

**Infection Prevention Model Policy and Procedure**  
**Hand Hygiene as an Infection Control Measure – how should it be applied?**

**REVIEW OF LITERATURE**

<b>TEAM UNDERTAKING REVIEW:</b> Parts A and B – Health Protection Scotland. Part C – Welsh Healthcare Associated Infection Programme (WHAIP)	
<b>CONTACT PERSON:</b> Dawn Hill	
<b>TOPIC:</b> Hand hygiene as an infection control measure – how should it be applied?	
<b>PRINCIPAL RESEARCH QUESTION/OBJECTIVE:</b> To assess the evidence in relation to hand hygiene being a method of reducing the spread of infection.	
<b>METHODOLOGY</b>	
<b>i) Search strategy for identification of studies</b>	
<i>Period of publication</i>	Part A: 1966-2004
	Part B: 2004-2006
	Part C: 2007 -2008



<b>Specialist web sites / portals for Part C</b>	Bandolier, EPIC, JBI-connect, national Electronic Library – Infections, National Library of Guidelines, CDC, Welsh Assembly Government (WAG), Scottish Executive health Dept. (SEHD), health protection Agency (HPA), Health protection Scotland (HPS), Department of health (DH), National patient Safety Agency – Cleanyourhands, Healthcare Associated Infection research Network, Department of health & Social Services & Public Safety (DHSSPS-NI) Northern Ireland, health Information and Quality Authority (Republic of Ireland – health), National Resources Infection Control (NRIC), WHO, Hospital Infection Society, Infection Prevention Society, Society for Healthcare Epidemiology of America (SHEA), NPHS Knowledge Base
<b>Hand searching journals (2008 only)</b>	American Journal of Infection Control, British Journal of Infection Control, BMJ, Infection Control and Hospital Epidemiology, Journal of Hospital Infection
<b>ii) Selection criteria for inclusion of studies</b>	
<b>Sample</b>	All health and social care workers.
<b>Outcome measure(s)</b>	Effectiveness of intervention to reduce bacterial count on hands.
<b>Other inclusion criteria</b>	N/A
<b>Language Limitations</b>	English language only.
<b>iii) Quality assessment</b>	
<b>Study quality assessment</b>	
<b>Part A (1966 – 2004)</b>	Identified articles were reviewed according to Roe’s model. Guidance documents, however, were unable to be subjected to all such criteria.
<b>Part B (2004 – 2006) and Part C (2007-2008)</b>	Identified articles were reviewed according to either the ROE model for critical appraisal of scientific studies, Sign 50 methodology for systematic reviews and meta-analyses and the AGREE instrument for the evaluation of guidance documents as appropriate.
<b>Data collation and analysis</b>	Qualitative analysis of data performed on studies uncovered using a case study approach. Guidance documents reviewed for any relevant commentary.

**RESULTS**

***Part A (1966 – 2004)***

Handwashing or hand antisepsis can take one of three forms, according to the literature uncovered and local guidance reflects this. For example, Ayrshire & Arran NHS Board's Infection Control Manual describes clearly the differentiation between social handwashing, antiseptic handwashing and surgical handwashing/scrub as is also documented in Larson's (1995) American guidance.

Social handwashing is routine handwashing with soap and water using a thorough technique, as outlined by Ayliffe et al. (1978). Care should be taken to wet all surfaces of the hands prior to applying soap in order to achieve a good lather on all surfaces. This type of handwash will remove most transient micro-organisms from hands (see attached).

Antiseptic handwashing involves washing hands with an antiseptic based detergent and water to ensure removal of transient micro-organisms, utilising the same technique.

Surgical handwashing/scrub intends to remove transient micro-organisms and substantially reduce the number of resident micro-organisms on hands using an antiseptic handwash solution. Ayrshire & Arran NHS Board's policy suggests doing so for two minutes to ensure effectiveness, however, the optimum duration is somewhat unclear from the literature.

Each of these techniques should be performed using warm running water while ensuring that all surfaces of the hands (and forearms for surgical handwashing) are covered and rinsed thoroughly. Care should be taken to dry hands thoroughly to complete the process.

Alcohol hand rubs/gels can be used as an alternative to handwashing, but only if hands are socially clean (i.e. not soiled with organic matter) as otherwise the alcohol will be rendered inactive. They can also be used as an additional step following handwashing/antiseptics, for example prior to aseptic procedures.

The ability and requirement to access all surfaces of hands while decontaminating is recognised and this includes (removal of) long sleeves and the wearing of jewellery (see literature review relating to hand hygiene and jewellery).

Many agents are available for use during handwashing/hand antisepsis and differ in the level of antisepsis they achieve. One such agent is non-antimicrobial liquid soap which literature suggests will remove organisms transferred from activities such as patient contact and handling of used equipment following 10-15 seconds of washing (Horton, 1995). On the other hand, antimicrobial soap's main action, according to the literature, is the mechanical removal and killing or inhibition of both transient and resident flora. Many studies provide evidence which supports the ability of antimicrobials to kill potentially pathogenic bacteria (Meers & Yeo, 1978, Larson et al., 1986, Larson et al., 1987) and, therefore, these may be considered for use in the care of patients who could potentially be carrying pathogenic bacteria. The effect of antimicrobial soap on viruses, which are less likely to be carried on hands, is not readily available in the literature and needs to be addressed. Furthermore, the use of bars of soap is not recommended. If used, Boyce & Pittet (2002) recommend use of small bars of soap racks to facilitate drainage. Scientific evidence suggests that bar soap has a higher bacterial count than liquid soap following use (McBride, 1984; Kabara & Brady, 1984); however, studies have failed to show the transfer of these micro-organisms to the hands on subsequent use (Heinze, 1985; Heinze and Yackovich, 1988).

A wide range of antiseptic solutions are available:

- Chlorexidine offers an intermediate range of antimicrobial activity with persistent chemical activity for up to 6 hours. It is minimally affected by organic matter.
- Iodophors have a wide range of antimicrobial activity, but is neutralised in the presence of organic material. It is most frequently used for surgical scrubbing.
- Triclosan offers an intermediate range of antimicrobial activity and persistent chemical activity and is commonly used in commercial hygiene products (Ward, 2000).

In contrast, the main action of alcohol handrubs/ gels is simply to inhibit flora without any effect on soil. Products containing alcohol are particularly useful when quick decontamination is needed and access to handwashing facilities is limited, but such products cannot be used when hands are soiled (Heenan, 1996, Kerr, 1998). In appropriate concentrations, alcohols (e.g. ethyl (ethanol), normal-propyl (n-propyl), isopropyl) provide the most rapid and greatest reduction in microbial counts on skin (Lawbury et al., 1974, Groschel & Pruett, 1991).

Concentrations of alcohol between 60% and 90% by weight appear to be most effective. (In the production process, it is necessary to dilute the alcohol with water to denature the protein.) Generally, a concentration of less than 70% is used as it causes less skin drying dermatitis and is less costly (Larson, 1995). Indeed, the drying effect of alcohol, possible skin problems as a result and possible resistance to disinfectants are highlighted by the literature (Gould, 1992).

It is important to use a sufficient quantity of hand gel/rub to thoroughly cover all surfaces of the hands. No clear indication is given in the literature as to the optimum amount to be applied. Users are instead directed to the manufacturer's instructions (normally 3ml for 30 seconds). Furthermore, it appears that assumptions are made that alcohol hand rubs/gels are applied using the same technique as for handwashing (see attachment). Alcohol applications as brief as 15 seconds have been shown to be effective in preventing transmission by hand of gram negative bacteria (Ehrenkranz & Alfonso, 1991). Allowing the alcohol to dry is essential for its effectiveness.

As alluded to earlier, the major disadvantage of alcohol is its drying effect. Reybrouck (1986) reported that personnel with dermatitis tend to shy away from hand decontamination, thereby carrying higher bacterial counts on damaged skin, resulting in a greater source of infection (Steere & Mallison, 1975). To address this issue, emollients are now added to minimise skin drying which may in fact enhance antimicrobial activity by slowing drying time, thus increasing contact time of alcohol with the skin. Following handwashing, healthcare workers are encouraged to apply hand cream as a preventative measure, but it should be noted that communal hand cream jars can also become contaminated with bacteria (Gould, 1994b).

Similarly, possible contamination of liquid soap dispensers with bacteria is highlighted by Reybrouck (1986), Ayliffe et al. (1992), and Kerr (1998) If these are not fully replaced, they should be emptied and cleaned (as well as nozzles) before being replenished due to build up of residual fluid and unwashed hand contact. Furthermore, several studies suggest soap dispensers should in fact be wall mounted, elbow/foot operated and have disposable cartridges.

The potential risks associated with the flammable properties of hand rubs/gels if used excessively or if splashed appear to be low, according to the literature. NHS Quality Improvement Scotland's report of the provision of such alcohol-based products, published in 2005, highlighted the work of Greene (2003) who suggests that the incidence of fires associated with alcohol hand gels within health care settings is very low.

	<p>The National Patient Safety Agency's alert (2004b) underlined the fact that two fires have been reported in the US while no such fires have been reported in the UK. However, they encouraged the appropriate placement of these products to minimise the risk to patients and staff alike. Any risk, although very low, is far outweighed by the benefits of improving hand hygiene.</p> <p>The availability of products and of hand decontamination facilities appear to have a major influence on good hand hygiene practice according to the literature. Kesavan et al. (1998) suggest the convenient placing of sinks and the adequate provision of soap and soft paper towels encourages frequent and appropriate handwashing. Meanwhile, Gould (1994a) suggests taps should be elbow or foot operated to avoid recontamination. A lack of mixer taps was cited as a factor influencing hand hygiene compliance by Larson &amp; Killien (1982). The use of plugs in sinks is not recommended given that running water should be used when washing hands to avoid contamination of hands with micro-organisms.</p>
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**Part B (2004 – 2006)**

The annual review aims to identify, review and critique any scientific studies or guidance, which have been published in the intervening period since the original literature review, to determine if changes to guidance are required.

There were very few additional scientific studies published during the period of the review which specifically covered how to perform hand hygiene. The WHO guidance document on Hand Hygiene in Health Care (WHO, 2006), currently available as an advance draft, was reviewed for content on this subject, in order to determine if any significant changes to practice on how to perform hand hygiene were recommended, however there were no changes identified.

The only area of difference identified within all the examined guidance documents (WHO, 2006, CDC, 2006, NHS Greater Glasgow, Infection Control Committee, 2005) is that there is some degree of variation in the recommended length of time it should take to perform the act of level 1 & 2 hand hygiene (social and hygienic). In the original literature review, a study (Horton et al) was quoted which assessed the efficacy of non- antimicrobial soap, which was shown to be effective for the removal of bacterial contamination from hands after a 10-15 seconds act of hand hygiene. In the intervening period since the original review, very few scientific studies and no randomised control trials have been published, specifically on this subject. The only study identified using the defined literature search methodology, studied the efficacy of different hand hygiene agents using performance durations of 30 seconds and above, which seems rather unrealistic and not in line with any current guidance (Kac *et al.*, 2005).

Any recommendation for duration of hand hygiene has to be realistic and practical; therefore in the absence of any additional scientific evidence, it seems reasonable to recommend that duration of the act of hand hygiene should be at least 15 seconds, which is also in line with current worldwide and UK guidance.

*Part C (2007 – 2008)*

No new scientific papers were identified in this period pertaining to how hand hygiene should be carried out. Due to the limitations of studies, recommendations continue to be based on existing expert opinion that the duration of hand decontamination, the exposure of all aspects of the hands and wrists to the preparation being used, the use of vigorous rubbing to produce friction, thorough rinsing in the case of hand-washing, and ensuring that hands are completely dry are key factors in effective hand hygiene and the maintenance of skin integrity.

The epic2 guidelines (*Pratt et al. 2007*) laid down a series of standards for hand hygiene including:

- \* Hands that are visibly soiled or potentially grossly contaminated with dirt or organic material (ie. following the removal of gloves) must be washed with liquid soap and water.
- \* An effective handwashing technique involves three stages: preparation, washing and rinsing, and drying. Preparation involves wetting hands under tepid running water before applying the recommended amount of liquid soap or an antimicrobial preparation. The handwash solution must come into contact with all of the surfaces of the hand. The hands must be rubbed together vigorously for a minimum of 10-15sec., paying particular attention to the tips of the fingers, the thumbs and the area between the fingers. Hands should be rinsed thoroughly prior to drying with good quality paper towels.
- \* Clinical staff should be aware of the potentially damaging effects of hand decontamination products. They should be encouraged to use an emollient hand cream regularly, for example, after washing hands before a break or going off duty, and when off duty, to maintain the integrity of the skin.

## **CONCLUSIONS**

### ***Part A (1966 – 2004)***

- Hand decontamination or hand antisepsis can take one of three forms: social handwashing; antiseptic handwashing; surgical handwashing (see literature review relating to circumstances requiring hand decontamination).
- Literature indicates that non-antimicrobial liquid soap removes most transient micro-organisms from hands on washing.
- Evidence indicates that the main action of antimicrobial soap is the mechanical removal and killing/inhibition of both transient and resident flora.
- Hands should be washed with liquid soap and water for 10-15 seconds to achieve effective decontamination.
- The main action of antiseptic hand rubs/ gels, is simply to inhibit flora, but has no effect on soil.
- Generally, alcohol hand gels/rubs of a concentration of less than 70% are used as they cause less skin drying dermatitis and are less costly.
- A sufficient quantity of liquid soap/ hand gel or rub should be used to thoroughly wet all surfaces of the hands (refer to manufacturer's instructions).
- Alcohol hand rub/gel should be applied using thorough technique as is applied when washing hands with soap/ antiseptic solution and water (see Ayliffe et al., 1978 technique).
- Alcohol applications of 15 seconds have been shown to be effective in preventing transmission by hand.
- The major disadvantage of alcohol is its drying effect. Emollients are now added to minimise skin drying.
- Emollients may enhance antimicrobial activity by slowing drying time, thus increasing contact time of alcohol with the skin.
- There is the potential for liquid soap containers to become contaminated with bacteria if not emptied and cleaned before being replenished. Soap dispensers should have disposable cartridges, they should be wall mounted, and wrist/elbow/foot operated.
- It should be noted that communal hand cream jars can also become contaminated.
- Evidence indicates that a lack of mixer taps is a factor influencing hand hygiene compliance.
- Appropriate and convenient placing of sinks is essential. Adequate provision of soap and soft paper towels encourages frequent and appropriate handwashing.
- Plugs are not recommended as running water should be used when washing hands to avoid contamination.

<b>Part B (2004 – 2006)</b>	<p>Hands should be washed with liquid soap and water for at least 15 seconds to achieve effective decontamination.</p> <p>As stated in the updated literature review covering use of alcohol rubs; hands should be washed with soap and water if exposure to spore forming organisms is strongly suspected or proven i.e. in the case of an outbreak of <i>Clostridium difficile</i>.</p>
<b>Part C (2007 – 2008)</b>	No new scientific evidence pertaining to technique of hand washing/decontamination were found.
<b>RECOMMENDATIONS</b>	
<b>Part A (1966 – 2004)</b>	<p>The appropriate level of handwashing should be applied according to the procedure undertaken (see review in relation to application of hand decontamination).</p> <p>All surfaces of the hand should be covered when using antimicrobial soap hand gel/rub.</p> <p>Warm running water should be used when washing hands. Hands should be rinsed and dried thoroughly.</p> <p>Hand decontamination facilities must be made readily available to staff to maximise compliance with good hand hygiene practice.</p>
<b>Part B (2004 – 2006)</b>	The wording of the hand hygiene model policy should be modified to state ‘hand hygiene should be performed for at least 15 seconds’.
<b>Part C (2007 – 2008)</b>	Nothing additional needs to be added to Infection Prevention Model Policy/Procedure 2 (version1) as a result of the Literature review for Part C.
<b>PRACTICAL APPLICATION</b>	As the hand hygiene measures described have been recommended for some time, no significant change to practice should be required; however, the standards set down must be achieved.
<b>RESOURCE IMPLICATIONS</b>	As per current policies. All resources required for dealing with hand hygiene should already be in place.

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***Part A (1966 – 2004)***

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