

REVIEW OF LITERATURE

TEAM UNDERTAKING REVIEW: Parts A and B – Health Protection Scotland. Part C – Welsh Healthcare Associated Infection Programme (WHAIP)	
CONTACT PERSON: Dawn Hill	
TOPIC: Hand hygiene, nails and nail polish	
PRINCIPAL RESEARCH QUESTION/OBJECTIVE: To assess the evidence in relation to the effect of nail hygiene on general hand hygiene.	
METHODOLOGY	
i) Search strategy for identification of studies	
<i>Period of publication</i>	Part A: 1966 - 2004 Part B: 2004 – 2006 Part C: 2007-2008

<p>Strategy key words for Part C</p> <p><i>From Health Protection Scotland literature review [2007]</i></p> <p><i>Supplemented with terms from SURE proposal to HTA</i></p>	<p>Hand hygiene, hand washing, handwashing, hand sanitizing, hand cleansing, hand decontamination, Hand\$1 adj2 wash\$.ti,ab Hand\$1 adj2 clean\$.ti,ab Hand\$1 adj2 decontamin\$.ti,ab Hand\$1 adj2 saniti\$.ti,ab Hand\$1 adj2 antiseptis\$.ti,ab Hand\$1 adj2 disinfect\$.ti,ab Exp hand/ Exp sterilization/ Cross infection Nosocomial Healthcare associated infection Health-care associated infection Healthcare acquired infection Hospital acquired infection Compliance,Adherence,Attitudes Perceptions,Professional compliance Health behaviour , health behaviour Attitude , attitude of health personnel Health knowledge, attitudes, practice/ Comply\$4.ti,ab Complies\$41.ti,ab Adher\$.ti,ab, obey\$.ti,ab, conform\$.ti,ab, follow\$3.ti,ab , fulfil\$.ti,ab observ\$.ti,ab abide\$.ti,ab Barrier\$.ti,ab obstacle\$.ti,ab hurdle\$.ti,ab obstruct\$.ti,ab facilitate\$.ti,ab enable\$.ti,ab assist\$.ti, ab help\$.ti,ab promot\$3.ti,ab encourage\$1.ti,ab encouraging.ti,ab attitude\$1.ti,ab practice\$.ti,ab practising.ti,ab practicing.ti,ab Knowledge\$.ti,ab difficult\$.ti,ab impede\$.ti,ab hinder\$.ti,ab hindrance\$.ti,ab Care, care equipment, environment, contaminated contact , delivery of health care, exp Equipment and supplies, hospital/ Health facility environment, hospital, healthcare, occupational transmission, focal infection, cross infection/ Exp Hospitals/ Occupational diseases/ Infection/ focal infection/ infection control/ Bacteri\$, virus\$, equipment contamination. Handwashing solution, hand washing solution, procedure, soaps, chlohexidine, air dryer, paper towel\$, hand towel\$, soap, liquid soap, soap solution, alcohol rub, alcohol solution, alcohol, alcohol\$ adj2 handrub\$4.ti,ab Surgical scrub\$.ti,ab Ring\$, jewellery, nail\$ nail polish, nails/ Cosmetics,</p>	
<p>Electronic databases for Part C</p> <p><i>(tick as appropriate)</i></p>	<p>MEDLINE ✓</p> <p>Science Direct</p> <p>CINAHL ✓</p> <p>Cochrane Library ✓</p> <p>HMIC ✓</p>	<p>PsycINFO</p> <p>EMBASE ✓</p> <p>SIGLE</p> <p>British Nursing Index ✓</p> <p>Health Technology Assessment ✓</p>

<i>Specialist web sites / portals for Part C</i>	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
<i>Hand searching journals (2008 only)</i>	American Journal of Infection Control, British Journal of Infection Control, BMJ, Infection Control and Hospital Epidemiology, Journal of Hospital Infection
ii) Selection criteria for inclusion of studies	
<i>Sample</i>	All health and social care workers.
<i>Outcome measure(s)</i>	Bacterial count on hands following intervention.
<i>Other inclusion criteria</i>	N/A
<i>Language Limitations</i>	English language only.

iii) Quality assessment	
<i>Study quality assessment</i>	
<i>Part A (1966 – 2004)</i>	Identified articles were reviewed according to Roe’s model. Guidance documents, however, were unable to be subjected to all such criteria.
<i>Part B (1966 – 2004) and Part C (2007-2008)</i>	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.
<i>Data collation and analysis</i>	Qualitative analysis of data performed on studies uncovered was undertaken using a case study approach. Guidance documents reviewed for any relevant commentary.

RESULTS

Part A (1966 – 2004)

On review of the literature, a considerable amount of research has been uncovered which considers the effect of nail hygiene on general hand hygiene, including the maintenance of nails and the wearing of nail polish.

At the centre of this literature are the guidelines both from Boyce & Pittet (2002) in conjunction with the Infection Control Practitioners Advisory Committee (CDC) and from the Association for Professionals in Infection Control and Epidemiology (APIC) on handwashing and hand antisepsis in health care settings, published by Larson in 1995. These guidelines both make reference to the work of McGinley et al. (1988) who suggested that nails are best kept short as the majority of flora on the hands is found under the nails. This informed some work by Larson in 1989 which recommended that particular attention be paid to cleaning underneath nails.

For the evidence, keeping nails short would, therefore, appear to decrease the likelihood of microorganisms harbouring beneath the nails. Furthermore, Larson (1995) highlights the fact that long nails may cause gloves to tear.

Although cleaning beneath the nails is recommended, Ward's (2000) review of handwashing facilities in the clinical area, underlines the fact that nail brushes should not be used to clean under nails. This review does not take into account the cleaning of nails during the surgical scrub technique. It should be noted, however, that brushing can cause minor abrasions which can then pose as a port entry for microorganisms. This view is corroborated by the BMA (1989), Larson (1995) and Kerr (1998).

Several studies have considered the wearing of nail polish and its effect on hand hygiene. According to Baumgardner et al (1993), nail polish on natural nails appears to have no detrimental influence if nails are short. However, Boyce & Pittet (2002) highlight Wynd's (1994) evidence to suggest that chipped polish may harbour greater numbers of microorganisms than polish which is freshly applied. If nail polish is worn, clear polish would be best, according to the 1995 APIC guidelines, as dark colours may obscure the subungal space making it more difficult to clean.

	<p>With the increase in popularity in recent years of artificial nails, Pottinger et al (1989) conducted research to assess the potential for contamination of such nails. Their findings indicated that artificial nails increase the microbial load on nails. Consequently, the Association of Perioperative Registered Nurses (AORN), among others, recommends that artificial nails should not be worn by theatre personnel. Indeed, staff wearing artificial nails have been epidemiologically implicated in a number of outbreaks of infection, primarily caused by gram negative bacilli (Passaro et al., 1997, Foca et al., 2000, Parry et al., 2001).</p> <p>Although key studies have addressed the effect on microbial load of nail length, nail polish and artificial nails, it is important to consider the possibility that the length of nails, the wearing of nail polish and/or the donning of artificial nails could lead to less rigorous handwashing which would compromise this infection control measure.</p>
<p>Part B (2004 – 2006)</p>	<p>The original literature review covered a considerable amount of published research concerned with the effect of nails on general hand hygiene and included maintenance of nails and wearing of artificial nails and polish. This review aims to address any additional information or guidance, which has been published in the intervening period to determine if changes to guidance in the model policy are required.</p> <p>The literature search using the described strategies identified only one paper within the period under review, which was specifically concerned with nails and hand hygiene. This paper (Gupta <i>et al.</i>, 2004), describes an outbreak of Extended-Spectrum Beta-Lactamase-Producing <i>Klebsiella Pneumoniae</i> in a neonatal intensive care unit in the USA, which was traced to a healthcare worker (HCW), who was found to be harbouring the organism under artificial nails. Based on the results of this investigation, the authors recommended that short well-groomed natural nails should be mandatory for HCWs. This advice has been reiterated in the recently available WHO guidelines on Hand Hygiene (WHO, 2006), which are currently available as an advanced draft for consultation, which state that artificial nails should not be worn and that natural nails should be kept short.</p> <p>Therefore there are no changes recommended to the Hand Hygiene policy associated with nails and nail care as a result of this annual review.</p>

<p>Part C (2007-2008)</p>	<p>This review aims to identify, review and critique any scientific studies or guidance, which have been published in the intervening period since the last literature review, to determine if changes to guidance are required.</p> <p>In practice, there have been few relevant publications. The epic2 guidelines set out standards pertaining to nails and hand hygiene practices as follows:</p> <p>* Fingernails should be kept short, clean and free from nail polish. False nails must not be worn by clinical staff.</p> <p><i>Gordin et al. (2007)</i>, show the relevance of these guidelines when they describe a cluster of hemodialysis-related bacteremias linked to artificial nails. A cluster of 5 haemodialysis patients who dialysed via tunnelled catheters developed gram-negative bacteraemias. A nurse used an artificial fingernail to open a vial of heparin and make up a bag of saline that was used throughout the day to flush dialysis catheters. The <i>S. marcescens</i> isolated from the artificial fingernail and patients were identical on the basis of 2 typing procedures.</p>
<p>CONCLUSIONS</p>	
<p>Part A (1966 – 2004)</p>	<p>Evidence would suggest that nails harbour the majority of hand microorganisms and, therefore, require particular attention when cleaning.</p> <p>Short nails harbour fewer organisms, are easier to clean and are less likely to tear gloves.</p> <p>Nail brushes are not recommended as they can cause abrasions, leaving the potential for infection.</p> <p>Fresh nail polish does not appear to increase microbial load. However, chipped polish should be removed as this can harbour increased numbers of microorganisms.</p> <p>Clear polish would be best as dark colours can make cleaning difficult.</p> <p>Artificial nails appear to increase microbial load.</p> <p>Artificial nails, long nails and wearing nail polish may lead to less rigorous handwashing.</p>
<p>Part B (2004 – 2006)</p>	<p>There are limited additional publications produced within the period of this annual review of the model policies. The only study, which has been published, further strengthens the case against wearing of artificial nails by HCWs and that nails should be well groomed and short.</p>

<i>Part C (2007-2008)</i>	No further new evidence exists on nails/nail care and hand hygiene, but there is further strengthening of evidence that artificial nails must not be worn when providing clinical care.
RECOMMENDATIONS <i>Part A (1966 – 2004)</i>	Health and social care workers should pay particular attention to cleaning their nails when washing their hands (by utilising the steps as described in the review relating to how hands should be decontaminated). Nails should be kept short to avoid harbouring of microorganisms. If worn, nail polish should be clear to avoid obscuring of the subungual space. Nail brushes are not recommended for use as they may increase the risk of infection. (This does not apply when undertaking a surgical scrub technique.) Artificial nails should not be worn.
<i>Part B (2004 – 2006)</i>	No change to present guidance recommended in literature review available 10/08/05.
<i>Part C (2007-2008)</i>	As a result of the literature review for Part C, nothing additional needs to be added to Infection Prevention Model Policy/Procedure 2 (version1).
PRACTICAL APPLICATION	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.
RESOURCE IMPLICATIONS	As per current policies. All resources required for dealing with hand hygiene should already be in place.
KEY REFERENCES	
<i>Part A (1966 – 2004)</i>	Ayliffe GAJ (1992), Efficacy of handwashing and skin disinfection. Current Opinion in Infectious Diseases, 5, 4: 542-6, 603. Ayrshire & Arran NHS Board Control of Infection Manual, 4th Edition.

	<p>Baumgardner CA, Maragos CS, Larson EL (1993) Effects of nail polish on microbial growth of fingernails: dispelling sacred cows. <i>AORN</i>, 58: 84-8.</p> <p>Boyce JM & Pittet D. (2002) Guideline for hand hygiene in healthcare settings. Recommendations of the Healthcare Infection Control Practitioners Advisory Committee and the ICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. <i>MMWR</i>, 51(RR16): 1-44.</p> <p>Editorials (1999) Handwashing – a modest measure with big effects. <i>British Medical Journal</i>, 318: 686.</p> <p>Ferigold (1997) <i>In Cutaneous Infection and Therapy</i>, p.15-25.</p> <p>Garner JS & Favero MS (1985) CDC guideline for handwashing and hospital environmental control. <i>Infection Control</i>, 7: 23 1-43.</p> <p>Gould D (1992), Hygienic hand decontamination. <i>Nursing Standard</i>, 6, 32: 33-36.</p> <p>Gould D (1994), The significance of hand-drying in the prevention of infection. <i>Nursing Times</i>, 90, 47: 33-5.</p> <p>Gould D (1994a), Nurses' hand decontamination practice: results of a local study. <i>Journal of Hospital Infection</i>, 28, 15: 30.</p> <p>Gould D. (1997b), Giving infection control a big hand. <i>Community Nursing Notes</i>, 15 (1), 3-6.</p> <p>Heenan ALJ (1996), Handwashing Solutions. <i>Professional Nurse</i>, 11, 9: 615-22.</p> <p>Hoffman PN, Cooke EM, McCarville MR, Emmerson AM (1985), Micro-organisms isolated from skin under wedding rings worn by hospital staff, <i>British Medical Journal</i>, 290, 206-207.</p> <p>Hoffman P & Wilson J (1995), Hands, hygiene and hospital. <i>PHLS Microbiology Digest</i>, 11, 4: 211-6.</p> <p>Horton R (1995) Handwashing: the fundamental infection control principle. <i>British Journal of Nursing</i>, 4, 8: 926-933.</p> <p>Infection Control Nurses Association (ICNA) (1998), Guidelines for hand hygiene, ICNA/Deb Ltd, West Lothian.</p> <p>Jacobson G, Thiele JE, McCune JH, Farrell LD (1985), Handwashing: ring-wearing and number of microorganisms. <i>Nurse Researcher</i>, 34: 186-8.</p> <p>Kerr J (1998), Handwashing. <i>Nursing Standard</i>, 12, 51: 35-42.</p> <p>Kesavan S, Barodawala S, Mulley GP (1998) Now wash your hands? A survey of hospital handwashing facilities. <i>Journal of Hospital Infection</i>, 40, 4: 291-3.</p>
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	<p>Larson E et al. (1998), Changes in bacterial flora associated with skin damage on hands of health care personnel. <i>American Journal of Infection Control</i>, 26, 5: 513-521.</p> <p>Larson EL (1981) Persistent carriage of gram-negative bacteria on hands. <i>American Journal of Infection Control</i>, 9, 2: 112-9.</p> <p>Larson EL (1988), A causal link between handwashing and risk of infection. <i>Infection Control Hospital Epidemiology</i>, 9, 1: 28-36.</p> <p>Larson EL, Norton Hughes CA, Pyrak JD, Sparks SM, Cagatay EU, Bartkus JM (1998), Changes in bacterial flora associated with skin damage on hands of health care personnel. <i>American Journal Infection Control</i>, 26: 513-21.</p> <p>Larson, E. (1995), APIC guideline for handwashing and hand antisepsis in health care settings, <i>American Journal of Infection Control</i>, 23, 4, 251-269.</p> <p>Marples RR & Towers AG. (1979), A laboratory model for the investigation of contact transfer of microorganisms. <i>Journal of Hygiene (London)</i>, 82: 237-48.</p> <p>McGinley KJ, Larson EL, Leyden JJ (1988) Composition and density of microflora in the subungual space of the hand. <i>Journal of Clinical Microbiology</i>, 26: 950-3.</p> <p>NHS Greater Glasgow, Infection Control Committee (2005), <i>Prevention and Control of Infection Manual</i>.</p> <p>Pittet D, Dharam S, Touveneau S et al. (1999), Bacterial contamination of the hands of hospital staff during routine patient care. <i>Archives Internal Medicine</i>, 159: 821-826.</p> <p>Pottinger J, Burns S, Manske C (1989), Bacterial carriage by artificial versus natural nails. <i>American Journal of Infection Control</i>, 17: 340-4.</p> <p>Salisbury DM, Hutfilz P, Treen LM, Bollin GE, Gautam S (1997) The effect of rings on microbial load of health care workers' hands. <i>American Journal of Infection Control</i>, 25: 24-7.</p> <p>Semmelweis IP. (1861) Die aetiologie, der begriff und die prophylaxis des kindbettfiebers. <i>Pest, Wien und Leipzig: CA Hartleben's Verlags-Expedition</i>, 325.</p> <p>Steere AC & Mallison GF. (1975) Handwashing practices for the prevention of nosocomial infections. <i>Annals Internal Medicine</i>, 83: 683-90.</p> <p>Ward D (2000), Handwashing facilities in the clinical area. <i>British Journal of Nursing</i>, 9, 2: 82-86.</p>
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	<p>Wilson J (2001), Infection control in clinical practice. 2nd Edition, Bailliere Tindall, Edinburgh.</p> <p>Yale New Haven Hospital – Infection Control Manual (2002), Yale New haven Hospital, New Haven, Connecticut, USA</p> <p>World Health Organisation (2005), WHO Guidelines on Hand Hygiene in Health Care (Advance Draft), World Alliance for Patient Safety, WHO, Geneva, Switzerland.</p>
Part B (2004 - 2006)	<p>Gupta, A. Della-Latta, P. Todd, B. San Gabriel, P. Haas, J. Wu, F. Rubenstein, D. & Saiman, L. (2004) Outbreak of extended-spectrum beta-lactamase-producing Klebsiella pneumoniae in a neonatal intensive care unit linked to artificial nails Infection Control & Hospital Epidemiology. 25(3) 2 10-5, 2004 Mar.</p> <p>World Health Organisation, (2006), WHO Guidelines on Hand Hygiene in Health Care (Advanced Draft), World Alliance for Patient Safety, WHO, Geneva</p>
Part C (2007-2008)	<p>Gordin, F. M., Schultz, M. E., Huber, R., Zubairi, S., Stock, F., and Kariyil, J. (2007) A cluster of hemodialysis-related bacteremia linked to artificial fingernails. <i>Infection Control & Hospital Epidemiology</i>, 28(6), 743-744.</p> <p>Pratt, R.J., Pellowe, C.M., Wilson, J.A., Loveday, H.P., Jones, S.R., McDougall, C., and Wilcox, M.H. (2007) epic2: national evidence-based guidelines for preventing healthcare-associated infections in NHS hospitals in England. <i>Journal of Hospital Infection</i>, 65(Suppl).</p>
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DATE ISSUED	6 th October 2009
REVIEW DATE	October 2012

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

REVIEW OF LITERATURE

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

<p>Strategy key words for Part C</p> <p><i>From Health Protection Scotland literature review [2007] Supplemented with terms from SURE proposal to HTA</i></p>	<p>Hand hygiene, hand washing, handwashing, hand sanitizing, hand cleansing, hand decontamination, Hand\$1 adj2 wash\$.ti,ab Hand\$1 adj2 clean\$.ti,ab Hand\$1 adj2 decontamin\$.ti,ab Hand\$1 adj2 saniti\$.ti,ab Hand\$1 adj2 antiseptis\$.ti,ab Hand\$1 adj2 disinfect\$.ti,ab Exp hand/ Exp sterilization/ Cross infection Nosocomial Healthcare associated infection Health-care associated infection Healthcare acquired infection Hospital acquired infection Compliance,Adherence,Attitudes Perceptions,Professional compliance Health behaviour , health behaviour Attitude , attitude of health personnel Health knowledge, attitudes, practice/ Comply\$4.ti,ab Complies\$41.ti,ab Adher\$.ti,ab, obey\$.ti,ab, conform\$.ti,ab, follow\$3.ti,ab , fulfil\$.ti,ab observ\$.ti,ab abide\$.ti,ab Barrier\$.ti,ab obstacle\$.ti,ab hurdle\$.ti,ab obstruct\$.ti,ab facilitate\$.ti,ab enable\$.ti,ab assist\$.ti, ab help\$.ti,ab promot\$3.ti,ab encourage\$1.ti,ab encouraging.ti,ab attitude\$1.ti,ab practice\$.ti,ab practising.ti,ab practicing.ti,ab Knowledge\$.ti,ab difficult\$.ti,ab impede\$.ti,ab hinder\$.ti,ab hindrance\$.ti,ab Care, care equipment, environment, contaminated contact , delivery of health care, exp Equipment and supplies, hospital/ Health facility environment, hospital, healthcare, occupational transmission, focal infection, cross infection/ Exp Hospitals/ Occupational diseases/ Infection/ focal infection/ infection control/ Bacteri\$, virus\$, equipment contamination. Handwashing solution, hand washing solution, procedure, soaps, chlohexidine, air dryer, paper towel\$, hand towel\$, soap, liquid soap, soap solution, alcohol rub, alcohol solution, alcohol, alcohol\$ adj2 handrub\$4.ti,ab Surgical scrub\$.ti,ab Ring\$, jewellery, nail\$ nail polish, nails/ Cosmetics,</p>	
<p>Electronic databases for Part C <i>(tick as appropriate)</i></p>	<p>MEDLINE <input checked="" type="checkbox"/></p>	<p>PsycINFO</p>
	<p>Science Direct</p>	<p>EMBASE <input checked="" type="checkbox"/></p>
	<p>CINAHL <input checked="" type="checkbox"/></p>	<p>SIGLE</p>
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Specialist web sites / portals for Part C	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
Hand searching journals (2008 only)	American Journal of Infection Control, British Journal of Infection Control, BMJ, Infection Control and Hospital Epidemiology, Journal of Hospital Infection
ii) Selection criteria for inclusion of studies	
Sample	All health and social care workers.
Outcome measure(s)	Bacterial count on hands following intervention.
Other inclusion criteria	N/A
Language Limitations	English language only.
iii) Quality assessment	
Study quality assessment	
Part A (1966 – 2004)	Identified articles were reviewed according to Roe’s model. Guidance documents, however, were unable to be subjected to all such criteria.
Part B (2004 – 2006) and Part C (2007-2008)	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.
Data collation and analysis	Qualitative analysis of data performed on studies uncovered was undertaken using a case study approach. Guidance documents reviewed for any relevant commentary.

RESULTS

Part A (1966 – 2004)

This literature review has uncovered some studies which provide data to support the need for hand hygiene when undertaking certain clinical procedures. However, guidance appears to be based largely on common sense and best practice, identifying times when hands are most likely to be significantly contaminated and, therefore, need to be cleaned.

The most recent and most comprehensive guidance in this area, published by Boyce & Pittet (2002), outlines a series of recommendations which indicate when handwashing/hand antisepsis should be undertaken while acknowledging the lack of data available in relation to those health care activities most likely to result in transmission of microorganisms (Sanderson & Weessler, 1992; Pittet et al, 1993). The recommendations are detailed below:

When hands are visibly dirty or contaminated with proteinaceous material or are visibly soiled with blood or other body fluids, wash hands with either a non-antimicrobial soap and water or an antimicrobial soap and water.

If hands are not visibly soiled, use an alcohol based hand rub for routinely decontaminating hands in all other clinical situations described in items 1C-J (IA). Alternately, wash hands with an antimicrobial soap and water in all descriptions described in 1C-J (IB).

Decontaminate hands before having direct contact with patients.

Decontaminate hands before donning sterile gloves when inserting a central intravascular catheter.

Decontaminate hands before inserting indwelling urinary catheters, peripheral vascular catheters, other invasive devices that do not require a surgical procedure.

	<p>Decontaminate hands after contact with a patient's intact skin (e.g. when taking a pulse or blood pressure, and lifting a patient).</p> <p>Decontaminate hands after contact with body fluids or excretions, mucous membranes, non-intact skin and wound dressings if hands are not visibly soiled.</p> <p>Decontaminate hands after contact with inanimate objects (including medical patient care equipment) in the immediate vicinity of the patient.</p> <p>Decontaminate hands after removing gloves.</p> <p>Before eating and after using a toilet, wash hands with a non-antimicrobial soap and water or an antimicrobial soap and water.</p> <p>Antimicrobial impregnated wipes may need to be considered if there is an interruption to the water supply; however, it should be noted that they are not as effective as alcohol based rubs or washing hands with an antimicrobial soap and water for reducing bacterial counts on hands of healthcare workers (HCWs) and, therefore, should not be considered as a substitute for using an alcohol based hand rub or antimicrobial soap.</p> <p>Wash hands with non-antimicrobial soap and water or with antimicrobial soap and water if exposure to <i>Bacillus anthracis</i> is suspected or proven. The physical action of washing and rinsing hands under such circumstances is recommended because alcohols, chlorexidine, iodophors and other agents have poor activity against bacterial spores, protozoan oocysts, and certain non-enveloped viruses. Recently, it has been considered that <i>Clostridium difficile</i> may also fall into this category. This situation will have to be monitored, specifically, within the healthcare setting.</p> <p>The recommendations outlined above are generally consistent with other policies available in the UK. Further documentation and literature is available in relation to the appropriateness and application of hand hygiene in healthcare settings, however, the detail of this is limited. CDC recommendations (1998) specify the need to wash hands after contact with blood, other body fluids containing visible blood, as well as semen, vaginal secretions, CSF, synovial fluid, pleural fluid, peritoneal fluid, pericardial fluid or amniotic fluid to reduce the potential for the transmission of blood borne viruses. These recommendations were put in place as evidence indicates that these fluids could pose a risk of transmission of infection if hands were not decontaminated.</p>
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	<p>Other studies also suggest antiseptic agents/soap should also be available at sinks for use following handwashing for those staff involved in invasive procedures, dealing with infectious patients or body fluids (Heenan, 1996).</p> <p>It has been highlighted in the literature that it is especially important to decontaminate hands when patients or staff have dermatological conditions. These individuals can often have higher rates of skin colonization with organisms such as <i>Staphylococcus aureus</i> and as such may be instrumental in passing on organisms. In addition, they can be more susceptible to picking up infections and again be a source of contamination.</p> <p>Evidence to support the recommendations highlighted by this review is at present sparse. Limited studies have considered in detail individual procedures and the risk of contamination involved. Until such time as this becomes available, guidance will have to rely on the general principles of infection control and limited evidence to drive best practice.</p>
<p>Part B (2004-2006)</p>	<p>The original literature review covered a considerable amount of published research concerned with when hand hygiene should be performed. 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.</p> <p>An interesting study has recently been published regarding the possible links between patient's hands and HAI (Banfield & Kerr, 2005). This is an area which has not previously been studied extensively, but it is clear that raising public awareness in hand hygiene generally, as in the recently launched Hand Hygiene Campaign, (HPS, 2006), will help raise patient awareness of their possible part in the 'chain of infection'.</p> <p>The importance of the performance of hand hygiene after entering case notes has also been highlighted in a recent publication (Panhotra et al., 2005), which looked at levels of contamination found on patient files in Intensive Care Units (ICUs). The results showed that ~85% of patients' case notes in ICUs were contaminated with pathogenic and potentially pathogenic bacteria, including MRSA. The contamination on patients' case notes was found to be lower in surgical wards, however it still represented ~25% of patient files which were contaminated with potentially pathogenic organisms. This stresses the importance of the requirement to perform hand hygiene after contact with inanimate objects around the patient / client. It may be useful to specifically mention patient files and case notes as an example to provide further clarification on the guidance</p>

<p>Part C (2007 – 2008)</p>	<p>This review aims to identify, review and critique any scientific studies or guidance, which have been published in the intervening period since the last literature review, to determine if changes to guidance are required.</p> <p>The epic2 guidelines (<i>Pratt et al., 2007</i>) suggest that in deciding when it is necessary to decontaminate hands prior to patient contact, four key factors need to be considered: the level of the anticipated contact with patients or objects; the extent of the contamination that may occur with that contact; the patient care activities being performed and the susceptibility of the patient. They state that hands must be decontaminated before every episode of patient care that involves direct contact with patients' skin, their food, invasive devices or dressings. Also that current expert opinion recommends that hands need to be decontaminated after completing an episode of patient care and following the removal of gloves to minimize cross contamination of the environment.</p> <p>An observational study by <i>Dedrick et al. (2007)</i>, highlights the problems of compliance of healthcare workers (HCWs) with hand hygiene (HH) practices. The objective of the study was to identify characteristics of encounters between HCWs and patients that correlated with HH adherence amongst HCWs. 767 patient encounters were observed. In all instances there was HCW contact with either the patient or the patients' environment. Adherence with HH practices occurred in 45% of observed encounters. Adherence was correlated with duration of encounter, and adherence to HH practices was lowest after brief patient encounter (< 2 minutes). In multivariate analyses, longer encounter duration, contact precautions status, patient contact, and nursing occupation were independently associated with adherence to HH recommendations. The study identified that alcohol-based rubs were underused and suggested that better use of these products could possibly address compliance issues after short duration patient or environment encounters.</p> <p><i>Hayden et al. (2008)</i>, carried out a structured observational study the objective being to estimate the level of hand or glove contamination with vancomycin-resistant enterococci (VRE) amongst healthcare workers (HCWs) who touch colonized patients and/or the colonised patients' environment during routine care. Samples were obtained from 22 patients colonized with VRE, and from specific sites within their environment. 17% (+/- 12%) of environmental samples grew VRE. The PFGE patterns of VRE isolates from patients matched those from the environment in all episodes. 44% of HCW's touched only the patient environment, whilst 56% touched both the patient and the patient's environment. No HCW touched only the patient. Culture samples were obtained from HCWs' hands and gloves before and after care. Of 103 HCWs whose hands were negative for VRE when they entered</p>
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the patient's room, 52% contaminated their hands or gloves after touching the environment only, and 70% contaminated their hands or gloves after touching the patient and their environment. 5% of those who wore gloves for contact had hands that were contaminated with VRE, emphasizing the need for HH after glove removal.. The authors highlight the need to view touching the environment of a patient colonized with VRE as an activity that poses a high risk for hand contamination.

Gould et al. (2008) carried out a systematic review of interventions that improve hand hygiene (HH) compliance in patient care. They identified studies which investigated the effectiveness of interventions to increase HH compliance in the short term and longer term, and tried to determine their success in terms of HH compliance and subsequent effects on rates of healthcare-associated infections. Of the 48 studies and 1 thesis identified, only 2 studies met the stringent inclusion criteria. Studies remain small, poorly controlled and follow up data collection is stopped too soon to establish the impact of interventions in the longer term Designs were found to be insufficiently robust to attribute any observed changes to the interventions. The review authors discuss how investigators might design future studies to better address the unanswered questions.

The low compliance of HCWs with hand hygiene is an acknowledged problem. Two standards from the epic2 guidelines (*Pratt et al., 2007*) state that hand hygiene resources and individual practice should be audited at regular intervals and the results fed back to HCWs, and that education and training in risk assessment, effective hand hygiene and glove use should form part of all HCWs annual updating. Improving staff compliance with hand hygiene measures remains a major issue for healthcare providers. One group used a novel technology to improve compliance (*Swoboda et al., 2007*). However, *Sax et al. (2007)* used a user-centred design approach incorporating strategies of human factors engineering, cognitive behaviour science and elements of social marketing which has resulted in a concept for recognising when hand hygiene should be carried out, as well as training, performance assessment and reporting of these activities. “**My five moments for hand hygiene**” describes the fundamental points for HCWs when hand hygiene is required to effectively interrupt microbial transmission- (1) before patient contact (2) before an aseptic task (3) after body fluid exposure (4) after patient contact and (5) after contacts with patient surroundings. It proposes a unified view which provides a solid basis to understand, teach, monitor and report hand hygiene practices.

CONCLUSIONS	
Part A (1966 – 2004)	<p>Handwashing/ hand antiseptics should be undertaken if health or social care workers' hands come into contact with blood or other body fluids.</p> <p>Handwashing/ antiseptics should be undertaken if health or social care workers are involved in any of the procedures detailed overleaf.</p> <p>Handwashing/antiseptics should be undertaken if patients are highly susceptible to infection</p> <p>Handwashing/ antiseptics should be undertaken if the health or social care worker suffers from dermatological problems to minimise risk both to him/herself and to highly susceptible patients.</p>
Part B (2004 – 2006)	<p>Patient's case notes or files may be a source of contamination and therefore, it may be useful to add this as an example of an inanimate object around the patient / client, requiring hand hygiene after contact with.</p> <p>Patient hand hygiene may be a factor in HAI and patient awareness of the importance of hand hygiene should be raised (i.e. by the use of public campaigns such as the recently launched Hand hygiene Campaign (HPS, 2006)).</p>
Part C (2007 – 2008)	<p>The epic2 guidelines set out key factors to consider and standards to adhere to when deciding when to decontaminate hands.</p> <p>The compliance of healthcare workers with hand hygiene standards remains a problem area.</p> <p>Healthcare workers are failing to recognize short duration patient contact or contact with the patient's environment as key times to apply hand hygiene measures.</p> <p>Alcohol-based hand rubs are underused.</p> <p>"My 5 moments for hand hygiene" describes the fundamental points for healthcare workers to decontaminate their hands and effectively interrupt microbial transmission.</p> <p>This framework can provide a unified view for understanding, teaching, monitoring and reporting hand hygiene practices.</p> <p>Hand hygiene practices should be monitored and fed back to healthcare workers.</p>
<u>RECOMMENDATIONS</u>	
Part A (1966 – 2004)	<p>Handwashing/antiseptics should be carried out under the conditions detailed earlier.</p>

<i>Part B</i> <i>(2004 – 2006)</i>	No change to present guidance recommendations in literature review available 11/08/05, although perhaps may be helpful to add this example to the list of when hand hygiene should be performed e.g. after updating patient files or casenotes.
<i>Part C</i> <i>(2007-2008)</i>	As a result of the literature review for Part C, nothing additional needs to be added to Infection Prevention Model Policy/Procedure 2 (version1).
PRACTICAL APPLICATION	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.
RESOURCE IMPLICATIONS	As per current policies. All resources required for dealing with hand hygiene should already be in place.

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<p>REVIEW STATUS</p>	<p>Complete</p>
<p>DATE ISSUED</p>	<p>6th October 2009</p>
<p>REVIEW DATE</p>	<p>October 2012</p>

Infection Prevention Model Policy and Procedure
Hand Hygiene as an Infection Control Measure – why?

REVIEW OF LITERATURE

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

<p>Strategy key words for Part C</p> <p><i>From Health Protection Scotland literature review [2007] Supplemented with terms from SURE proposal to HTA</i></p>	<p>Hand hygiene, hand washing, handwashing, hand sanitizing, hand cleansing, hand decontamination, Hand\$1 adj2 wash\$.ti,ab Hand\$1 adj2 clean\$.ti,ab Hand\$1 adj2 decontamin\$.ti,ab Hand\$1 adj2 saniti\$.ti,ab Hand\$1 adj2 antiseptis\$.ti,ab Hand\$1 adj2 disinfect\$.ti,ab Exp hand/ Exp sterilization/ Cross infection Nosocomial Healthcare associated infection Health-care associated infection Healthcare acquired infection Hospital acquired infection Compliance,Adherence,Attitudes Perceptions,Professional compliance Health behaviour , health behaviour Attitude , attitude of health personnel Health knowledge, attitudes, practice/ Comply\$4.ti,ab Complies\$41.ti,ab Adher\$.ti,ab, obey\$.ti,ab, conform\$.ti,ab, follow\$3.ti,ab , fulfil\$.ti,ab observ\$.ti,ab abide\$.ti,ab Barrier\$.ti,ab obstacle\$.ti,ab hurdle\$.ti,ab obstruct\$.ti,ab facilitate\$.ti,ab enable\$.ti,ab assist\$.ti, ab help\$.ti,ab promot\$3.ti,ab encourage\$1.ti,ab encouraging.ti,ab attitude\$1.ti,ab practice\$.ti,ab practising.ti,ab practicing.ti,ab Knowledge\$.ti,ab difficult\$.ti,ab impede\$.ti,ab hinder\$.ti,ab hindrance\$.ti,ab Care, care equipment, environment, contaminated contact , delivery of health care, exp Equipment and supplies, hospital/ Health facility environment, hospital, healthcare, occupational transmission, focal infection, cross infection/ Exp Hospitals/ Occupational diseases/ Infection/ focal infection/ infection control/ Bacteri\$, virus\$, equipment contamination. Handwashing solution, hand washing solution, procedure, soaps, chlohexidine, air dryer, paper towel\$, hand towel\$, soap, liquid soap, soap solution, alcohol rub, alcohol solution, alcohol, alcohol\$ adj2 handrub\$4.ti,ab Surgical scrub\$.ti,ab Ring\$, jewellery, nail\$ nail polish, nails/ Cosmetics,</p>		
<p>Electronic databases for Part C</p> <p><i>(tick as appropriate)</i></p>	<p>MEDLINE</p>	<p>√</p>	<p>PsycINFO</p>
	<p>Science Direct</p>	<p></p>	<p>EMBASE</p>
	<p>CINAHL</p>	<p>√</p>	<p>SIGLE</p>
	<p>Cochrane Library</p>	<p>√</p>	<p>HMIC</p>
	<p>British Nursing Index</p>	<p>√</p>	<p>Health technology Assessment</p>

<i>Specialist web sites / portals for Part C</i>	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	
<i>Hand searching journals (2008 only)</i>	American Journal of Infection Control, British Journal of Infection Control, BMJ, Infection Control and Hospital Epidemiology, Journal of Hospital Infection	
ii) Selection criteria for inclusion of studies		
<i>Sample</i>	All health and social care workers.	
<i>Outcome measure(s)</i>	Effectiveness of hand hygiene as a measure for preventing the spread of infection.	
<i>Other inclusion criteria</i>	N/A	
<i>Language Limitations</i>	English language only	
iii) Quality assessment		
Study Quality Assessment		
<i>Part A (1966 – 2004)</i>	Identified articles were reviewed according to Roe’s model. Guidance documents, however, were unable to be subjected to all such criteria.	
<i>Part B (2004 – 2006) and Part C (2007-2008)</i>	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.	
<i>Data collation and analysis</i>	Qualitative analysis of data performed on studies uncovered was undertaken using a case study approach. Guidance documents reviewed for any relevant commentary.	

<p><u>RESULTS</u></p> <p><i>Part A (1966 – 2004)</i></p>	<p>Almost one hundred and fifty years ago, Semmelweis (1861) insisted doctors washed their hands before delivering babies. This action was considered instrumental in the subsequent reduction of maternal mortality due to streptococcal puerperal sepsis from 22% to 3%. Today, handwashing is recognised as the most effective means of preventing cross infection (Boyce & Pittet, 2002).</p> <p>The importance of hand hygiene in the prevention of the spread of infection was made plain by Gould’s (1997b) statement that hands used to ‘care, treat and comfort may potentially become instruments of harm’ and this statement is supported by Larson’s (1995) guidelines for handwashing and hand antisepsis in health care settings produced for the Association for Professionals in Infection Control and Epidemiology (APIC). This guidance indicates that handwashing produces a significant reduction in the carriage of potential pathogens on hands (Steere & Mallison, 1975; Garner & Favero, 1986).</p>
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	<p>Furthermore, the Yale New Haven Hospital Infection Control Manual highlights, in particular, its effectiveness in preventing the spread of nosocomial infections. Indeed, many studies and guidance papers have confirmed that decontamination of healthcare workers' hands between patients can reduce hospital associated infection (HAI) rates. No specific figure, however, is available within the literature as many of the studies conducted are multi modal in nature and fail to take into account the potential impact of other factors involved in healthcare which may have a role to play. The terms hand hygiene and hand decontamination are used interchangeably in research in this field to describe the process by which handwashing or hand antisepsis is achieved to remove microorganisms from the skin:</p> <p>Resident microorganisms are generally harmless and form part of normal skin flora. They are not readily transferred to other people or surfaces. Infection may sometimes result in patients undergoing surgery or other invasive procedures or those who are immunocompromised.</p> <p>Transient microorganisms include different potentially pathogenic microorganisms, primarily bacteria. Hands acquire microorganisms from other sites on an individual's body, from other people and from the environment. Transient organisms do not normally survive for long periods on individuals' hands and so either die or are passed to objects or others through touch contact. The ease with which these organisms can be passed to and from the hands makes them extremely efficient vectors for infection (AAHB Control of Infection Manual, 4th Edition).</p> <p>Most transient microorganisms are removed by washing with liquid soap and water. Resident microorganisms are largely left on the skin after washing with soap and water, but can be greatly reduced when using an antiseptic detergent wash and a surgical scrub technique. The agent used is dependent on the degree of antisepsis required.</p> <p>Despite the high profile of handwashing as an infection control measure, studies have shown healthcare workers frequently do not comply with guidance. Evidence indicates that compliance is sub-optimal, leaving patients and staff more susceptible to infection.</p> <p>Of those studies undertaken over the course of the 1990s, Dubbert (1990) found an average rate of compliance with intensive care units of 32%. Little improvement was seen towards the end of that decade when Pittet et al. (1999) undertook a large hospital wide survey and found a compliance rate of 36% within ICUs.</p>
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	<p>Wilson (2001) underlined several factors, including poor staffing levels, inadequate sinks and poor water temperature controls, as reasons which discourage handwashing. Skin irritation is also perceived to be a significant barrier to compliance with hand hygiene (Larson, 1995). However, further studies are required to determine the effect of individual factors on compliance as the majority of those conducted to date have been multi modal in nature and as a result have produced data which are difficult to interpret. A number of recent initiatives have been launched to address some of these issues and to improve compliance amongst healthcare staff, including the National Patient Safety Association's 'Clean Your Hands Campaign', the English Bulletin recommending hand gels at each bed, the NHS Scotland HAI Task Force Mandatory Training Programme, NHS Education Scotland's Cleanliness Champions Programme and the RCN and ICNA initiatives</p>
<p>Part B (2004 – 2006)</p>	<p>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.</p> <p>There were a number of scientific studies published within the review period which provided additional evidence to support the importance of hand hygiene (Gordin <i>et al.</i>, 2005, Johnson <i>et al.</i>, 2005, King, 2004, Rosenthal <i>et al.</i>, 2005). These studies were particularly concerned with the reduction of nosocomial infection rates following introduction of alcohol hand rub regimes into healthcare settings. In addition, some studies focussed on evaluation of actual microbiological contamination levels on the hands of healthcare workers (HCWs) before and after different hand hygiene techniques (Kac <i>et al.</i>, 2005). One study reported that achievement in reduction of rates of HAI, particularly in ICU settings is a multi-factorial process, of which hand hygiene forms only a part (Silvestri <i>et al.</i>, 2005).</p> <p>A number of observational studies published within the period of the review, demonstrated that rates of compliance with hand hygiene are still relatively low, despite introduction of alcohol hand rub, sufficient and accessible hand hygiene facilities, staff education etc (Chudleigh <i>et al.</i>, 2005, Creedon, 2005, Parry <i>et al.</i>, 2005, Pessoa-Silva <i>et al.</i>, 2004, van de Mortel & Murgu, 2006).</p>

	<p>Several recently published studies have therefore been concerned with methods of improving compliance; such as use of the 6- Sigma Process and performance feedback of hand hygiene (Eldridge et al., 2006, Kampf, 2004, MacDonald et al., 2004). Evaluation of the use of these methods all report a degree of success with increased compliance with hand hygiene demonstrated within the period of the reports. Therefore the introduction and use of improvement programmes to raise staff awareness and compliance with hand hygiene may be useful to support implementation of guidance.</p> <p>In this respect, there has been a recently launched Hand Hygiene Campaign (HPS, 2006) which is a media campaign, designed to raise public awareness of the importance of hand hygiene and also, a specific NHS campaign to raise awareness of hand hygiene within healthcare settings, which aims to target NHS Scotland staff, patients and visitors.</p>
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<p><i>Part C (2007 – 2008)</i></p>	<p>This review aims to identify, review and critique any scientific studies or guidance, which have been published in the intervening period since the last literature review, to determine if changes to guidance are required.</p> <p>An integrative review by <i>Beckman et al. (2008)</i> looking at the evidence on the relationship between hand hygiene interventions (HHIs) and the incidence of healthcare-associated infections (HCAIs) concluded that although the number of publications in this area was large, methodological issues with studies remained significant. The multiple interventions used and diverse factors related to the presence of HCAI's made it difficult or impossible to isolate the specific effects of hand hygiene or any other component of the interventions. The review demonstrates that the evidence linking HHI's and HCAI's is present, but is not well quantified and concludes that more robust analytical research designs are needed to obtain better evidence on which HHIs are associated with reductions in incidences of which HCAIs, in a variety of settings.</p> <p><i>Aiello et al. (2008)</i> carried out a meta-analysis on the effect of hand hygiene on infectious disease risk in the community setting. This meta-analysis was carried out to quantify the effect of hand-hygiene interventions in the community on rates of gastrointestinal and respiratory illnesses, and to identify the interventions which provide greatest efficacy. The researchers conclude that improvements in hand hygiene resulted in reductions in gastrointestinal illness of 31% and reductions in respiratory illness of 21%. The most beneficial intervention was hand hygiene education with the use of nonbacterial soap. Use of antibacterial soap showed little added benefit compared with the use of non-bacterial soap, and there was little evidence for an additional impact of new alcohol-based hand sanitizers. Results like these, may help in formulating consistent community based hand hygiene guidelines. However there would be a need to include microbiological assessments of the agents that may be associated with clinical symptoms so that agent-specific targeted hand hygiene practices can be evaluated.</p> <p>Literature reviewed in the <i>EPIC 2: National evidence-based guidelines for preventing healthcare-associated infections in NHS hospitals in England</i>, suggests that effective hand decontamination can reduce cross-transmission and cross-infection rates (<i>Pratt et al., 2007</i>). However, overall compliance with hand hygiene measures by healthcare workers remains low (<i>Bahal et al. 2007, Dedrick et al. 2007</i>). Bahal's observational study on ICU's and surgical wards in Birmingham and Sydney showed that , although remaining low, post-patient contact with hand hygiene measures was slightly better than pre-patient contact, and compliance after glove removal was very poor.</p>
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CONCLUSIONS	
<i>Part A (1966 – 2004)</i>	<p>Historically, hand hygiene has been an important measure in reducing the spread of infection.</p> <p>Handwashing is often referred to as the single most effective means of preventing the spread of infection.</p> <p>Handwashing can reduce the spread of nosocomial infections.</p> <p>Handwashing compliance has been recognised as sub-optimal.</p>
<i>Part B (2004 – 2006)</i>	<p>Scientific studies have shown a decrease in nosocomial infection rates following the introduction of alcohol hand rub regimes into healthcare facilities.</p> <p>Recently published scientific studies still show relatively low levels of compliance with hand hygiene.</p> <p>Details and evaluation of a number of improvement programmes have been reported, all of which demonstrated a resulting increased compliance with hand hygiene after introduction, e.g. use of performance feedback etc.</p> <p>Improvement programmes could be used effectively at local level to support implementation of guidance and improve compliance with hand hygiene.</p> <p>There has been a recently launched Hand Hygiene Campaign designed to raise the awareness of the importance of hand hygiene aimed at the general public and NHS Scotland staff, patients and visitors.</p>
<i>Part C (2007 – 2008)</i>	<p>Evidence linking hand hygiene interventions (HHIs) and healthcare-associated infections (HCAs) is present, but is not well quantified.</p> <p>More robust analytical research designs are needed to obtain better evidence on which HHIs are associated with reductions in incidences of which HCAs, in different settings.</p> <p>Hand hygiene interventions are beneficial in community settings.</p> <p>Overall compliance with hand hygiene measures by healthcare workers remains low.</p>
RECOMMENDATIONS	
<i>Part A (1966 – 2004)</i>	<p>All health and social care workers should adhere to hand hygiene policy.</p>

Part B (2004 - 2006)	No change to present guidance recommendations in literature review available 10/08/05.
Part C (2007 – 2008)	Nothing additional needs to be added to Infection Prevention Model Policy/Procedure 2 (version1) as a result of the literature review for Part C.
PRACTICAL APPLICATION	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.
RESOURCE IMPLICATIONS	As per current policies. All resources required for dealing with hand hygiene should already be in place.
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REVIEW STATUS	Complete
DATE ISSUED	6 th October 2009
REVIEW DATE	October 2012

REVIEW OF LITERATURE

TEAM UNDERTAKING REVIEW: Parts A and B – Health Protection Scotland. Part C – Welsh Healthcare Associated Infection Programme (WHAIP)	
CONTACT PERSON: Dawn Hill	
TOPIC: Use of alcohol hand rub/gel as a means of decontaminating hands.	
PRINCIPAL RESEARCH QUESTION/OBJECTIVE: To assess the evidence in relation to the effectiveness/appropriate application of alcohol hand rub/gel as a method for decontaminating hands.	
METHODOLOGY	
i) Search strategy for identification of studies	
<i>Period of publication</i>	Part A: 1966-2004
	Part B: 2004-2006
	Part C: 2007-2008

<p>Strategy key words for Part C</p> <p><i>From Health Protection Scotland literature review [2007]</i></p> <p><i>Supplemented with terms from SURE proposal to HTA</i></p>	<p>Hand hygiene, hand washing, handwashing, hand sanitizing, hand cleansing, hand decontamination, Hand\$1 adj2 wash\$.ti,ab Hand\$1 adj2 clean\$.ti,ab Hand\$1 adj2 decontamin\$.ti,ab Hand\$1 adj2 saniti\$.ti,ab Hand\$1 adj2 antiseptis\$.ti,ab Hand\$1 adj2 disinfect\$.ti,ab Exp hand/ Exp sterilization/ Cross infection Nosocomial Healthcare associated infection Health-care associated infection Healthcare acquired infection Hospital acquired infection Compliance,Adherence,Attitudes Perceptions,Professional compliance Health behaviour , health behaviour Attitude , attitude of health personnel Health knowledge, attitudes, practice/ Comply\$4.ti,ab Complies\$41.ti,ab Adher\$.ti,ab, obey\$.ti,ab, conform\$.ti,ab, follow\$3.ti,ab , fulfil\$.ti,ab observ\$.ti,ab abide\$.ti,ab Barrier\$.ti,ab obstacle\$.ti,ab hurdle\$.ti,ab obstruct\$.ti,ab facilitate\$.ti,ab enable\$.ti,ab assist\$.ti, ab help\$.ti,ab promot\$3.ti,ab encourage\$1.ti,ab encouraging.ti,ab attitude\$1.ti,ab practice\$.ti,ab practising.ti,ab practicing.ti,ab Knowledge\$.ti,ab difficult\$.ti,ab impede\$.ti,ab hinder\$.ti,ab hindrance\$.ti,ab Care, care equipment, environment, contaminated contact , delivery of health care, exp Equipment and supplies, hospital/ Health facility environment, hospital, healthcare, occupational transmission, focal infection, cross infection/ Exp Hospitals/ Occupational diseases/ Infection/ focal infection/ infection control/ Bacteri\$, virus\$, equipment contamination. Handwashing solution, hand washing solution, procedure, soaps, chlohexidine, air dryer, paper towel\$, hand towel\$, soap, liquid soap, soap solution, alcohol rub, alcohol solution, alcohol, alcohol\$ adj2 handrub\$4.ti,ab Surgical scrub\$.ti,ab Ring\$, jewellery, nail\$ nail polish, nails/ Cosmetics,</p>	
<p>Electronic databases for Part C</p> <p><i>(tick as appropriate)</i></p>	<p>MEDLINE ✓</p>	<p>PsycINFO</p>
	<p>Science Direct</p>	<p>EMBASE ✓</p>
	<p>CINAHL ✓</p>	<p>SIGLE</p>
	<p>Cochrane Library ✓</p>	<p>HMIC ✓</p>
	<p>British Nursing Index ✓</p>	<p>Health technology Assessment ✓</p>

<i>Specialist web sites / portals for Part C</i>	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
<i>Hand searching journals (2008 only)</i>	American Journal of Infection Control, British Journal of Infection Control, BMJ, Infection Control and Hospital Epidemiology, Journal of Hospital Infection
ii) Selection criteria for inclusion of studies	
<i>Sample</i>	All health and social care workers.
<i>Outcome measure(s)</i>	Effectiveness of intervention to reduce bacterial count on hands.
<i>Other inclusion criteria</i>	N/A
<i>Language Limitations</i>	English language only.

iii) Quality assessment	
<i>Study quality assessment</i>	
<i>Part A (1966 – 2004)</i>	Identified articles were reviewed according to Roe’s model. Guidance documents, however, were unable to be subjected to all such criteria.
<i>Part B (2004 – 2006) and Part C (2007-2008)</i>	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.
<i>Data collation and analysis</i>	Qualitative analysis of data performed on studies uncovered was undertaken using a case study approach. Guidance documents reviewed for any relevant commentary.

RESULTS

Part A (1966 – 2004)

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), otherwise the alcohol will be rendered inactive.

The main action of alcohol hand rubs/ 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, alcohol (e.g. ethyl (ethanol), normal-propyl (n-propyl), isopropyl) provides the most rapid and greatest reduction in microbial counts on skin. (Lawbury et al., 1974, Groschel & Pruett, 1991).

According to the literature, 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 60% to 70% is used as it causes less skin drying dermatitis than gels of higher concentrations 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 wet 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 (on average 3ml for 30 seconds). In terms of duration, 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). Furthermore, it appears that assumptions are made through the literature that alcohol hand rubs/gels are applied using the same technique as for hand washing (see appendix)

1). Allowing the alcohol to dry is essential for its effectiveness.

As eluded to earlier, the major disadvantage of alcohol is its drying effect.

	<p>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 alcohol hand rubs/gels to minimise skin drying which may in fact enhance antimicrobial activity by slowing drying time, thus increasing contact time of alcohol with the skin. Concerns regarding the possible flammable properties of hand rubs/gels if used excessively or if splashed have been raised, however, no evidence to support these has been published.</p> <p>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. 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 hand hygiene products and of handwashing facilities appears to have a major influence on good hand hygiene practice, according to research. Kesavan et al. (1998) suggest the appropriate and convenient placing of sinks is essential and the adequate provision of soap and soft paper towels encourages frequent and appropriate handwashing. In light of published evidence, the Chief Nursing Officer for NHS Scotland published a letter outlining the placing of alcohol hand rubs/gels at every bedside by April 2005, taking one step towards improving compliance.</p>
<p>Part B (2004 – 2006)</p>	<p>The original literature review covered a considerable amount of published research concerned with the action of alcohol in terms of hand hygiene. 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.</p> <p>Recent studies have provided further evidence of the reduction of nosocomial infection rates in healthcare settings after the introduction of alcohol based hand rub usage (Gordin <i>et al.</i>, 2005, Johnson <i>et al.</i>, 2005, King, 2004).</p>

The Chief Nursing Officer (CNO) circulated a letter (SEHD, 2005) in February 2005, which detailed the Executive's proposal for establishing widespread use of alcohol based handrubs in NHS Scotland. This document recommended that alcohol based handrubs should be made available to staff as near to each individual patient as possible. This could be via a wall mounted dispenser, or one attached to the end of each bed or personal dispenser carried by staff on the belt or in the pocket, in certain clinical situations i.e. with very young patients.

Furthermore, a Health Technology Assessment (HTA) published by NHS Quality Improvement Scotland, (NHS QIS, 2005) stated that the potential benefit of the provision of alcohol based handrubs for use by all NHS Scotland staff in clinical areas, is likely to outweigh the costs and also recommended the provision of alcohol hand rub for the use of visitors particularly where hand washing facilities are limited. One study recently published showed results demonstrating that although alcohol hand gels were the most efficacious in bacterial removal, that they were less efficient with high levels of viral contamination (Sickbert-Bennett *et al.*, 2005). Furthermore, this study also showed that the use of alcohol hand rubs showed the best efficiency after a single episode of hand hygiene but this decreased over subsequent ten hand hygiene episodes, which were assessed as part of this study. However, this study did not make any recommendations based on the results and similar results have not been reported elsewhere, but it may be worth monitoring for future studies.

One of the disadvantages of alcohol gel is reported reluctance of use by staff, particularly due to perceived drying of the skin. As previously stated, emollients are now added to the alcohol hand rubs / gels to minimise skin drying. A study has been recently published (Houben *et al.*, 2006), which analyses in depth, actual skin condition associated with the intensive use of alcohol as well as a sensorial evaluation by the users. None of the alcohol gels used in the study caused skin irritation; however sensorial evaluation by users showed a preference for alternatives to isopropanol. This study also found that the favoured concentration of alcohol for avoiding skin irritation was 70%, with the addition of emollients, which is in line with the current model policy on use of alcohol hand gels for hand hygiene.

WHO Guidelines on Hand Hygiene in Healthcare (advance draft) has recently been made available for final consultation (WHO, 2006). These guidelines state that hands should be washed with soap and water if exposure to spore-forming organisms is strongly suspected or proven.

This guidance is based on a study (Weber *et al.*, 2003), which looked at the efficacy of various hand hygiene agents used to remove *Bacillus atrophaeus* (a surrogate for *Bacillus anthracis*) from contaminated hands. This study showed that alcohol hand rub solution was not effective in removing these spores and recommended the use of hand washing with soap and water. Furthermore, the CDC Guideline for Hand Hygiene in Health-Care Settings published in 2002 (Boyce & Pittet, 2002), also recommend that hands should be washed with non anti-microbial or anti-microbial soap and water if exposure to *Bacillus anthracis* is suspected or proven. The recommendation goes on to state that it is the physical action of washing and rinsing hands under such circumstances, which is recommended because alcohols, chlorhexidine, iodophors and other antiseptic agents have poor activity against spores.

There have been some case studies which have been recently published and critiqued during the process of this literature review which demonstrate a general reduction of nosocomial infection rates following the introduction of alcohol hand rubs, however without concomitant reduction in cases of *Clostridium difficile*-associated diarrhoea (CDAD) (Gordin *et al.*, 2005, King, 2004).

The current guidance is that soap and water should be used for hand decontamination in preference to alcohol hand gels, if the hands are visibly soiled; i.e. if contaminated with soilage or organic matter. However, bacterial spores are not visible to the naked eye and therefore it may not be clear when contamination of the hands with *Clostridium* spores has occurred e.g. in the case of an outbreak.

Therefore, although there are no recent studies which have specifically assessed the effect of alcohol on the organism, *Clostridium difficile*, it is felt that the weight of evidence that the use of alcohol gels is less effective against spores is sufficient and that the recommendation in the model policy on hand hygiene should be altered to reflect this.

<p><i>Part C(2007 -2008)</i></p>	<p>This review aims to identify, review and critique any scientific studies or guidance, which have been published in the intervening period since the last literature review, to determine if changes to guidance are required.</p> <p>A systematic review carried out by NHS Quality Improvement Scotland (<i>Stout et al., 2007</i>) looked at the clinical effectiveness of alcohol-based products in increasing hand hygiene compliance and reducing infection rates. Alcohol-based hand hygiene products are usually introduced as part of a multi-faceted intervention programme to improve hand hygiene compliance and infection rates, rather than in isolation. The evidence showed that multi-component interventions that include alcohol-based products are as effective as those that do not, both in achieving sustained hand hygiene compliance and in reducing the incidence of healthcare-associated infections (HAIs). However, they encountered problems in assessing these studies. It was not possible to assess the effect of alcohol-based products independently of other components, studies varied in their methodology and, as commented upon before in these reviews, there were methodological weaknesses in the studies which were examined. The reviewers were unable to compare or make definite conclusions about the effects of specific interventions, or to measure the magnitude of effects. However, they conclude that the costs of providing alcohol-based hand hygiene products and an effective promotional campaign are likely to be relatively small when compared to the costs of HAIs for healthcare providers and patients.</p> <p><i>Lausten et al. (2008)</i>, examined the effect of correctly using alcohol-based hand rub in a clinical setting. This was an observational study with microbiological sampling of hands. They found that 56% of HCWs correctly used the alcohol-based rub before the procedures and 58% after the procedures. The correct use reduced the CFU's on the hands by 90%, but the incorrect use only reduced it by 60%. Testing after the procedures showed that correct use reduced counts by 82% and incorrect use by 54%. The researchers defined correct use as an adequate volume (2 pump strokes, approx 2-3ml), rubbing for 30s until hands dry and covering all surfaces of the hands. This re-iterates the importance of the correct use of these products.</p> <p>In another study published in 2008, <i>Rupp et al.</i> describe a prospective controlled cross-over trial of alcohol-based hand gel in critical care units. They examined rates of adherence to hand hygiene practices when alcohol-based hand gel was provided and monitored the impact of use on the incidence of healthcare-associated infections (HAIs). The overall rate of adherence to hand hygiene recommendations was significantly affected by receipt of education and the availability of alcohol based hand gel. Adherence rates improved dramatically after the introduction of alcohol-gel, increasing from 38% to 68% in one unit, and from 38% to</p>
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69% in the second unit, and improvement was noted in all groups of HCWs. Hand hygiene rates were better at higher workloads when hand gel was available. The improvement in compliance with hand hygiene measures was not associated with detectable changes in the incidence of HAIs. Further studies would be needed to better address the relationship between hand hygiene and HAI's.

Loffler et al. (2007), published a study in the British Journal of Dermatologists examining how irritant to skin alcohol-based hand rubs are. On the basis of patch testing they found that alcohol-based hand rubs cause less skin irritation than hand washing, and that even on previously irritated skin they did not enhance irritation. In addition, an alcohol-based hand rub may even decrease rather than increase skin irritation after a hand wash due to a mechanical partial elimination of the detergent.

The epic2 guidelines (*Pratt et al., 2007*) review relevant literature in this area. They highlight that alcohol is not effective against some microorganisms like *Clostridium difficile*, may not be effective in some outbreak situations and will not remove dirt and organic material. The standards pertaining to the use of alcohol-based hand rubs as follows:

- * Hands should be decontaminated between caring for different patients or between different care activities for the same patient. For convenience and efficacy an alcohol-based handrub is preferable unless hands are visibly soiled. Local infection control guidelines may advise an alternative product in some outbreak situations.

- * Hands should be washed with soap and water after several consecutive applications of alcohol handrub.

- * When decontaminating hands using an alcohol-based hand-rub, hands should be free of dirt and organic material. The hand-rub solution must come into contact with all surfaces of the hand. The hands must be rubbed together vigorously, paying particular attention to the tips of the fingers, the thumbs and areas between the fingers, until the solution has evaporated and the hands are dry.

CONCLUSIONS

Part A (1966 – 2004)

Evidence indicates that 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 60% to 70% are used as they cause less skin drying dermatitis than those gels of higher concentrations.

A sufficient quantity of hand gel/rub should be used to thoroughly wet all surfaces of the hands (refer to manufacturers' instructions – on average 3ml).

Alcohol applications of 15 seconds have been shown to be effective in preventing transmission by hand. Refer to manufacturers' instructions – on average 30 seconds.

Alcohol hand rub/gel should be applied using thorough technique as is applied when washing hands with soap and water (see appendix 1 for technique of Ayliffe et al. (1978); Lawrence (1985)).

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.

Sufficient time should be given to allow the alcohol hand rub/gel to dry.

The risk regarding the flammability of alcohol hand gels if used excessively or splashed is considered low, according to the literature and is far outweighed by the benefits of improving hand hygiene.

<p>Part B (2004 – 2006)</p>	<p>Current research continues to provide evidence that the use of alcohol gels in healthcare settings has coincided with a decrease in nosocomial infection rates.</p> <p>Rates of <i>Clostridium difficile</i> infection have been unaffected by the increased usage of alcohol hand rubs / gels. Scientific evidence shows that alcohol has little or no effect against spores</p> <p>Current guidance in the hand hygiene model policy states that hands should not be decontaminated with alcohol if contaminated with soilage / organic matter. However, bacterial spores are not visible to the naked eye and therefore it may not be clear when contamination of the hands with <i>Clostridium</i> spores has occurred e.g. in the case of an outbreak</p> <p>A statement should be added that soap and water should be used to decontaminate hands 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>
<p>Part C (2007-2008)</p>	<p>The costs of providing alcohol-based hand hygiene products and an effective promotional campaign are likely to be relatively small when compared to the costs of HAIs for healthcare providers and patients.</p> <p>The correct method of applying alcohol-based hand rubs needs to be emphasized to staff in much the same way as the correct hand washing technique is.</p> <p>Compliance with hand hygiene can be improved by the provision of alcohol-based hand rubs, especially at higher workloads.</p> <p>Alcohol-based hand rubs are less irritant to skin than washing with detergents.</p> <p>Alcohol-based hand rubs are not effective against <i>Clostridium difficile</i> or in certain outbreaks, and will not remove dirt or organic material. In these situations hands need to be decontaminated with soap and warm water.</p> <p>Hands should be washed with soap and water after several consecutive applications of alcohol handrub.</p>

RECOMMENDATIONS	
Part A (1966 – 2004)	<p>Alcohol hand rubs/gels can be used when quick decontamination is needed and access to handwashing facilities is limited, but such products cannot be used when hands are soiled as this will inactivate the alcohol.</p> <p>All surfaces of the hand should be covered when using antimicrobial soap hand gel/rub (see appendix 1).</p> <p>Refer to manufacturers' instructions for amount required and duration (on average 3ml for 30 seconds).</p> <p>Alcohol hand rub/gel should be allowed to dry thoroughly.</p> <p>Hand decontamination products must be made available to staff to maximise compliance with good hand hygiene practice.</p>
Part B (2004 – 2006)	<p>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>
Part C (2007-2008)	<p>As a result of the literature review for Part C, nothing additional needs to be added to Infection Prevention Model Policy/Procedure 2 (version1).</p>
PRACTICAL APPLICATION	<p>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.</p>
RESOURCE IMPLICATIONS	<p>As per current policies. All resources required for dealing with hand hygiene should already be in place.</p>

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REVIEW STATUS	Complete
DATE ISSUED	6 th October 2009
REVIEW DATE	October 2012

Appendix 1



1. Both palm to palm.



2. Back of left hand to palm of right hand.



3. Palm of left hand to back of right hand.



4. Back of right hand to palm of left hand.



5. Back of right hand to back of left hand.



6. Back of right hand to palm of left hand.

Figure 1. Hand hygiene technique (Adapted from WHO, 2009).

REVIEW OF LITERATURE

TEAM UNDERTAKING REVIEW: Parts A and B – Health Protection Scotland. Part C – Welsh Healthcare Associated Infection Programme (WHAIP)	
CONTACT PERSON: Dawn Hill	
TOPIC: Hand hygiene as an infection control measure – the importance of drying hands.	
PRINCIPAL RESEARCH QUESTION/OBJECTIVE: To assess the evidence in relation to hand drying methods following hand hygiene/decontamination.	
METHODOLOGY	
i) Search strategy for identification of studies	
<i>Period of publication</i>	Part A: 1966 – 2004
	Part B: 2004 – 2006
	Part C: 2007-2008

<p>Strategy key words for Part C</p> <p>From Health Protection Scotland literature review [2007]</p> <p>Supplemented with terms from SURE proposal to HTA</p>	<p>Hand hygiene, hand washing, handwashing, hand sanitizing, hand cleansing, hand decontamination, Hand\$1 adj2 wash\$.ti,ab Hand\$1 adj2 clean\$.ti,ab Hand\$1 adj2 decontamin\$.ti,ab Hand\$1 adj2 saniti\$.ti,ab Hand\$1 adj2 antiseptis\$.ti,ab Hand\$1 adj2 disinfect\$.ti,ab Exp hand/ Exp sterilization/ Cross infection Nosocomial Healthcare associated infection Health-care associated infection Healthcare acquired infection Hospital acquired infection Compliance,Adherence,Attitudes Perceptions,Professional compliance Health behaviour , health behaviour Attitude , attitude of health personnel Health knowledge, attitudes, practice/ Comply\$4.ti,ab Complies\$41.ti,ab Adher\$.ti,ab, obey\$.ti,ab, conform\$.ti,ab, follow\$3.ti,ab , fulfil\$.ti,ab observ\$.ti,ab abide\$.ti,ab Barrier\$.ti,ab obstacle\$.ti,ab hurdle\$.ti,ab obstruct\$.ti,ab facilitate\$.ti,ab enable\$.ti,ab assist\$.ti, ab help\$.ti,ab promot\$3.ti,ab encourage\$1.ti,ab encouraging.ti,ab attitude\$1.ti,ab practice\$.ti,ab practising.ti,ab practicing.ti,ab Knowledge\$.ti,ab difficult\$.ti,ab impede\$.ti,ab hinder\$.ti,ab hindrance\$.ti,ab Care, care equipment, environment, contaminated contact , delivery of health care, exp Equipment and supplies, hospital/ Health facility environment, hospital, healthcare, occupational transmission, focal infection, cross infection/ Exp Hospitals/ Occupational diseases/ Infection/ focal infection/ infection control/ Bacteri\$, virus\$, equipment contamination. Handwashing solution, hand washing solution, procedure, soaps, chlohexidine, air dryer, paper towel\$, hand towel\$, soap, liquid soap, soap solution, alcohol rub, alcohol solution, alcohol, alcohol\$ adj2 handrub\$4.ti,ab Surgical scrub\$.ti,ab Ring\$, jewellery, nail\$ nail polish, nails/ Cosmetics,</p>	
<p>Electronic databases for Part C</p> <p>(tick as appropriate)</p>	<p>MEDLINE ✓</p> <p>Science Direct</p> <p>CINAHL ✓</p> <p>Cochrane Library ✓</p> <p>British Nursing Index ✓</p>	<p>PsycINFO</p> <p>EMBASE ✓</p> <p>SIGLE</p> <p>HMIC ✓</p> <p>Health technology Assessment ✓</p>

<i>Specialist web sites / portals for Part C</i>	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
<i>Hand searching journals (2008 only)</i>	American Journal of Infection Control, British Journal of Infection Control, BMJ, Infection Control and Hospital Epidemiology, Journal of Hospital Infection
ii) Selection criteria for inclusion of studies	
<i>Sample</i>	All health and social care workers.
<i>Outcome measure(s)</i>	Bacterial count on hands following different hand drying interventions.
<i>Other inclusion criteria</i>	N/A
<i>Language Limitations</i>	English language only.

iii) Quality assessment	
<i>Study quality assessment</i>	
<i>Part A (1966 – 2004)</i>	Identified articles were reviewed according to Roe’s model. Guidance documents, however, were unable to be subjected to all such criteria.
<i>Part B (2004 – 2006) and Part C (2007-2008)</i>	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.
<i>Data collation and analysis</i>	Qualitative analysis of data performed on studies uncovered was undertaken using a case study approach. Guidance documents reviewed for any relevant commentary.

RESULTS

Part A (1966 – 2004)

According to the literature, hand drying is a critical factor in the hand hygiene process. Insufficient hand drying would render the handwashing process ineffective. As Marples & Towers (1979) and Macintosh & Hoffman (1984) have previously recognised, residual moisture plays a significant role in cross contamination. Marpus & Towers (1979) and Hoffman & Wilson (1994) both found that wet surfaces transfer microorganisms more effectively than dry ones. More recently, Patrick et al. (1997) produced evidence to show that residual moisture left on hands after washing allows translocation of microorganisms from fingers to solid surfaces during touch contact. The authors then went on to show that the translocation of bacteria following touch contact is also related to the time spent drying in order to remove sufficient microorganisms.

Given these findings, Gould underlined the importance of drying hands following handwashing in her 2000 review of handwashing facilities in the clinical area, and she raised the issue of the best method for drying hands which has been the subject of much research and debate in recent years.

Many studies have been conducted to ascertain the most effective method of drying hands. Drying hands with disposable paper towels, cloth drying and warm air drying have all been compared as outlined in the APIC guideline (1995). Evidence has been uncovered in relation to the use of warm air dryers with many studies showing increased contamination of hands due to recirculated air and the saturation of filters with bacteria. However, as reported in the APIC guideline (1985), further studies exist which show no such increase. Furthermore, evidence would suggest that warm air drying is a slow method of drying hands in comparison with cloth towels. Patrick et al. (1997) compared these methods. Ten seconds drying with a cloth towel removed 96% of water while 45 seconds of drying with warm air was required to get same effect. Redway et al. (1994) also argue that drying hands with cloth towels is quicker and more effective than warm air drying and, therefore, it could be assumed that healthcare workers find this more suitable given the busy ward environment.

Generally, disposable paper towels appear to be advocated as they rub away transient organisms and dead skin cells and they remove bacteria from deeper layers because of associated friction and in the process remove moisture (Gould, 1994b).

	<p>Comparative studies of paper towels and cloth towels have revealed paper towels to be the most effective hand drying method (Gould, 2000). Ansari et al. (1991) found disposable paper towels to be more effective in reducing contamination than cloth towels.</p> <p>Although the use of paper towels is best supported in the literature, Heenan (1996) argues that attention should be paid to providing adequate supplies of paper towels which are user-friendly; otherwise harsh, non absorbent towels could discourage compliance.</p> <p>To avoid the potential for re-contamination of hands, several studies have referred to the need for foot-operated pedals on waste disposal units (Gould, 1992). If not available, guidance recommends that a paper towel should be used to open the unit to avoid recontamination, thereby completing the hand hygiene process and maximising its effectiveness.</p> <p>When using alcohol hand gel/rub to decontaminate hands, hand drying is equally as important. Evidence indicates that similar care should be taken to allow sufficient drying time following application in order to maximise effectiveness.</p>
Part B (2004 – 2006)	<p>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.</p> <p>There were no additional scientific papers published during the period of the review, which specifically covered hand drying. The WHO Guidelines for Hand Hygiene document (WHO 2006) currently available as an advance draft, was reviewed for content on this subject, however no changes to practice were identified.</p>
Part C (2007 – 2008)	<p>No new scientific papers were identified in the literature search pertaining to hand drying in the hand hygiene process.</p>

CONCLUSIONS

Part A (1966 – 2004)

Hand drying is considered a critical factor in the hand hygiene process.

Evidence indicates that wet surfaces transfer microorganisms more readily than dry ones.

Studies show that residual moisture left on hands following washing enables translocation of microorganisms from fingers to solid surfaces during touch contact.

The most effective method for drying hands (e.g. paper towels, cloth towels, warm air) has been the subject of much research and debate.

Evidence supports the use of paper towels as the most effective method for reduction in contamination by removing moisture and remaining transient organisms and dead skin cells.

	<p>Paper towels must be user-friendly to encourage compliance.</p> <p>Waste disposal units should be foot-operated to avoid recontamination of hands.</p> <p>Care should be taken to allow hands to dry completely following use of alcohol hand gel/rub.</p>
Part B (2004 – 2006)	There are no additional publications specifically on this subject produced within the period of this annual review of the model policies. Therefore there is no change to guidance recommended.
Part C (2007 – 2008)	No additional conclusions.
RECOMMENDATIONS	
Part A (1966 -2004)	<p>Following washing, hands should be dried with paper towels.</p> <p>Paper towels supplied should be user friendly.</p> <p>Waste disposal bins should have foot-operated pedals.</p>
Part B (2004 – 2006)	No change to present guidance recommendations in literature review available 10/08/05.
Part C (2007 – 2008)	Nothing additional needs to be added to Infection Prevention Model Policy/Procedure 2 (version1) as a result of the literature review for Part C.
PRACTICAL APPLICATION	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.
RESOURCE IMPLICATIONS	As per current policies. All resources required for dealing with hand hygiene should already be in place.

KEY REFERENCES

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<i>Part B (2004 – 2006)</i>	World Health Organisation, (2006), <i>WHO Guidelines on Hand Hygiene in Health Care (Advanced Draft)</i> World Alliance for Patient Safety, WHO, Geneva
<i>Part C (2007 – 2008)</i>	None
REVIEW STATUS	Complete
DATE ISSUED	6 th October 2009
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Infection Prevention Model Policy and Procedure
Hand Hygiene as an Infection Control Measure – how should it be applied?

REVIEW OF LITERATURE

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

<p>Strategy key words for Part C</p> <p>From Health Protection Scotland literature review [2007]</p> <p>Supplemented with terms from SURE proposal to HTA</p>	<p>Hand hygiene, hand washing, handwashing, hand sanitizing, hand cleansing, hand decontamination, Hand\$1 adj2 wash\$.ti,ab Hand\$1 adj2 clean\$.ti,ab Hand\$1 adj2 decontamin\$.ti,ab Hand\$1 adj2 saniti\$.ti,ab Hand\$1 adj2 antiseptis\$.ti,ab Hand\$1 adj2 disinfect\$.ti,ab Exp hand/ Exp sterilization/ Cross infection Nosocomial Healthcare associated infection Health-care associated infection Healthcare acquired infection Hospital acquired infection Compliance, Adherence, Attitudes Perceptions, Professional compliance Health behaviour , health behaviour Attitude , attitude of health personnel Health knowledge, attitudes, practice/ Comply\$4.ti,ab Complies\$41.ti,ab Adher\$.ti,ab, obey\$.ti,ab, conform\$.ti,ab, follow\$3.ti,ab , fulfil\$.ti,ab observ\$.ti,ab abide\$.ti,ab Barrier\$.ti,ab obstacle\$.ti,ab hurdle\$.ti,ab obstruct\$.ti,ab facilitate\$.ti,ab enable\$.ti,ab assist\$.ti, ab help\$.ti,ab promot\$3.ti,ab encourage\$1.ti,ab encouraging.ti,ab attitude\$1.ti,ab practice\$.ti,ab practising.ti,ab practicing.ti,ab Knowledge\$.ti,ab difficult\$.ti,ab impede\$.ti,ab hinder\$.ti,ab hindrance\$.ti,ab</p> <p>Care, care equipment, environment, contaminated contact , delivery of health care, exp Equipment and supplies, hospital/ Health facility environment, hospital, healthcare, occupational transmission, focal infection, cross infection/ Exp Hospitals/ Occupational diseases/ Infection/ focal infection/ infection control/ Bacteri\$, virus\$, equipment contamination.</p> <p>Handwashing solution, hand washing solution, procedure, soaps, chlohexidine, air dryer, paper towel\$, hand towel\$, soap, liquid soap, soap solution, alcohol rub, alcohol solution, alcohol, alcohol\$ adj2 handrub\$4.ti,ab Surgical scrub\$.ti,ab Ring\$, jewellery, nail\$ nail polish, nails/ Cosmetics,</p>	
<p>Electronic databases for Part C</p> <p><i>(tick as appropriate)</i></p>	<p>MEDLINE ✓</p> <p>Science Direct</p> <p>CINAHL ✓</p> <p>Cochrane Library ✓</p> <p>HMIC ✓</p>	<p>PsycINFO</p> <p>EMBASE ✓</p> <p>SIGLE</p> <p>British Nursing Index ✓</p> <p>Health technology Assessment ✓</p>

<i>Specialist web sites / portals for Part C</i>	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
<i>Hand searching journals (2008 only)</i>	American Journal of Infection Control, British Journal of Infection Control, BMJ, Infection Control and Hospital Epidemiology, Journal of Hospital Infection
ii) Selection criteria for inclusion of studies	
<i>Sample</i>	All health and social care workers.
<i>Outcome measure(s)</i>	Effectiveness of intervention to reduce bacterial count on hands.
<i>Other inclusion criteria</i>	N/A
<i>Language Limitations</i>	English language only.
iii) Quality assessment	
<i>Study quality assessment</i>	
<i>Part A (1966 – 2004)</i>	Identified articles were reviewed according to Roe’s model. Guidance documents, however, were unable to be subjected to all such criteria.
<i>Part B (2004 – 2006) and Part C (2007-2008)</i>	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.
<i>Data collation and analysis</i>	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 & 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.

Part B (2004 – 2006)	<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>
Part C (2007 – 2008)	No new scientific evidence pertaining to technique of hand washing/decontamination were found.
RECOMMENDATIONS	
Part A (1966 – 2004)	<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>
Part B (2004 – 2006)	The wording of the hand hygiene model policy should be modified to state ‘hand hygiene should be performed for at least 15 seconds’.
Part C (2007 – 2008)	Nothing additional needs to be added to Infection Prevention Model Policy/Procedure 2 (version1) as a result of the Literature review for Part C.
PRACTICAL APPLICATION	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.
RESOURCE IMPLICATIONS	As per current policies. All resources required for dealing with hand hygiene should already be in place.

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Part B (2004 – 2006)	<p>Centers for Disease Prevention and Control, (2006), <i>Management of multidrug-resistant organisms in healthcare settings</i>, CDC, Atlanta</p> <p>Horton R (1995) Handwashing: the fundamental infection control principle. <i>British Journal of Nursing</i>, 4, 8: 926-933.</p> <p>Kac, G. Podglajen, I. Gueneret, M. Vaupre, S. Bissery, A. & Meyer, G. (2005) Microbiological evaluation of two hand hygiene procedures achieved by healthcare workers during routine patient care: a randomized study <i>Journal of Hospital Infection</i>. 60 32-9, 2005 May.</p> <p>NHS Greater Glasgow, Infection Control Committee (2005), <i>Prevention and Control of Infection Manual</i>.</p> <p>World Health Organisation, (2006), <i>WHO Guidelines on Hand Hygiene in Health Care (Advanced Draft)</i>, World Alliance for Patient Safety, WHO, Geneva</p>
Part C (2007 – 2008)	<p>Pratt, R.J., Pellowe, C.M., Wilson, J.A., Loveday, H.P., Jones, S.R., McDougall, C., and Wilcox, M.H. (2007) epic2:national evidence-based guidelines for preventing healthcare-associated infections in NHS hospitals in England. <i>Journal of Hospital Infection</i>, 65(Suppl).</p>
REVIEW STATUS	Complete
DATE ISSUED	6 th October 2009
REVIEW DATE	October 2012

REVIEW OF LITERATURE

TEAM UNDERTAKING REVIEW : Parts A and B - Health Protection Scotland. Part C – Welsh Healthcare Associated Infection Programme (WHAIP)	
CONTACT PERSON: Dawn Hill	
TOPIC: Hand hygiene and jewellery.	
PRINCIPAL RESEARCH QUESTION/OBJECTIVE: To assess the evidence in relation to the effect of wearing jewellery on hand hygiene.	
METHODOLOGY	
i) Search strategy for identification of studies	
<i>Period of publication</i>	Part A: 1966 – 2004
	Part B: 2004 - 2006
	Part C: 2007-2008

<i>Specialist web sites / portals for Part C</i>	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
<i>Hand searching journals (2008 only)</i>	American Journal of Infection Control, British Journal of Infection Control, BMJ, Infection Control and Hospital Epidemiology, Journal of Hospital Infection
ii) Selection criteria for inclusion of studies	
<i>Sample</i>	All health and social care workers.
<i>Outcome measure(s)</i>	Bacterial count on hands following intervention.
<i>Other inclusion criteria</i>	N/A
<i>Language Limitations</i>	English language only.

iii) Quality assessment	
Study quality assessment	
Part A (1966 – 2004)	Identified articles were reviewed according to Roe’s model. Guidance documents, however, were unable to be subjected to all such criteria.
Part B (2004- 2006) and Part C (2007-2008)	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.
Data collation and analysis	Qualitative analysis of data performed on studies uncovered was undertaken using case study approach. Guidance documents reviewed for any relevant commentary.
RESULTS	
Part A (1966 – 2004)	<p>This review of the literature referring to the effect of wearing rings and wrist jewellery on hand hygiene has uncovered evidence to suggest that total bacterial counts on hands are higher when rings are worn (Jacobson et al., 1985; Hoffman et al., 1985). Furthermore, Hoffman et al. (1985) argue that bacteria could colonize the hands of staff who wear rings.</p> <p>Although Jacobson et al. (1985) found no significant difference following handwashing in the bacterial count on hands with or without rings, a study by Salisbury et al. (1999) showed a greater reduction in the number of colonies after handwashing by health care workers without rings. The limitations of the study, however, in terms of its non-randomised sample should be noted.</p> <p>Despite the fact that Jacobson et al. (1985) believe that the removal of bacteria is not affected by rings during handwashing, they do assert that rings might cause gloves to tear. Furthermore, the ICNA (1998) refer to anecdotal evidence and expert opinion when they suggest that rings do interfere with thorough handwashing.</p> <p>It should be noted that this review focuses primarily on the effect of ring wearing on hand hygiene while little research which considers the effect of wrist jewellery on hand hygiene was uncovered. Best practice and anecdotal evidence will dictate related infection control measures until further evidence is available.</p>

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.

The literature search using the described strategies identified a study on the levels of bacterial load found present under jewellery, specifically finger rings (Kelsall *et al.*, 2006). This study demonstrated results of significantly higher bacterial colony counts on the skin under rings or on the skin adjacent to the ring. Interestingly this study also demonstrated a significantly lower number of bacterial colonies beneath silver rings than either, gold or platinum. If the ring had been removed before surgical scrub, then there was no difference between the bacterial load of that and the control. This study further strengthens the guidance in respect to removal of jewellery prior to carrying out hand hygiene.

<p>Part C (2007-2008)</p>	<p>This review aims to identify, review and critique any scientific studies or guidance, which have been published in the intervening period since the last literature review, to determine if changes to guidance are required.</p> <p>A study by <i>Fagernes et al. (2007)</i>, investigated the impact of a single plain ring on the bacterial load on the hands of healthcare workers (HCWs). A total of 121 HCWs wearing one plain ring and 113 HCWs wearing no rings had both hands sampled by the “glove juice” technique. Quantitative culture of the samples was performed and the microorganisms identified. Wearing a single plain ring did not increase the total bacterial load on the hands, nor was it associated with an increased rate of Enterobacteriaceae carriage. The study does not address quality of hand hygiene technique or whether the Enterobacteriaceae findings enhances the risk of transmission.</p> <p><i>Wongworawat et al. (2007)</i> carried out a randomized controlled study looking at the influence of rings on the efficacy of hand sanitization and residual bacterial contamination. They compared the impact of finger rings on the effectiveness of scrubless and water-aided alcohol-based hand sanitization methods with that of povidone-iodine scrub. The subjects were a pool of perioperative staff and medical students who knew how to carry out a pre-op surgical scrub. There was no significant difference in the number of bacteria between hands with and hands without rings (1 ring, >90% smooth) for the groups that used alcohol wash or alcohol-chlorhexidine lotion. In the povidone-iodine group, the number of bacteria on hands with rings was greater than the group without rings. The alcohol-chlorhexidine group had the lowest bacterial count, regardless of the presence of rings. The presence of 1 ring did not appear to negatively impact on the effectiveness of alcohol-based hand sanitizers in a group of HCWs who were familiar with surgical scrubbing procedures.</p>
<p>CONCLUSIONS</p>	
<p>Part A (1966 – 2004)</p>	<p>Evidence would suggest that hand bacterial load is greater when rings are worn.</p> <p>Evidence would suggest that removal of bacteria through handwashing is hampered by the wearing of rings.</p> <p>Wearing of rings may cause gloves to tear.</p> <p>Rings may interfere with thorough handwashing.</p> <p>Limited information available in relation to wrist jewellery and its effect on hand hygiene.</p>

<i>Part B (2004 – 2006)</i>	There are limited additional publications on this subject produced within the period of this annual review of the model policies. The only study, which has been published, further strengthens the guidance in respect to removal of jewellery prior to carrying out hand hygiene.
<i>Part C (2007-2008)</i>	<p>One study identified showed that wearing one single band (ring) did not result in an increased bacterial load on hands of healthcare workers.</p> <p>A second study suggested that the presence of one plain ring did not appear to negatively impact on the effectiveness of alcohol-based hand sanitizers in a group of healthcare workers who knew how to use the correct hand hygiene techniques.</p>
<u>RECOMMENDATIONS</u> <i>Part A (1966 – 2004)</i>	Rings or other wrist jewellery should not be worn when providing care to patients.
<i>Part B (2004 – 2006)</i>	No change to present guidance recommendations in literature review available 10/08/05.
<i>Part C (2007-2008)</i>	As a result of the literature review for Part C, nothing additional needs to be added to Infection Prevention Model Policy/Procedure 2 (version1).
PRACTICAL APPLICATION	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.
RESOURCE IMPLICATIONS	As per current policies. All resources required for dealing with hand hygiene should already be in place.

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