Standard Infection Control Precautions Literature Review:
Hand Hygiene:
Hand hygiene products

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Author:	**Name:**	Laura MacDonald
	Role:	Healthcare Scientist (Health Protection)
	Division:	HPS
Owner:	Infection Control	
Approver:	Lisa Ritchie	
Approved by and Date:	August 2015	
Contact	**Name:**	Infection Control Team
	Tel:	0141 300 1175
	Email:	nss.hpsinfectioncontrol@nhs.net

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This literature review will be updated as new evidence emerges.

Version	Date	Summary of changes	Changes marked
3.0	August 2015	Updated after review of current literature	
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3.0	August 2015	Steering (Expert Advisory) Group for SICPs and TBPs		
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Purpose:	To inform the Standard Infection Control Precaution (SICP) section on Hand Hygiene Products in the National Infection Prevention and Control Manual.
Description:	This literature review examines the available professional literature on Hand Hygiene (hand hygiene products) in health and social care settings.
Target audience:	All NHS staff involved in the prevention and control of infection in NHSScotland.
Circulation list:	Infection Control Managers, Infection Prevention and Control Teams, Public Health Teams
Update/review schedule:	Updated as new evidence emerges with changes made to recommendations as required.
Cross reference:	National Infection Prevention and Control Manual http://www.nipcm.scot.nhs.uk/
Update level:	Change to practice – No significant change to practice Research – No significant change

Contents:

1. Objectives

The aim of this review is to examine the extant scientific literature regarding the use of hand hygiene products for standard infection control purposes in health and social care settings. The specific objectives of the review are to determine:

- When should non-antimicrobial soap be used for hand hygiene in health and social care settings?
- When should antimicrobial soap be used for hand hygiene in health and social care settings?
- When should alcohol based hand rub (ABHR) be used for hand hygiene in health and social care settings?
- When should non-alcohol based hand rub be used for hand hygiene in health and social care settings?
- When should antimicrobial hand wipes be used for hand hygiene in health and social care settings?
- Which products are suitable for surgical scrubbing/surgical rubbing?

2. Methodology

This targeted literature review was produced using a defined methodology as described in the National Infection Prevention and Control Manual: Development Process.

3. Recommendations

This review makes the following recommendations based on an assessment of the extant scientific literature on hand hygiene products for standard infection control purposes in health and social care settings:

When should non-antimicrobial soap be used for hand hygiene in health and social care settings?

Hands should be washed with non-antimicrobial soap and water when visibly contaminated/soiled or when there is likely to be exposure to spore forming organisms (e.g. *C.difficile*, *B.anthracis*) or gastrointestinal (GI) infections (e.g. norovirus). [ABHR is the preferred product for hand hygiene otherwise.]

(AGREE rating: Recommend)

When should antimicrobial soap be used for hand hygiene in health and social care settings?

Antimicrobial soaps with immediate and sustained antimicrobial effect are suitable for surgical scrubbing.

(Grade D recommendation)

When should alcohol based hand rub (ABHR) be used for hand hygiene in health and social care settings?

ABHR is the preferred product for hand hygiene in health and social care settings unless hands are visibly contaminated/soiled, or when there is likely to be exposure to spore forming organisms (*C.difficile* or *B.anthracis*) or infectious diarrhoeal diseases (norovirus).

(AGREE rating: Recommend)

(Grade D recommendation)

ABHR solutions should contain 60-80% alcohol by volume.

(AGREE rating: Recommend)

Application of a sufficient volume of ABHR to cover all surfaces of the hands is important to ensure effective hand hygiene.

(Good Practice Point (GPP))

When should non-alcohol based hand rub be used for hand hygiene in health and social care settings?

The use of non-alcohol based hand rub products for hand hygiene is not recommended in health and social care settings.

(Good Practice Point (GPP))

When should antimicrobial hand wipes be used for hand hygiene in health and social care settings?

Hand wipes **should not** be used for hand hygiene by staff in health and social care settings unless there is no running water available. In this instance, staff may use hand wipes followed by ABHR and wash their hands at the first available opportunity.

(Good Practice Point (GPP))

Which products are suitable for surgical scrubbing/surgical rubbing?

Surgical rubbing with an alcohol-based rubbing agent is a suitable alternative to surgical scrubbing with an antimicrobial scrub agent.
(Grade B recommendation)

Surgical scrubbing should be performed with an agent that has immediate and sustained antimicrobial effect (e.g. chlorhexidine, povidone-iodine).
(Grade D recommendation)

Surgical rubbing should be performed with an agent that has immediate and sustained antimicrobial effect (e.g. alcohol plus chlorhexidine).
(Grade D recommendation)

4. Discussion

4.1 Implications for practice

When should non-antimicrobial soap be used for hand hygiene in health and social care settings?

The evidence identified in this review indicates that non-antimicrobial soap is less effective against microorganisms than antimicrobial soap and ABHR.[1-5] This is likely due to the fact that non-antimicrobial soaps only have detergent properties (i.e. do not destroy microorganisms).[6] The cleaning effect of non-antimicrobial soap is due to the detergent properties, which remove loosely adherent transient microorganisms along with dirt and organic matter.[6] Evidence also indicates that friction during hand washing is an important aspect of removing microorganisms from the hands – this applies to antimicrobial and non-antimicrobial soaps.[7] The results of one study indicate that increasing the amount of contact time or product volume does not increase the efficacy of non-antimicrobial soap.[1]

Guidance is consistent in the recommendations that hand washing with soap is the preferred method of hand hygiene when hands are visibly contaminated/soiled (with dirt, blood, body fluids) or when there is likely to be exposure to spore forming organisms (e.g. *C.difficile*, *B.anthracis*) or gastrointestinal (GI) infections (e.g. norovirus).[6;8-15] It is assumed that the guidance refers to non-antimicrobial soap.

(AGREE rating: Recommend)

When should antimicrobial soap be used for hand hygiene in health and social care settings?

Antimicrobial soap is a generic term for soap products with a range of antimicrobial active ingredients, including chlorhexidine, triclosan, hexachlorophene, chloroxyenol, povidone iodine and quaternary ammonium compounds.[6] In general, evidence indicates that antimicrobial soaps result in better reductions in the transient and resident microorganisms found on hands than non-antimicrobial soaps.[1-4]

Experimental studies have compared a variety of different antimicrobial soaps (active ingredients; concentrations) in a variety of different ways (technique; contact times; volume; *in vivo*; *in vitro*) against a range of microorganisms (viral; bacterial; fungal), which does not

facilitate comparison.[2-4;16] No clear conclusions can be drawn on the most appropriate type of antimicrobial soap for a given circumstance on the basis of this evidence.

Evidence-based and consensus guidance is unclear as to when it is appropriate to use antimicrobial soap. Only one piece of guidance identified for this review specifically states that either non-antimicrobial soap or antimicrobial soap is appropriate for washing visibly contaminated/soiled hands or when there is exposure to spore forming organisms or infectious diarrhoea.[14]

Antimicrobial soap is used for surgical hand antisepsis (see 'Which products are suitable for surgical scrubbing/surgical rubbing?').

(Grade D recommendation)

When should alcohol based hand rub (ABHR) be used for hand hygiene in health and social care settings?

Evidence, including evidence from a randomised controlled trial, indicates that ABHR has better microbicidal properties than non-antimicrobial soap.[2;5;17;18]

The evidence is mixed on whether the microbicidal properties of ABHR are better than those of antimicrobial soap: some evidence indicates that ABHR is better[19;20]; some evidence indicates that antimicrobial soap is better[3]; and some evidence indicates that there is no difference.[21;22] There is limited evidence on this, and it is likely that the different findings are due to the different product formulations used in the studies, the different hand decontamination protocols used, and the influence of the different study designs.

Evidence indicates that hand washing with soap and water is more effective than use of ABHR against *C.difficile* spores, due to the fact that spores are resistant to the effects of alcohol.[23;24] Guidance consistently recommends that ABHR should not be used when there is likely to be exposure to spore forming organisms (e.g. *C.difficile*, *B.anthracis*) or infectious diarrhoea (e.g. norovirus).[6;8-14]

Guidance also consistently recommends that ABHR should not be used when hands are visibly contaminated/soiled, as it does not have detergent properties.[6;8-14] This recommendation is supported by experimental evidence.[25] The results of one study indicate that ABHR may have activity against *S.marcescens* even in the presence of blood contamination on hands, however,

this study was restricted to a single organism and was carried out in controlled experimental circumstances, so provides insufficient evidence to draw conclusions or make recommendations.[26]

In summary, the evidence indicates that ABHR should be the preferred method for hand hygiene unless hands are visibly contaminated/soiled, or when there is likely to be exposure to spore forming organisms (e.g. *C.difficile* or *B.anthracis*) or infectious diarrhoeal diseases (e.g. norovirus).

(AGREE rating: Recommend)

(Grade D recommendation)

It is unclear from the evidence identified whether the ABHR preparation type (i.e. gel, foam or liquid) has an influence on efficacy.[6;27;28] It is also unclear from the experimental evidence identified for this review which formulation of ABHR (alcohol type, alcohol concentration, additional ingredients) has the best microbicidal properties. Studies identified in this review explored a wide range of ABHR formulations in a range of different ways, making it challenging to synthesise this heterogeneous evidence and draw conclusions.[3;5;22;23;26-33] However, there is evidence to indicate that there is a dose-dependent effect, with higher alcohol concentrations having better microbicidal properties.[32;33] The WHO Guidelines on Hand Hygiene in Healthcare state that alcohol solutions containing 60-80% alcohol are most effective, with higher concentrations being less effective due to the fact that proteins are not easily denatured in the absence of water.[6]

(AGREE rating: Recommend)

The volume of ABHR for optimum efficacy is likely to vary for different formulations.[6] Evidence indicates that there is a relationship between volume of ABHR applied and efficacy, with larger volumes having better microbicidal efficacy.[28;34] This is likely due to the fact that the larger the volume of ABHR applied, the greater hand coverage is likely to be.[35] In addition, contact time is likely to increase because larger volumes take longer to dry, and evidence indicates that longer ABHR application times increase efficacy.[33] However, evidence indicates that the volumes of ABHR likely to be used in practice may not be optimum because drying times of appropriate volumes may exceed 30 seconds.[31] The evidence does not allow an evidence-based recommendation to be made on ABHR volume.

When should non-alcohol based hand rub be used for hand hygiene in health and social care settings?

Non-alcohol based hand rub products have been developed as alternatives to ABHRs. This review identified very limited evidence on such products. The three studies identified investigated different product formulations with different active ingredients including: polyhexamethylene guanidine; 5-pyrrolidone-2-carboxylic acid; copper sulphate pentahydrate; and iodine.[32;36;37] While the studies provide preliminary evidence that some non-alcohol based hand rubs may have bactericidal properties comparable to those of ABHR agents, the evidence is limited and heterogeneous. It is therefore not possible to draw any conclusions or make evidence-based recommendations on this question.

When should antimicrobial hand wipes be used for hand hygiene in health and social care settings?

Only three studies were identified that considered antimicrobial hand wipes.[3;32;38] One study found that an ethanol hand wipe had better bactericidal efficacy on hands than ethanol hand rub[38], while another found that a 95% ethanol wipe completely inhibited MRSA growth *in vitro*, as did several of the ethanol-based rubbing agents tested.[32] The final study found that the antimicrobial hand wipe tested was less effective than ABHR or hand washing.[3] Due to the fact that the evidence is limited, mixed and of low quality, it is not possible to draw conclusions or make evidence-based recommendations on this question.

Which products are suitable for surgical scrubbing/surgical rubbing?

Surgical scrubbing with antimicrobial scrubbing agents is a long established practice for surgical hand antisepsis, while surgical rubbing with alcohol-based surgical rubbing agents is a newer, less established practice.

There is evidence to indicate that there is no difference in the rate of surgical site infections/wound infections when either surgical rubbing with an alcohol-based agent or surgical scrubbing is carried out for surgical hand antisepsis.[39-41] Therefore, surgical rubbing with an alcohol-based rubbing agent is an appropriate alternative to surgical scrubbing with an antimicrobial scrub agent.

(Grade B recommendation)

The evidence identified for this review indicates that surgical rubbing with alcohol based agents containing chlorhexidine has similar or better immediate bactericidal efficacy to surgical scrubbing with either povidone iodine, chlorhexidine or sodium hypochlorite based scrub agents.[28;42-48] In addition, there is some evidence identified that indicates that surgical rubbing with alcohol based agents containing chlorhexidine has better sustained bactericidal efficacy than surgical scrubbing with either povidone iodine or sodium hypochlorite based scrub agents.[44;46-48]

The evidence is mixed in relation to surgical rubbing with alcohol-only agents compared with surgical scrubbing with either povidone iodine or chlorhexidine based scrub agents. The results of one study indicate that alcohol-only rubbing agents may have better immediate bactericidal efficacy[49], while other studies indicate that alcohol-only rubbing agents have similar or even lower immediate bactericidal efficacy to scrub agents.[42;50;51]

There were three studies identified as part of this review that compared the efficacy of different alcohol-only surgical rubbing agents, however the evidence is insufficient to draw conclusions on the best formulation in terms of bactericidal efficacy.[52-54]

The WHO Guidelines on Hand Hygiene in Healthcare state that the lack of appropriate, conclusive clinical trials precludes uniformly acceptable criteria for surgical hand preparation agents.[6]

On basis of the evidence identified, is not possible to specifically recommend any alcohol-based surgical rubbing agent over others. It is recommended that surgical rubbing should be performed with an agent that has immediate and sustained antimicrobial effect (e.g. alcohol plus chlorhexidine).

(Grade D recommendation)

This review identified some evidence to indicate that chlorhexidine based scrubbing agents have better immediate and sustained bactericidal efficacy than povidone iodine-based scrubbing agents.[41;55;56]

The evidence identified is not strong enough to specifically recommend any specific surgical scrubbing agent over others. As such, it is recommended that surgical scrubbing should be performed with an agent that has immediate and sustained antimicrobial effect (e.g.

chlorhexidine or povidone iodine).

(Grade D recommendation)

4.2 Implications for research

There are uncertainties around the efficacy of antimicrobial hand wipes and non-alcohol based hand rubs. In addition, current evidence is insufficient to definitively determine the most effective ABHR, surgical scrubbing or surgical rubbing agents. Further research in these areas may be warranted, as use of the appropriate agents for hand hygiene contributes to the prevention and control infection in health and social care settings.

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