American Red Cross

Scientific Advisory Council

ARC SAC Scientific Review
Hand Hygiene

Questions addressed:

In a first aid situation (scene safety, unknown medical history of patient(s), limited resources & training, & time), what is the "best" practice of hand hygiene for the Certified Lay Responder and the Lay Community Responder?
(Alternatives when ideal can't be met.)

What are the hand hygiene practices recommended for home care providers to limit disease transmission?

What are the general guidelines for hand hygiene for the general public to limit disease transmission?

Review Process and Literature Search Performed

CAB Abstracts
Biosis 1969-present
Current Contents 1995-present
Derwent Drug File 1983-present
Embase 1974-present
Medline 1951-present
Pascal 1973-present
Sci Search 1974-present
Tos File 1965-present
Chem Abstracts 1967-present
JICST Eplus 1985-present
Dissertation Abstracts 1861-present
EBM Reviews 1966 to October 2005 (Cochrane Database of Systematic Reviews; ACP Journal Club; Database of Abstracts of Reviews of Effects; Cochrane Central Register of Controlled Trials; Ovid Healthstar)
The Center for Disease Control's (CDC) 2002 report "Guideline for Hand Hygiene in Health-Care Settings Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force, provided additional resources for this statements development (http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5116a1.htm, accessed 10/10/05).

A search was done through the Merck Library Service as part of a series of searches completed looking at disinfection for viruses and other microbials. Subsequent searches were conducted by ACFAS members.
In 2005 two literature searches were conducted. First an on-line search of "Evidence Based Medicine" (EBM) reviews from 1966 to October 2005 was performed in the following data bases: EBM Reviews; Cochrane Database of Systematic Reviews; ACP Journal Club; Database of Abstracts of Reviews of Effects; Cochrane Central Register of Controlled Trials; Ovid Healthstar, by ACFAS members.

The second literature search was conducted by Merck in the following databases: CAB Abstracts 1972-present, Biosis 1969-present, Current Contents 1995-present, Derwent Drug File 1983-present, Embase 1974-present, Medline 1951-present, Pascal 1973-present, SciSearch 1974-present, ToxFile 1965-present Chemical Abstracts 1967-present, Japanese Science and Technology 1985-present and Dissertation Abstracts 1861-present. Search terms for this literature search included: resistance, tolerance, antiinfectives, antibacterial, antiviral, disinfective, effectiveness, susceptibility.

The Centers for Disease Control's (CDC) 2002 report "Guideline for Hand Hygiene in Health-Care Settings Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force, provided additional sources for the development of this statement.
(http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5116a1.htm, accessed 10/10/05).

Search Terms: Hand Sanitizers, Hand Hygiene, Handwashing, Hand Washing, antibacterial, soap, gel, first aid, EMS,
Merck Search: terms for this literature search included: resistance, tolerance, antiinfectives, antibacterial, antiviral, disinfective, effectiveness, susceptibility.

Introduction/Overview:

It is generally recognized that good hand hygiene is effective in reducing the spread of infection, however there is a lack of scientific evidence which definitively demonstrates this. A number of options are available to lay rescuers, home care givers, and the general public for hand hygiene. No universal consensus exists on the types of hygiene agents, quantity of use, time required or application/washing technique. Each of these factors is thought to have an impact on adherence. The Centers for Disease Control (CDC) have provided Guidelines for Hand Hygiene in Health Care Settings (2002) which is based on a thorough review of the literature since publication of the last guidelines in 1985.

Good hand hygiene reduces the transmission of microbes that introduce disease into the body. Persons providing first aid or personal care most often function in an environment where those microbes exist (bodily fluids, contaminated objects, and individuals with diseases. The Centers For Disease Control (CDC)[i] provides specific recommendations for those who work in health care based on current science. However, the Certified Lay Responder and the Lay Community Responder will not have the resources, time, or ability based urgency of the situation to fully adopt the CDC's recommendation for Health Care Workers (HCWs), including Professional Rescuers. Therefore, this advisory utilizes the CDC's recommendations in the context/ paradigm of the first aid provider. Similarly, the home health care provider will not have the same resources, level of training, or risks of cross-contamination as health care workers (HCS) in hospital settings. Therefore, this advisory utilizes CDC's recommendations as a starting point but makes adaptations based on more recent literature reviews and applicability to the home care situation.

The options for hand hygiene include soap (with and without anti-microbial agents) & water, wipes impregnated with alcohol or other cleaning agents, and anti-microbial agents in aqueous, gel or foam solutions that destroy or help remove viruses, bacteria, spores and natural flora. No universal consensus exists for the total removal of dangerous microbes on the hands for practical use within the first aid field. Different cleaning agents, application amount, technique, and time contact with hands, as well as drying techniques and times vary with each product. The CDC recommends following the manufacturer's directions, which are developed for and tracked by the Federal Drug Administration in health care settings.

Scientific Foundation:
A literature search was completed to examine the effective use of hand sanitizers by both professional and lay emergency responders. There is a certain amount of variability in the definition of terms used in hand hygiene practice. Hand hygiene is a general term that encompasses handwashing (also referred to as "scrubs"), antiseptic handwashing, antiseptic hand rub (with either liquids or gels) and surgical hand antisepsis (CDC, 2002). For the purposes of this review hand sanitizer/sanitization will not include handwashing which is defined as washing hands with plain (ie., non-antimicrobial) soap and water. (CDC, 2002)

The basic credo of first aid is to "do no further harm" and practicing good hand hygiene provides part an essential barrier in the transmission of disease causing microbes between a Certified Lay Responder or the Lay Community Responder and a victim, including self rendered care. While there are no published studies of hand hygiene efficacy in reducing illness rates or disease transmission specific to "first aid providers", studies including Hammond et al[ii] and White et al[iii], established that effective hand hygiene programs reduce the spread of infections. The options for hand hygiene include soap (with and without bactericides) & water, commercial wipes impregnated with alcohol or other cleaning agents, and commercial waterless gels.

Studies have shown lower rates of infection in health care institutions after introduction of hand antisepsis programs, (Larson et al[iv], Gordin et al[v]).

Montville[vi]examined the literature related to hand washing in order to determine those factors that would influence bacterial levels on the hands of food service workers. They concluded that while a number of factors influence final counts on the hand, hand washing is generally best at reducing the risk of bacterial contamination, followed by hand drying.

Several studies demonstrated the effectiveness of hand hygiene programs in reducing illness related absenteeism in elementary schools (ex. Hammond et al., 2000) and university residence halls (ex. White et al[iii]). Meadows and LeSaux[vii] conducted a systematic review of the literature related to the effectiveness of antimicrobial rinse free hand sanitizers in reducing absenteeism in school children and reported that while all studies reported statistically significant reductions due to the use of hand gel, none of the available studies were properly conducted as blinded and randomized clinical trials.

Sandora et al[viii] in a randomized controlled trial demonstrated a reduction in gastrointestinal (but not respiratory) illness rates in homes with children in out-of-home care after the introduction of a hand hygiene program that included an alcohol-based sanitizer and hand hygiene education.

Hand washing techniques have significant effects on the overall efficacy of any hand hygiene program. Widmer and Dangel[ix] concluded that not washing for the recommended amount of time (approximately 1 minute in their study) and cleaning all surfaces of the hands and fingers are two aspects of hand washing that are often poorly performed. Lin et al[x]compared several hand washing techniques and hand washing and antisepsis products for their ability to remove *E.coli* or caliciviruses. They determined that the greatest reduction in microbial populations was seen after hand washing with a nailbrush using soap and water and that the least reduction was obtained from using alcohol-based hand rub. They further recommend not wearing artificial nails or extenders and maintaining shorter length natural nails.

The CDC's[i] recommendations remarked on the amount of time it takes to properly cleanse hands with traditional soap and water and the lesser time it takes to use a waterless alternative. Having an alternative to water and soap cleaning for hands in first aid situations may also decrease time it takes to provide care, especially when combined with proper use of gloves designed for first aid use.

Technique concluded Widmer and Dangel[ix], held crucial importance in hand antisepsis. Major deficiencies were detected among even highly trained health care workers in their study. Training or highlighting techniques for using cleaning products (including drying) should be provided to those being trained in first aid.

Techniques in hand drying contribute to the reduction of microbes on hands according to Yamamoto et al[xi]. Their study showed varied reduction of bacteria on washed hands, with the largest decrease on hands held stationary under warm air dryers and not rubbed. Ultraviolet light reinforced the removal of bacteria during warm air drying. Paper towels were useful for removing bacteria from fingertips but not palms and fingers.

Other factors considered in implementing a hand hygiene program include, compliance and cost. Wendt[xii] et al., (2004) reported that compliance with hand hygiene varied as a function of type of health care worker (physician versus nurse), type of activity (higher compliance with more riskier activities) and location in hospital (higher compliance in less busy wards than ICUs). Repeated hand washing and hand washing has been associated with skin dryness and irritation (CDC[i], 2002). Pittet[xiii] et al., (2004) demonstrated that the cost of hand hygiene promotion is less than 1% of the costs associated with nososcomial infections.

The CDC does warn about the flammability of alcohol based cleaners, noting that static electricity may ignite cleaner that has not been completely "rubbed" dry (CDC[i], p.13).

There are also concerns about the development of resistant strains of bacteria with the increased use of "antibacterial" cleaning products (CDC[i], p.17).

Efficacy of Hand Hygiene Products

The CDC[i] reviewed the efficacy of different preparations used for hand hygiene in developing their Guidelines. The review considered the following: alcohol-based antiseptics, plain (non-

antimicrobial) soap, chlorhexidine, chloroxylenol, hexachlorophene, iodine and iodophors, quaternary ammonium salts, triclosan and other compounds. Performance results varied as a function of the methodology used to determine efficacy, microbial agent, and length of time as well as technique for hand washing or sanitizing.

Different methods have been employed to study both the in vitro and in vivo efficacy of hand washing and hand antisepsis. The FDA regulates antiseptic hand washing products based on requirements outlined in the Tentative Final Monograph for Healthcare Antiseptic Drug Products[xiv] (known as the TFM) (1994). Products are considered efficacious if they result in a 2-log10 reduction of the indicator organism (*Serratia marcescens*) on each hand within 5 minutes after the first use and a 3-log10 reduction of the indicator organism on each hand after the 10th use. In the EU, the efficacy of hand hygiene products is regulated by the European EN 1500 Standard [xv](1997). In this standard, product efficacy is established for a product if it results in performance equal to disinfection with 60% isopropyl alcohol (approximately 4-log10). Kramer[xvi] et al., (2002) tested 14 different alcohol-based hand gels or hand rinses according to the EU EN 1500 Standard and found that while the bacterial reduction factors of the gels ranged from 2.13-log10 to 4.09-log10, none of the hand gels met the same level of activity as the reference standard. Each of the hand rinses did meet the EN1500 requirements however, prompting the conclusion that hand gels should not replace alcohol–based liquid disinfectants in hospitals. No scientific studies have established standard tests of efficacy of products for viruses or fungi and no scientific studies have been conducted to determine the extent to which microorganisms on hands need to be reduced (1-log10 to 4-log10 or 90% to 99.99%) in order to minimize their transmission (CDC, 2002; Diekema,[xvii] 2002).

Alcohol-based products are generally the most efficacious for broad spectrum hand antisepsis in the health care sector (CDC[i], 2002). Alcohol acts to denature proteins and solutions containing between 60-95% alcohol are most generally effective (Larson and Morton,[xviii] 1991). The majority of products utilize either isopropanol or ethanol or a combination of these with n-propanol along with other antiseptic agents. Alcohols have excellent efficacy against gram positive and gram negative bacteria, M. tuberculosis, fungi and certain enveloped viruses including: herpes simplex, HIV, influenza and Hepatitis B (CDC[i], 2002, p. 8-13). They are less efficacious against non-enveloped viruses (Rotter[xix], 2001), but are effective against rotavirus (Ansari[xx] et al., 1989; Bellamy et al.,[xxi] 1993), and rhinovirus (Hendley[xxii] et al.,1978). Wolff[xxiii] et al., (2001) tested two alcohol-based disinfectants against Hepatitis A using an in vitro suspension test. They found that although the disinfectants caused a 1.8-3-log10 reduction in virus titre, they did not achieve the required 4-log 10 reduction necessary for virucidal activity in accordance with German guidelines. Alcohols are not effective against bacterial spores. Alcohol based products are not appropriate for use when hands are visibly dirty or contaminated with proteinaceous materials (Larson and Bobo[xxiv], 1992). Efficacy is also dependent on contact time, volume of alcohol used and whether or not the hands are wet when applied (CDC[i], 2002).

Lay Responder versus Professional Rescuer

In making hand hygiene recommendations for emergency responders, separate consideration should be given to the general public, Certified Lay Responder and the Lay Community Responder, and professional rescuers. For the professional, it is recommended that the

Guidelines for Hand Hygiene in Health Care Settings be followed (CDC[i], 2002). The CDC Guidelines are designed for use in health care settings and are not intended for use in food processing or food service establishments.

Emergency situations create several challenges for first aid providers including location, severity of situation, supplies, lack of personal health history of victims, and the time period in which care is needed and provided. Care providers need to recognize the challenges present at the time and place of rendering care and make decisions on how to act based on training. Current first aid guidelines stress taking proper regard for preventing "cross infection" before an emergency, during first aid care, and post-care, which includes proper hand hygiene.

Educating Certified Lay Responder and the Lay Community Responder and the general public to good hand hygiene practices (see ARCSAC Advisory on Hand Hygiene Practices for Home Care Providers; ARCSAC Advisory Statement on Hand Hygiene Practices for the General Public) is the first practical step for reducing disease transmission, through motivation, practical information, and resource identification (CDC[i], p. 26). These include washing hands before and after eating, after using the toilet, etc. Maintaining clean hands through regular cleaning, especially while preparing or eating food and "bathroom" use, will decrease the distribution of microbes on equipment and between individuals.

Summary:

The recommendations are based on the CDC's work, as no contrary literature was noted after 2002. Since 2002, the SARS & pandemic flu possibilities have heightened the role of good hygiene in thwarting the spread of disease. The role of the Certified Lay Responder and the Lay Community Responder is to be trained in understanding the methodology of Universal Precautions, using appropriate personal protective equipment, and ability to adapt resources in responding appropriately to different patient and scene needs.

Occupational Safety & Health Administration (OSHA) (2003) maintains that employees: "removing gloves and has had contact, meaning occupational exposure to blood or blood or other potentially infectious materials (OPIM), hands must be washed with an appropriate soap and running water. If a sink is not readily accessible (e.g., in the field) for instances where there has been occupational exposure, hands may be decontaminated with a hand cleanser or towelette, but must be washed with soap and running water as soon as feasible. If there has been no occupational exposure to blood or OPIM, antiseptic hand cleansers may be used as an appropriate "handwashing" practice."[xxv]

When no advanced professional care will be rendered in first aid scenarios, for example minor injuries or delayed help situations (i.e., wilderness, disaster) proper hand hygiene elevates in priority. Having access to large amounts of clean water and soap and/or waterless hand sanitizer as well as the training and education is difficult in disaster or wilderness settings. Having resources to filter/ disinfect water or having waterless hand sanitizers is important in disaster kits and first aid kits.

Overall Recommendation:

Hand hygiene guidelines have been available for health care workers for many years. The American Red Cross Advisory Council for First Aid and Safety is recommending improved hand hygiene practices, for three population groups. These three groups are: first aid providers (professional and lay), home care givers and the general public. Improved hand hygiene, including handwashing following contact with contaminated individuals or objects is recommended in order to reduce the transmission of pathogenic microorganisms. Additional recommendations for handwashing technique, skin care and gloves are also provided.

First aid educational and motivational programs:

As part of an overall program to improve hand hygiene practices of Certified Lay Responders and the Lay Community Responder, educate individuals regarding the types of care activities that can result in hand contamination and the advantages and disadvantages of various methods used to clean and dry their hands (CDC[i], p. 33)[viii,ix] **(II)**

Prior to rendering care to others or to self and as the situation and resources allow*, the available research suggests that Certified Lay Responder and the Lay Community Responder:

- For visibly soiled hands, first wash with soap and water (CDC[i], p.32). **(I)**
- For not-visibly soiled hands, use hand rub, wash with soap and water, or both
    - When using soap and water, wet hands first with water, apply an amount of product recommended by the manufacturer to hands, and rub hands together vigorously for at least 15 seconds, covering all surfaces of the hands, giving added attention to finger nails and jewelry. Rinse hands with water and dry thoroughly with a disposable towel. Use towel to turn off the faucet. (CDC[i], p.32) **(I)**
    - When using an alcohol based hand rub, use directed amount of gel, rub thoroughly over all surfaces of the hands, including nail areas and between fingers. Rub until product dries. (CDC[i], p. 32) **(I)**
- Maintain a barrier (i.e., donning gloves designed for first aid use [i.e., vinyl, nitrile] [CDC[i], p. 33] **(I- OSHA Required for professional rescuers)**
    - A dressing, or extra clothes placed between provider and the victim's body fluids may be an improvised barrier.
    - Take care not to touch any unclean object (including self) with soiled gloves.

* *The majority of first aid rendered is of non-life threatening nature, allowing for pre-care hand cleansing. If the situation (i.e., life threatening situation) or resources do not allow (i.e., disaster, no clean water) for all steps to be taken the first aid provider should modify them as needed (ex, if no running water, continue use of hand gel or other waterless cleaning agent, or if no cleaning agents maintain a barrier with the cleanest materials available).*

During care:

- Wash hands or use gel and change gloves after rendering care for one victim and before rendering care for another victim. (CDC[i], p.32). **(I)**
    - Remove gloves by turning them inside out and dispose of them properly.
- Avoid touching eyes, nose, and mouth while giving care. Avoid eating during first aid.**[IV]**

Post-care:

- Clean up the immediate vicinity to prevent secondary contamination of others or objects
    - Dispose of dressings, bandages, sharps, gloves and soiled clothing safely and correctly, while continuing to wear gloves.
    - Place waste materials inside a plastic bag, and then place that bag inside another plastic bag. Tie both securely. Do not place in rubbish bin. Seek advice from your local health department or EMS on disposal options. **[IV]**
- After removing gloves (or if no gloves were available):
    - Wash hands with soap and water thoroughly or use a waterless gel if the hands are not visibly soiled and no soap and water are available. (CDC[i], p. 32) **(I)**

Special situations exist when no advanced professional care will be rendered, for example minor injuries or delayed help situations (i.e., wilderness, disaster).

- Hand hygiene is a priority that is difficult in the absence of large amounts of clean running water. Having resources to filter/ disinfect water or having waterless hand sanitizers is important in disaster kits and first aid kits. **(IV)**
- The CDC[i] (p. 45) found that the best Hand-Hygiene Antiseptic Agents were ones that contain a concentration 60%–95% alcohol, were excellent, as well as fast acting, in reducing Gram-positive bacteria, Gram-negative bacteria, Mycobacteria, Fungi, Viruses (compared to agents containing Chlorhexidine (2% and 4% aqueous), Iodine compounds, Iodophors, Phenol derivatives, Tricolsan, and Quaternary ammonium compounds. Soap and water cleaning is recommended if there is possible exposure to spores (ex. *Bacillus anthracis)* (CDC[i], p. 32). **(I)**
- Wash hands with soap (either non-antimicrobial or antimicrobial) and water if exposure to anthrax is suspected. The physical action of washing and rinsing hands is recommended because alcohols, chlorhexidine, iodophors, and other antiseptic agents have poor activity against spores (CDC[i], p. 32) **(I)**
- The use of hand sanitizers is recommended only as a part of a hand hygiene regimen and **not** for use in wound cleansing.

Recommendations and Strength:

Standards:

- For visibly soiled hands, first wash with soap and water (CDC[i], p.32). **(I)**
- For not-visibly soiled hands, use hand rub, wash with soap and water, or both
    - When using soap and water, wet hands first with water, apply an amount of product recommended by the manufacturer to hands, and rub hands together vigorously for at least 15 seconds, covering all surfaces of the hands, giving added attention to finger nails and jewelry. Rinse hands with water and dry thoroughly with a disposable towel. Use towel to turn off the faucet. (CDC[i], p.32) **(I)**
    - When using an alcohol based hand rub, use directed amount of gel, rub thoroughly over all surfaces of the hands, including nail areas and between fingers. Rub until product dries. (CDC[i], p. 32) **(I)**
- Maintain a barrier (i.e., donning gloves designed for first aid use [i.e., vinyl, nitrile] [CDC[i], p. 33] **(I- OSHA Required for professional rescuers)**

- Wash hands or use gel prior to care; change gloves and re-wash hands after rendering care for one victim and before rendering care for another victim. (CDC[i], p.32). **(I)**
- After removing gloves (or if no gloves were available):
    - Wash hands with soap and water thoroughly or use a waterless gel if the hands are not visibly soiled and no soap and water are available. (CDC[i], p. 32) **(I)**
- Wash hands with soap (either non-antimicrobial or antimicrobial) and water if exposure to anthrax is suspected. The physical action of washing and rinsing hands is recommended because alcohols, chlorhexidine, iodophors, and other antiseptic agents have poor activity against spores (CDC[i], p. 32) **(I)**

Guidelines:

- As part of an overall program to improve hand hygiene practices of first aid providers, home care providers, & general public, educate individuals regarding the types of care activities that can result in hand contamination and the advantages and disadvantages of various methods used to clean and dry their hands (CDC[i], p. 33)[viii,ix] **(II)**
- Avoid touching eyes, nose, and mouth while giving care. Avoid eating during first aid.**[IV]**

Post-care:

- Clean up the immediate vicinity to prevent secondary contamination of others or objects
    - Dispose of dressings, bandages, sharps, gloves and soiled clothing safely and correctly, while continuing to wear gloves.
    - Place waste materials inside a plastic bag, and then place that bag inside another plastic bag. Tie both securely. Do not place in rubbish bin. Seek advice from your local health department or EMS on disposal options. **[IV]**

Options:

- Hand hygiene is a priority that is difficult in the absence of large amounts of clean running water. Having resources to filter/ disinfect water or having waterless hand sanitizers is important in disaster kits and first aid kits. **(IV)**

Further Action Recommended by ARCSAC

- Include alcohol based hand sanitizer in ARCSAC approved/ recommended FA and or disaster kits. **(IV)**
- Develop strategies for First Aid and Safety Instructors to introduce and educate on proper hand hygiene strategies for general use, home care application, and first aid care. **(II)**

Recommendations for Hand Hygiene for the Home Care Provider

Prior to rendering care, home care providers should:

1. Trim long fingernails (II).
2. Remove rings (II).[xxvi]
3. For visibly soiled hands, wash with soap and water (I).
4. For not-visibly soiled hands, use an alcohol-based hand rub (I). Alternatively, wash with an antimicrobial soap and water (II).
5. Don (II) vinyl, nitrile, or similar gloves when appropriate. Be sure hands are dry prior to donning gloves as alcohol hand rubs can agglutinate the cornstarch powder in gloves and alcohol can harden latex.[xxvii]

During care:

1. Wear vinyl, nitrile, or similar gloves when providing care (II) for "dirty" patient care procedures.
    a. While wearing gloves, avoid touching unclean objects (including self) except the patient and items required for the patient's care.
    b. Avoid touching eyes, nose, and mouth while giving care.
    c. Avoid eating while providing care wearing gloves.
2. Properly remove gloves, sanitize or wash hands, and don a new clean pair of gloves between caring for more than one patient (II) or between "dirty" and "clean" body-site care on the same patient (III).
    a. Remove gloves by turning them inside out (II).

Post-care:

1. Properly dispose of dressings, bandages, sharps, gloves and soiled clothing (II).
    a. Place waste materials inside a plastic bag, and then place that bag inside another plastic bag. Tie both securely. Do not place in rubbish bin. Seek advice from your local health department on disposal options.
    b. Place sharp objects in a special container that they cannot penetrate prior to placing the container in the plastic bag.
2. Remove gloves if worn.
3. Sanitize hands or wash hands thoroughly with soap and water (II).

Prior to food preparation:

1. Wash hands with soap (with or without antibacterial agents) and water (II).

Hand hygiene technique

1. When decontaminating hands with an alcohol-based hand rub, apply product to the palm of one hand and rub hands together, covering all surfaces of hands and fingers until hands are dry (II). Follow manufacturer's recommendation regarding volume of product to use. The routine use of soap and water following using alcohol-based hand sanitizers can lead to dermatitis and is not recommended.
2. When washing hands with soap and water, wet hands first with water, apply an amount of product recommended by the manufacturer to hands and rub hands together vigorously for at least 15 seconds, covering all surfaces of the hands and fingers.

Liquid, bar, leaflet or powdered forms of plain soap are acceptable when washing hands with a non-antimicrobial soap and water (III). When using bar soap, use soap racks that facilitate drainage and small bars of soap (III) [xxviii].

3. Rinse hands with water. Avoid using hot water, because repeated exposure to hot water may increase the risk of dermatitis (II) [xxix]. Use paper towel to turn off the faucet (II).
4. Dry the hands using warm air without rubbing or disposable paper towels (II) [xxx]. Do not use multiple-use cloth towels of the hanging or roll type (III).
5. Skin care

1. If desired, apply hand lotions or creams twice daily to minimize the occurrence of irritant contact dermatitis associated with repeated hand sanitizing or hand washing (I).

Other aspects of hand hygiene

1. Wear gloves when providing care, especially when contact with blood or other potentially infectious materials, mucous membranes and non-intact skin is likely to occur (II)
2. Remove gloves after caring for a patient. Do not wear the same pair of gloves for the care of more than one patient and do not wash gloves between uses with different patients (II).
3. Before eating and after using a restroom, both home care givers and their patients should wash hands with a non-antimicrobial soap and water or with an antimicrobial soap and water (II)[xxxi].
4. Consider antimicrobial-impregnated wipes (i.e., towelettes) as an alternative to washing hands with non-antimicrobial soap and water because they are not as effective as alcohol-based hand rubs or washing hands with an antimicrobial soap and water (II)[xxxii].
5. In the case of anthrax exposure, wash hands with soap (either non-antimicrobial or antimicrobial) and water. The physical action of washing and rinsing hands is recommended because alcohols have poor activity against spores (III) [xxxiii], [xxxiv].

Recommendations and Strength:

Standards: Home caregivers should sanitize hands using soap and water after using the bathroom, prior to food preparation or eating, and when their hands are visibly soiled prior to providing patient care. If their hands are not visibly soiled, home caregivers should sanitize hands using alcohol-based gels or alternatively soap and water prior to and after patient care and after removing gloves.

Guidelines: Use of soap and water requires vigorous rubbing for at least 15 seconds, rinsing, and drying hands using clean paper towels. Sufficient gel complies with manufacturer's recommendations and covers the hands and fingers entirely. Keep fingernails trimmed. Remove rings.

Options: To minimize skin irritation, use a hand lotion twice daily that does not compromise the integrity of the gloves.

Recommendations for Hand Hygiene for the General Public:

Indications for hand washing and hand sanitizing

1. When hands are visibly dirty or contaminated with biological material or are visibly soiled with blood, food and or body fluids, wash hands with either a non-antimicrobial soap and water or an antimicrobial soap or water
2. If hands are not visibly soiled, use an alcohol based hand rub for decontaminating hands or alternatively wash hands with an antimicrobial soap and water
3. Decontaminate hands after contact with any body fluids or excretions, mucous membranes, non-intact skin or wound dressings or intact skin
4. Decontaminate hands after contact with inanimate objects in the vicinity of an contaminated person
5. Before eating and after using a restroom, wash hands with a non-antimicrobial soap and water or with a antimicrobial soap and water

Hand hygiene technique

1. When decontaminating hands with an alcohol-based hand rub, apply product to the palm of one hand and rub hands together, covering all surfaces of hands and fingers until hands are dry. Follow manufacturer's recommendations regarding volume of product to use.
2. When washing hands with soap and water, wet hands first with water, apply an amount of product recommended by the manufacturer to hands and rub hands together vigorously for at least 15 seconds, covering all surfaces of the hands and fingers. Rinse hands with water and dry thoroughly with a disposable towel. Use towel to turn off the faucet
3. Liquid, bar, leaflet or powdered forms of plain soap are acceptable when washing hands with a non-antimicrobial soap and water.
4. Multiple-use cloth towels of the hanging or roll type as well as air dryers are not recommended for drying. Rather use disposable paper towels.

Skin care

1. Hand lotions or creams can be used to minimize the occurrence of irritant contact dermatitis associated with repeated hand sanitizing or hand washing**. NOTE:** this recommendation was included in the CDC Guideline, but may not be necessary for lay rescuer guidance where repeated hand washing is unlikely.

Other aspects of hand hygiene

1. Wear gloves when contact with blood or other potentially infectious materials, mucous membranes and non-intact skin occur.
2. Remove gloves after caring for a sick person. Do not wear the same pair of gloves for the care of more than one person and do not wash gloves between uses with different people**. NOTE:** this guidance may not be necessary for the lay rescuer.

3. Remove all jewelry and sanitize separately **NOTE:** the professional rescuer should remove all jewelry before care however this cannot be done for the general public. Literature evidence indicates that jewelry can negatively impact the efficacy of hand hygiene
4. If artificial fingernails, extenders or natural fingernails beyond ¼ inch are worn, additional care must be given to washing beneath the nail.

Footnote

Each recommendation in the CDC Guidelines is categorized on the basis of existing scientific data, theoretical rationale, applicability and economic impact. The system categories are as follows:

IA. Strongly recommended for implementation and strongly supported by well designed experimental, clinical or epidemiologic studies.

IB. Strongly recommended for implementation and supported by certain experimental, clinical or epidemiologic studies and a strong theoretical rationale.

IC. Required for implementation, as mandated by federal or state regulation or standard

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

No recommendation. Unresolved issue. Practices for which insufficient evidence or no consensus regarding efficacy exist.

Summary of Key Articles/Literature Found and Level of Evidence

Author(s)	Full Citation	Summary of Article	Level of Evidence (Using table below)
Center for Disease Control.	Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force: Guideline for Hand Hygiene in Health-Care Settings. 2002: Oct. 51(RR16);1-44 http://www.cdc.gov/mmwr/PDF/rr/rr5116.pdf accessed 3/13/06.	Current guidelines for HCWs from govn't.	**Level 5**
Diekema, D.J.,	Diekema, D.J., (2002) Alcohol-based hand gels and hand hygiene in hospitals, Lancet, 360: 1510.		
Gordin FM, Schultz ME, Huber RA, Gill JA.	Gordin FM, Schultz ME, Huber RA, Gill JA. Reduction in nosocomial transmission of drug-resistant bacteria after introduction of an alcohol-based handrub. Infection Control & Hospital Epidemiology. 2005:26(7):650-653.	provide clinical validation of the recent CDC recommendation that ABHRs be the primary choice for hand decontamination	**Level 2c**
Hammond B, Ali Y, Fendler E, Dolan M, Donovan S.	Hammond B, Ali Y, Fendler E, Dolan M, Donovan S. Effect of hand sanitizer use on elementary school absenteeism. American Journal of Infection control. 2000: 28(5):340-346.	Elementary school absenteeism due to infection is significantly reduced when an alcohol gel hand sanitizer is used in the classroom as part of a hand hygiene program.	**Level 1a**
Hendley, J.O., Mika, L.A., Gwaltney, J.M	Hendley, J.O., Mika, L.A., Gwaltney, J.M. (1978) Evaluation of virucidal compounds for inactivation of rhinovirus on hands, Antimicrob. Agent Chemother., 14: 690 – 694,		
Kramer, A., and Rudolph, P., et al,	Kramer, A., and Rudolph, P., et al, (2002) Limited efficacy of alcohol-based hand gels, Lancet, 359: 1489 – 1490		
Larson E. and Bobo, L.,	Larson E. and Bobo, L., (1992) Effective hand degerming in the presence of blood, J. Emerg. Med., 10: 7 – 11.		

Larson EL, Cimiotti J, Haas J. et al.	Larson EL, Cimiotti J, Haas J. et al. Effect of antiseptic handwashing vs alcohol sanitizer on health care-associated infections in neonatal intensive care units. Archives of Pediatrics & Adolescent Medicine. 2005:159(4):377-383.	Infection rates and microbial counts on nurses' hands were equivalent during handwashing and alcohol phases, and nurses' skin condition was improved using alcohol. However, assessing the impact on infection rates of a single intervention is challenging because of multiple contributory factors such as patient risk, unit design, and staff behavior. Other practices such as frequency and quality of hand hygiene are likely to be as important as product in reducing risk of cross-transmission.	**Level 1b**
European Standard Committee	European Standard Committee, (1997) Chemical disinfectants and antiseptics – hygienic hand rubs – test method and requirements, European Standard, EN1500, Brussels		
FDA	FDA, (1994) Tentative final monograph for healthcare antiseptic drug products, Fed. Reg., 59: 31441 – 52.		
Larson, E.L. and Morton, H.E.,	Larson, E.L. and Morton, H.E., (1991) Alcohols. In: Block SS, ed. Disinfection, sterilization and preservation, 4th ed. Philadelphia, Lea and Fibiger, 642 – 54.		
Lin CM, Wu FM, Kim HK, Doyle MP, Michael BS, Williams LK	(Abstract) Lin CM, Wu FM, Kim HK, Doyle MP, Michael BS, Williams LK. A comparison of hand washing techniques to remove Escherichia coli and caliciviruses under natural or artificial fingernails. Journal of Food Protection. 2003:66(12):2296-2301	that best practices for fingernail sanitation of food handlers are to maintain short fingernails and scrub fingernails with soap and a nailbrush when washing hands	**Level 2a**
Meadows E, Le Saux N.	Meadows E, Le Saux N. A systematic review of the effectiveness of antimicrobial rinse-free hand sanitizers for prevention of illness-related absenteeism in elementary school children. BMC Public Health. 2004:4(1):50. [accessed online	The available evidence for the effectiveness of antimicrobial rinse-free hand sanitizer in the school environment is of low quality. The results suggest that the strength of the benefit should be interpreted with caution. Given the potential to reduce student absenteeism, teacher	**Level 4**

	http://www.pubmedcentral.gov/articlerender.fcgi?tool=pmcentrez&artid=534108]	absenteeism, school operating costs, healthcare costs and parental absenteeism, a well-designed and analyzed trial is needed to optimize this hand hygiene technique.	
Montiville R, Chen Y, Schaffner DW	Montiville R, Chen Y, Schaffner DW. Risk assessment of hand washing efficacy using literature and experimental data. International Journal of Food Microbiology. 2002:72(2-3):305-313.	Soap with an antimicrobial agent (in particular, CHG) was observed to be more effective than regular soap. Hot air drying had the capacity to increase the amount of bacterial contamination on hands, while paper towel drying caused a slight decrease in contamination. There was little difference in the efficacy of alcohol and alcohol-free sanitizers. Ring wearing caused a slight decrease in the efficacy of hand washing. The experimental data validated the simulated combined effect of certain hand washing procedures based on distributions derived from reported studies. The conventional hand washing system caused a small increase in contamination on hands vs. the touch-free system. Sensitivity analysis revealed that the primary factors influencing final bacteria counts on the hand were sanitizer, soap, and drying method. This research represents an initial framework from which sound policy can be promulgated to control bacterial transmission via hand contacts.	**Level 2c**
OSHA	03/31/2003 - Acceptable use of antiseptic-hand cleansers for bloodborne pathogen decontamination and as an appropriate handwashing practice.	Rule that “employees” must wash hands asap after exposure to blood, etc. w/o water hand sanitizer can be used until water & soap are available.	**Level 6**
Pittet, D., and Sax, H., et al	Pittet, D., and Sax, H., et al, (2004) Cost implications of successful hand hygiene promotion, Infect. Control, 25: 264 – 266.		
Rotter, M.L.,	Rotter, M.L., (2001) Arguments for alcoholic hand disinfection J. Hosp. Infect., 48: S4 – S8.		

Sandora T, Taveras E, Shih M. et al	Sandora T, Taveras E, Shih M. et al. A randomized, controlled trial of a multifaceted intervention including alcohol-based hand sanitizer and hand-hygiene education to reduce illness transmission in the home. Pediatrics. 2005:116(3):587-594	A multifactorial intervention emphasizing alcohol-based hand sanitizer use in the home reduced transmission of GI illnesses within families with children in child care. Hand sanitizers and multifaceted educational messages may have a role in improving hand-hygiene practices within the home setting.	**Level 1a**
Wendt, C.,	Wendt, C., (2001) Hand hygiene – comparison of international recommendations, J. Hosp. Infect., 48: S23 – S28.		
White C, Kolble R, Carlson R, et al.	White C, Kolble R, Carlson R, et al. The effect of hand hygiene on illness rate among students in university residence halls. American Journal of Infection Control. 2003:31(6):364-370.	Hand-hygiene practices were improved with increased frequency of handwashing through increasing awareness of the importance of hand hygiene, and the use of alcohol gel hand sanitizer in university dormitories. This resulted in fewer upper respiratory-illness symptoms, lower illness rates, and lower absenteeism.	**Level 2a**
Widmer AE. Dangel M	Widmer AE. Dangel M. Alcohol-based handrub: evaluation of technique and microbiological efficacy with international infection control professionals. Infection Control & Hospital Epidemiology. 2004:25(3):207-209	Technique is of crucial importance in hand antisepsis. Major deficiencies were detected among even highly trained HCWs. Training should be provided before switching from handwashing to the alcohol handrub	**Level 2a**
Wolff, M.H., Schmitt, J., et al	Wolff, M.H., Schmitt, J., et al, (2001) Hepatitis A virus: A test method for virucidal activity, J. Hosp. Infect., 48: S18 – S22.		
Yamamoto Y, Ugai K, Takahashi Y	Yamamoto Y, Ugai K, Takahashi Y. Efficiency of hand drying for removing bacteria from washed hands: comparison of paper towel drying with warm air drying. Control & Hospital Epidemiology. 2005:26(3):316-320	Holding hands stationary and not rubbing them was desirable for removing bacteria. Ultraviolet light reinforced the removal of bacteria during warm air drying. Paper towels were useful for removing bacteria from fingertips but not palms and fingers	**Level 2a**

Level of Evidence	Definitions (See manuscript for full details)
Level 1a	Randomized clinical trials or meta-analyses of multiple clinical trials with substantial treatment effects
Level 1b	Randomized clinical trials with smaller or less significant treatment effects
Level 2a	Prospective, controlled, non-randomized, cohort studies
Level 2b	Historic, non-randomized, cohort or case-control studies
Level 2c	Case series: patients compiled in serial fashion, lacking a control group
Level 3	Animal studies or mechanical model studies
Level 4	Extrapolations from existing data collected for other purposes, theoretical analyses with limited correlation to current question
Level 5	Peer-reviewed, state of the art articles, review articles, editorials, or consensus statements
Level 6	Non-peer reviewed published opinions, such as textbook statements, official organizational publications, guidelines and policy statements and consensus statements
Level 7	Rational conjecture (common sense); common practices accepted before evidence-based guidelines
Level 1-6E	Extrapolations from existing data collected for other purposes, theoretical analyses which is on-point with question being asked. Modifier E applied because extrapolated but ranked based on type of study.

[i] Center for Disease Control. Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force: Guideline for Hand Hygiene in Health-Care Settings. 2002: Oct. 51(RR16);1-44 http://www.cdc.gov/mmwr/PDF/rr/rr5116.pdf accessed 3/13/06.

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[vi] Montiville R, Chen Y, Schaffner DW. Risk assessment of hand washing efficacy using literature and experimental data. International Journal of Food Microbiology. 2002:72(2-3):305-313.

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[xiii] Pittet, D., and Sax, H., et al, (2004) Cost implications of successful hand hygiene promotion, Infect. Control, 25: 264 – 266.

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Kabara JJ, Brady MB (1984). Contamination of bar soaps under "in use" condition. *J Environ Pathol Toxicol Oncol 5*: 1-14.

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Standaert SM, Hutcheson RH, Schaffner W (1994). Nosocomial transmission of *Salmonella gastroenteritis* to laundry workers in a nursing home. *Infect Control Hosp Epidemiol 15*: 22-6.

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