A Strategy for the Control of
Antimicrobial Resistance in Ireland

SARI

Guidelines for Hand Hygiene in Irish Health Care Settings

SARI Infection Control Subcommittee

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Introduction

Hand hygiene, often previously referred to as hand washing, is critical in the prevention of healthcare-associated infection by reducing the incidence of cross-infection. This is a simple measure but all too often is poorly carried out and compliance with hand hygiene recommendations is sub-optimal amongst a range of healthcare professional groups. The Strategy for the Control of Antimicrobial Resistance in Ireland (SARI), which was launched by the Minister for Health and Children Mícháel Martin in April 2001, provides a blue print for the prevention and control of antimicrobial resistance. Amongst its recommendations were the development of guidelines in relation to infection control in the hospital and in the community setting, and hand hygiene is a key component of this. The SARI Infection Control Subcommittee consists of:

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The Subcommittee undertook to draft national guidelines for hand hygiene as part of its remit under SARI. The following document represents the deliberations of this Subcommittee. Following a consultation exercise with a range of professional and other groups, these guidelines were revised and are being launched nationally for implementation. The Subcommittee would particularly like to acknowledge the considerable input from Ms. Eleanor Devitt and Dr. Mary Crowe, who took the lead in the drafting of this document. Ms. Devitt also designed the hand hygiene audit tool (Appendix 9)

The Subcommittee would like to thank the Infection Control Team at St James's Hospital, Dublin, and PEI (www.pei.ie) for permission to reproduce the posters in Appendix 2 and 3.

The Subcommittee would also like to acknowledge the comments received in response to the consultation exercise. A list of groups and individuals who submitted formal responses is given in Appendix 10.

Executive summary

Hand hygiene is the responsibility of all individuals involved in the provision of healthcare. As part of the Strategy for the control of Antimicrobial Resistance in Ireland (SARI), the Infection Control Subcommittee has drafted a set of guidelines on hand hygiene for implementation in all healthcare facilities. These are based on the best available evidence and follow an extensive consultation exercise.

Corporate responsibility for implementation of these guidelines lies with the Chief Executive Officer or the Director of each healthcare institution but the individual has an obligation to comply with best practice. Hand hygiene is the single most important intervention to prevent transmission of infection and should be a quality standard in all healthcare institutions. Senior healthcare workers such as medical consultants, nurse managers and others must act as role models to actively promote hand hygiene and to ensure better compliance. Social hand hygiene may be achieved with plain soap and warm water or an alcohol hand rub, but antiseptic hand hygiene, such as before patient contact in critical care areas, requires an antiseptic hand wash agent.

Careful consideration needs to be given to choosing a suitable hand hygiene product which has appropriate antimicrobial properties but which also is well tolerated by the user and does not cause adverse effects on the skin. Consequently, there needs to be close liaison between the infection control team, occupational health team and the management of the institution when choosing the correct agent and also in ensuring that there are adequate hand hygiene facilities, such as alcohol hand rubs and wash hand basins readily available. In critical care areas such as the intensive care unit, an alcohol hand rub should be available at the bedside of each patient to facilitate compliance with hand hygiene recommendations. Hand hygiene education must be a mandatory component of all clinical courses and induction programmes. Finally, audit of compliance with hand hygiene guidelines should be a component of the overall infection control programme in each institution and the results fed back to relevant individuals in the institution.

Summary of Recommendations for Hand Hygiene in the Healthcare Setting

Category I: Recommended for implementation and supported by experimental, clinical or epidemiologic studies with a strong theoretical background.

Category II: Suggested for implementation and supported by suggestive clinical or epidemiologic studies or a theoretical rationale.

Category III: Recommended based on experience of experts in the field.

1. Responsibility and accountability

- Corporate responsibility for implementation of these hand hygiene guidelines lies with the Chief Executive Officer (CEO) / Director of each health care institution. This responsibility includes involving the Infection Control Team (ICT) in project development, provision of adequate hand hygiene facilities in all clinical areas, provision of adequate infection control resource to facilitate education, audit and implementation of guidelines (III).
- The CEO / Director of each health care institution will be informed of the results of hand hygiene audits and attendance at education sessions by the Clinical Risk Management committee (III).
- Hand hygiene must become a standard of quality care in health care institutions (II).
- Hand hygiene is the single most important intervention to prevent transmission of infection and should be a quality standard in all health care institutions (I).
- Senior Health Care Workers (HWC's) such as medical consultants, nurse managers and managers in the allied health professional groups, catering, domestic and technical services must act as role models and actively promote hand hygiene (II).
- Each and every HCW has a responsibility to prevent transmission of infection (I).
- Breaches in adherence to hand hygiene procedures should be addressed within the Risk Management framework of the health care institution and consideration should be give to the introduction of sanctions for repeated offences (III).
- The ICT in liaison with Ward Managers should undertake audits of hand hygiene practice as part of the ongoing infection control audit process (Appendices 6, 7, 9). The results of these audits should be referred to the Clinical Risk Management Committee (III).

2. Hand hygiene preparation

- Nails must be kept short and cut smoothly (II).
- Nail varnish (III), and/or false nails (I) must not be worn.
- All wrist and hand jewellery (except plain wedding bands) must be removed (II).
- Shirts should have short or turn up sleeves (III).

3. *Social hand hygiene* with plain soap and warm water, or an alcohol hand rub product* which is used on visibly clean hands - indications for use

- When hands are visibly contaminated with dirt, soil or organic material (I) (Always wash hands when visibly contaminated)
- At the beginning and end of the work shift (III).
- Before and after each patient contact (II).
- After moving from a contaminated to a clean area during care of an individual patient (II).
- After removing gloves (I).
- After handling soiled equipment, materials or environment (II).
- Before preparing or handling food (I). .
- After personal bodily functions such as blowing nose or using the lavatory (I). .

4. *Antiseptic hand hygiene* with an antiseptic handwash agent, or alcohol handrub product* which is used on visibly clean hands- indication for use

- Before and after each patient contact in critical care units (II), those who are immunocompromised (III) or with large wounds or burns (I) and before entering units/wards with such patients (I).
- After all contact with patients on transmission-based precautions and prior to leaving wards/rooms with such patients (I).
- When hands are inadvertently contaminated with a heavy microbial load such as foul or infectious material (I). (Always wash hands when visibly contaminated.)
- Before performing invasive procedures as part of an aseptic technique (I).

* An alcohol-based product should only be used on visibly clean hands and is recognised as a superior hand hygiene product for almost every situation. Alcohol handrub products with added emollient reduce the risk of dermatological side effects. **Repeated use of alcohol-based products with added emollients may result in an excessive build up of emollient on the hands, and this may be reduced by periodic washing with soap and water.**

5. Surgical hand hygiene with an antiseptic scrub or an alcohol based (60 – 70%) handrub product

- In addition to measures outline in 2 above, wedding bands should be removed (II). .
- Debris should be removed from beneath nails using a sterile single use or autoclavable nail cleaner (II).
- There should be no nail bed injuries or inflammatory processes (III).

6. Choosing a hand hygiene product

- The product should be deemed suitable for its intended use by the manufacturer, also by European and American Standards (I).
- A good quality liquid soap in conjunction with an emollient-based alcohol rub is highly recommended (I).
- Consideration should be given to the risk of dermatological side effects when choosing products (II).

- The volume and duration of an antiseptic scrub/wash/rub should be in accordance with the manufacturers instructions (I).
- Potential interactions between agents, if they are used sequentially, and with other skin care products or types of gloves used should be evaluated (II).
- Cost of hand hygiene products should not be the primary factor influencing product selection (I).
- Skin tolerance, fragrance and feel of product should be evaluated (II).
- The users should be actively involved in choosing an antiseptic hand hygiene agent, to maximise acceptance of the hand hygiene product (I).

7. Prevention and management of skin damage resulting from hand hygiene

- The Occupational Health Team (OHT) and ICT should work together in promoting safe hand hygiene products and the identification of vulnerable HCW (III).
- Health Care Management should promote the use of good quality hand hygiene products including alcohol handrub products with added emollient, good quality paper towels, powder free latex gloves, perfume free detergents and sensitising-preservative free creams/lotions (I).
- Dry hands thoroughly using a patting motion rather than rubbing to reduce friction of the skin (III).
- Avoid prolonged use of gloves or using gloves when not required, examples include making beds which are not contaminated with blood or body fluids and washing patients (III).
- Seek input from the manufacturers regarding any known interactions between soaps or rubs (plain or antiseptic), skin care products, and gloves used, an important factor in influencing product selection (II).
- There should be access to occupational health expertise, and if required Dermatological referral, for the effective management of occupational dermatoses in the healthcare setting (III).

8. Hand Hygiene facilities location and design

- The involvement of the ICT, Medical Consultants, Senior Nurses Managers and Service Engineers from the early stage of planning and in project design teams is essential (II).
- Handwash sinks should be independent of patients' and/or en-suite sinks (I).
- Handwash facilities should be positioned close to exit doors of isolation rooms, wards and units (II)
- Clinical institutions should aspire to installing at least one handwash sink per 4-6 beds in general open wards and a minimum of one sink per 1-3 beds in critical care areas (I).
- Handwash sinks should be available in all clinical areas; they should be centrally located and free from obstruction (II).
- Handwash sinks should be of adequate size to avoid splashing the surrounding floor and surround (I).
- Handwash sinks should be positioned so that there is adequate space for the operation of taps and the installation of hand hygiene products and towel dispensers above the sink (I).
- Taps should be hands free (I).
- Handwash sinks should employ mixer taps, to allow regulation of water temperature (III).

- All sinks should be fitted with washable back splash with all joints completely sealed (II).
- Liquid hand hygiene products should be stored in closed containers and never topped up (III).
- Evaluate the hand hygiene product dispenser system, to ensure that it will function adequately and consistently deliver an appropriate volume of product (II).
- Alcohol handrub should be available at the bedside of each patient in Critical care Units and in each patient room/clinical room (II).
- The use of good quality disposable paper towels and hand lotions are recommended (II). Air dryers are not recommended (III).
- Waste bins should be hands free and institutions should aspire to purchasing bins, which close quietly (III).

9. Hand hygiene education and promotion

- Hand hygiene education must be a mandatory component on all clinical course curricula with annual updates on commencement of clinical placements and must form part of the final clinical/professional examination (III).
- Mandatory attendance at hand hygiene education during the hospital induction programme is required followed by updates every one to two years (I).
- Strategies for hand hygiene promotion are outlined in appendix 5 (II).

10. Audit of compliance

- Audit of compliance with hand hygiene guidelines and hand hygiene facilities must be undertaken in all health care institutions as part of the overall infection control programme (I).
- The performance of audits at local ward or unit level is also recommended as part of the overall local ward/unit management programme (I).
- Audit of the amount of hand hygiene agents used may also be useful measurement of compliance (I).

Review of Hand Hygiene and Prevention of Skin Damage Associated with Use of Hand Hygiene Agents

I. Background

Handwashing in the health care setting has been promoted for generations and is recognised as the single most important procedure for preventing infection[1,2].The concept, which emerged in the 19th century, was only formularised in the 1970s with the subsequent development of guidelines on hand hygiene practices in hospitals by recognised bodies associated with the practice of infection control. Hand hygiene is now recognised as an integral part of the quality of patient care, and is included in the standards for hospital accreditation. The Strategy for the control of Antimicrobial Resistance in Ireland (SARI) Infection Control Subcommittee recognising the importance of hand hygiene, and new developments in this area have reviewed the literature and developed new guidelines. These guidelines on hand hygiene have been adopted from the Centers for Disease Control and Prevention (CDC) hand hygiene guidelines 2002, with input from guidelines developed by Health Canada 1998, the Association for Professionals in Infection Control and Epidemiology (APIC) guidelines 1995, the EPIC project team, UK 2001, Infection Control Nurses Association (ICNA), UK 2003, the American Operating Theatre Nurses Association (AORN) 1999, and the Department of Health, Australia 2002 (draft no 22) [3-9].

The aim of this document is to highlight the importance of hand hygiene in preventing transmission of infection, and to promote the successful implementation of hand hygiene practices by both the healthcare worker (HCW), patient and the public.

These guidelines are intended for use by all healthcare workers within health care settings within the Republic of Ireland and all visitors to such settings.

II. Normal bacterial skin flora

A knowledge of the normal bacterial skin flora is essential in understanding the objectives of the different approaches to hand hygiene. Bacteria recovered from the hands can be divided into transient and resident flora.

Transient flora colonise the superficial layers of the skin and are the organisms most frequently associated with hospital or healthcare associated infection, for example *Staphylococcus aureus*, Gram-negative bacilli or yeasts. Transient flora are more amenable to removal by social hand hygiene.

The **resident flora,** attached to the deeper layers of the skin, are more resistant to removal and examples include coagulase negative staphylococci and diphtheroids. Resident flora are not usually associated with healthcare associated infection, however they can cause infection in patients who are severely immunocompromised, particularly following invasive procedures, and in those who have an implanted device such as a heart valve, intravascular device or an artificial orthopaedic prosthesis.

III. Transmission of pathogens on hands

There is ample evidence of the presence of nosocomial pathogens on the hands of HCWs[10-13]. Such contamination may occur during contact with a patient's infected wounds, mucous membranes or with secretions, but also following contact with intact skin or contaminated objects in the patient's environment. The hands of HCWs have been shown to be contaminated during 'clean activities' e.g. taking a patient's pulse, lifting a patient or touching a patient's hand or shoulder[14]. It is worth noting that certain patient groups e.g. those with diabetes, patients undergoing haemodialysis, those with chronic dermatitis are more likely to carry *S. aureus* on intact skin[15-17]. Staphylococci and other organisms may easily contaminate the patient's environment such as bed linens, clothing and furniture during the normal process of skin shedding, from where they may transfer to the HCWs hand.

Outbreak investigations have shown an association between hospital-acquired infection and understaffing or overcrowding which has been consistently linked with poor adherence to hand hygiene[18-20]. There is evidence that antiseptic handwashing / hand hygiene reduces the rate of healthcare associated infection, and that increased frequency of handwashing / hand hygiene among HCWs has been associated with decreased transmission of nosocomial pathogens[14,21,22].

IV. Evaluation of the efficacy of hand hygiene agents

The following are the standards against which antiseptic agents are tested, and which define suitable uses for these agents:

In the USA

1) The Food And Drug Administration Tentative Final Monograph For Healthcare Antiseptic Drug Products 1994 (**FDA TFM**) [23]

In Europe

2) **EN 1500** – Chemical Disinfectants and Antiseptics. Hygienic Hand-Rub Test Method and Requirements [24]

3) **EN 1499** – Chemical Disinfectants. Hygienic Hand-Wash Test and Requirements [25]

4) **prEN 12054** Test for the evaluation of bactericidal activity of chemical disinfectants and antiseptics for hygienic and surgical handrub and handwash used in human medicine (in vitro test)[26]

5) **prEN 12791** Test for the evaluation of bactericidal activity of chemical disinfectants and antiseptics for surgical handrub (in vivo test)[27]

The FDA standard method of evaluation requires use of the antiseptic agent for at least 30 seconds, and preferably one minute, despite the observation in the majority of studies that the average duration of handwashing by hospital personnel is < 15 seconds[28-31]. CDC suggest that further studies are required among practicing HCWs using standardised hand hygiene protocols to obtain more realistic views of microbial colonisation and risk of cross infection. The characteristics of commonly used agents are described in tables 1 and 2.

V. The different levels of hand hygiene

There are three recommended levels of hand hygiene to ensure that the hand hygiene performed is suitable for the task being undertaken. The efficacy of hand hygiene will depend on application of an adequate volume of a suitable hand hygiene agent with good technique for the correct duration of time, and finally ensuring that hands are dried properly (Appendices 1, 2 and 3):

A) Social hand hygiene

The aim of social hand washing with plain soap and warm water is to remove dirt and organic material, dead skin and most transient organisms[32,33]. On visibly clean hands social hand hygiene may be undertaken using an alcohol hand rub product, and this will effectively remove transient organisms.

Social hand wash involves washing hands with ordinary soap and warm running water for at least 15 seconds, then drying with a disposable paper towel[4, 5, 7, 8, 34]. A good quality liquid soap rather than bar soap is recommended as it difficult to store bar soap dry at a sink[4, 33]. A hand wash technique has been described by Ayliffe and Lobury to ensure coverage of all surfaces of the hand[33] . Prior to the introduction of this technique it was recognised that certain parts of the hands were often missed such as parts of the thumb, back of the hand, back of fingers, under the nails[28, 32, 35].

Recommendation

***Social hand hygiene* with plain soap and warm water, or an alcohol hand rub product, which is used on visibly clean hands - indications for use**

- When hands are visibly contaminated with dirt, soil or organic material (I) (Always wash hands when visibly contaminated)
- At the beginning and end of the work shift (III)[5] .
- Before and after each patient contact (II)[4,5]
- After moving from a contaminated to a clean area during care of an individual patient (II)[4,7,36].
- After removing gloves (I)[3,4,7,37-39] .
- After handling soiled equipment, materials or environment (II)[11,12,40]
- Before preparing or handling food (I)[4,5,7,21] .
- After personal bodily functions such as blowing nose or using the lavatory (I)[4,5,7] .

B) Antiseptic hand hygiene:

The aim of antiseptic handwash / rub is to remove all transient organisms and this achieves a higher level of cleanliness than during social hand washing[41].

Recommendation

***Antiseptic hand hygiene* with an antiseptic handwash agent, or alcohol handrub product, which is used on visibly clean hands- indication for use**

- Before and after each patient contact in critical care units (II), those who are immunocompromised (III) or with large wounds or burns (I) and before entering units/wards with such patients (I)[7,42,,43].
- After all contact with patients on transmission based precautions and prior to leaving wards/rooms with such patients (I)[44-46].
- When hands are inadvertently contaminated with a heavy microbial load such as foul or infectious material (I)[47,48]. (Always wash hands when visibly contaminated.)
- Before performing invasive procedures as part of an aseptic technique (I)[3-5,7,8,10].

The hand hygiene technique used is demonstrated in Appendix 2 and 3

Alcohol based hand rub products:

Alcohol based hand rubs with added emollients are very effective antimicrobial agents when applied to hands for a minimum of 15 seconds, using an adequate volume to completely wet the hands. In addition, time must be allowed for the hands to dry completely by evaporation[49]. Alcohol based hand rubs with added emollient are recognised as a superior hand hygiene product for almost every situation [4].**They are highly recommended for social and antiseptic hand hygiene in all patient care areas, however they should only be used on visibly clean hands** [3,4,6,21,34,50,51]Alcohols

are not good cleaning agents, and therefore are not recommended for use in the presence of physical dirt[4,51]. Alcohol handrubs have been used successfully for pre-operative hand hygiene in Europe for years[52,53]. Alcohol handrubs are effective for hand antisepsis[45] and applications of 15 seconds duration have been shown to be effective in preventing transmission of Gram-negative bacteria[54].

Alcohol handrubs with added emollient are less damaging to the skin, and more acceptable for use by healthcare workers than soaps or antimicrobial detergents[50,55-58]. With repeated use of alcohol hand rubs with added emollient an excessive build of emollient on the hands may occur; this may be removed by periodic washing with soap and water.

Health care facilities should perform a risk assessment to determine the safest and most user-friendly alcohol handrub products to use. A risk of splashing exists when dispensing any liquid solution therefore, great care must be taken to avoid splashing into the eyes and mucous membranes when using liquid alcohol hand rubs. The chosen agent must be acceptable to the user that is both healthcare workers and the public[4]. (Alcohol handrubs are recommended for use by the public in critical care areas, in isolation facilities and during outbreak situations)

Antiseptic handwash: An adequate volume of antiseptic soap should be applied to wet skin for at least 15 seconds and in accordance with manufacturers recommendations, and then the hands rinsed and dried with a disposable paper towel[3,7] (Table 1 and Appendix 4). A sterile disposable towel is advised for drying hands where operative procedures are being performed.

Recommendation:

Antiseptic agents or alcohol handrubs, used for a minimum of 15 seconds, are effective and recommended for use as antiseptic / hygienic hand hygiene soaps / rubs. (II) (see Appendix 1)

C. Surgical hand hygiene with an antiseptic scrub or an alcohol rub:
Surgical hand antisepsis should be performed prior to all surgical procedures, with the aim of removing all transient flora and substantially reducing resident flora[3-5,9]. The effect should be rapid and persistent[1,4,9]. The antiseptic agents used should be carefully chosen and validated for use in surgical hand disinfection according to defined standards such as the Food and Drug Administration's 'Tentative Final Monograph for Healthcare Antiseptic Drug Products' [23] or the European standards as described in prEN 12054 and prEN 12791 [26,27] and according to the manufacturers recommendations.

The antiseptic agent used must provide broad-spectrum microbiocidal activity, act rapidly, and persist on the skin over several hours, and ideally also provide a cumulative effect after repeated use [4,9]. The agent should be non-toxic, non-irritating, and with the ability to reduce the potential for skin damage, thereby facilitating good skin condition and compliance with the surgical scrub routine[4].

Surgical hand antisepsis involves thorough washing and disinfection of hands, subungual areas and forearms,[4] either using:

(a) An antiseptic soap and water[9]

(b) Plain soap and water, followed by application of an alcohol based handrub[59].

(c) Plain soap and water followed by an alcohol based handrub with added antiseptic to produce persistent effect[58,60].

(d) Antiseptic soap followed by an alcohol based hand rub between cases[52].

As there is a lack of experience particularly with regard to safety and dermatological side effects associated with the

sequential use of antiseptic soaps and alcohols, or the use of alcohols with added antiseptic agents, the SARI Infection Control Subcommittee currently favour options (a) and (b) above.

Pre-operative hand hygiene using alcohol rubs:

Alcohol based rub products have been used in pre-operative hand disinfection in Europe for many years[58], and the European reference method for surgical hand disinfection uses the application of 60% n-propanol for 5 minutes[27]. Recently evidence is accumulating in favour of alcohol-based hand-rubs for surgical antisepsis[20,52,53,58,61]. Alcohol hand-rubs in the correct concentration and formulation are generally known to produce greater logarithmic reductions in microbial counts than with any other hand antiseptic agent[62,63]. In a comparative study from Australia, alcohol-based surgical hand antisepsis was found to be 'as effective and no more damaging to the skin than the more time consuming detergent based antiseptics'[52] and in a more recent study, alcohol based hand rubs were found to be 'more effective and better for the skin than certain antiseptic surgical handwash agents'[20]. When using alcohol hand rub for pre-operative hand hygiene, first wash hands and subungual spaces thoroughly with plain soap and water and a single use or sterile nail cleaner, and dry with a sterile disposable towel. The alcohol hand rub should be applied in accordance with manufacturers instructions, that is an adequate volume and number of applications to keep the hands and forearms wet usually for a duration of 3 - 5 minutes [3,4,9,52]. After application of an alcohol-based handrub allow hands and forearms to dry thoroughly by evaporation before donning sterile gloves [4]. If there is more than an hour between operative cases it is recommended that hands are washed again before applying alcohol rub antiseptic agent [64]. However, if the time between cases is less than an hour, the hand wash may be omitted as repeated hand-washing between cases may only impair the efficacy of consecutive handrubs, and promote skin dryness and dermal irritation. Some studies have found that certain alcohol gels were less effective than alcohol liquid rubs[61,65,66]. As with any pre-operative hand hygiene product, it is important to ensure that the manufacturer has data to recommend the product as suitable for pre-operative hand hygiene.

Pre-operative hand hygiene using antimicrobial soap

When performing pre-operative hand hygiene using antimicrobial soap, the duration of the surgical scrub and volume of antimicrobial soap used should be guided by the manufacturers instructions[4,9]. In the past, surgical staff have been required traditionally to undertake a ten minute pre-operative scrub, which frequently resulted in skin damage[4]. The CDC Hand Hygiene Guidelines 2002 cite several studies which show that scrub times of five minutes duration reduce bacterial counts as effectively as a ten minute scrub and others have shown that pre-operative scrub times of two to three minutes reduce bacterial counts to acceptable levels[5,52,61,64]. In general the duration of pre-operative surgical scrub recommended varies between two and six minutes, as per manufacturers guidelines[4,9,67]

Recommendation:

Surgical hand hygiene should be undertaken before all surgical procedures. It involves thorough washing and disinfection of hands, subungual areas and forearms,[4] either using:

(a) An antiseptic soap and water[9]

(b) Plain soap and water, followed by application of an alcohol based handrub[59].

(c) The product used should be deemed suitable for its intended use by the manufacturer[3], and by European and American Standards (I). [4,23,26,27] The volume and duration of an antiseptic scrub/wash/rub should be in accordance with the manufacturers instructions (I).[3,4,9,52,61]

(d) A good quality liquid soap in conjunction with an emollient-based alcohol rub is highly recommended (I).[4]

VI. Finger nails and hand jewellery:

There is evidence that bacteria may be harboured in the subungual areas of the hands in high concentrations, and that chipped nail varnish and artificial nails may support the growth of organisms on finger nails[4,68]. HCW's wearing artificial nails have been epidemiologically linked to outbreaks, however the CDC advise that additional studies in this area are warranted[3,69].

Over the years many studies have identified the wearing of rings by HCWs as a cause of persistent bacterial contamination of the hands, particularly with *Staphylococcus aureus* and Gram negative bacilli[70,71]. They may also make the donning of gloves difficult, and may cause gloves to tear.[3] Apart from the Infection Control aspect there is also a health and safety risk where stoned rings may tear a patient's skin during the application of care. It is therefore recommended that rings are removed (with the exception of plain wedding ring) to facilitate the performance of proper social/antiseptic hand hygiene, to prevent tearing of gloves and to protect the patient from injury.[3-6]. However all rings including wedding bands **should** be removed when performing pre-operative hand hygiene[4,9]. Both the ICNA and the EPIC guidelines recommend the removal of wrist jewellery prior to performing hand hygiene, whilst the CDC and the AORN advise wrist jewellery must be removed prior to performing pre-operative hand hygiene[4-6,9]. The SARI Infection Control Subcommittee recommends that the base of the wrist should be free of jewellery and watches to allow access to this area when performing social or antiseptic hand hygiene.

Recommendation:

A: Nails should be kept short (II) and nail varnish (III), or false nails (I) should not be worn by those working in clinical settings

B: Hand (I) and wrist jewellery (II) should be removed prior to performing all levels of hand hygiene (II). Plain wedding rings may be worn except for pre-operative surgical hand wash procedures when they should be removed (II)

Table 1: Summary of CDC's Antiseptic Agents Available for Hand Hygiene

Product	Review
Plain soap **(non-antimicrobial)**	• Available in bar, leaflet, powdered and liquid preparations. • Minimal if any antimicrobial activity; when used with water removes dirt, loosely adherent, transient bacteria & reduces bacterial counts on the skin. Paradoxical increase in bacterial counts occasionally e.g. when soap causes skin damage. May fail to remove pathogens. • Can result in skin dryness; addition of an emollient may reduce skin irritability. • Liquid soaps in disposable containers are preferred. Store in closed containers, DO NOT TOP UP. There is evidence that plain soaps including bar soaps may become contaminated.
Alcohol **(Isopropanol, Ethanol, n-Propanol)** 60 - 95% (by weight) (Concentrations > 70% generally not used because of risk of skin dryness or dermatitis, see manufacturers instructions)	• Alcohols, optimal concentration of 60-70%, act by denaturing protein. Conc > 95% are less potent as water is required for antimicrobial activity. Conc > 70% generally not used. • Rapidly microbiocidal. No appreciable persistent / residual activity, but sub lethal effect may slow bacterial re-growth. • Active against Gram positive, Gram negative bacteria, Mycobacterium tuberculosis, fungi & enveloped viruses such as herpes simplex, human immunodeficiency, influenza, respiratory syncitial viruses; moderate activity against hepatitis B and C viruses. Poor activity against certain non-enveloped viruses such as hepatitis A virus, norovirus, polio & other enteroviruses (like other antimicrobial hand hygiene agents, see tables 1 & 2, CDC guidelines). Very poor activity against spores, protozoal oocysts. Addition of another antiseptic agent e.g. chlorhexidene, triclosan, quaternary ammonium compound, increases persistence. • Alcohols available in liquid, gel or foam formulation. Alcohol based products more effective at reducing bacterial counts on hands than plain soap and water, or antimicrobial soaps or detergents (See table 3, CDC guidelines). Efficacy dependant on alcohol type, concentration, volume (1 ml substantially less effective than 3 mls), duration of contact, and condition of hands (hands must be visibly clean to be effective). Alcohols not good cleaning agents. • Frequent use of alcohol preparations may cause skin drying; may be reduced by added emollients or other skin conditioning agents. • Alcohols are flammable (flash points range from 21°C - 24°C), and should be stored away from high temperatures and flames. Alcohol hand-rubs must be allowed to dry completely before performing any activity to reduce any risk of flash fire. • Alcohol based hand rubs, used safely and effectively for years in Europe. • 60% n-propanol proven to be more effective than 70% iso-propanol in reducing bacterial load & has been used effectively in Europe for pre-operative hand hygiene.
Chlorhexidene 0.5 - 4%	• Chlorhexidene binds & disrupts cytoplasmic membrane, with precipitation of cellular contents. • Active against Gram positive organisms, slightly less active against Gram negative bacteria and fungi, minimal activity against tubercle bacilli. Good activity against enveloped viruses, substantially less activity against non-enveloped viruses. No activity against spores. Chlorhexidene has residual activity. • Efficacy minimally affected by organic matter including blood. • Compatibility with other soaps and skin care products should be confirmed. Chlorhexidene is a cationic molecule, activity therefore reduced by natural soaps, inorganic anions, nonionic surfactants and anionic hand creams. • 4% chlorhexidene gluconate proven effective for pre-operative hand hygiene.
Iodine & iodophors (e.g. 7.5% - 10% povidone iodine)	• Iodine molecules rapidly penetrate cell wall, forming complexes with amino acids, fatty acids, inactivating the cell. • Iodine causes skin irritation & discoloration. Iodophors (largely replaced iodine) are less irritant, water soluble & promote sustained iodine release. Iodophors are composed of iodine, iodide and triiodide complexed with a polymer molecule e.g. polyvinyl pyrrolidone (povidone). • Bactericidal against Gram positive & Gram negative organisms, active against mycobacteria, fungi and viruses. Although some sporicidal activity not usually sporicidal at concentrations used. Poor persistent activity. • Activity is substantially reduced by organic substances. • Iodophors can cause irritant contact dermatitis.
Triclosan (0.2 - 2%) (2,4,4' - trichloro 2 - hydroxy - diphenyl ether)	• Binds to active site of enoyl acyl carrier protein reductase, often bacteriostatic. • Active against Gram positive organisms, less active against Gram negative bacilli. Reasonable activity against Mycobacteria spp. & Candida spp., limited activity against filamentous fungi. Good anti viral activity. • Less effective in reducing bacterial counts than chlorhexidene, iodophors or alcohols. • Persistent activity, not substantially affected by organic material, affected by pH, surfactants, emollients and ionic nature of formulation.

Liquid Soap

Disposable containers are preferred. If re-usable containers are used they should be washed and dried thoroughly before re-filling, and routine maintenance schedules should be followed and documented.
Bar soap is **not** recommended in the hospital, primary care or nursing home setting. If it has to be used in the residential home setting then soap racks that facilitate drainage and small bars should be used.

Other agents available

Chlorxylenol (Parachlorometaxylenol): Halogen substituted phenolic compound Good activity against Gram positive bacteria, fair activity against Gram negative bacteria, mycobacteria and certain viruses, poor activity against *Pseudomonas aeruginosa*. Classified by FDA as 'insufficient data to classify as safe and effective for use as an antiseptic handwash'. **Not recommended**

Hexachlorophene: A bisphenol compound. Inactivates essential enzyme systems. Bacteriostatic. Good anti staphylococcal activity, relatively weak activity against Gram-negative bacteria, fungi and mycobacteria. Absorbed through skin potentially causing neurotoxicity, must not be used for routine bathing of neonates or bathing of patients with burns or extensive areas of sensitive skin. The FDA classifies it as not generally recognised as safe and effective for use as an antiseptic handwash. **Not recommended**

Hypochlorite: Irritating to skin & strong odour. **Not recommended**

Surfacine: Composed of silver containing polymers on an ethanol carrier, currently undergoing investigation. **Not recommended**

Quaternary ammonium compounds (QAC): Bacteriostatic, active against Gram positive bacteria, less active against Gram negative bacilli, only weakly active against mycobacteria & fungi. Activity against enveloped viruses. Activity reduced in presence of organic material, not compatible with anionic detergents, prone to contamination with Gram negative bacilli. Benzalkonium chloride and Benzethonium chloride, FDA tentative classification category: 'insufficient data to classify as safe & effective for use as an antiseptic hand wash'. May be found as an additive in alcohol hand rub. **Not recommended**

Sporicidal activity of hand hygiene agents.

None of the recommended antiseptic agents discussed in table 1 have reliable sporicidal activity[4]. The SARI Infection Control Subcommittee advise that after caring for a patient with *Clostridium difficile* diarrhoea (or other spore forming bacterial infection) the health care worker should wash hands with soap (antimicrobial or non antimicrobial) and water. If a non-antimicrobial soap is used, after drying, an alcohol handrub should be applied to the hands.

Norovirus activity of hand hygiene agents:

Handwashing with antiseptic soap, or with plain soap followed by use of an alcohol rub, is the most important measure in preventing norovirus transmission[73]. A recent study however has confirmed that alcohol rubs do have some activity against norovirus Using a feline calicivirus as a surrogate for norovirus, 70% ethanol and 70% n-propanol produced an in-vivo log10 reduction in viral counts of 3.78 and 3. 58 respectively [74].

Table 2: Level of antimicrobial activity of commonly used hand hygiene agents

adopted from Health Canada Hand Washing Guidelines 1998 (ref 7)

Product	Gram positive bacteria	Gram negative bacteria	*M. tuberculosis*	Fungi	Virus	Spores	Speed of action	Inactivated by organic material
Alcohols 60 - 70%	Good	Good	Good	Good	Good*	Very poor	Fast (poor persistence)	Moderate
Chlorhexi-dene 4%	Good	Good	Minimal	Fair	Good*	None	Intermediate (good persistence)	Minimal
Iodophors 5-10%	Good	Good	Good	Good	Good	Poor	Fast (poor persistence)	Marked
Triclosan 0.2-2%	Good	Fair-Good Fair against *P. aeruginosa*	Fair	Poor	Good	None	Intermediate Often bacteriostatic (persistence)	Minimal

*Good activity against enveloped / lipophilic viruses, may have poor activity against some non enveloped / non lipophilic viruses

Proposed methods for reducing adverse effects of hand hygiene agents

Physiology of the normal skin

The skin's primary function is to reduce water loss, to act as a permeability barrier to the environment and to provide protection against infection and other insults[4]. The thin outermost horny layer (*stratum corneum*) is responsible for this barrier function. It is a dynamic structure with synthesis occurring at the same rate as loss. Any disruption of this balance will lead to impairment of the skin's barrier function. The *stratum corneum* is composed of flat non-nucleated cells held together in a lipid rich intercellular region[4]. **The barrier function may be compromised by physical abrasion, frequent washing with detergents which remove lipid, and exposure to a variety of irritant chemicals.** [4]

Occupational dermatitis

Clinical healthcare workers are required to wash their hands very frequently during the working day to reduce the transmission of microorganisms. Hand washing up to 30 times per shift is not unusual.[4] Occupational dermatitis is common in this setting and ranges from mild symptoms of irritation to severe symptoms of skin irritation that may occasionally require people to change their jobs. Irritant dermatitis is a non-immunological inflammatory reaction of the skin to an external agent.

The healthcare setting provides many opportunities for this irritation, including:

1. **Wet work**, frequent hand washing, washing with hot water

2. **Use of detergents**

3. **The wearing of gloves** which increases perspiration, lipid and water loss from the skin, and also the shearing forces of donning and removing gloves.

4. **Inadequate hand drying**, use of poor quality paper towels, and failure to use protective hand lotions/creams.

Contact allergy

his may complicate the picture and is more commonly seen in those prone to allergies. Allergic reactions to latex, hand creams/lotions and antiseptic handwash agents have all been reported. It is worth noting that allergic contact dermatitis to alcohol-based handrub products is uncommon[4].

Damaged areas of skin are more prone to colonisation with micro-organisms (e.g. methicillin-sensitive *S. aureus* (MSSA) and methicillin-resistant *S. aureus* (MRSA)), therefore the appropriate management of all forms of dermatitis is essential for the healthcare worker and also the patients in their care.

Prevention of occupational dermatitis in the healthcare setting:

The Occupational Health Team (OHT) and ICT should work together in developing and promoting a safe and effective hand hygiene policy.

- Identify vulnerable HCWs at pre employment health assessment. Examples include but are not limited to HCWs with previous history of dermatitis or atopic reactions.
- Careful choice of the hand hygiene products available to the HCW is essential in preventing adverse reactions among HCWs:

    1. Choose a product with low irritation potential, with the addition of emollients and other hand care substances as required (a user friendly product)[4].

    2. Promote use of alcohol based hand rubs containing emollients and other hand care substances[4].

    3. Promote use of hand lotions and creams to increase skin hydration and replace depleted skin lipids. Each of these products however should be initially evaluated for possible adverse effects on the skin, on the efficacy of antiseptic agents used and integrity of gloves.

4. To maximise the acceptance of hand hygiene products seek input from HCWs regarding the feel, fragrance and skin tolerance of products under consideration. By using products, which are acceptable to the HCW, the level of hand hygiene compliance will increase[4]. This will ultimately result in a reduction in health care associated infection. The cost of hand hygiene agents should **not** be a primary factor influencing product selection. To put this into perspective, one severe surgical site infection, lower respiratory tract infection or bloodstream infection may cost the hospital more than the entire annual budget for antiseptic hand hygiene agents[4,75].

- There should be access to occupational health expertise for all HCWs.

- There should be provision of treatment for occupational dermatoses and dermatological referral for further investigation and management as indicated.

- Advice on appropriate work restriction for HCW's with symptomatic active dermatitis when caring for infected patients, or those at increased risk of infection, should be available.

Recommendations:

OHT and ICT should work together to promote safe hand hygiene and should emphasise the use of liquid soaps and alcohol hand rub products with added emollients (II). The use of hand lotions and/or creams in all health care settings is also recommended (III).

Hand Hygiene Facilities

1. Design

The provision of clinical hand hygiene facilities is an essential element of hospital design, and their location and number will be determined by the nature of the procedures to be performed in the area under design or reconstruction. Accurate projections for the ultimate use of the facilities will assist in determining the number and positioning of hand hygiene facilities required[76]. The hand hygiene facilities must be in a prominent position in the clinical area, unobstructed for example by doors, curtains around the patient's bed, pillars or equipment[76]. There should be adequate space between patients' beds and furnishings to eliminate the risk of splashing patients[76].

In clinical areas taps should be hands-free: elbow, knee, or foot operated or automatic[4,76]. Handwash sinks should have mixer taps, that allow mixing of hot and cold water and delivery of water form a single tap outlet[76].

Soap / antiseptic dispensers should be designed to deliver the liquid directly into the cupped hand, and to facilitate easy cleaning of the dispensing nozzle; regular cleaning of the dispensing nozzle is required to maintain patency[33].

Disposable containers are preferred for liquid products. If re-usable containers are used, however, they should be thoroughly washed and dried before refilling, and routine maintenance schedules should be followed and documented[33]. Liquid products should be stored in closed containers and should **never** be 'topped up'[33].

Good quality disposable paper towels should be used in clinical areas. Hand dryers are not advised as they usually result in a longer time for complete hand drying[4] (hence result in poor practice), only allow one-person use at a time, and require maintenance.

Hands-free waste bins are recommended to avoid hand recontamination. Health care institutions should aspire to purchasing bins, which close quietly in order to facilitate patient's rest.

There must be senior hospital management support and the necessary finance for adequate design, construction and maintenance of hand hygiene facilities in the healthcare setting[77].

It is imperative to involve the ICT, Medical Consultants, Senior Nurse Managers and Technical Services Engineers in the project team at the commencement of planning to ensure, among other things, an adequate number and the correct siting of hand hygiene facilities[75-78].

Recommendations:

The involvement of the ICT, Medical Consultants, Senior Nurse Managers and Technical Services Engineers in the planning and design project teams from the commencement of planning is necessary to advise on the required number of hand hygiene facilities and to ensure siting in prominent unobstructed positions (III).

A good quality liquid hand wash soap is the soap of choice and should be used in conjunction with emollient-based alcohol handrubs (II). Air dryers are not recommended (II). The use of good quality disposable paper towels and hand lotions are recommended (III).

Waste bins should be hands free and institutions should aspire to purchasing bins that close quietly.

2. Specific design considerations

Compliance with hand hygiene is influenced by the availability and location of hand hygiene facilities. These include clinical handwash sinks, wall mounted soap dispensers, dispensers with disposable hand towels, and mounted alcohol hand rubs. The hand wash facilities must be located in adequate numbers per patient bed to facilitate easy unobstructed access in clinical areas, with at least one sink positioned close to each point of exit[76]. Each single room must be equipped with their own hand wash facilities[76]. Handwashing sinks for use by healthcare workers should be **independent of the patient's sink or en-suite facilities**[76]. There should be a minimum of one hand wash sink per 4-bedded room[76]. Where room capacity is greater than four the SARI Infection Control Subcommittee recommend a minimum of one sink per 4-6 beds. This sink should be centrally located to facilitate easy access from all beds. Within

open plan critical care units such as Intensive Care (ICU), High Dependency (HDU) etc. a minimum of one hand wash sinks per 1-3 hospital beds is recommended[6]. Where health care institutions do not meet with these requirements, alcohol rubs must be supplied and strategically located in each room to facilitate the performance of hand hygiene (optimum number of alcohol dispensers is one per bed in critical care areas and a minimum of one per each patient room/procedure room in non critical care areas).

Clinical hand hygiene facilities are also required in all areas where there is clinical activity such as examination, procedure rooms, drug preparation areas, clinic rooms, sluice rooms, X-ray rooms etc[76]. It is important that the sink area is kept free from obstacles and that there are adequate hand washing supplies (non-antimicrobial and antimicrobial soaps, good quality disposable hand towels and moisturising/barrier creams as directed by OHT and ICT) available at all times. Both bedside alcohol dispensers and carriage of a personal pocket alcohol based handrubs have been associated with substantial improvements in compliance with hand hygiene[21,79].

When purchasing hand hygiene facilities consideration should be given to the design and size of the sinks, taps and dispensers. The sinks should be of adequate width and depth (sizes available in NHS document HTM 64 'Sanitary assemblies') to avoid splashing water onto the floor/surrounds, and particular attention should be given to the clearance required for the handles of elbow operated taps[76]. To protect the surrounds and facilitate cleaning, back splashes are recommended and all joints including the joint between the sink and back splash should be sealed with a water repellent sealant[76]. Sink stoppers should be avoided.

To avoid recontamination of washed hands, taps should be hands-free such as elbow, knee-operated or with automatic sensor taps. The choice of system may be determined by local needs, location, cleaning and or maintenance requirements. If taps are not hands free recontamination of hands can be avoided by using paper towel to turn off taps. Dispensers should facilitate easy cleaning particularly of the dispensing nozzle to maintain patency and to avoid contamination[33].

Hand sinks/taps and soap dispensers must be maintained in a clean condition at all times.

Recommendation:

Clinical handwash sinks are required in all areas where clinical activities are performed, should be independent of patient and/or en-suite sinks, of adequate size to avoid splashing and positioned to allow for soap and towel dispenser fittings above the sink with easy access (unobstructed) (II). Taps should be hand-free or sensor operated. Clinical institutions should aspire to installing one sink per 4-6 beds in general wards/day units and 1-3 beds in critical areas (II).

3. Isolation facilities

Hand wash sinks/facilities in single rooms should be positioned adjacent to the exit door to facilitate hand washing immediately prior to leaving the room[76]. However, all rooms currently used for transmission based precautions in health care facilities may not be designed to meet this recommendation. In such situations alcohol hand rub should be strategically sited at the exit door to facilitate hand hygiene prior to leaving the room.

Recommendation:

Handwash facilities should be positioned close to exit door of single rooms and wards (III).

Hand Hygiene Promotion, Education and Audit

The ongoing and long-term promotion of hand hygiene is essential for the successful implementation and adherence to hand hygiene policies as part of a strategy to reduce healthcare-associated infection and the control of antimicrobial resistance[79].

This requires senior hospital management commitment towards education in hand hygiene for all in the clinical environment, audit of practice, and the necessary support for structural design, maintenance and speedy repair of hand hygiene facilities[79]. Ultimately adherence to recommended hand hygiene practices should be part of a culture of patient safety and promotion of quality within the healthcare setting[4,79].

Strategies for the successful promotion of hand hygiene in hospitals are outlined in Appendix 5.

Recommendation:

Hand hygiene must become a standard of quality patient care within Health Care institutions (II).

Senior staff in healthcare institutions such as medical consultants, nurse managers and managers in the allied health professional groups, catering, domestic and technical services should act as role models and actively promote hand hygiene (II). Repeated breaches in adherence to hand hygiene procedures should be addressed within the risk and safety framework of health care institutions (III).

I. Education

All HCWs who work in the clinical environment **MUST** be educated in hand hygiene theory and technique prior to commencing work[79]. The SARI Infection Control Subcommittee recommends that that this should be achieved through an Infection Control component within the induction programme, and attendance must be mandatory[79]. To maintain hand hygiene technique, attendance at updates every one to two years is strongly recommended.

The SARI Infection Control Subcommittee also recommends that undergraduate medical, nursing, and other clinical health care course curricula include education and examination in hand hygiene theory and technique. This must be mandatory and completed before entry into the clinical setting. Annual updates are recommended at undergraduate level as clinical contact time is limited. It should also form part of the final clinical/professional examination.

Medical consultants and other senior clinical staff must act as role models in implementation of the hand hygiene policy.

Recommendation:

Mandatory attendance at hand hygiene education and practice is required for all HCWs involved in clinical areas. This may be undertaken during hospital induction programme followed by annual updates. Hand hygiene education and practice must be mandatory for all healthcare undergraduate courses with annual updates, and should form part of final clinical/professional examinations (III).

II. Audit

In December 2003, the English Department of Health recommended 'that all clinical teams will demonstrate consistently high levels of compliance with hand washing and hand disinfection protocols.' The SARI Infection Control Subcommittee recommends that this should be extended to all HCWs with direct clinical involvement in the health care setting. Measurement of compliance through audit with feedback of results is recommended and may be useful in determining the level of hand hygiene being performed, and in promoting good practice. These may be performed as part of an Infection Control programme on an institutional wide level and/or at local level by HCWs under the guidance of infection control. Sample audit forms are provided in Appendices 6,7,8 and 9.

Auditing the amount of hand hygiene agents used in an institution, such as liquid soap, alcohol handrub and antiseptic agents / 1000 patient days, may be useful markers of hand hygiene compliance.[3] In addition, it is important to audit hand hygiene facilities to ensure (a) that the sinks/dispensers are stocked adequately with hand wash agents and paper towels (b) taps are functioning and aligned properly and (c) waste bins are functioning correctly.

Recommendation:

Audit of compliance to hand hygiene in all health care settings is required (II). An example of an audit form is included in Appendix 3

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Appendix 1: Levels of hand hygiene techniques

	Social hand wash	Antiseptic hand hygiene Wash/rub	Surgical hand hygiene Scrub/rub
Rationale	• To attain socially clean hands • To remove dead skin cells and most transient micro - organisms (section 1.2)	• To achieve a higher level of cleanliness than that achieved during social hand washing • To remove all transient microorganisms	• To remove all transient micro- organisms. • To obtain a substantial reduction in resident microorganisms
Hand hygiene agent	• Good quality liquid soap and warm water	• Antiseptic soaps such as Chlorhexidine† • Alcohol handrub products on visibly clean hands	Suitable antiseptic soaps such as: • Chlorhexidine or Providine Iodine based soaps x 2 - 6 minutes • Plain soap & water followed by 3-5 minute alcohol hand rub
Duration	• At least 15 seconds	• At least 15 seconds	• Antispetic soap x 2-6 minutes†† • Alcohol rub 3-5 minutes††
Indication	**Before:** • Commencing work • Eating • Handling food • Each patient contact • drainage bags, giving injections etc **After** • **Removing gloves** • Handling soiled equipment and materials • Using the lavatory • Using handkerchiefs • End of duty each day	**Before** • Any non-surgical procedure that requires aseptic technique. • Entering isolation rooms • Entering critical care areas **After** • Leaving isolation rooms • Same as for social hand hygiene	**Before** • Any invasive surgical procedure
Technique	• Remove jewellery • Turn on taps • Wet hands • Apply 5mls (1 tsp.) soap to hands • Wash using method as outlined in Appendix 2 • Rinse well • Turn off tap using hands free method or paper towel • Pat dry well with disposable paper towels • Discard paper towel into waste bin - open bin by foot pedal only • Do not touch taps with clean hands	• Same as for social hand wash	See Appendix 4

† Recognised antiseptic soaps/detergents as documented in TFM '95 and / or EN 1500, EN1499 and for pre-operative hand hygiene TFM ,95, prEN 12054, prEN 12791

†† AS PER MANUFACTURER'S ADVICE, recommendations re: suitability, volume and duration of use

Appendix 2: Social Hand hygiene Poster

Full colour version available from www.hpsc.ie

Appendix 3: Alcohol rub hand hygiene poster

Full colour version available from www.hpsc.ie

Appendix 4: Surgical scrub technique using a conventional antiseptic handscrub agent (AORN 1999)

Step 1: Perform a short pre-scrub wash of the hands and forearms, with non anti-microbial soap, to loosen surface debris and remove transient organisms.

Step 2: Clean subungual areas under running water using a single use sterile nail cleaner.

Step 3: Apply the antimicrobial agent to the hands and forearms rubbing thoroughly. Visualise the fingers hands and arms as having four sides each of which must be scrubbed effectively. The volume of the antiseptic agent used and the duration of the scrub (usually 2 – 6 minutes) should be in accordance with manufacturers recommendations.

Hold hands higher than the elbow and away from surgical attire. Care should be taken to avoid splashing the surgical attire or gowns.

Step 4: Rinse hands and forearms thoroughly, commencing at the hands and working down to the elbow. Dry hands and arms well with a sterile disposable towel, using a patting motion rather than rubbing.

Alcohol handrubs for surgical scrub.
Step 1: Wash hands thoroughly with non-medicated soap and dry hands well with a disposable paper towel using a patting motion at the beginning of the list.

Step 2: Clean subungual areas under running water using a single use sterile nail cleaner.

Step 3: Apply an alcohol based surgical hand rub deemed suitable for pre-operative hand disinfection by the manufacturers to the hands an forearms. Visualise the fingers hands and arms as having four sides to which the alcohol must be applied liberally. The volume and number of applications is determined by the need to keep the hands and forearms wet for the required duration of the application as recommended by the manufacturers.

Step 4: On completion of application allow the alcohol on the hands and forearms to evaporate completely before donning sterile gowns and gloves. At the same time keep the hands and elbows away from the body to avoid risk of contamination.

If there is more than one hour between cases, hands must be washed again before applying alcohol rub. If the time between cases is less than an hour then hand washing is not required before application of alcohol.

Appendix 5: Strategies for promoting hand hygiene

Parameter	Tool for change
Education	E, M. S
Routine observation and feedback	S (E, M)
Engineering controls	S
Make hand hygiene easy, convenient	S
Make available alcohol-based hand rub	S
Alcohol-based hand rub available in high-demand situations.	S(SM)
Patient education	S
Reminders in the workplace	S
Administrative sanctions, rewards	S(E)
Change in hand hygiene agents.	S(E)
Promote, facilitate skin care for HCW hands	EMS/S(M)
Obtain active participation at individual and institutional level	S(E.M)/S
Ensure institutional safety climate	EMS
Enhance individual and self-efficacy	
Avoid overcrowding, understaffing, excessive workload	
Combination of above strategies	

[a]E=education; M-motivation; S-system; HCW=Health Care Worker

Source: Pittet D. Improving adherence to hand hygiene practices a multidisciplinary approach. *Emerging Infectious Diseases* (2001); 7: 234-240

Appendix 6: Social hand hygiene audit form

Hand Hygiene Audit Tool

Area/Ward: _____ **Date of Observation:** _____ **Time of Observation:** _____

Performed By: _____

Employee Category	W/soap >=15 sec	W/soap <15sec	Water only	Alcohol Handrub	Did not wash	Dry paper towel	Comments w/disposable
CON INT SHO REG RN PHY S&L CN RAD SW OT ATT DS CAT Other							
CON INT SHO REG RN PHY S&L CN RAD SW OT ATT DS CAT Other							
CON INT SHO REG RN PHY S&L CN RAD SW OT ATT DS CAT Other							
CON INT SHO REG RN PHY S&L CN RAD SW OT ATT DS CAT Other							
CON INT SHO REG RN PHY S&L CN RAD SW OT ATT DS CAT Other							
CON INT SHO REG RN PHY S&L CN RAD SW OT ATT DS CAT Other							

Codes:

CON - Consultant
INT - Intern
SHO - Senior House Officer
REG - Registrar
RN -Registered Nurse
PHY - Physio
S&L - Speech and Language
CN - Clinical Nutrition
RAD - Radiography
SW - Social Work
OT - Occupational Therapy
ATT Attendants.
DS - Domestic Services
CAT - Catering

Form adapted from Oakland Children's Hospital, USA.

Appendix 7: Aseptic hand hygiene observation tool

Aseptic Hand Hygiene Observation Tool (Suggest one observation session by one observer)

Date of Observation: _____ Time of Observation:_____ Performed By: _____

Person Observed (CON, INT, SHO, REG, RN, OTHER)	**Opportunity Assessed** a) Before patient care b) During patient care c) After patient care	**Adequacy of Hand Hygiene** a) Adequate (10-15 sec) b) Inadequate (<10-15 sec) c) Non-compliance (not done)	**Break in Compliance if Observed** 1. Initial scrub. 2. Using phone. 3. Using beeper. 4. Nappy change. 5. Chart use. 6 Computer use. 7. Scale use. 8. One touch. 9. Use of supplies. 10. Touch of glasses. 11. Touch face. 12. Touch hair. 13. Other.

Appendix 8: Hand hygiene competency validation tool

The following competency validation tool is shared from VON NICQ 2000 Nosocomial Infection Focus Group. USA.

Name: _____ **Employee number:** _____

Department: _____ **Job:** _____

Title: _____

After successful completion of this evaluation, this provider is considered competent to verbalise and demonstrate appropriate handwashing policies and techniques in the Intensive Care Nursery.

Skill	Learning Resources*/ Methods Used**	Date Done	Initials
Information Pamphlet and Test			
Reads Handwashing Guidelines Pamphlet and completes test in pamphlet with score of 100% correct.			
Handwashing Observations			
Performs at least 10 observations of staff in regards to timeliness and adequacy of handwashing/antisepsis in any of the following situations: Initial hand wash Handwashing before and after patient care Handwashing after touching potentially contaminated objects			
Glo Germ™ Assessment			
Completes 'Glo Germ ™' assessment of handwashing adequacy			

Evaluated by:_____ Initials: _____

Initials:_____

*Learning Resources Legend	Number
Hospital Standard or Policy	
Demonstrated	

**Method Legend
A. Testing
B. Direct Observation

Appendix 9: Hand hygiene facilities audit tool

Standard: Systems are in place in order to facilitate performance of Hand Hygiene.

INDICATORS
1.Sink/taps are aligned correctly (to facilitate use by elbows)
2.Soap dispensers in good working order
3.Adequate amount of handwash liquid soap available.
4.Adequate amount of antiseptic handwash liquid available.
5.Alcohol hand rub available in each room/bed space.
6.Disposable paper towel dispenser in good working order
7.Adequate amount of disposable paper towels available.
8.Waste bin in good working order.
9.Hand hygiene poster available at each sink.
10.Access to handwash sink is not obstructed.

KEY: Y = yes, N = No, N/A = Not Applicable, ND = Not Documented, NC = Not Checked by ICN.

Room number	Room Type	Indicators										Comments
		1	2	3	4	5	6	7	8	9	10	
Percentage Total												

Department:_____ Performed by:_____

Date: _____

Appendix 10: Responses to consultation exercise

The following groups and individuals submitted formal responses to the request for consultation on these guidelines:

- Department of Health and Children, Acute Hospitals Division
- Executive Management Board, Tralee General Hospital
- Infection Control Team, HSE South Eastern Region
- Department of Health and Children, Health Promotion Unit
- Shield Health Ltd.
- Dr Margaret O'Sullivan, RCPI Faculty of Public Health Medicine
- Dr Dominick Natin, RCPI Faculty of Occupational Medicine
- Ms Dorothy Gallagher, Consumers' Association of Ireland
- Dr Emer O'Reilly, Irish College of General Practitioners
- Ms Breda Corrigan (Infection Control Nurse Specialist)
- Dr Anthony Breslin (Specialist in Public Health Medicine)
- Ms Ann O'Reilly French (Infection Control Nurse Specialist)
- Ms Noreen Moynihan (Infection Control Nurse Specialist)
- Dr Phil Jennings (Specialist in Public Health Medicine)
- Ms Catriona Woods (Infection Control Nurse Specialist)
- Ms Marina Burd (Infection Control Nurse Specialist)
- Dr Bartely Cryan (Consultant Microbiologist)
- Ms Celine O'Carroll (Infection Control Nurse Specialist)
- Ms Una Sheridan (Infection Control Nurse Specialist)
- Dr Anne Gilleece (Consultant Microbiologist)
- Ms Mairead Twohig (Infection Control Nurse Specialist)
- Ms Maura Hallahan (Infection Control Nurse Specialist)