



ACFAS Scientific Review Hand Hygiene

Questions to be 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?

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?

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 that definitively demonstrates this in non-hospital settings. 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 and Prevention (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 often function in an environment where those microbes exist (bodily fluids, contaminated objects, and individuals with diseases). The Centers for Disease Control and Prevention (CDC)¹ provides specific recommendations for those who work in health care settings, based on current science. The CDC does not address non-health care settings. The Red Cross recognizes that Certified Lay Responders, Lay Community Responders and, to a lesser extent, home health care providers and the general public often lack the resources, time, or ability to adopt in full the CDC’s recommendation for Health Care Workers (HCWs), including Professional Rescuers. Therefore, this review considers the CDC’s recommendations in the context/ paradigm of three settings -- the first aid provider, the home health care provider, and the general public for disease prevention. Therefore, this scientific review utilizes CDC’s recommendations as a starting point but makes adaptations based on more recent literature reviews and applicability to non health care settings.

The options for hand hygiene include soap (with or 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 in non-health care settings. Cleaning agents, application amounts, techniques, 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.

Review Process and Literature Search Performed:

Databases Reviewed

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).

PubMed 2001 – present

Literature Search Process

Three separate literature searches were conducted. The first search was done in 2004 as part of a series of searches completed looking at disinfection for viruses and other microbials. This literature was subsequently expanded by ACFAS in 2005 and the search terms for this search included: resistance, tolerance, anti-infectives, antibacterial, antiviral, disinfective, effectiveness, susceptibility.

The third literature search was conducted also by ACFAS using PubMed and included the following search terms: hand sanitizers, hand hygiene, handwashing, antibacterial, soap, gel, first aid and EMS.

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).

Scientific Foundation:

A literature search was completed to examine the effective use of hand sanitizers in non-health care settings. 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 hand washing (also referred to as “scrubs”), antiseptic hand washing, 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 hand washing which is defined as washing hands with plain (i.e., non-antimicrobial) soap and water. (CDC, 2002)

The basic credo of first aid is to “do no further harm.” Practicing good hand hygiene can contribute to reducing the risk for 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 al² and White et al³, established that effective hand hygiene programs reduce the spread of infections. Studies have shown lower rates of infection in health care institutions after introduction of hand antisepsis programs, (Larson et al⁴, Gordin et al⁵).

Montville et al⁶ 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 influenced final counts on the hand, hand washing was the most influential factor for 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 al³). Meadows and LeSaux⁷ 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 al⁸ 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 Dangel⁹ 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 were two aspects of hand washing that were often poorly performed. Lin et al¹⁰ 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 an alcohol-based hand rub. They further recommend not wearing artificial nails or extenders and maintaining shorter length natural nails.

The CDC's¹ recommendations noted the amount of time required to cleanse hands properly using soap and water and the lesser time to use a waterless alternative. Using a more rapid method of hand sanitizing in first aid situations could decrease the time until care is rendered.

Widmer and Dangel⁹ concluded that technique held crucial importance in hand antisepsis. They detected major deficiencies among even highly trained health care workers. By extension, first aid training should highlight techniques for using cleaning products (including drying).

According to Yamamoto et al¹¹, techniques in hand drying contributed to the reduction of microbes on hands. 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 removed bacteria from fingertips but not palms and fingers.

Other factors considered in studies of hand hygiene programs included compliance and cost. Wendt¹² 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 risky activities) and location in hospital (higher compliance in less busy wards than ICUs). Repeated hand washing has been associated with skin dryness and irritation (CDC¹, 2002), which could account for some instances of non-compliance. Pittet¹³ et al., (2004) demonstrated that the cost of hand hygiene promotion was less than 1% of the costs associated with nosocomial infections.

The CDC does warn about the flammability of alcohol based cleaners, noting that static electricity could potentially ignite cleaners that have not been completely “rubbed” dry (CDC¹, p.13).

There are also concerns about the development of resistant strains of bacteria with the increased use of “antibacterial” cleaning products (CDC¹, p.17).

Efficacy of Hand Hygiene Products

The CDC¹, reviewed the efficacy of different preparations used for hand hygiene in developing its Guidelines. The preparations considered were 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, the microbial agent, and the 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 Products¹⁴ (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

Standard¹⁵ (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). Kramer¹⁶ 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 determined 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,¹⁷ 2002).

Alcohol-based products are generally the most efficacious for broad-spectrum hand antisepsis in the health care sector (CDC¹, 2002). Alcohol acts to denature proteins and solutions containing between 60-95% alcohol are most generally effective (Larson and Morton,¹⁸ 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 (CDC¹, 2002, p. 8-13). They are less efficacious against non-enveloped viruses (Rotter¹⁹, 2001), but are effective against rotavirus (Ansari²⁰ et al., 1989; Bellamy et al.,²¹ 1993), and rhinovirus (Hendley²² et al., 1978). Wolff²³ 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 titer, the disinfectants studied did not achieve the required 4-log₁₀ 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 Bobo²⁴, 1992). Efficacy is also dependent on contact time, volume of alcohol used and whether or not the hands are wet when applied (CDC¹, 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. It is recommended that Professional Rescuers follow the Guidelines for Hand Hygiene in Health Care Settings (CDC¹, 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. First aid 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 about good hand hygiene practices using motivation, practical information, and resource identification (see ACFAS Advisory on Hand Hygiene Practices for Home Care Providers; ACFAS Advisory Statement on Hand Hygiene Practices for the General Public) is the first practical step for reducing disease transmission (CDC¹, p. 26). Good hand hygiene practices include washing hands before and after eating, after using the toilet, etc. Maintaining clean hands through regular washing 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 and pandemic flu possibilities have heightened the role of good hygiene in thwarting the spread of disease. The American Red Cross should train Certified Lay Responders and Lay Community Responders in the methodology of Universal Precautions, using appropriate personal protective equipment, and adapting resources for responding appropriately to different patient and scene needs.

The 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 "hand washing" practice."²⁵

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 is often 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.

Recommendations for Hand Hygiene in First Aid and Strength

Standards:

- For visibly soiled hands, wash with soap and water **(I)**
- For not-visibly soiled hands, use hand rub, wash with soap and water, or both.
 - When using soap and water, wet hands with water, apply an amount of product recommended by the manufacturer, and rub hands together vigorously for at least 15 seconds, covering all surfaces of the hands, giving added attention to fingernails and jewelry. Rinse hands with water and dry thoroughly with a disposable towel. Use towel to turn off the faucet., **(I)**
 - When using an alcohol based hand rub, use the amount of gel recommended by the manufacturer, rub it thoroughly over all surfaces of the hands including nail areas and between fingers until the product dries. (CDC¹, p. 32) **(I)**
- Maintain a barrier (i.e., don gloves designed for first aid use [i.e., vinyl, nitrile]) **(I-OSHA Required for professional rescuers)**
- Wash hands or use gel and change gloves after rendering care for one victim and before rendering care for another victim. **(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. **(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 **(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 **(II)**
- Avoid touching one's own 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:

- Have resources to filter/ disinfect water or have waterless hand sanitizers in disaster kits and first aid kits. **(IV)**

Further Action Recommended by ACFAS

- Include alcohol based hand sanitizer in ACFAS 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 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 **(I)**.
- 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 **(I)**.

Guidelines:

- Use of soap and water requires vigorous rubbing for at least 15 seconds, rinsing, and drying hands using clean paper towels. Assure sufficient gel complies with manufacturer's recommendations and covers the hands and fingers entirely. Keep fingernails trimmed. Remove rings **(II)**.

Options:

- To minimize skin irritation, use a hand lotion twice daily that does not compromise the integrity of the gloves (II).

Recommendations for Hand Hygiene for the General Public and Strength:**Standards:**

- When hands are visibly dirty or contaminated with biological 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 or water (I,)
- If hands are not visibly soiled, use an alcohol based hand rub for decontaminating hands (I,) or alternatively wash hands with an antimicrobial soap and water (II,)
- Decontaminate hands after contact with any body fluids or excretions, mucous membranes, non-intact skin or wound dressings (I,) or intact skin (II)
- Decontaminate hands after contact with inanimate objects in the vicinity of a contaminated person (III)
- Before eating and after using a restroom, wash hands with a non-antimicrobial soap and water or with a antimicrobial soap and water (II)
- Wear gloves when in contact with blood or other potentially infectious materials, mucous membranes and non-intact skin occur (I)

Guidelines:

- 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 recommendations regarding volume of product to use.
- 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 (II)
- 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 (IV).

Options:

- Liquid, bar, leaflet or powdered forms of plain soap are acceptable when washing hands with a non-antimicrobial soap and water (III)
- Hand lotions or creams can be used to minimize the occurrence of irritant contact dermatitis associated with repeated hand sanitizing or hand washing (I).

- Remove jewelry on hands if possible and sanitize separately (**IV**)
- If artificial fingernails, extenders or natural fingernails beyond ¼ inch are worn, give extra care to washing beneath the nail (**No recommendation**).

Class	Description	Implication	Level of Evidence
I	Convincingly justifiable on scientific evidence alone.	Usually supports Standard	One or more Level 1 studies are present (with rare exceptions). Study results consistently positive and compelling
II	Reasonably justifiable by scientific evidence and strongly supported by expert opinion.	Usually supports Guideline but if volume of evidence is great enough and support from expert opinions is clear may support standard	Most evidence is supportive of guideline. Level 1 studies are absent, or inconsistent, or lack power. Generally higher levels of evidence. Results are consistently supportive of guideline.
III	Adequate scientific evidence is lacking but widely supported by available data and expert opinion. Based on	Usually supports Option.	Generally lower or intermediate levels of evidence. Generally, but not consistently results are supportive of opinion.
IV	No convincing scientific evidence available but supported by rational conjecture, expert opinion and/or non peer-reviewed publications	Usually does not support standard, guideline, or option. Statement may still be made which presents what data and opinion exists. In some cases and in conjunction with rational conjecture may support option.	Minimal evidence is available. Studies may be in progress. Results inconsistent, or contradictory.

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 hand washing following contact with contaminated individuals or objects, is recommended in order to reduce the transmission of pathogenic microorganisms. Additional recommendations for hand sanitizing, skin care and glove use are also provided.

First aid:

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 (CDC¹, p. 33) **(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 (CDC¹, 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, 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. (CDC¹, p.32) **(I)**
 - When using an alcohol based hand rub, use an amount of gel recommended by the manufacturer, rub thoroughly over all surfaces of the hands, including nail areas and between fingers until product dries. (CDC¹, p. 32) **(I)**
- Maintain a barrier (i.e., don gloves designed for first aid use [i.e., vinyl, nitrile] [CDC¹, p. 33]) **(I- OSHA Required for professional rescuers)**
 - A dressing, or extra clothes placed between provider and the victim's body fluids can serve as an improvised barrier.
 - Take care not to touch with the gloves any unclean object (including self) except for the first aid care location.

** 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. (CDC¹, p.32). **(I)**
 - Remove gloves by turning them inside out and dispose of them properly.
- Avoid touching one's own 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. (CDC¹ 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 CDC¹ (p. 45) found that Hand-Hygiene Antiseptic Agents that contained 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*) (CDC¹, p. 32). **(I)**
- Washing hands with soap (either non-antimicrobial or antimicrobial) and water is preferable if exposure to anthrax is suspected because alcohols, chlorhexidine, iodophors, and other antiseptic agents have poor activity against spores (CDC¹ 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.

Home Care Providers:

As part of an overall program to improve hand hygiene practices of Home Care Providers, 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. The available research suggests that home care providers should:

Prior to Rendering Care:

1. Trim long fingernails (II).
2. Remove rings (II).²⁶
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.²⁷

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 one’s own 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 antibacterials 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) ²⁸.
3. Rinse hands with water. Avoid using hot water, because repeated exposure to hot water can increase the risk of dermatitis (II) ²⁹. Use a paper towel to turn off the faucet (II).
4. Dry the hands using warm air without rubbing or disposable paper towels (II) ³⁰. Do not use multiple-use cloth towels of the hanging or roll type (III).

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)³¹.
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)³².
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)^{33, 34}.

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 or other body fluids, wash hands with either a non-antimicrobial soap and water or an antimicrobial soap or water (I).
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 (I).
3. Decontaminate hands after contact with any body fluids or excretions, mucous membranes, non-intact skin or wound dressings or intact skin (I).
4. Decontaminate hands after contact with inanimate objects in the vicinity of a contaminated person (II).
5. Before eating and after using a restroom, wash hands with a non-antimicrobial soap and water or with an antimicrobial soap 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. Follow manufacturer's recommendations regarding volume of product to use (II).

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 (II).
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 (IV).

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. This recommendation may not be necessary for lay rescuer guidance where repeated hand washing is unlikely (I).

Other aspects of hand hygiene

1. Wear gloves when contact with blood or other potentially infectious materials, mucous membranes and non-intact skin occur (I).
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 (II).
3. Remove all jewelry and sanitize separately (IV).
4. If artificial fingernails, extenders or natural fingernails beyond ¼ inch are worn, additional care must be given to washing beneath the nail (No recommendation).

Summary of Key Articles/Literature Found and Level of Evidence/Bibliography

Author(s)	Full Citation	Summary of Article	Level of Evidence (Using table below)
Ansari, SA, Sattar SA, et.al.	In vivo protocol for testing efficacy of hand washing agents using rotavirus, <i>Applied Env. Microbio.</i> (1989) 55: 3113-3118	In a prospective study of efficacy of handwashing agents alcohol (70% isopropanol or ethanol) were shown to be more effective than Savlon, proviodine, Dettol, Hibisol soaps in removing rotavirus or E. coli from contaminated hands	Level 2a
Bellamy, K, Alcock, R., et. al.,	A test for the assessment of hygienic hand disinfection using rotavirus, <i>J. Hosp. Infect.</i> , (1993) 24: 201-210	Using a standardized method in which fingers are inoculated with bovine rotavirus, it was shown that alcoholic hand rubs were much more effective than soap and water or disinfectant detergents at removing virus from contaminated hands	Level 2a
Centers for Disease Control and Prevention	Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDS A 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 government.	Level 5
Diekema, D.J.,	Alcohol-based hand gels and hand hygiene in hospitals, <i>Lancet</i> , (2002) 360: 1510.	Offers an alternative conclusion based on the study of Kramer et al, which concludes that a four log reduction in bacterial count is not necessary as there is no data to show that a 3 log reduction results in increased pathogen transmission	Level 7
Gordin FM, Schultz ME, Huber RA, Gill JA.	Reduction in nosocomial transmission of drug-resistant bacteria after introduction of an alcohol-based handrub. <i>Infection Control & Hospital</i>	provide clinical validation of the recent CDC recommendation that ABHRs be the primary choice for hand decontamination	Level 2c

	Epidemiology. 2005:26(7): 650-653.		
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	Evaluation of virucidal compounds for inactivation of rhinovirus on hands, <u>Antimicrob. Agent Chemother.</u> (1978) 14: 690 – 694,	Alcohol-based hand rubs are effective against rhinovirus	Level 2a
Kampf G and Ostermeyer C.	Efficacy of two distinct ethanol based hand rubs for surgical hand disinfection – a controlled trial according to prEN12791, BMC Infect. Dis. (2005) 22: 17	Study shows alcohol rub based on 80% ethanol was effective in disinfecting hands contaminated with E coli, while an a hand rub based on 61% ethanol and 1% chlorhexidine gluconate was not according to the German government guidelines (4 log reduction in E coli counts)	Level 2a
Kramer, A., and Rudolph, P., et al,	Limited efficacy of alcohol-based hand gels, <u>Lancet</u> , (2002) 359: 1489 – 1490	Study shows alcohol based hand rinses are more effective than alcohol based hand gels in disinfecting E coli according to the German government methodology (4 log reduction in E coli counts)	Level 2a
Larson E. and Bobo, L.,	Effective hand degerming in the presence of blood, <u>J. Emerg. Med.</u> ,(1992) 10: 7 – 11.	Study shows alcohol hand rubs are not appropriate for use when hands are visibly dirty or contaminated with proteinaceous material	Level 2a
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 hand washing 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	Level 1b

		risk of cross-transmission.	
European Standard Committee	Chemical disinfectants and antiseptics – hygienic hand rubs – test method and requirements, <u>European Standard</u> , (1997) EN1500, Brussels	Government based review article and recommendations	Level 5
FDA	Tentative final monograph for healthcare antiseptic drug products, <u>Fed. Reg.</u> , (1994) 59: 31441 – 52.	Government based review article and recommendations	Level 5
Johnson PD, Martin R., et al.,	Efficacy of an alcohol/chlorhexidine hand hygiene program in a hospital with high rates of nosocomial methicillin-resistant Staphylococcus aureus (MRSA) infection Med J Aust. (2005) 183: 509-514	Introduction of alcohol/chlorhexidine hand rub and behavioral changes resulted in a improved hand hygiene compliance and reduced MRSA nosocomial infections	Level 2a
Kac G. Podglajen I et. al.,	Microbiological evaluation of two hand hygiene procedures achieved by healthcare workers during routine patient care: a randomized study J. Hosp Infect. (2006) 60: 32-39	Study demonstrated use of alcohol hand rubs were more effective than handwashing with unmedicated soap and water for decontaminating hands after patient contact	Level 2a
Larson, E.L. and Morton, H.E.,	Alcohols. In: Block SS, ed. <u>Disinfection, sterilization and preservation</u> , 4 th ed. Philadelphia, Lea and Fibiger, 642 – 54. (1991)	Review article of different hand hygiene techniques	Level 5
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	The 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.	A systematic review of the effectiveness of antimicrobial rinse-free hand sanitizers for	The available evidence for the effectiveness of antimicrobial rinse-free hand sanitizer in the school environment is of low quality. The	Level 4

	prevention of illness-related absenteeism in elementary school children. BMC Public Health. 2004;4(1): 50. [Accessed online http://www.pubmedcentral.gov/articlerender.fcgi?tool=pmcentrez&artid=534108]	results suggest that the strength of the benefit should be interpreted with caution. Given the potential to reduce student absenteeism, teacher 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	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 hand washing 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.,	Cost implications of	Evaluation shows total cost of hand	Level 4

and Sax, H., et al	successful hand hygiene promotion, <u>Infect. Control</u> , (2004)25: 264 – 266.	hygiene program emphasizing alcohol-based hand rubs cost less than 1% of the costs associated with nosocomial infections.	
Rotter, M.L.,	Arguments for alcoholic hand disinfection <u>J. Hosp. Infect.</u> , (2001) 48: S4 – S8.	Review article concludes that alcohol based hand rubs exert the strongest and fastest antimicrobial activity against the widest spectrum of bacteria and fungi. Alcohols not effective against bacterial spores or non-enveloped viruses	Level 5
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. <u>Pediatrics</u> . (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 childcare. Hand sanitizers and multifaceted educational messages may have a role in improving hand-hygiene practices within the home setting.	Level 1a
Seal, LA, Rizer, RL., Maas-Irslinger, R	A unique water optional health care personnel handwash provides antimicrobial persistence and residual effects while decreasing the need for additional products <u>Am J. Infect. Control</u> (2005) 33: 207-216.	Alcohol hand rub containing 61% ethanol plus zinc pyrithione resulted in a greater than 3 log reduction in <i>Serratia marcescens</i> counts when test in accordance with the US FDA protocol and thus considered suitable for hand hygiene settings	Level 2a
Sickbert-Bennett, EE, Weber, DJ et al	Comparative efficacy of hand hygiene agents in the reduction of bacteria and viruses	Fourteen hand hygiene agents were studied according to the USFDA protocol. Antimicrobial handwashing agents were most efficacious in bacterial removal than waterless agents. Alcohol based hand rubs had better efficacy after a single washing than after multiple episodes	Level 2a
Trick WE, Vernon MO, Haye, RA, Nathan, C, Rice, TW, Peterson, BJ, Segreti, J, Welbel,	Impact of ring wearing on hand contamination and comparison of hand hygiene agents in a hospital. <u>Cin.Infect. Dis.</u> (2003): 36(11) 1383-90.	Ring wearing increased the frequency of hand contamination and use of alcohol-based hand rub resulted in significantly less hand contamination in surgical intensive care nurses	Level 2 a

SF, Solomon SL, Weinstein RA			
Weber DJ, Sickbert- Bennett E, Gergen, MF, Rutala	Efficacy of selected hand hygiene agents used to remove <i>Bacillus atrophaeus</i> (a surrogate of <i>Bacillus anthracis</i>) from Contaminated hands. JAMA (2003), 289(10): 1274-1277.	Handwashing with soap and water, 2% chlorhexidine gluconate or chlorine-containing towels reduced the spore contamination whereas the use of a waterless rub containing ethyl alcohol was not effective in removing spores	Level 2a
Wendt, C.,) Hand hygiene – comparison of international recommendations, <u>J. Hosp. Infect.</u> , (2001)48: S23 – S28.	Review and comparison of international recommendations for hand hygiene regarding technique and indication	Level 5
Whitby, M., McLaws, ML., Ross, MW	Why healthcare workers don't wash their hands: a behavioral explanation Infect Control Hosp Epidemiol (2006) 27: 484-492	Study shows that introduction of alcohol based hand rubs resulted in a small improvement in handwashing adherence and that behavioral modification is needed for sustained increase.	Level 2a
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 hand washing through <u>increasing awareness of the importance of hand hygiene</u> , 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. <u>Dangel</u> <u>M</u>	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 hand washing to the alcohol handrub	Level 2a
Wolff, M.H., Schmitt, J.,	Hepatitis A virus: A test method for virucidal activity, <u>J. Hosp.</u>	Study showed that two alcohol based hand rubs (80% ethanol with isopropanol and 95% ethanol without	Level 2a

et al	<u>Infect</u> ,(2001) 48: S18 – S22.	isopropanol) were ineffective in accordance with German government guidelines at removing hepatitis A virus from hands. The hand rubs did not result in a log10 reduction factor of 4 after 10 mins.	
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. <u>Control & Hospital Epidemiology</u> . (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	<u>Prospective</u> , controlled, non-randomized, cohort studies
Level 2b	<u>Historic</u> , non-randomized, cohort or case-control studies
Level 2c	<u>Case series</u> : 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.

¹ Centers for Disease Control and Prevention. 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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- ⁸ 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.
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- ¹¹ 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.
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