Standard Infection Control Precautions Literature Review:
Hand Hygiene
Surgical hand antisepsis in the clinical setting

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Version History:

This literature review will be updated in real time if any significant changes are found in the professional literature or from national guidance/policy.

Version	Date	Summary of changes	Changes marked
4.0	December 2016	**Recommendations updated:** **What is the correct technique to ensure that all surfaces of the hands are covered during surgical hand antisepsis?** Removal of bullet point • At this point local policy may advise repeating the steps above but to the mid-arms only, rinsing as described above when complete. Inclusion of new bullet points 3 and 4 • Rinse hands by passing them through the water in one direction only, from fingertips to elbow. Do not move the arm back and forth through the water • Put antimicrobial soap into the palm of your left hand using the elbow of the right arm to operate the dispenser. **Discussion updated:** **What is the correct technique to ensure that all surfaces of the hands are covered during surgical hand antisepsis?** Removal of text 'and this is current practice in NHSScotland' from bullet point 8.	
3.0	November 2015	Updated after review of current literature	
2.0	April 2014	Updated after review of current literature	
1.0	January 2012	Defined as final	

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Version	**Date Approved**	**Name**	**Job Title**	**Division**
4.0	December 2016	National Policies, Guidance and Outbreaks Steering Group		
3.0	November 2015	Steering (Expert Advisory) Group for SICPs and TBPs		
2.0	April 2014	Steering (Expert Advisory) Group for SICPs and TBPs		
1.0	January 2012	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 in the National Infection Prevention and Control Manual in order to facilitate the prevention and control of healthcare associated infections in NHS Scotland hospital settings.
Description:	This literature review examines the available professional literature on Hand Hygiene (Surgical hand antisepsis) in the clinical setting.
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/ SICP Literature Review: Handwashing http://www.nipcm.scot.nhs.uk/resources/literature-reviews/standard-infection-control-precautions-literature-reviews/
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 professional literature regarding the correct technique for surgical hand antisepsis in the clinical setting e.g. theatre. The specific objectives of the review are to determine:

- When should surgical hand antisepsis be performed?
- What is the recommended water temperature for surgical hand antisepsis in the clinical setting?
- What is the recommendation relating to finger nails to enable effective surgical hand antisepsis?
- What is the evidence regarding the wearing of hand and wrist jewellery in the clinical theatre setting?
- Should nail brushes/sponges be used when performing surgical hand antisepsis?
- What is the correct technique to ensure that all surfaces of the hands are covered during surgical hand antisepsis?
- How long should surgical hand antisepsis be carried out to ensure good technique?
- How should hands be dried after surgical hand antisepsis in the clinical setting?
- What is the correct technique for surgical hand rubbing?
- How long should surgical hand rubbing be carried out to ensure good technique?
- What are the hand hygiene facilities requirements for surgical hand antisepsis?

Recommendations relating to specific hand hygiene products, i.e. soap types, are outlined in the hand hygiene products literature review.

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 professional literature on surgical hand antisepsis in the clinical setting.

When should surgical hand antisepsis be performed?

Surgical hand antisepsis should take place **before** donning sterile surgical PPE (i.e. gloves and gown).

(Grade D recommendation)

(AGREE rating: Recommend)

Alcohol based hand rub (ABHR) suitable for surgical rubbing may be used between surgical procedures or for hand decontamination between glove changes if hands are not visibly soiled.

(Grade D recommendation)

What is the recommended water temperature for surgical hand antisepsis in the clinical setting?

Warm/tepid water with a steady flow should be used for carrying out surgical hand antisepsis.

(Grade D recommendation)

(AGREE rating: Recommend)

What is the recommendation relating to finger nails to enable effective surgical hand antisepsis?

The recommendations for normal hand hygiene practices should be followed (i.e. short, clean and free from nail products and false/artificial nails).

(Grade D recommendation)

(AGREE rating: Recommend)

Finger nails should not exceed ¼ inch (approx. 0.5cm) beyond the end of the finger tip to prevent the accumulation of debris under nails and to facilitate effective hand hygiene.

Artificial nails should not be worn as they inhibit hand hygiene and pose an infection risk.

Nail products should not be worn as chips may harbour bacteria and thus represent an infection risk.

(Grade D recommendation)

(AGREE rating: Recommend)

What is the evidence regarding the wearing of hand and wrist jewellery in the clinical theatre setting?

All hand and wrist jewellery including all finger rings should be removed prior to commencing surgical hand antisepsis.

(Grade D recommendation)

(AGREE rating: Recommend)

A surgical hand antisepsis policy that includes the removal of all finger rings provides the surgical team with a highly visible way to:

- Demonstrate their commitment to good infection prevention and control practice.
- Highlight their determination to reduce Surgical Site Infection (SSI)/Healthcare Associated Infection (HAI), thus contributing to improved patient safety.
- Effectively comply with good surgical hand antisepsis technique/preparation.

(Good Practice Point (GPP))

Should nail brushes/sponges be used when performing surgical hand antisepsis?

Nail brushes **should not** be used for surgical hand antisepsis.

Nail cleaners (e.g. nail picks (single-use)) can be used if nails are visibly dirty.

(Grade D recommendation)

(AGREE rating: Recommend)

Soft, non-abrasive, sterile (single-use) sponges may be used to apply antimicrobial liquid soap to the skin if licensed for this purpose.

(Good Practice Point (GPP))

What is the correct technique to ensure that all surfaces of the hands are covered during surgical hand antisepsis?

If hands are visibly soiled, or if this is the first surgical hand antisepsis of the day, wash hands with non-antimicrobial liquid soap and running water using the normal steps for hand washing immediately prior to beginning surgical hand antisepsis.

The following technique should be used to ensure that all surfaces of the hands and forearms, to elbows, are covered during surgical hand antisepsis (manufacturers guidance on products used should also be taken into consideration):

- Start timing.
- Wet hands and arms. Apply the appropriate amount of antimicrobial liquid soap to the hands and arms. For 2 min, wash each side of each finger, between the fingers, and the back and front of **both** hands.
- Rinse hands by passing them through the water in one direction only, from fingertips to elbow. Do not move the arm back and forth through the water.
- Put antimicrobial soap into the palm of your left hand using the elbow of the right arm to operate the dispenser.
- For 1 min, wash the right arm from wrist to elbow, keeping the hand higher than the arm at all times.
- Repeat the process on the left arm, keeping hands above elbows at all times. (If the hand touches anything at any time, the scrub must be lengthened by 1 min for the area that has been contaminated).
- Rinse hands and arms by passing them through the water in one direction only, from fingertips to elbow. Do not move the arm back and forth through the water.
- Hold hands above elbows at all times.
- Hands and arms should be dried using a sterile towel and aseptic technique (See "**How should hands be dried after surgical antisepsis in the clinical setting?"**) before donning sterile gown and gloves.

- Do not splash water onto surgical attire/scrubs.
- Do not shake hands to disperse water from them.

Once all surgical procedures are finished, general hand hygiene (i.e. non-antimicrobial liquid soap and water or ABHR (if hands are not visibly soiled)) should be performed after surgical gloves are removed and before any other activities are undertaken.

(Grade D recommendation)

(AGREE rating: Recommend)

How long should surgical hand antisepsis be carried out to ensure good technique?

The process described above will take a minimum of 4 min to complete, however, manufacturer's guidance for the minimum specific time that is deemed effective for their product should be adhered to and the process lengthened if required.

(Grade D recommendation)

(AGREE rating: Recommend)

How should hands be dried after surgical hand antisepsis in the clinical setting?

- The skin should be blotted dry with sterile towels (rubbing will disturb skin cells).
- Using one towel per hand and arm work from fingertips to elbows by placing the opposite hand behind the towel and blotting the skin using a corkscrew movement to dry from the hand to the elbow.
- Using a second towel repeat the process on the other hand and arm to the elbow.
- The towel must not be returned to the hand once the arm has been dried and must be discarded immediately.

(Grade D recommendation)

(AGREE rating: Recommend)

What is the correct technique for surgical hand rubbing?

The following technique should be used to ensure that all surfaces of hands and forearms, to elbows, are covered during surgical rubbing:

- Hands should be washed with non-antimicrobial liquid soap and dried thoroughly using the normal steps for hand washing, if visibly dirty.
- Put the recommended amount of ABHR in the palm of your left hand, using the elbow of your right arm to operate the dispenser.
- Dip the fingertips of your right hand in the ABHR to decontaminate under the nails, (as per manufacturer's instructions).
- Smear the ABHR on the right forearm up to the elbow. Ensure that the whole skin area is covered by using circular movements around the forearm until the hand rub has fully evaporated (as per manufacturer's instructions).
- Hands and forearms should remain wet (i.e. the ABHR should not be allowed to fully evaporate until the surgical hand rubbing process is complete) throughout the surgical hand rub.
- Repeat the process for the left fingertips, hand and forearm.
- When hands are dry, sterile surgical gown and gloves can be donned.

* Always follow the manufacturer's application volumes and rub times to ensure the effectiveness of the product used.

Once all surgical procedures are finished, general hand hygiene (i.e. non-antimicrobial liquid soap and water or ABHR (if hands are not visibly soiled)) should be performed after surgical gloves are removed and before any other activities are undertaken.

(Grade D recommendation)

(AGREE rating: Recommend)

How long should surgical hand rubbing be carried out to ensure good technique?

Manufacturer's guidance should be referred to, to ensure the effectiveness of the product used.

(Grade D recommendation)

(AGREE rating: Recommend)

What are the hand hygiene facilities requirements for surgical hand antisepsis?

The following recommendations should be adhered to when considering surgical hand antisepsis facilities:

- If using a recessed 'scrub' area, this must enable staff to perform surgical hand antisepsis, gown and circulate concurrently without risk of contamination from each other or from the surrounding fittings.
- The sink and furniture should be at a height to facilitate hand and arm washing and prevent splashing of surgical attire/scrubs.
- The design and drainage should ensure that the floor does not become wet during washing procedures.
- Foot pedals and/or elbow adjustments should be provided to operate taps and dispense hand hygiene solutions.
- Provision of hot and cold water is essential and water should flow at a steady rate.
- The use of sonic accessories i.e. non-touch, fixtures and fittings should be considered.
- Where sensor taps are in operation they must allow a sufficient run-on-time for the hand hygiene/scrub protocol to be completed. The run on time should be a minimum of 20 seconds.
- Foot operated disposal bins for waste paper should be provided.

(Grade D recommendation)

4. Discussion

4.1 Implications for practice

There is consensus in the literature regarding the recommended method for surgical hand antisepsis in the clinical setting, which can be summarised as follows:

When should surgical hand antisepsis be performed?

Surgical hand antisepsis is used to reduce the levels of skin (resident) bacteria present on the hands in addition to removing all transient bacteria and soiling prior to operating.[1-6] The consensus/practice guidelines found the most appropriate time for this to take place is **before** donning sterile theatre kit (e.g. gloves and gown).[2-4;6;7]

ABHR products may be used between surgical procedures if hands are not visibly soiled and if the product is licensed for this use.[3;6]

(Grade D recommendation)

(AGREE rating: Recommend)

What is the recommended water temperature for surgical hand antisepsis in the clinical setting?

The temperature of water used for surgical hand antisepsis is described in a limited volume of evidence identified by the review. These studies were generally non-systematic reviews or consensus/practice guidelines and as such had a low level of evidence. They recommend that warm water with a steady flow be used as this is both comfortable for the person undertaking the procedure, in addition to improving the effectiveness of the antiseptic and soap being used.[1;3;6]

(Grade D recommendation)

(AGREE rating: Recommend)

What is the recommendation relating to finger nails to enable effective surgical hand antisepsis?

The recommendations relating to finger nails and surgical hand preparation identified from the literature are the same as those for normal hand hygiene practices (i.e. short, clean and free from nail products e.g. polish and false/artificial nails).[2-8]

A recent systematic review[9] failed to find high quality evidence concerning the impact of nail polish on the bacterial density of scrubbed personnel and suggested that expert opinion should be referred to regarding this matter. However, from other low level literature identified, it was found that there is consensus regarding these practices for the reason that short natural nails free from nail polish, are easier to clean, reduce the risk of bacterial transmission and the incidence of glove tears.[1;10;11]

(Grade D recommendation)

(AGREE rating: Recommend)

What is the evidence regarding the wearing of hand and wrist jewellery in the clinical theatre setting?

It is recommended in the guidance and literature identified by this review that all hand and wrist jewellery is removed prior to surgical hand antisepsis as it may harbour microorganisms, cause allergic reactions as a result of antimicrobial product accumulating underneath and inhibit the correct procedures for surgical hand antisepsis.[2-8;11] There have however been no randomised control trials (RCTs) conducted assessing the SSI rates and finger rings.[9]

(Grade D recommendation)

(AGREE rating: Recommend)

A rapid literature review regarding the wearing of finger rings by theatre staff has been produced by Health Protection Scotland's Infection Control Team.[12] The review assessed the literature in terms of the bacterial contamination of finger rings, their association with glove perforations and their connection with surgical site infections and outbreaks. It concluded that the evidence that wearing a finger ring may increase the risk of surgical site infection by acting as a source of contamination and/or causing surgical glove perforation is inconclusive. There

was however evidence that finger rings (including plain rings) may harbour bacteria and cause surgical glove perforations. The absence of conclusive evidence does not necessarily equate to an absence of risk, and currently NHSScotland is doing everything practicable to reduce the incidence of Healthcare Associated Infection (HAI). Although the likely reduction in risk from removing rings when part of the surgical team is likely to be low, it will enhance patient safety without a disproportionate adverse effect on the wearer. A surgical hand antisepsis policy that includes the removal of finger rings also provides the surgical team with a highly visible way to:

- Demonstrate their commitment to good infection prevention and control practice.
- Highlight their determination to reduce Surgical Site Infection (SSI)/Healthcare Associated Infection (HAI), thus contributing to improved patient safety.
- Effectively comply with good surgical hand antisepsis technique/preparation.

(Good Practice Point (GPP))

Should nail brushes/sponges be used when performing surgical hand antisepsis?

The use of nail brushes when performing surgical hand antisepsis has been widely discussed in the literature. A Cochrane review[13] concluded that it could find no studies relating to the use of nail brushes and other equipment in hand antisepsis and a reduction in surgical site infections. Studies by Tanner *et al*[14] and Alcan *et al*[15] both found that there was no significant difference in the number of colony forming units (CFU) present on the hands of participants if they did or did not use a nail brush or nail pick and concluded that their use should be optional. In addition, there is consensus in the literature that the use of nail brushes can be detrimental on the condition of the healthcare workers skin and lead to increased skin cell shedding.[1;10;16;17] The guideline documents identified as part of this review also do not support the use of nail brushes for surgical hand antisepsis but do support the use of nail cleaners (e.g. nail picks) for the removal of soiling from underneath fingernails.[2-8;18]

(Grade D recommendation)

(AGREE rating: Recommend)

The use of sponge applicators to assist with the surgical hand antisepsis procedure is not widely discussed in the literature. These applicators are typically either plain sponges (used to apply antimicrobial soap) or sponges impregnated with antimicrobial products which may also have soft, flexible bristles (often called a 'brush sponge'). No evidence was identified in this review regarding the use of impregnated sponges or 'brush sponges', however, there is guidance to support the use of soft, non-abrasive sponges to apply antimicrobial soap.[8]

(Good Practice Point (GPP))

What is the correct technique to ensure that all surfaces of the hands are covered during surgical hand antisepsis?

There is consensus in the literature regarding the recommended method for surgical hand antisepsis in the clinical setting. The WHO provides the following technique to ensure that all surfaces of the hands and arms are covered during surgical hand antisepsis, however, manufacturers guidance for products used should also be taken in to consideration:

- Wash hands with non-antimicrobial liquid soap and running water using the normal steps for hand washing (if hands are visibly soiled) immediately prior to beginning the surgical hand antisepsis.
- Start timing. Wet hands and forearms. Scrub each side of each finger, between the fingers, and the back and front of the right hand for 2 minute (using an antimicrobial soap).
- Scrub the right arm, keeping the hand higher than the arm at all times to prevent recontamination of the hands by water from the elbows and bacteria-laden soap and water from contaminating the hands.
- Wash each side of the arm from the wrist to the elbow for 1 minute.
- Repeat the process on the other hand and arm, keeping hands above elbows at all times. (If the hand touches anything at any time, the scrub must be lengthened by 1 minute for the area that has been contaminated).
- Rinse hands and arms by passing them through the water in one direction only, from fingertips to elbow. Do not move the arm back and forth through the water.

- Hold hands above elbows.
- The AfPP recommends that the procedure is repeated to the mid forearms only.
- Hands and arms should be dried using a sterile towel and aseptic technique before donning gown and gloves.[2-4;6-8]

It is important for healthcare workers not to splash water on to surgical attire/scrubs or shake their hands to disperse water from them.[2;3;6-8]

Once all surgical procedures are finished, general hand hygiene (i.e. non-antimicrobial liquid soap and water, or ABHR (if hands are not visibly soiled)) should be performed after surgical gloves are removed and before any other activities are undertaken.[3]

(Grade D recommendation)

(AGREE rating: Recommend)

How long should surgical hand antisepsis be carried out to ensure good technique?

The length of time required to perform surgical hand antisepsis is well studied in the literature. The majority states that a 10 minute 'scrub' is **not** required and that a time of 2 to 6 minutes is sufficient, although manufacturer's guidance for the specific time that is deemed effective for their product should be adhered to.[1-6;8;16;17] A recent Cochrane review of the literature confirmed this by stating that there is no difference in the numbers of CFUs when comparing durations of two, three and five minutes.[13]

(Grade D recommendation)

(AGREE rating: Recommend)

How should hands be dried after surgical hand antisepsis in the clinical setting?

It is important that hands are dried well before donning sterile surgical gloves. There are two reasons for this; one is to reduce the transfer of bacteria and the other is to prevent any interactions between the antiseptic product used and the gloves.[3] Several methods of drying have been evaluated but it was found there was little difference in their effectiveness[1], however, it is important to remember that the towels for this stage of the surgical scrub procedure should

be sterile.[1;3;6;7] The Association for Perioperative Practice guidelines[3] gave the most complete description and recommended the following:

- The skin should be blotted dry with sterile towels (rubbing will disturb skin cells).
- Using one towel per hand work from fingertips to elbows.
- Hands are dried firstly by placing the opposite hand behind the towel and blotting the skin – then using a corkscrew movement to dry from the hand to the elbow.
- The towel must not be returned to the hand once the arm has been dried and must be discarded immediately.
- The process is then repeated for the opposite hand.

(Grade D recommendation)

(AGREE rating: Recommend)

What is the correct technique for surgical hand rubbing?

The use of ABHR products for surgical hand antisepsis is a new concept but evidence shows that it can be more effective than a traditional surgical scrub.[1] A standardised application technique has not been decided as yet[6], however the basic technique described is similar among the literature identified as part of this review.[1;2;4;6;8;11;17] The WHO provides the following technique to ensure that all surfaces of their hands are covered during surgical rubbing:

- Hands should be washed with non-antimicrobial liquid soap and dried thoroughly.
- Put approximately 5ml (3 doses)* of ABHR in the palm of your left hand, using the elbow of your other arm to operate the dispenser.
- Dip the fingertips of your right hand in the hand rub to decontaminate under the nails (5 seconds*).
- Smear the hand rub on the right forearm up to the elbow. Ensure that the whole skin area is covered by using circular movements around the forearm until the hand rub has fully evaporated (10-15 seconds*).
- Put approximately 5ml (3 doses)* of ABHR in the palm of your right hand, using the elbow of your other arm to operate the dispenser.

- Dip the fingertips of your left hand in the hand rub to decontaminate under the nails (5 seconds*).
- Smear the hand rub on the left forearm up to the elbow. Ensure that the whole skin area is covered by using circular movements around the forearm until the hand rub has fully evaporated (10-15 seconds*).
- Put approximately 5ml (3 doses)* of ABHR in the palm of your left hand, using the elbow of your other arm to operate the distributor. Rub both hands at the same time up to the wrists, and ensure that the all surfaces of the hands are covered using the standard ABHR procedure for hand hygiene.
- When hands are dry, sterile surgical clothing and gloves can be donned.[6;8]

It is important that hands and forearms remain wet (i.e. the ABHR should not be allowed to fully evaporate until the surgical hand rubbing process is complete) throughout the surgical hand rub.[6]

* Always follow the manufacturer's application volumes/times to ensure the effectiveness of the product used.[6;8;8]

Once all surgical procedures are finished, general hand hygiene (i.e. non-antimicrobial liquid soap and water or ABHR (if hands are not visibly soiled)) should be performed after surgical gloves are removed and before any other activities are undertaken.[2]

(Grade D recommendation)

(AGREE rating: Recommend)

How long should surgical hand rubbing be carried out to ensure good technique?

Tanner et al found that a 1 minute hand wash and a 3 minute rub was more effective than a 5 minute rub[13], however shortened application times of 1.5 minutes have also been quoted in the literature but this was in relation to a specific product.[11] Therefore it is recommended that ABHR products be tested for their effectiveness[19], and the manufacturer's application time for their product followed.[4;6;8;11]

(Grade D recommendation)

(AGREE rating: Recommend)

What are the hand hygiene facilities requirements for surgical hand antisepsis?

It is important that adequate facilities are in place for surgical hand antisepsis. The Association for Perioperative Practice guidelines[3] recommend the following:

- If using a recessed 'scrub' area, this must enable staff to perform surgical hand antisepsis, gown and circulate concurrently without risk of contamination from each other or from the surrounding fittings.
- The sink and furniture should be at a height to facilitate hand and arm washing and prevent splashing of clothes.
- The design and drainage should ensure that the floor does not become wet during washing procedures.
- Foot pedals and/or elbow adjustments should be provided to operate taps and dispense hand hygiene solutions.
- Provision of hot and cold water is essential and water should flow at a steady rate.
- The use of sonic accessories i.e. non-touch, fixtures and fittings should be considered.
- Where sensor taps are in operation they must allow a sufficient run-on-time for the hand hygiene/scrub protocol to be completed. The run on time should be a minimum of 20 seconds.
- Foot operated disposal bins for waste paper should be provided.

(Grade D recommendation)

4.2 Implications for research

There is an extensive body of literature which examines surgical hand antisepsis in the hospital/clinical setting. Literature looking at aspects of surgical hand antisepsis specifically in relation to reductions in SSI rates would be a useful addition to the currently available evidence base. Further study is required also in relation to the wearing of plain finger rings by the surgical team in order for a more robust evidence based recommendation to be made. International collaboration should also take place to finalise a standard method for the use of ABHR products for surgical hand antisepsis.

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