands that the new timing would be acceptable to them.

15th November, 9am. The researcher visited students in class to remind them again that the handwashing experiments would commence at 13.30 in the laboratory on the first floor of the CP Snow Building and last for two hours.

Handwashing experiments: 10 students attended.
22nd November 2000. Follow-up laboratory session: five students attended.

Student Groups 4, 5, 6

6th November 2000. The researcher visited students in class and negotiated the laboratory practical timetable with them, drawing on lessons learned from Groups 1, 2 and 3.

6th December 2000. Two weeks prior to the session for Groups 4,5,and 6, the students were not in class in University but were out on clinical placements. So flyers on coloured paper were sent to each student at their term time address to remind them of the sessions and to invite them to participate.

13th December 2000. On the morning of the laboratory session, the researcher went in person to the classroom to remind students about the study. Students again asked if the session was compulsory. They were informed that it was not but it was stressed that their participation would be very much appreciated. A show of hands suggested that only about 12-15 were interested so they were told that they could *all* be accommodated in the first session at 1.30pm, which they were happy with.

13th December. Handwashing experiments: six students attended.

20th December 2000. Follow-up laboratory session: three students attended.

Final Sample

A total of 16 students (9%) attended the laboratory session (six from groups 1,2,3 and 10 from groups 4,5,6). Of these, only three from groups 1,2,3 and five from groups 4,5,6 attended the follow-up session. Of these, only six completed follow-up questionnaires which were mailed to them at their term time address for return in the internal mail.

Analysis

Whilst no meaningful data analysis could be performed on such a small sample, the completed questionnaires were examined to see if any of the questions required modification, but this did not appear to be necessary.

Results

As a result of the very small numbers of diploma students who volunteered to take part in the pilot study, it was decided to test the effect of the educational intervention on undergraduate students, both nurses and paramedics, who are required to attend the microbiology laboratory practical as part of their time-tabled sessions.

Appendix 9 Method for laboratory practical exercise, Study 3

Method for microbiology laboratory practical exercise

1. To examine the efficacy of handwashing

Divide a malt extract plate (M) and a nutrient plate (N) into two sectors by drawing a line across the back of the plate and label one side 'washed' and the other 'unwashed'. Place a set of your fingerprints from one hand onto the 'unwashed' side of both the malt and nutrient plate. Wash your hands thoroughly using either chlorhexidine gluconate 4% or soap and repeat the exercise using the 'washed' side of the plate.

Incubate the plates at 30°C.

At the next practical examine your plates and assess the effectiveness of both your handwashing and the experimental method.

2. To examine the bacterial flora of a human hair

Remove a few (!) hairs from your head and your colleague's and lay them across an N plate, making sure that the hairs are in contact with the agar – use a bacteriological loop to achieve this.

3. To estimate the number of bacterial and fungal propagules landing on the bench surface per hour

Expose one N plate and one M plate on your bench for one hour. Incubate. At the next practical estimate the number of propagules that landed on the plate h^{-1} m^{-2}, for both fungi and bacteria.

4. To Gram stain bacteria

You are provided with the following bacterial cultures:-

Bacillus globigii
Bacillus subtilis
Staphylococcus aureus
Pseudomonas sp.
Escherichia coli
Klebsiella aerogenes

Gram stain at least one of the two *Bacillus* cultures, *Staphylococcus* and one from the remaining 3 organisms. Please ensure that all 6 organisms are stained on your bench so that you can observe them all.

Appendix 9 (continued) Method for laboratory practical exercise, Study 3

Method:-

1. Prepare a dried smear of your culture – as demonstrated
2. Allow to dry; heat fix by passing through Bunsen burner 6 times
3. Stain with a crystal violet – 20 seconds
4. Wash quickly in tap water
5. Add Lugol's iodine – 20 seconds
6. Wash with 95% ethanol, alternating with water until the washings are almost colourless
7. Add carbol fuchsin – 5 to 10 seconds
8. Wash gently with tap water, blot dry. Examine microscopically – as demonstrated

Pink Cells = Gram negative ; Purple cells = Gram positive

Using x 1000 magnification, observe the shape, size, arrangement and Gram reaction of your preparations.

5. To observe the antibacterial spectrum of a range of antibiotics

Sets of demonstration plates have been set up to illustrate the antibacterial spectrum of a range of antibiotics. Also, the susceptibility of each selected bacterium to the antibiotics will be assessed.

Spread plates of the following bacteria have been prepared:-

Bacillus subtilis; Escherichia coli; Staphylococcus aureus

Filter paper discs impregnated with different antibiotics have been placed on the plates after spreading. The plates were then incubated overnight at 37^{0}C. The antibiotics and the amounts used are as follows:-

Antibiotic	**Abbreviation**	**Amounts (*ug*)**
Ampicillin	Amp 25	25
Ampicillin	Amp 10	10
Chloramphenicol	C	30
Neomycin	N	10
Neomycin	N	30
Streptomycin	S	25
Tetracycline	TE	30
Kanamycin	K	5

Observe the plates and measure the diameters of the zones of inhibition. Use your data to assess:-

i the antibacterial spectra of the antibiotics used

ii the susceptibility of the three organisms to the antibiotics

Appendix 9 (continued) Method for laboratory practical exercise, Study 3

Introduction to Microbiology – Proforma

Name: .... Date: .... Group No. ....

(Please use only the spaces provided for your answers)

1. Handwashing

	unwashed	washed	
		soap	Chlorhexidine gluconate 4%
Total number of colonies on M plate Total number of colonies on N plate			

Brief comments on the effect of handwashing with:-

(a) Soap:-

(b) Chlorhexidine gluconate 4%:-

(4 marks)

2. Bacteria and fungi landing on bench surface

Number of colony forming units (c.f.u.'s) landing per plate per hour on:-

N agar:-

M agar:-

Have only bacteria developed on N agar; and only fungi on M agar?

Comment briefly on the selectivity of the two media:

(4 marks)

3. **Gram staining**

	Name of Bacterium 1	2	3
shape of cells, their arrangement (in pairs, clusters) - draw			
size of cells (in µm)			
Gram stain reaction			

(6 marks)

4. **Antibiotics**

From your data, state:-

(i) Antibacterial spectrum of:-

(a) ampicillin –

(b) chloramphenicol –

(c) gentamycin –

(d) streptomycin –

(e) tetracycline –

(f) kanamycin –

(ii) *B.subtilis* is susceptible to:-

E.coli is susceptible to:-

S. aureus is susceptible to:-

(6 marks)

Appendix 10 Questionnaire for Studies 3, 4 and 5

QUESTIONNAIRE ON HAND HYGIENE

This questionnaire seeks YOUR VIEWS about various aspects of hand hygiene practice. Please take a little time to consider each question carefully. Your participation is very much appreciated.

Section 1

In this section, I am interested in YOUR VIEWS on the value of hand decontamination as a means of preventing cross-infection*

*Decontamination is taken to mean:-

- either washing hands with water and a liquid soap/antiseptic
- or using an alcoholic hand rub/gel

Please respond to each statement by circling a number

1. I believe that hospital-acquired infections would be substantially reduced if all healthcare professionals decontaminated their hands before and after contact with each patient

Strongly Disagree 1 2 3 4 5 6 7 8 9 **Strongly Agree**

2. In my view, hand decontamination is one of the most important factors in the prevention of cross-infection

Strongly Disagree 1 2 3 4 5 6 7 8 9 **Strongly Agree**

3. I believe I have a significant role to play in the prevention of hospital-acquired infections by decontaminating my hands

Strongly Disagree 1 2 3 4 5 6 7 8 9 **Strongly Agree**

4. In my opinion, hand decontamination is very important as it will reduce the risk of my acquiring an infection through my work

Strongly Disagree 1 2 3 4 5 6 7 8 9 **Strongly Agree**

5. I think it important to decontaminate my hands before and after contact with each patient

Strongly Disagree 1 2 3 4 5 6 7 8 9 **Strongly Agree**

6. In order to decontaminate my hands properly, it is very important not to wear a wrist watch whilst on duty

Strongly Disagree 1 2 3 4 5 6 7 8 9 Strongly Agree

7. Wearing rings on my fingers prevents adequate hand decontamination

Strongly Disagree 1 2 3 4 5 6 7 8 9 Strongly Agree

8. I believe that wearing gloves is an adequate substitute for decontaminating hands before and after each patient contact

Strongly Disagree 1 2 3 4 5 6 7 8 9 Strongly Agree

Section 2

In this section, I am interested in finding out how important you think it is to decontaminate* your hands BEFORE the following procedures

*Decontamination is taken to mean:-

- either washing hands with water and a liquid soap/antiseptic
- or using an alcoholic hand rub/gel

Please respond to each statement by circling a number

9. I believe that decontaminating my hands before giving any type of injection is

Not at all important 1 2 3 4 5 6 7 8 9 Very important

10. I believe that decontaminating my hands before feeding a patient is

Not at all important 1 2 3 4 5 6 7 8 9 Very important

11. I believe that decontaminating my hands before putting a dressing on a wound is

Not at all important 1 2 3 4 5 6 7 8 9 Very important

12. Decontaminating my hands before attending to an immuno-compromised patient is

Not at all important 1 2 3 4 5 6 7 8 9 Very important

13. I believe that decontaminating my hands before eating food is

Not at all important 1 2 3 4 5 6 7 8 9 **Very important**

14. Decontaminating my hands before caring for an infected patient is

Not at all important 1 2 3 4 5 6 7 8 9 **Very important**

15. In my opinion, decontaminating my hands before putting gloves on is

Not at all important 1 2 3 4 5 6 7 8 9 **Very important**

16. In my opinion, decontaminating my hands before coming on duty is

Not at all important 1 2 3 4 5 6 7 8 9 **Very important**

17. I think that decontaminating my hands before the administration of oral medicines is

Not at all important 1 2 3 4 5 6 7 8 9 **Very important**

18. I think it important to decontaminate my hands before contact with each patient

Strongly Disagree 1 2 3 4 5 6 7 8 9 **Strongly Agree**

Section 3

In this section, I am interested in finding out how important you think it is to decontaminate* your hands AFTER the following procedures

*Decontamination is taken to mean

- either washing hands with water and a liquid soap/antiseptic
- or using an alcoholic hand rub/gel

19. I believe that decontaminating my hands after feeding a patient is

Not at all important 1 2 3 4 5 6 7 8 9 **Very important**

20. I believe that decontaminating my hands after giving any type of injection is

Not at all important 1 2 3 4 5 6 7 8 9 **Very important**

21. I believe that decontaminating my hands after putting a dressing on a wound is

Not at all important 1 2 3 4 5 6 7 8 9 **Very important**

22. Decontaminating my hands after attending to an immuno-compromised patient is

Not at all important 1 2 3 4 5 6 7 8 9 **Very important**

23. I believe that decontaminating my hands after eating food is

Not at all important 1 2 3 4 5 6 7 8 9 **Very important**

24. Decontaminating my hands after caring for an infected patient is

Not at all important 1 2 3 4 5 6 7 8 9 **Very important**

25. In my opinion, decontaminating my hands after taking gloves off is

Not at all important 1 2 3 4 5 6 7 8 9 **Very important**

26. In my opinion, decontaminating my hands as soon as I have come off duty is

Not at all important 1 2 3 4 5 6 7 8 9 **Very important**

27. I think that decontaminating my hands after the administration of oral medicines is

Not at all important 1 2 3 4 5 6 7 8 9 **Very important**

28. I think it important to decontaminate my hands after contact with each patient

Strongly Disagree 1 2 3 4 5 6 7 8 9 **Strongly Agree**

Thank you very much indeed for completing this questionnaire.

Appendix 11 Handwashing quiz, Study 5

HANDWASHING QUIZ

Activity	Yes	No
Before preparing or handling food		
After visiting the toilet		
Whenever hands are visibly dirty		
After bedmaking		
After removing gloves		
Before wearing sterile gloves		
Before and after administering medication		
After any possible microbial contamination		
Before and after any situation which involves direct patient/client contact e.g. bathing, toileting		
Before leaving source isolation		
Before and after handling wounds, urethral catheters, intravenous lines		
Before and after handling medical notes		
Before and after emptying urine drainage bags		
Before caring for susceptible patients		
Before commencing work and after leaving the work area		
After handling contaminated laundry and waste		

Appendix 12 List of care activities observed, Study 8

Activity
Contact with body substances
Contact with urine
Contact with faeces
Contact with blood
Contact with patient
Taking observations; touching patient
Handling/moving/examining the patient
Feeding patient/serving food
Administration of medicines - oral
Administration of medicines - via nasogastric tube
Administration of medicines – via percutaneous endo-gastrostomy (PEG)tube
Administration of medicines – via nebuliser
Administration of medicines – via intravenous (IV) route
Tracheal suction
Bladder catheterisation
Wound management
Contact with patient/equipment infected/colonised with methicillin-resistant *Staphylococcus aureus* (MRSA)
Contact with fomites
Handling/cleaning equipment
Self
Taking meal break

Appendix 13 Observation schedule, Study 8

Ward: VH/DF JY/BS

Staff Code: ………………..

Bay/ Pat.Bed no.:………/………..

Activity:……………………………
……………………………………..
……………………………………..
……………………………………..
……………………………………..
……………………………………..

Wash when? B A

Agent used? H B LS AG WO

Comments:…………………………………
…………………………………………….
…………………………………………….
…………………………………………….
…………………………………………….

Ward: VH/DF JY/BS

Staff Code:……………..

Bay/Pat.Bed no…………../………..

Activity:…………………………
……………………………………..
……………………………………..
……………………………………..
……………………………………..
……………………………………..

Wash when? B A

Agent used? H B LS AG WO

Comments:…………………………
……………………………………….
……………………………………….
……………………………………….
……………………………………….

Ward: VH/DF JY/BS

Staff Code:……………..

Bay/Pat.Bed no………../…………..

Activity:……………………………
………………………………………..
………………………………………..
………………………………………..
………………………………………..
………………………………………..

Wash when? B A

Agent used? H B LS AG WO

Comments:…………………………
……………………………………..
……………………………………..
……………………………………..
……………………………………..

Key

Wash when?	B = Before care activity	Agent used?	H = Hibiscrub
	A = After care activity		B = Betadine.
			LS = Liquid soap
			AG = Alcohol gel
			WO = Water only

Appendix 14 Risk scoring protocol, Study 8

Activity	Risk of introducing infection to patient before procedure	Risk of transferring infection to other patients after procedure	Risk to self[2]
Contact with body substances[1]			
Contact with urine[1]	1= if bedpan 3= if catheter	2 3 = if catheter	1
Contact with faeces[1]	1	3	3
Contact with blood[1]	1	3[3]	3
Contact with patient			
Taking observations; touching patient	1	1	1
Handling/moving the patient	1	1	1
Feeding patient/serving food	2	1	1
Administration of medicines - oral	1	1	1
Administration of medicines - Nasogastric	2	1	1
Administration of medicines -PEG	2	2	1
Administration of medicines - nebuliser	3	3	1
Administration of medicines – IV[1]	3	2	1
Tracheal suction (aerosolisation; visors)[1]	3	3	2
Bladder catheterization [1]	3	2	1
Wound management[1]	3	3	1
Contact with MRSA patient/equipment [1]	1	3	2
Contact with fomites			
Handling/cleaning equipment	1	2	1
Self			
Taking meal break	2	1	2

Notes
1] Assume gloves being worn for these procedures, but hands should be washed before and after anyway because of limitations of gloves.
[2] Risk to self perceived to be lower because staff member presumed to be fit and healthy.
[3] Premise that all patients may be infected with blood-borne virus.

Risk of introducing infection is conditional upon transfer of micro-organisms to susceptible site.

Degree of risk	Nature of contact
0-1 = none to low	Small risk of transfer of pathogens to a susceptible site; hands in contact with normal intact skin.
2 = medium	Hands in contact with intact mucous membranes; may be contaminated with virulent or readily transmissible organisms; procedures on highly susceptible patients.
3 = high	Hands in direct contact with a break in skin or mucous membranes; contact with sterile body cavity; contact with known infected patient or equipment.

Adapted from: Ayliffe, Coates, Hoffman (1993).

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