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BACK TO BASICS

The Hand Hygiene Primer



Hand hygiene is touted by the Centers for Disease Control and Prevention (CDC) as the No. 1 way to fight healthcare-associated infections (HAIs) but it should be incorporated into a bundle of interventions that also includes environmental hygiene, surveillance, antimicrobial stewardship and other elements of a multi-modal approach to infection prevention and control. We present the basics of hand hygiene as a refresher for all healthcare workers and to help review one of the essentials of HAI prevention.

How to Wash and Sanitize Hands

It may sound simplistic, but many individuals do not know or practice correct handwashing technique. Let's review proper handwashing protocol as outlined by the World Health Organization and the CDC:

How To Wash Your Hands

- ▶ Wet hands with water
- ▶ Apply enough soap to cover all hand surfaces
- ▶ Rub hands palm to palm
- ▶ Right palm over left dorsum with interlaced fingers and vice versa
- ▶ Palm to palm with fingers interlaced
- ▶ Backs of fingers to opposing palms with fingers interlocked
- ▶ Rotational rubbing of left thumb clasped in right palm and vice versa
- ▶ Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa
- ▶ Rinse hands with water
- ▶ Dry hands thoroughly with a single-use towel
- ▶ Use towel to turn off faucet



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The CDC explains the rationale for these steps through various studies in the medical literature:

- ◆ Wet your hands with clean, running water (warm or cold), turn off the tap, and apply soap, because hands could become re-contaminated if placed in a basin of standing water that has been contaminated through previous use. (Palit, et al. 2012) The temperature of the water does not appear to affect microbe removal; however, warmer water may cause more skin irritation and is more environmentally costly. (Carrico, et al. 2013; Laestadius, et al. 2005; Michaels, et al. 2002)

- ◆ Using soap to wash hands is more effective than using water alone because the surfactants in soap lift soil and microbes from skin, and people tend to scrub hands more thoroughly when using soap, which further removes germs. (Burton, et al. 2011; Todd, et al. 2010)

- ◆ Lather your hands by rubbing them together with the soap. Be sure to lather the backs of your hands, between your fingers, and under your nails. Lathering and scrubbing hands creates friction, which helps lift dirt, grease and microbes from skin. Microbes are present on all surfaces of the hand, often in particularly high concentration under the nails, so the entire hand should be scrubbed. (Gordin et al. 2007; Hogue et al. 2003; Lin et al. 2003; McGinley et al. 1988; Todd et al. 2010)

- ◆ Scrub your hands for at least 20 seconds. Need a timer? Hum the “Happy Birthday” song from beginning to end twice. Determining the optimal length of time for handwashing is difficult because few studies about the health impacts of altering handwashing times have been done. Of those that exist, nearly all have measured reductions in overall numbers of microbes, only a small proportion of which can cause illness, and have not measured impacts on health. Solely reducing numbers of microbes on hands is not necessarily linked to better health. (Luby et al. 2007) The optimal length of time for handwashing is also likely to depend on many factors, including the type and amount of soil on the hands and the setting of the person washing hands. Nonetheless, evidence suggests that washing hands for about 15 to 30 seconds removes more germs from hands than washing for shorter periods. (Fuls et al. 2008; Jensen et al. 2012; Todd et al. 2010)

- ◆ Dry your hands using a clean towel or air dry them. Germs can be transferred more easily to and from wet hands; therefore, hands should be dried after washing. (Patrick et al. 1997; Todd et al. 2010) However, the best way to dry hands remains unclear because few studies about hand drying exist, and the results of these studies conflict. Additionally, most of these studies compare overall concentrations of microbes, not just disease-causing germs, on hands following different hand-drying methods. It has not been shown that removing microbes from hands is linked to better health; nonetheless, studies suggest that using a clean towel or air drying hands are best. (Gustafson et al. 2000; Huang et al. 2012; Jensen et al. 2012)

In situations when handwashing with soap and water is not required (such as when hands are not visibly soiled), alcohol-based handrubs are a convenient and effective way to sanitize hands. Let's review proper handrub protocol as outlined by the World Health Organization and the CDC:



It may sound simplistic, but many individuals do not know or practice correct handwashing technique.

How to Handrub

- ▶ Apply a palmful of the product in a cupped hand, covering all surfaces
- ▶ Rub hands palm to palm
- ▶ Right palm over left dorsum with interlaced fingers and vice versa
- ▶ Palm to palm with fingers interlaced
- ▶ Backs of fingers to opposing palms with fingers interlocked
- ▶ Rotational rubbing of left thumb clasped in right palm and vice versa
- ▶ Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa
- ▶ Once dry, your hands are clean

The CDC explains the rationale for these steps through various studies in the medical literature:



◆ Washing hands with soap and water is the best way to reduce the number of microbes on them in most situations. If soap and water are not available, use an alcohol-based hand sanitizer that contains at least 60 percent alcohol. Many studies have found that sanitizers with an alcohol concentration between 60 percent and 95 percent are more effective at killing germs than those with a lower alcohol concentration or non-alcohol-based hand sanitizers. Non-alcohol-based hand sanitizers may: 1) not work equally well for all classes of germs (for example, Gram-positive vs. Gram-negative bacteria, *Cryptosporidium*, norovirus); 2) cause germs to develop resistance to the sanitizing agent; 3) merely reduce the growth of germs rather than kill them outright, or 4) be more likely to irritate skin than alcohol-based hand sanitizers. (Kampf et al. 2004; Todd et al. 2010)



◆ Alcohol-based hand sanitizers can quickly reduce the number of microbes on hands in some situations, but sanitizers do not eliminate all types of germs. Although alcohol-based hand sanitizers can inactivate many types of microbes very effectively when used correctly (CDC 2002; Edmonds et al. 2010; Grayson et al. 2009; Hammond et al. 2000; Hubner et al. 2010; Kramer et al. 2006; Lee et al. 2005; Sandora et al. 2005; Stebbins et al. 2011; Kampf et al. 2010), people may not use a large enough volume of the sanitizers or may wipe it off before it has dried. Furthermore, soap and water are more effective than hand sanitizers at removing or inactivating certain kinds of germs, like *Cryptosporidium*, norovirus, and *Clostridium difficile*. (Barbee et al. 199; Blaney 2011; Charbonneau et al. 2000; Grayson et al. 2009; Oughton et al. 2009)



◆ Hand sanitizers may not be as effective when hands are visibly dirty or greasy. Many studies show that hand sanitizers work well in clinical settings like hospitals, where hands come into contact with germs but generally are not heavily soiled or greasy. (Todd et al. 2010) Some data also show that hand sanitizers may work well against certain types of germs on slightly soiled hands. (Pickering et al. 2011; Pickering et al. 2010) When hands are heavily soiled or greasy, hand sanitizers may not work well. (Todd et al. 2010; Charbonneau et al. 2000; Edmonds et al. 2010) Handwashing with soap and water is recommended in such circumstances.



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When to Wash and Sanitize Hands

Healthcare workers (HCWs) should practice hand hygiene at key points in time to disrupt the transmission of microorganisms to patients including: before patient contact; after contact with blood, body fluids or contaminated surfaces (even if gloves are worn); before invasive procedures; and after removing gloves (wearing gloves is not enough to prevent the transmission of pathogens in healthcare settings).

The World Health Organization (WHO) has introduced the concept of “five moments for hand hygiene” which aims to foster positive outcome evaluation by linking specific hand hygiene actions to specific infectious outcomes in patients and HCWs (positive outcome beliefs); and increase the sense of self-efficacy by giving HCWs clear advice on how to integrate hand hygiene in the complex task of care (positive control beliefs). Furthermore, it reunites several of the attributes that have been found to be associated with an increased speed of diffusion of an innovation such as relative advantage by being practical and easy to remember, compatibility with the existing perception of microbiological risk, simplicity as it is straightforward, trialability as it can be experimented with on a limited basis, and specifically tailored to be observable. The fact that the concept uses the number 5 like the five fingers of the hand gives it a ‘stickiness factor’, i.e., the capacity to “stick” in the minds of the target public and influence its future behavior, that could make it a carrier of the hand hygiene message and help it to achieve the tipping point of exponential popularity. Since its development in the context of the Swiss National Hand Hygiene Campaign and its integration in the WHO Multimodal Hand Hygiene Improvement Strategy, the concept of “five moments for hand hygiene” has been adopted in hospitals worldwide.

The WHO’s five moments for hand hygiene are:

MOMENT 1 Before touching a patient: This occurs between the last hand-to-surface contact with an object belonging to the healthcare area and the first within the patient zone. Hand hygiene at this moment will mainly prevent colonization of the patient with healthcare-associated microorganisms, resulting from the transfer of organisms from the environment to the patient through unclean hands, and exogenous infections in some cases. A clear example would be the temporal period between touching the door handle and shaking the patient’s hand: the door handle belongs to the healthcare area outside the patient zone, and the patient’s hand belongs to the patient zone. Therefore hand hygiene must take place after touching the door handle and before shaking the patient’s hand. If any objects are touched within the patient zone after opening the door handle, hand hygiene might take place either before or after touching these objects, because the necessity for hand hygiene before touching objects within the patient zone is not supported by evidence; in this case the important point is that hand hygiene must take place before touching the patient. (WHO, 2009)

MOMENT 2 Before a clean/aseptic procedure: Once within the patient zone, very frequently after a hand exposure to the patient’s intact skin, clothes or other objects, the HCW may engage in a clean/aseptic procedure on a critical site with infectious risk for the patient, such as opening a venous access line, giving an injection, or performing wound care. Importantly, hand hygiene required at this moment aims at preventing HAI. In line with the predominantly endogenous origin of these infections, hand hygiene is taking place between the last exposure to a surface, even within the patient zone and immediately before access to a critical site with infectious risk for the patient

or a critical site with combined infectious risk. This is important because HCWs customarily touch another surface within the patient zone before contact with a critical site with infectious risk for the patient or a critical site with combined infectious risk. (WHO, 2009)

MOMENT 3 After body fluid exposure risk: After a care task associated with a risk to expose hands to body fluids, e.g., after accessing a critical site with body fluid exposure risk or a critical site with combined infectious risk (body fluid site), hand hygiene is required instantly and must take place before any next hand-to-surface exposure, even within the same patient zone. This hand hygiene action has a double objective. First and most importantly, it reduces the risk of colonization or infection of HCWs with infectious agents that may occur even without visible soiling. Second, it reduces the risk of a transmission of microorganisms from a “colonized” to a “clean” body site within the same patient. This routine moment for hand hygiene concerns all care actions associated with a risk of body fluid exposure and is not identical to the – hopefully very rare – case of accidental visible soiling calling for immediate handwashing. (WHO, 2009)

MOMENT 4 After touching a patient: When leaving the patient zone after a care sequence, before touching an object in the area outside the patient zone and before a subsequent hand exposure to any surface in the healthcare area, hand hygiene minimizes the risk of dissemination to the healthcare environment, substantially reduces contamination of HCWs’ hands with the flora from patient X, and protects the HCWs themselves. (WHO, 2009)

MOMENT 5 After touching patient surroundings: The fifth moment for hand hygiene is a variant of Moment 4: it occurs after hand exposure to any surface in the patient zone, and before a subsequent hand exposure to any surface in the patient-care area, but without touching the patient. This typically extends to objects contaminated by the patient flora that are extracted from the patient zone to be decontaminated or discarded. Because hand exposure to patient objects, but without physical contact with the patients, is associated with hand contamination, hand hygiene is still required. (WHO, 2009)

The 2014 updated Compendium of Strategies to Prevent Healthcare-Associated Infections in Acute Care Hospitals from SHEA aims to clarify best practices for hand hygiene and update key recommendations, which include:

- ▶ Improve Accessibility and Acceptability of Products: Soap and alcohol-based handrubs (ABHR) should be convenient for routine hand hygiene in all patient care areas. Consult staff about tolerability of products on hands.
- ▶ Stress Hand Hygiene at Critical Moments: Healthcare personnel should clean hands with ABHR or soap and water: Before direct patient contact; before preparing or handling medication in anticipation of patient care; before moving from a contaminated body site to a clean body site on the same patient; before and after inserting and handling invasive device; after contact with blood or bodily fluids, after direct patient contact, or contact with patient environment.
- ▶ Measure Progress: Monitoring hand hygiene adherence is critical to improving practice, but there are many monitoring methods used and promoted in various settings, including advanced technologies. Consider advantages and limitations of each type of monitoring when deciding on a monitoring system.

- ▶ Recognize the Importance of Glove Use as a Complement to Hand Hygiene: Gloves protect hands from contamination with micro-organisms and are essential when contact with blood or body fluid is anticipated. Gloves are also critical in instances when hand hygiene may be insufficient to prevent transmission via hands (e.g., during *Clostridium difficile* or norovirus outbreaks).
- ▶ Empower Healthcare Personnel: Develop a multidisciplinary team that includes representatives from administrative and unit-level leadership to create a hand hygiene program that works best for the institution. Provide meaningful feedback on hand hygiene performance with clear targets and an action plan for improving adherence.
- ▶ Wash Hands When Soiled: Hand hygiene should be performed using soap and water, not ABHR, when hands are visibly soiled.
- ▶ Avoid Triclosan-Containing Soaps: A review of current literature found triclosan to be no more effective in preventing transmission of micro-organisms in healthcare settings than products currently recommended (e.g., ABHR and soap). Further, triclosan kills a narrower spectrum of organisms compared to ABHR and soap, which can lead to contamination and resistance.

The Compendium presents the following strategies to prevent HAIs through hand hygiene:

I. Basic practices for hand hygiene: recommended for all acute care hospitals

- 1** Select appropriate products.
- 2** Provide convenient access to hand hygiene equipment and products by placing them strategically and assuring that they are refilled routinely as often as required.
- 3** Involve healthcare personnel (HCP) in choosing products.
- 4** Perform hand hygiene with an alcohol-based hand rub or, alternatively, an antimicrobial or non-antimicrobial soap for the following indications.
- 5** Perform hand hygiene with antimicrobial or non-antimicrobial soap when hands are visibly soiled.
- 6** Assess unit- or institution-specific barriers to hand hygiene with frontline HCP for the purpose of identifying interventions that will be locally relevant.
- 7** Implement a multimodal strategy (or “bundle”) for improving hand hygiene adherence to directly address the organization’s most significant barriers.
- 8** Educate, motivate, and ensure competency of HCP (anyone caring for the patient on the institution’s behalf) about proper hand hygiene.
- 9** Measure hand hygiene adherence via direct observation (human observers), product volume measurement, or automated monitoring.
- 10** Provide feedback to HCP on hand hygiene performance.

II. Special approaches for hand hygiene practices

- 1** During norovirus outbreaks, in addition to contact precautions requiring the use of gloves, consider preferential use of soap and water after caring for patients with known or suspected norovirus infection.
- 2** During *C. difficile* outbreaks or in settings with hyperendemic CDI, in addition to contact precautions requiring the use of gloves, consider preferential use of soap and water after caring for patients with known or suspected CDI.

Glove Use

A quick word about proper glove use is essential to any discussion of basic hand hygiene. According to the WHO hand hygiene guideline (2009), the following are indications for gloving and for glove removal:



Glove use

- ▶ Before a sterile condition
- ▶ Anticipation of a contact with blood or another body fluid, regardless of the existence of sterile conditions and including contact with non-intact skin and mucous membrane
- ▶ Contact with a patient (and his/her immediate surroundings) during contact precautions

Glove removal

- ▶ As soon as gloves are damaged (or non-integrity suspected)
- ▶ When contact with blood, another body fluid, non-intact skin and mucous membrane has occurred and has ended
- ▶ When contact with a single patient and his/her surroundings, or a contaminated body site on a patient has ended
- ▶ When there is an indication for hand hygiene

The WHO hand hygiene guideline (WHO, 2009) provides guidance as to the type of glove needed for the task:

1 Sterile gloves are indicated for any surgical procedure; vaginal delivery; invasive radiological procedures; performing vascular access and procedures (central lines); preparing total parental nutrition and chemotherapeutic agents.

2 Examination gloves are indicated in clinical situations where there is the potential for touching blood, body fluids, secretions, excretions and items visibly soiled by body fluids.

- ▶ Direct patient exposure: Contact with blood; contact with mucous membrane and with non-intact skin; potential presence of highly infectious and dangerous organism; epidemic or emergency situations; IV insertion and removal; drawing blood; discontinuation of venous line; pelvic and vaginal examination; suctioning non-closed systems of endotracheal tubes.
- ▶ Indirect patient exposure: Emptying emesis basins; handling/cleaning instruments; handling waste; cleaning up spills of body fluids.

3 Gloves are not indicated (except for contact precautions) if:

- ▶ There is no potential for exposure to blood or body fluids, or contaminated environment
- ▶ Direct patient exposure: Taking blood pressure; temperature and pulse; performing SC and IM injections; bathing and dressing the patient; transporting patient; caring for eyes and ears (without secretions); any vascular line manipulation in absence of blood leakage.
- ▶ Indirect patient exposure: Using the telephone, writing in the patient chart; giving oral medications; distributing or collecting patient dietary trays; removing and replacing linen for patient bed; placing non-invasive ventilation equipment and oxygen cannula; moving patient furniture.

(For more information, see ICT's Back to Basics: The PPE Primer available now at <http://www.infectioncontroltoday.com/digital-issues/2014/07/back-to-basics.aspx>)

Surgical Hand Antisepsis

Surgical hand preparation should reduce the release of skin bacteria from the hands of the surgical team for the duration of the procedure in case of an unnoticed puncture of the surgical glove releasing bacteria to the open wound, explains the WHO hand hygiene guideline (2009). In contrast to the hygienic handwash or handrub, surgical hand preparation must eliminate the transient and reduce the resident flora. It should also inhibit growth of bacteria under the gloved hand. Rapid multiplication of skin bacteria occurs under surgical gloves if hands are washed with a non-antimicrobial soap, whereas it occurs more slowly following preoperative scrubbing with a medicated soap. The skin flora, mainly coagulase-negative staphylococci, *Propionibacterium* spp., and *Corynebacteria* spp., are rarely responsible for SSI, but in the presence of a foreign body or necrotic tissue even inocula as low as 100 CFU can trigger such infection. The virulence of the microorganisms, extent of microbial exposure, and host defense mechanisms are key factors in the pathogenesis of postoperative infection, risk factors that are largely beyond the influence of the surgical team. Therefore, products for surgical hand preparation must eliminate the transient and significantly reduce the resident flora at the beginning of an operation and maintain the microbial release from the hands below baseline until the end of the procedure. The spectrum of antimicrobial activity for surgical hand preparation should be as broad as possible against bacteria and fungi.

The WHO hand hygiene guideline (2009) outlines the following steps before starting surgical hand preparation:

- ▶ Keep nails short and pay attention to them when washing your hands – most microbes on hands come from beneath the fingernails.
- ▶ Do not wear artificial nails or nail polish.
- ▶ Remove all jewelry (rings, watches, bracelets) before entering the operating theatre.
- ▶ Wash hands and arms with a non-medicated soap before entering the operating theatre area or if hands are visibly soiled.
- ▶ Clean subungual areas with a nail file. Nailbrushes should not be used as they may damage the skin and encourage shedding of cells. If used, nailbrushes must be sterile, once only (single use). Reusable autoclavable nail brushes are on the market.

The WHO hand hygiene guideline (2009) outlines the following protocol for surgical scrub with a medicated soap:

- ▶ Start timing. Scrub each side of each finger, between the fingers, and the back and front of the hand for 2 minutes.



In contrast to the hygienic handwash or handrub, surgical hand preparation must eliminate the transient and reduce the resident flora.

- ▶ Proceed to scrub the arms, keeping the hand higher than the arm at all times. This helps to avoid recontamination of the hands by water from the elbows and prevents bacteria-laden soap and water from contaminating the hands.
- ▶ Wash each side of the arm from wrist to the elbow for 1 minute.
- ▶ Repeat the process on the other hand and arm, keeping hands above elbows at all times. If the hand touches anything at any time, the scrub must be lengthened by 1 minute for the area that has been contaminated.
- ▶ Rinse hands and arms by passing them through the water in one direction only, from fingertips to elbow. Do not move the arm back and forth through the water.
- ▶ Proceed to the operating theatre holding hands above elbows.
- ▶ At all times during the scrub procedure, care should be taken not to splash water onto surgical attire.
- ▶ Once in the operating theatre, hands and arms should be dried using a sterile towel and aseptic technique before donning gown and gloves.



Rapid multiplication of skin bacteria occurs under surgical gloves if hands are washed with a non-antimicrobial soap, whereas it occurs more slowly following preoperative scrubbing with a medicated soap.

Recommendations for surgical hand preparation from the WHO (2009) include the following:

- A.** Remove rings, wrist-watch, and bracelets before beginning surgical hand preparation. Artificial nails are prohibited.
- B.** Sinks should be designed to reduce the risk of splashes.
- C.** If hands are visibly soiled, wash hands with plain soap before surgical hand preparation (II). Remove debris from underneath fingernails using a nail cleaner, preferably under running water.
- D.** Brushes are not recommended for surgical hand preparation.
- E.** Surgical hand antisepsis should be performed using either a suitable antimicrobial soap or suitable alcohol-based handrub, preferably with a product ensuring sustained activity, before donning sterile gloves.
- F.** If quality of water is not assured in the operating theatre, surgical hand antisepsis using an alcohol-based handrub is recommended before donning sterile gloves when performing surgical procedures
- G.** When performing surgical hand antisepsis using an antimicrobial soap, scrub hands and forearms for the length of time recommended by the manufacturer, typically 2 to 5 minutes. Long scrub times (e.g. 10 minutes) are not necessary.

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