ARC SAC SCIENTIFIC REVIEW
Hand Hygiene

Questions to be addressed:

Original:
Good hand hygiene is recognized as a deterrent to the spread of disease-causing microbes. In a first aid situation, what is the "best" method of hand hygiene for Certified Lay Responder and the Lay Community Responder?

For those providing care in the home for someone who is sick or disabled, what is the best method of hand hygiene to protect the patient, the caregiver, and other members of the household from disease transmission?

What hand hygiene methods can be promoted to the general public to reduce disease transmission?

Updated 2019:
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?

What are the general guidelines about hand hygiene products to include in first aid kits? (Note: this was a SAC Answer in 2010 that is now incorporated into the Hand Hygiene SR for 6-2019.)

Introduction/Overview:
Provide the rationale for this review, context for the review and any background that would help the reader understand the issues covered and why this was an important question(s)

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)[i] 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-heath 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.

Search Strategy and Literature Search Performed

Updated 2019:

Review Process and Literature Search of Evidence Since Last Approval Performed

A literature search was performed and included the following results:

Search ("Hand Hygiene"[Mesh] OR "Hand Disinfection"[Mesh] OR “hand hygiene” OR “hand disinfection” OR “hand washing”) Filters: Clinical Trial; Comparative Study; Consensus Development Conference; Evaluation Studies; Meta-Analysis; Randomized Controlled Trial; Review; Systematic Reviews; Publication date from 2016/01/01 to 2019/03/27; English 330 items PubMed

Interface - EBSCOhost Research Databases [CINAHL Complete;Global Health;Health Source - Consumer Edition;Health Source: Nursing/Academic Edition] (hand hygiene or handwashing or hand washing or hand sanitation) AND (EMERGENCY OR LAY RESPONDERS OR FIRST RESPONDERS) Limiters - Published Date: 20150101-20191231 Narrow by Language: - English 173 330+163 =493 dups removed=447

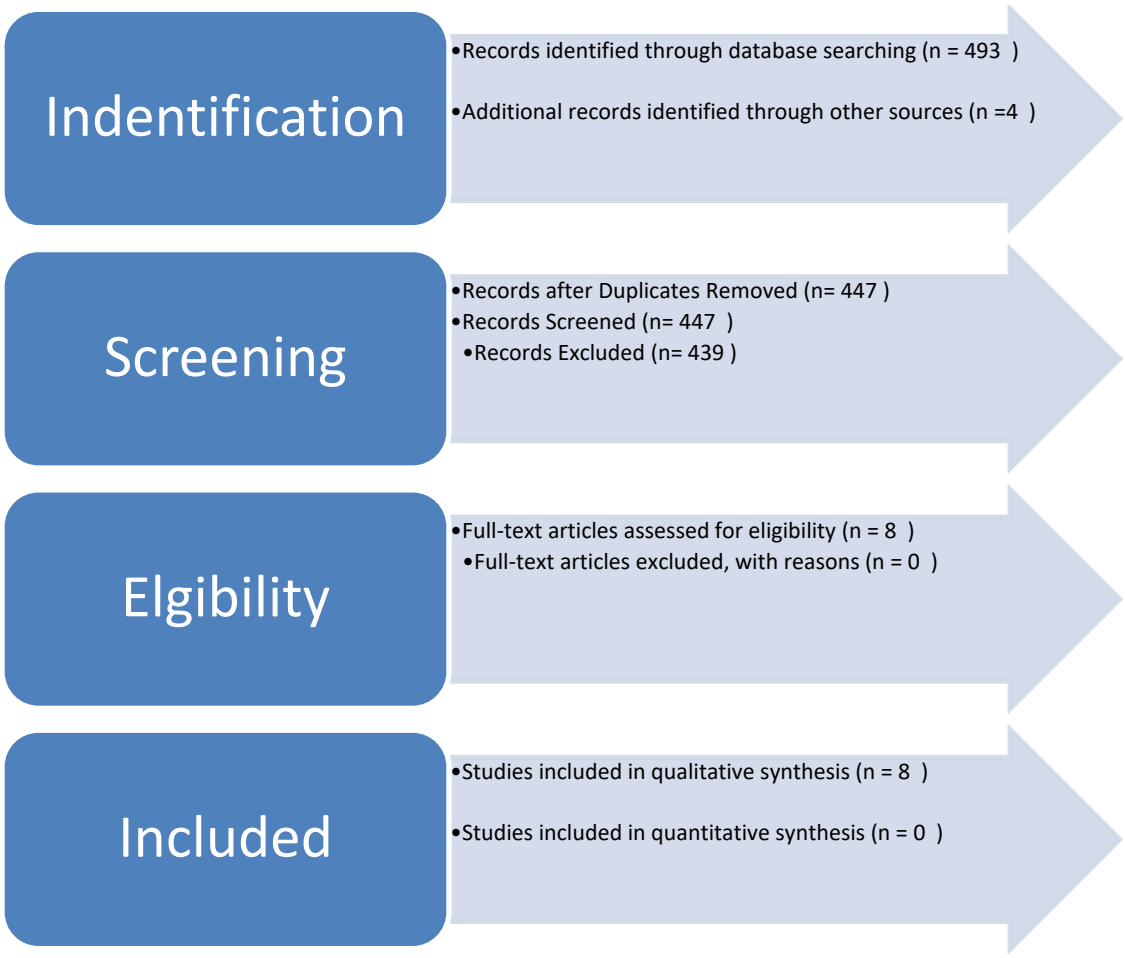
For this TR 447 titles were reviewed by the team assigned hand hygiene with 5 full text studies ultimately included. The CDC.gov website for hand hygiene was also reviewed.

Key Words Used

Inclusion Criteria (time period, type of articles and journals, language, methodology)

Exclusion Criteria (only human studies, foreign language, etc…)

Databases Searched and Additional Methods Used (references of articles, texts, contact with authors, etc...)


Indentification
•Records identified through database searching (n = 493)
•Additional records identified through other sources (n =4)
Screening
•Records after Duplicates Removed (n= 447)
•Records Screened (n= 447)
•Records Excluded (n= 439)
Elgibility
•Full-text articles assessed for eligibility (n = 8)
•Full-text articles excluded, with reasons (n = 0)
Included
•Studies included in qualitative synthesis (n = 8)
•Studies included in quantitative synthesis (n = 0)

Scientific Foundation:

2019 Updated Scientific Foundation:

Previous triennial reviews on hand hygiene have made note that multiple research articles on hand hygiene overwhelming focus on the care provider's compliance with hand hygiene rather than new products or methods for hand hygiene. For this updated 2019 TR, the vast majority of research articles are similarly focused on hand hygiene compliance. The original scientific review on this topic provided recommendations for hand hygiene for three groups: Lay First Aid Responders, Home Care Providers, and the general public and is based on the CDC recommendations for hand hygiene. An extensive literature review at this time has not produced significant new information and **the CDC has not issued a new statement since their 2002 publication.**[1] As there are no new recommendations from the CDC at this time, and no significant new studies, there are no recommendations to change the prior 2016 hand hygiene guidelines and recommendations from the American Red Cross SAC.

Five publications were identified and included in the 2019 triennial review, including one survey, one systematic review, and one narrative review. No randomized controlled studies or cohort studies of hand hygiene were identified.

For *first aid kits*, there was no evidence found of a particular hand sanitizer item that should be included in kits that would improve hand hygiene compliance, however there is evidence that the while the presence of available hand sanitizer in the ambulance did not improve reported hygiene rates but improved reported rates of cleaning the stethoscope. One study found that ABHS must contain at least 60% ethanol or more and applied in a quantity to saturate all surfaces of both hands (generally at least 2 mL).[15,17] The recommended time of contact for alcohol-based sanitizers varies between CDC recommendation of 20 seconds to dry and other studies suggesting between 15 and 30 second. If an adequate quantity is applied to thoroughly coat all surfaces, it will likely take close to 20 seconds to dry. A previous SAC Answer on hand hygiene products contained suggestions that are supported by this current triennial review: Factors to be considered in identifying a product to be placed in a first aid kit or disaster kit:

- disposable foil type packets helpful in making sure the recommended amount is used
    - foil packets limit cross contamination
    - Emergency or Disaster kits may consider multiple use bottle for rationing to serve more people
- appropriate quantity for intended use (i.e., clean hand pre & post care; sheltering in place)
- adequate quantity supplied to ensure proper application of a palmful of alcohol-based hand rub and adequate coverage for the entire surfaces of both hands for each application
- expiration date labeled on any item must be considered
- appropriate packaging for durability and accessibility
- storage temperature range must be considered which would include possible storage locations including environmental disaster (cold or heat) and areas like cars.

A recent study by Buchner et.al. evaluated 1494 responses to surveys about hand hygiene practices.[2] Overall reported hand hygiene practices were poor among pre-hospital providers in all clinical situations. Women reported that they washed their hands more frequently than men

overall, although the differences were unlikely to be clinically significant. Hygiene after invasive procedures was reported to be poor. The presence of available hand sanitizer in the ambulance did not improve reported hygiene rates but improved reported rates of cleaning the stethoscope (absolute difference 0.4, p=0.0003). Providers who brought their own sanitizer were more likely to clean their hands.

A systematic review by Foddai et.al.[3] collated scientific information on the efficacy of hand sanitizers compared with washing hands with soap and water for the removal of foodborne pathogens from the hands of food handlers.[3] Scientific evidence seems to support the historical skepticism about the use of waterless hand sanitizers in food preparation settings. Water and soap appear to be more effective than waterless products for removal of soil and microorganisms from hands. Alcohol-based products achieve rapid and effective inactivation of various bacteria, but their efficacy is generally lower against nonenveloped viruses.

Kampf et.al.[4] conducted a narrative review to assess the potential benefits and risks for disinfecting gloved hands during patient care for multiple activities with indicated glove use on the same patient. Three independent studies were reviewed and shown that decontamination is at least as effective on gloved hands as on bare hands and that puncture rates are usually not higher after up to 10 disinfections. One study on a neonatal intensive care unit showed that promotion of disinfecting gloved hands during care on the same patient resulted in a significant reduction in the incidence of late-onset infections and of necrotizing enterocolitis. The authors concluded that disinfection of gloved hands by HCWs may substantially reduce the risk of transmission when gloves are indicated for the entire episode of patient care and when performed during multiple activities on the same patient.

Pires, D et. Al[18] evaluated the influence of hand-rubbing duration on the reduction of bacterial counts on the hands of healthcare personnel. We performed an experimental study based on the European Norm 1500. Hand rubbing was performed for 10, 15, 20, 30, 45, or 60 seconds, according to the WHO technique using 3 mL alcohol-based hand rub. It was reported that hand rubbing for 15 seconds was not inferior to 30 seconds in reducing bacterial counts on hands under the described experimental conditions. There was no gain in reducing bacterial counts from hand rubbing longer than 30 seconds.

Currently hand hygiene procedures also include the use of alcohol-based hand sanitizers (ABHS) as a means of eliminating contamination from hands. The CDC legitimated ABHS because it recognized that the efficacy of alcohol sanitizers was greater than soap and water, that the requirement of traditional soap-and-water handwashing was difficult during a busy hospital day, and that healthcare workers were more likely to use hand sanitizers which are accessible, fast, and more gentle on hands.[5] Updated issues regarding ABHS include the following:

The Centers for Disease Control[6] notes that ABHS contains ethyl alcohol, which readily evaporates at room temperature into an ignitable vapor, and is considered a flammable liquid. Although the incidence of fires related to ABHS is very low, it is vital that ABHS is stored safely and that bulk dispensers are installed and maintained correctly. Fire safety includes activities that reduce sources of ignition, ensures storage of flammable liquids in a safe manner, and establishes methods for quick exits in case of fire.

Clostridium difficile is a common healthcare-associated infection that causes severe diarrhea. *C. difficile* forms spores that are not killed by an ABHS. The spores can be transferred to patients via the hands of healthcare providers who have touched a contaminated surface or item. The Centers for Disease Control[7] recommends that the most effective way to prevent the spread of *C. difficile* is by washing your hands with soap and water after touching potentially contaminated surfaces and not ABHS.

The U.S. Food and Drug Administration issued a final rule[8,9] designed to help ensure that hand sanitizers available over-the-counter (OTC) are safe and effective for those who rely on them. The rule establishes that certain active ingredients are not allowed to be used in OTC hand sanitizers. Currently the FDA has banned 28 ABHS active ingredients, including triclosan and benzethonium chloride in over the counter hand sanitizers sold in the US. At this time, three active ingredients—benzalkonium chloride, ethyl alcohol, and isopropyl alcohol—are being deferred from further rulemaking to allow for the ongoing study and submission of additional safety and effectiveness data necessary to make a determination regarding whether these active ingredients are generally recognized as safe and effective

One study reported that in a clinical setting, a three-step hand hygiene protocol resulted in higher compliance with both hand hygiene technique and indications compared with the six-step method endorsed by WHO.[10] Researchers conducted a cluster-randomized trial of the three-step process; consists of covering all surfaces of the hands followed by rotational rubbing of fingertips in the palm of the alternate hand and rotational rubbing of both thumbs. Among 294 health care workers, researchers observed 2,923 hand hygiene indications with an overall compliance rate of 70.7% (n = 2,066). On wards assigned to the three-step technique, compliance with hand hygiene indications was 75.9% and technique compliance was 51.7%. On wards assigned to the six-step technique, hand hygiene indication compliance was 65% and compliance to technique was 12.7%, according to the study. Furthermore, when both techniques were compared, the reduction factor of bacterial counts did not differ ($P = .629$).

In healthcare workers, dry, cracked skin, known clinically as cumulative irritant contact dermatitis, results largely from the frequent hand washing required to reduce the spread of germs and prevent infection. Healthy skin is a barrier to infection, whereas compromised skin is vulnerable to the pathogens prevalent in healthcare facilities. The physical structure of dry, cracked skin makes it easier for pathogenic organisms to thrive.[11,16] This has led to previous recommendations to use hand lotion twice daily to prevent chafing and cracking of skin. However, a recent study[12] evaluated the current state of bacterial contamination of hand lotions used in clinics and to determine the efficacy of hand lotion preservatives to kill bacteria. Unopened containers were studied and of the 81 containers sampled, 16 supported bacterial growth, such MRSA (19.8%). Container threads displayed the highest contamination compared with other container locations ($p < 0.01$). No bacteria were found in unopened lotion containers. Enrichment cultures using lotions studied here supported the growth of several bacterial species. These findings suggest the need for standardized protocols for use of hand lotions to help reduce potential healthcare-associated infections due to use of lotions. Improved efficacy of preservatives added to lotions should be a priority.

Regarding hand lotions, a recent study[13] highlighted the three-step hand hygiene process, hand wash, hand sanitizer and hand sanitizer lotion that provides increased skin moisturization without compromising antimicrobial efficacy by comparing it to a two-part hand hygiene regimen, hand wash and hand sanitizer. Statistical analyses of the data revealed the addition of the hand sanitizer lotion to the handwashing regimen produced greater antimicrobial reductions and Corneometer readings confirmed the increase in skin moisturization with no adverse effects.

Regular, scheduled use of an appropriate lotion is the key to maintaining healthy skin. An effective skin lotion must rehydrate the skin to maintain its flexibility and help prevent cracking. It also must replace the natural oils removed by washing to help retain moisture. The three general ingredients needed to achieve these goals are emollients, humectants, and skin nutrients. Healthcare workers and home care providers need to use hand moisturizers even if they don't think their skin is dry. Hospitals and health care providers are moving to a medical-grade antibacterial lotion that works with chlorhexidine gluconate (CHG) washes in a pump bottle rather than multiuse lotion container so less risk of contamination.[14]

2006 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 al[ii] and White et al[iii], 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 al[iv], Gordin et al[v]).

Montville et al[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 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 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 were two aspects of hand washing that were 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 an alcohol-based hand rub. They further recommend not wearing artificial nails or extenders and maintaining shorter length natural nails.

The CDC's[i] 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 Dangel[ix] 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 al[xi], 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. 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 has been associated with skin dryness and irritation (CDC[i], 2002), which could account for some instances of non-compliance. Pittet[xiii] et al., (2004) demonstrated that the cost of hand hygiene promotion was 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 could potentially ignite cleaners that have 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 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 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 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,[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 titer, the disinfectants studied 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. It is recommended that Professional Rescuers follow the Guidelines for Hand Hygiene in Health Care Settings (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. 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 (CDC[i], 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 & 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."[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 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.

2019 Textual summary of recommendations:
Current science supports the reaffirmation of the Red Cross Advisory statements for hand hygiene for home healthcare providers, lay First Aid providers, and the general public. Based on low overall compliance with hand hygiene, which the CDC reports is performed around half the times that is recommended in healthcare settings,[1] the Red Cross should continue to include hand hygiene training in its courses. Given the high rate of low compliance with hand hygiene, the Red Cross should consider investigating educational methods that will encourage compliance with hand hygiene for course participants.

In addition, the Red Cross should also include in education to home care providers that when involved in food preparation and handling that water and soap appear to be more effective than hand sanitizers in removal of soil and microorganisms from hands. For First Aid responders and other health care workers, the Red Cross should include in education that disinfection of gloved hands with hand sanitizers may substantially reduce the risk of transmission when gloves are indicated for the entire episode of patient care and when performed during multiple activities on the same person.

Healthcare providers should use a lotion that is a 'medical grade' lotion.

Recommendations and Strength (Updated 6-2019, changes highlighted)

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 ABHS or alternatively soap and water prior to and after patient care and after removing gloves.

Home caregivers known to be caring for persons contaminated with Clostridium difficile should wash their hands with soap and water after touching potentially contaminated surfaces.

In *First Aid situations*, visibly soiled hands should be washed with soap and water.

- 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
    - 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.

- Maintain a barrier (i.e., don gloves designed for first aid use [i.e., vinyl, nitrile])
- Wash hands or use gel and change gloves after rendering care for one victim and before rendering care for another victim.
- 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.
- Wash hands with soap (either non-antimicrobial or antimicrobial) and water if exposure to anthrax or C. difficile 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

Guidelines:

Home Caregivers:

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.

First Aid Situations:

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

- Avoid touching one's own eyes, nose, and mouth while giving care. Avoid eating during first aid.
- 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.

First Aid Kits

First aid kits should be equipped with an ethanol-based product of 60% ethanol or more in a quantity to allow saturation of all surfaces of both hands (generally at least 2 mL).

Options: To minimize skin irritation, use a hand lotion twice daily that does not compromise the integrity of the gloves. Healthcare providers should use a lotion that is a 'medical grade' to avoid bacterial contamination.

Under austere circumstances, first aid responders and other health care workers may consider disinfecting their gloved hands with an ABHS when caring for a single patient if providing care for multiple contaminated areas.

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

(Please fill in the following table for articles that were used to create your recommendations and/or guidelines. For references please us the American Medical Association Manual of Style and please only use abbreviations for journal names as listed in index medicus) 2006:

Author(s)	Full Citation	Summary of Article	Level of Evidence (Using table below)
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.	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 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	**Level 1b**

		be as important as product in reducing risk of cross-transmission.	
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.	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	**Level 4**

	[Accessed online http://www.pubmedcentral.gov/articlerender.fcgi?tool=pmcentrez&artid=534108]	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	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	**Level 2c**

		bacterial transmission via hand contacts.	
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., 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 childcare. 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	Hand-hygiene practices were improved with increased frequency of hand washing through increasing awareness of the importance of hand hygiene, and the use of alcohol gel	**Level 2a**

	Infection Control. 2003:31(6): 364-370.	hand sanitizer in university dormitories. This resulted in fewer upper respiratory-illness symptoms, lower illness rates, and lower absenteeism.	
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 hand washing 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**

2019 Updated Table of Evidence:

Author(s)	Full Citation	Summary of Article (provide a brief summary of what the article adds to this review including which question(s) it supports, refutes or is neutral)	Methodology[1]	Bias Assessment[2]	Indirectness/ Imprecision/ Inconsistency	Key results and magnitude of results	Support, Neutral or Oppose Question	Level of Evidence (Using table below)	Quality of study (excellent, good, fair or poor) and why
Supporting Articles									
Bucher, J., Donovan, C. Ohman-Stickland, P. & McCoy, J.	Bucher, J., Donovan, C. Ohman-Stickland, P. & McCoy, J. (2015) Hand Washing Practices Among Emergency Medical Services Providers. Western Journal of Emergency Medicine, 16, 5, 727-735.	This study evaluated 1494 responses to surveys about hand hygiene practices. Overall reported practices were poor among pre-hospital providers in all clinical situations. Women reported that they washed their hands more frequently than men overall, although the differences were unlikely to be clinically significant. Hygiene after invasive procedures was reported to be poor. The presence of available hand sanitizer in the ambulance did not improve reported hygiene rates but improved reported rates of cleaning the stethoscope (absolute difference 0.4, p=0.0003). Providers who brought their own sanitizer were more likely to clean their hands.	A survey was distributed various national EMS organizations through email. Descriptive statistics were calculated for survey items and subpopulations of survey respondents to identify relationships between variables. Analysis of variance was used to test differences in means between subgroups.	Despite large number of surveys, a convenience sample was used so there may have been selection bias perhaps over-estimating hand hygiene practices. There may be recall bias & findings may only represent an association rather than causal relationship. Although results are statistically significant, they may not be clinically significant.	There is no **Indirectness** in that the study did limit participants to emergency responders No significant **Imprecision** appears to exist as the sample was large. **Inconsistency** could be judged to exist related to potential selection bias.	The presence of available hand sanitizer in the ambulance did not improve reported hygiene rates but improved reported rates of cleaning the stethoscope (absolute difference 0.4, p=0.0003). Providers who brought their own sanitizer were more likely to clean their hands.	**Support** These results, at initial view could seem to support the use hand sanitizers in ambulances or care environment as a best practice that would encourage better hand hygiene.	2b weak Defined as a retrospective study using online surveys with assumed limitations.	Fair to Good. The study did attempt to answer the question is a retrospective study. The weakness comes from the limitations already addressed.
Foddal, A.C.G., Grant, I.R. & Dean, M.	Foddai, A.C.G., Grant, I.R. & Dean, M. (2016)	The aim of this systematic review was to collate scientific information on the efficacy of hand sanitizers compared with	Systematic review to collate scientific information on the efficacy of hand sanitizers	Since this is not a study, but a systematic review, it is inherently at	This review **Indirectly** addresses of the better method for hand hygiene	An extensive literature search was carried out using three electronic	This systematic review does provide evidence that for home care	5	Good. The study appears to be appropriately

[1] Determination of study types is based on the classification system proposed by the Center for Evidence-based Medicine (CEBM) at Oxford University. (https://www.cebm.net/2014/04/study-designs/)

[2] Bias assessment based on bias definitions proposed by the Center for Evidence-based Medicine (CEBM) at Oxford University and maintained as "The Catalogue of Bias." (https://catalogofbias.org/)

Author(s)	Full Citation	Summary of Article (provide a brief summary of what the article adds to this review including which question(s) it supports, refutes or is neutral)	Methodology[1]	Bias Assessment[2]	Indirectness/ Imprecision/ Inconsistency	Key results and magnitude of results	Support, Neutral or Oppose Question	Level of Evidence (Using table below)	Quality of study (excellent, good, fair or poor) and why
	Efficacy of Instant Hand Sanitizers Against Foodborne Pathogens Compared with Hand Washing with Soap & Water in Food Preparation Settings: A Systematic Review. Journal of Food Protection, 79, 6, 1040-1054.	washing hands with soap and water for the removal of foodborne pathogens from the hands of food handlers. scientific evidence seems to support the historical skepticism about the use of waterless hand sanitizers in food preparation settings. Water and soap appear to be more effective than waterless products for removal of soil and microorganisms from hands. Alcohol-based products achieve rapid and effective inactivation of various bacteria, but their efficacy is generally lower against nonenveloped viruses.	compared with washing hands with soap and water for the removal of foodborne pathogens from the hands of food handlers. An extensive literature search was carried out using three electronic databases: Web of Science, Scopus, and PubMed. Twenty-eight scientific publications were ultimately included in the review.	risk for bias from the studies that were reported. However, the risk of bias should be minimal.	relative to food preparation. No **imprecision** noted. This report does not appear to have **Inconsistency**	databases: Web of Science, Scopus, and PubMed. Twenty-eight scientific publications were ultimately included in the review. Analysis of this literature revealed various limitations in the scientific information owing to the absence of a standardized protocol for evaluating the efficacy of hand products and variation in experimental conditions. However, despite conflicting results, scientific evidence seems to support the historical skepticism about the use of waterless hand sanitizers in food preparation settings. Water and soap appear to be more effective than waterless products for removal of soil and microorganisms from hands. Alcohol-based products achieve rapid and effective inactivation of various bacteria, but	providers, while preparing food, washing hands with soap and water is more effective than hand sanitizers.		formulated for a systematic review and does answer question on hand hygiene.

Author(s)	Full Citation	Summary of Article (provide a brief summary of what the article adds to this review including which question(s) it supports, refutes or is neutral)	Methodology[1]	Bias Assessment[2]	Indirectness/ Imprecision/ Inconsistency	Key results and magnitude of results	Support, Neutral or Oppose Question	Level of Evidence (Using table below)	Quality of study (excellent, good, fair or poor) and why
						their efficacy is generally lower against nonenveloped viruses. The presence of food debris significantly affects the microbial inactivation rate of hand sanitizers.			
Kampf, G. & Lemmen, S.	Kampf, G. & Lemmen, S. (2017). Disinfection of Gloved Hands for Multiple Activities with Indicated Glove Use on the Same Patient. Journal of Hospital Infection, 97, 3-10.	The aim of this narrative review is to assess the potential benefits and risks for disinfecting gloved hands during patient care for multiple activities with indicated glove use on the same patient. We conclude that disinfection of gloved hands by HCWs may substantially reduce the risk of transmission when gloves are indicated for the entire episode of patient care and when performed during multiple activities on the same patient.	Systematic literature review, studies were selected when they provided original data on glove use and hand hygiene compliance for multiple and/or single patient care activities.	Since this is not a study, but a systematic review, it is inherently at risk for bias from the studies that were reported. However, the risk of bias should be minimal.	This review **Indirectly** addresses of the better method for hand hygiene relative to food preparation. No **imprecision** noted. This report does not appear to have **Inconsistency**	Observational Report of a possible problem. Not an experimental design	Neutral (Tangential evidence regarding possible harm of the intervention)	3b (Case series)	Not a study. Simply a letter to editor reporting an observation.
Pires, D., Soule, H., Bellissimo-Rodrigues, F., Gayet-	Pires, D., Soule, H., Bellissimo-Rodrigues, F., Gayet-Ageron, A.,	Hand rubbing was performed for 10, 15, 20, 30, 45, or 60 seconds, according to the WHO technique using 3 mL alcohol-based hand rub.	Experimental	None noted	Directly answered the question about how long to rub the ABHS solution on hands	In total, 32 HCP performed 123 trials. All durations of hand rubbing led to significant reductions in	neutral	1b	Good

Author(s)	Full Citation	Summary of Article (provide a brief summary of what the article adds to this review including which question(s) it supports, refutes or is neutral)	Methodology[1]	Bias Assessment[2]	Indirectness/ Imprecision/ Inconsistency	Key results and magnitude of results	Support, Neutral or Oppose Question	Level of Evidence (Using table below)	Quality of study (excellent, good, fair or poor) and why
Ageron, A., Pittet, D	Pittet, D. (2017). Hand hygiene with alcohol-based hand rub: How long is long enough? Infect Control Hosp Epidemiol, 38(5), 547-552.	Hand contamination with E. coli ATCC 10536 was followed by hand rubbing and sampling. A generalized linear mixed model with a random effect on the subject adjusted for hand size and gender was used to analyze the reduction in bacterial counts after each hand-rubbing action. In addition, hand-rubbing durations of 15 and 30 seconds were compared to assert non-inferiority (0.6 log10).				bacterial counts (P<.001). Reductions achieved after 10, 15, or 20 seconds of hand rubbing were not significantly different from those obtained after 30 seconds. The mean bacterial reduction after 15 seconds of hand rubbing was 0.11 log10 lower (95% CI, -0.46 to 0.24) than after 30 seconds, demonstrating non-inferiority.			

Level of Evidence	Definitions (See manuscript for full details)
Level 1a	**Experimental and Population based studies -** population based, randomized prospective studies or meta-analyses of multiple higher evidence studies with substantial effects
Level 1b	**Smaller Experimental and Epidemiological studies -** Large non-population based epidemiological studies or randomized prospective studies with smaller or less significant effects
Level 2a	**Prospective Observational Analytical** - Controlled, non-randomized, cohort studies
Level 2b	**Retrospective/Historical Observational Analytical** - non-randomized, cohort or case-control studies
Level 3a	**Large Descriptive studies** – Cross-section, Ecological, Case series, Case reports
Level 3b	**Small Descriptive studies** – Cross-section, Ecological, Case series, Case reports
Level 4	**Animal studies or mechanical model studies**
Level 5	**Peer-reviewed Articles** - state of the art articles, review articles, organizational statements or guidelines, editorials, or consensus statements
Level 6	**Non-peer reviewed published opinions -** such as textbook statements, official organizational publications, guidelines and policy statements which are not peer reviewed 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.

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