



Understanding the whys of hand hygiene

Washing your hands is something you've probably known how to do for practically your entire life, but have you ever stopped to think about the process? Or have you ever wondered if the types of products used really matter? Hot water or cold? Antimicrobial soap or regular? Paper towels or air? This resource will help to demystify the process and allow you to make better decisions about the products and protocols you use to wash your hands in the future.

The process

We've all seen those posters on the wall that have detailed steps for handwashing, probably thinking "that's too many steps" or "that seems way too long!" or even, "I've managed to survive this long!" Does any of it really matter? Surprisingly, the process really does matter, as do the products. Let's break it down step by step.



STEP 1: Wetting your hands with water

Wet hands with water first.¹ This seems like a no-brainer, but skipping this step is actually very common. Many people will go straight to the soap, put it on their hands, and then put their hands under the water. However, there are a few problems with this. Firstly, there is a risk that the product will fall off the hands or will be washed off when water is applied, which can be wasteful or lead to less soap than desired on the hands. Secondly, this behavior works against how soap is intended to be used effectively. Soap is meant to combine with water and friction to create a lather that then is able to remove soil (dirt, germs, etc.) from the hands.¹ Just as we don't put shampoo on dry hair, we shouldn't put soap on dry hands. We want the hands to be wet enough prior to application to create the lather necessary for proper cleaning. Lastly, for people who wash hands frequently or are using stronger hand cleansers, frequent exposure to cleanser directly on the skin may increase the chances of dermatitis or skin irritation.²



STEP 2: Apply soap and lather thoroughly

Now that we've covered why hands should be wet first, we can talk about applying the soap. It's important to use enough soap for hands to be covered.^{1, 3} This means that the amount of soap needed can vary depending on hand size, or even how soiled hands are prior to hand washing. The goal is to apply enough soap to comfortably cover the entire hand with lather.



STEP 3: Rubbing & scrubbing for at least 20-30 seconds

(It may be longer if you are in a hygiene critical role such as healthcare or the food industry. Workers should follow hand washing protocols provided by their workplace as some industries have more strict hand washing guidelines.)

Lathering and scrubbing the hands creates the friction needed to help lift dirt, grease, and microbes off the skin. It is important to try to scrub all areas of the hands, including the backs of the hands, in between fingers, and even under the fingernails. As far as the time requirement, scientific evidence suggests that washing hands for 15-30 seconds removes more germs than washing hands for shorter periods of time. 20 seconds is the scrubbing time recommended by the CDC.^{1, 3, 4}



STEP 4: Rinsing the hands

After all of that rubbing and scrubbing, it is time to rinse away the soil from the hands. Rinsing the hands under clean, running water will help wash everything lifted off the skin off the hands. Proper rinsing will also help to minimize skin irritation from any remaining soap on the hands.^{1, 3, 4}



STEP 5: Drying the hands with a single-use paper towel

The importance of drying in hand hygiene procedures is typically underappreciated. The truth is that germs are transferred more easily from wet hands⁵, so drying hands thoroughly after washing is critical. Given that roughly 95% of people do not wash their hands correctly, the chances that germs still remain on hands may be high.⁶ Numerous studies suggest that drying hands with a single-use paper towel is the most hygienic method of hand drying and should be recommended for hygiene-critical environments.⁷ In fact, paper towels can remove 77% of the bacteria that may remain on hands after hand washing. Paper towels likely help to further remove any residual microbes left behind after improper hand washing through friction.⁸ Paper towels also have some added benefits such as being strongly preferred to air dryers, quiet, less likely to exacerbate skin irritation, and quick.⁷ They are also versatile in helping to shut off the water faucet or open a door handle if needed once hands are clean,^{3, 4} and are less likely to lead to a queue or bottleneck in the washroom like hand dryers do given that air dryers can only be used by one person at a time.

In addition to the benefits that single-use paper towels provide in the hand hygiene process, they also help to mitigate the risk of introducing additional bacteria into the process. Some powerful air dryers, called “jet air dryers,” have also been shown to blow water droplets containing bacteria and viruses as far as 6.5 feet away, and those droplets can linger in the air for up to 15 minutes.^{9, 10, 11} A study from 2018 even demonstrated that many different kinds of bacteria, including harmful organisms and spores, can be deposited on hands exposed to bathroom hand dryers and also be circulated throughout the environment via this hand contamination.¹² These types of dryers can also increase bacteria on user’s fingers by 42% during the drying process.⁸





Other questions

You may also be wondering about using specific products or about other factors that potentially affect efficacy. Let's cover some of those common questions next.

Does it matter if I use antimicrobial soap or not?

The short answer is no. There have been no studies yet that demonstrate an added health benefit to using antimicrobial soaps compared to plain soap for the general public.^{1, 4} The fundamental principle behind washing hands with soap is that the surfactants within soap combined with water and friction create a lather that loosens germs, dirt, and any other soil from the skin. The loosened germs and dirt are then rinsed off the skin with the application of running water after scrubbing. Thus, the focus should be on good handwashing technique and proper duration rather than relying on antimicrobial soap.^{1, 4} For those in hygiene-critical professions such as healthcare, food processing, and food preparation, there may be protocols which mandate the use of antimicrobial soaps for employees. These individuals typically undergo specialized hand hygiene training which requires them to learn necessary protocols which may include the use of any specialty soaps.^{2, 4, 13, 14, 15}

Are all soap dispensers the same?

No. Some soap dispensers are refillable, while others have "closed" soap containers that can be thrown away or recycled and then replaced when empty. Studies have shown that 1 in 4 refillable soap (sometimes called "bulk" soap) dispensers can become contaminated with harmful bacteria that can remain on the users hands even after using the soap. These germs include fecal bacteria, as

well as *Pseudomonas aeruginosa*, which may lead to skin and eye infections. The bacteria may also be transferred to other surfaces nearby.¹⁶ Additionally, bulk soap dispensers can be tampered with such that additional contaminants could be added, or even water in an effort to make the soap last longer. However, adding water dilutes the concentration of the cleansing ingredients and may also further be a source of contamination.¹⁷ Lastly, refilling soap can also lead to spillage, which may increase the risk of slips, trips, and falls. To maximize the efficacy and safety of the hand washing experience and preserve a hygienic environment, it is best to use closed soap systems.^{16, 17}

Does the water temperature matter?

The temperature of the water should be comfortable. Water that is too hot or too cold may create an experience that deters people from washing their hands for the time required for optimal cleaning, and there is no evidence that using hot water leads to improved hand cleaning.⁴ Additionally, extreme temperature may contribute to skin irritation, particularly in dry seasons or climates.^{18, 19}

How does hand sanitizer facilitate good hand hygiene?

Hand sanitizer that contains at least 60% alcohol is a great addition to a good hand hygiene routine. For the general public, hand sanitizer can play a key role in maintaining hand hygiene in between hand washing opportunities.^{4, 20} For those in healthcare, using hand sanitizer frequently may be more preferred to kill germs and maintain skin health than constantly washing hands with soap and water. However, certain types of infections require hand washing with soap and water to ensure cleanliness, so healthcare workers should follow necessary protocols related to specific infections and hand hygiene methods.^{4, 13, 15, 20}

It is also important to note that hand sanitizer may not be optimally effective on hands that are visibly dirty or greasy and may not kill all types of germs. Proper technique is also helpful to maximize efficacy. The sanitizer should cover all surfaces of the hands. Then, hands and fingers should be rubbed together until the hands are dry, which should take about 20-30 seconds.^{4, 13, 15, 20}

Does using alcohol-based hand sanitizer lead to microbial resistance?

The United States Centers for Disease Control & Prevention (CDC) states that, "Alcohol-based hand sanitizers do not contribute to antibiotic resistance. Alcohol-based hand sanitizers kill germs, including antibiotic-resistant germs, by destroying the proteins and breaking down the protective outer membrane that germs need to survive."⁴ The CDC and WHO also recommend the use of alcohol-based hand sanitizers as the primary method for hand hygiene in most healthcare situations unless hands are visibly dirty (or certain pathogens are known to be present) due to the high frequency with which healthcare workers need to clean their hands.^{4, 13, 15, 20} For the general public, hand sanitizer use is recommended whenever soap and water are not readily available.^{4, 20}

If my only choice to dry hands is an air dryer, what should I do?

Because wet hands are capable of transferring more germs to surfaces than dry hands,⁵ it is very important to dry hands after hand washing using whatever method is available. While paper towels are preferred by most users and are considered by many researchers to be more hygienic,^{7, 8, 9, 10, 11, 12} someone may have no option but to use an air dryer in order to dry hands.

What are some ways to improve hand hygiene compliance?

First and foremost, the ability to participate in hand hygiene requires that necessary products such as clean water, soap, and a hand drying method are present in a washroom or hand hygiene station. Therefore, those who maintain those areas should be vigilant about checking product levels, making sure products and dispensers are clean and sanitary, and restocking as needed. Skincare solutions like soap and hand sanitizer should be non-irritating to the skin to help minimize the chance of skin reactions.^{14, 18, 19} Any fragrances used should be mild to avoid objections to those with sensitivities to them. Hand sanitizer dispensers should be placed in easily accessible, common areas such as near elevators, office areas, in hallways, breakrooms, and near entrances and exits. Finally, helping people to better understand the basics of good hand hygiene may also help encourage compliance.

Does improving hand hygiene in places like offices really make any difference to health?

Yes, hand hygiene does matter. While the benefits of improved hand hygiene are well known and accepted in the healthcare industry, several studies have investigated the potential benefit of hand hygiene interventions to office environments.^{21, 22, 23, 24, 25} Findings within these studies demonstrate benefits such as reductions in (a) transmission of germs (through use of tracer organisms), (b) reported illnesses (such as respiratory and gastrointestinal illnesses), (c) insurance claims, and (d) absenteeism.^{21, 22, 23, 24, 25} The CDC states that handwashing benefits the entire community by reducing illnesses such as colds by 21%, reducing the number of people who get sick with diarrhea by 31%, and reducing diarrheal illness in people with weakened immune systems by 58%. Having good hand hygiene habits benefit everyone in all work and community settings.²⁰

References

- Centers for Disease Control: Show Me the Science – How to Wash Your Hands, <https://www.cdc.gov/handwashing/show-me-the-science-handwashing.html>
- Todd ECD, Michaels BS, Smith D, Greig JD, Bartleson CA, “Outbreaks Where Food Workers Have Been Implicated in the Spread of Foodborne Disease. Part 9. Washing and Drying of Hands to Reduce Microbial Contamination,” *Journal of Food Protection*, 2010, Volume 73(10): 1937-1955.
- World Health Organization: How to Hand Wash https://www.who.int/docs/default-source/patient-safety/how-to-handwash-poster.pdf?sfvrsn=7004a09d_2
- Centers for Disease Control: Show Me the Science – Frequent Questions About Hand Hygiene, <https://www.cdc.gov/handwashing/faq.html>
- Findon DRP, Miller TE, “Residual moisture determines the level of touch-contact-associated bacterial transfer following hand washing,” *Epidemiol. Infect.*, 1997, Volume 119: 319-325.
- Borchgrevink CP, Cha J, Kim S, “Hand Washing Practices in a College Town Environment,” *Journal of Environmental Health*, 2013, Volume 75(8): 18-24.
- Huang C, Ma W, Stack S, “The Hygienic Efficacy of Different Hand-Drying Methods: A Review of the Evidence,” *Mayo Clinic Proceedings*, 2012, Volume 87(8): 791-798.
- Redway K, Fawdar S, “A comparative study of three different hand drying methods: paper towel, warm air dryer, jet air dryer,” *European Tissue Symposium*, November 2008.
- Best EL, Redway K, “Comparison of Different Hand-Drying Methods: The Potential for Airborne Microbe Dispersal and Contamination,” *Journal of Hospital Infection*, 2015, Volume 89(3): 215-217.
- Kimmit PT, Redway KF, “Evaluation of the Potential for Virus Dispersal During Hand Drying: A Comparison of Three Methods,” *Journal of Applied Microbiology*, 2016, Volume 120(2): 478-486.
- Best EL, Parnell P, Wilcox MH, “Microbiological Comparison of Hand-Drying Methods: The Potential for Contamination of the Environment, User and Bystander,” *Journal of Hospital Infection*, 2014, Volume 88(4): 199-206.
- Juesca-Espitia L, Aslanzadeh J, Feinn R, Joseph G, Murray TS, Setlow P, “Deposition of Bacteria and Bacterial Spores by Bathroom Hot-Air Hand Dryers,” *Applied and Environmental Microbiology*, 2018, Volume 84(8).
- Centers for Disease Control: Hand Hygiene in Healthcare Settings, <https://www.cdc.gov/handhygiene/providers/index.html>
- Green LR, Radke V, Mason R, Bushnell L, Reimann DW, Mack JC, Motsinger MD, Stigger T, Selman CA, “Factors Related to Food Worker Hand Hygiene Practices,” *Journal of Food Protection*, 2007, Volume 70(3): 661-666.
- WHO Guidelines on Hand Hygiene in Health Care, 2009.
- Zapka CA, Campbell EJ, Maxwell SL, Gerba CP, Dolan MJ, Arbogast JW, Macina DR, “Bacterial Hand Contamination and Transfer after Use of Contaminated Bulk-Soap-Refillable Dispensers,” *Applied and Environmental Microbiology*, 2001, 77(9): 2898-2904.
- Kania K, “What You Need to Know about Sealed Soap Dispensers,” CleanLink, 1/31/2023, https://www.cleanlink.com/cp/article/What-You-Need-to-Know-About-Sealed-Soap-Dispensers---293357o-ly_enc_id=6244A9867712D1A
- Kampf G, Löffler H, “Prevention of Irritant Contact Dermatitis among Health Care Workers by Using Evidence-Based Hand Hygiene Practices: A Review,” *Industrial Health*, 2007, Volume 45: 645-652.
- Arbogast JW, Moore-Schiltz L, Jarvis WR, Harpster-Hagen A, Hughes J, Parker A, “Impact of a Comprehensive Workplace Hand Hygiene Program on Employer Health Care Insurance Claims and Costs, Absenteeism, and Employee Perceptions and Practices,” *J Occup Environ Med*, 2016, Volume 58(6): e231-e240.
- Kurgat EL, Sexton JD, Garavito F, Reynolds A, Contreras RD, Gerba CP, Leslie RA, Edmonds-Wilson SL, Reynolds KA, “Impact of a Hygiene Intervention on Virus Spread in an Office Building,” *International Journal of Hygiene and Environmental Health*, 2019, Volume 222(3): 479-485.
- Reynolds KA, Beamer PI, Plotkin KR, Simentes LY, Koenig DW, Gerba CP, “The Healthy Workplace Project: Reduced Viral Exposure in an Office Setting,” *Archives of Environmental & Occupational Health*, 2016, 71(3): 157-162.
- Hovi T, Ollgren J, Savolainen-Kopra C, “Intensified Hand-Hygiene Campaign Including Soap-and-Water Wash May Prevent Acute Infections in Office Workers, as Shown by a Recognized-Exposure-Adjusted Analysis of a Randomized Trial,” *BMC Infectious Diseases*, 2017, Volume 17.