

Cleaning and Disinfecting Bathrooms



A study at Fayetteville State University found 87 percent of public restrooms surveyed in the city were configured in such a way that washed hands could be re-contaminated in seconds by touching faucets and door handles.

Public Health Reasons

Bathroom surfaces can be potential sources of pathogenic microorganisms because fecal material contains large numbers of microorganisms that can be introduced to toilet surfaces upon excretion. One study showed that as many as 10^{14} enteric pathogens (pathogens present in the human gastrointestinal tract) can be excreted in a single bowel movement of 100 grams, and an individual person can produce 100 to 200 grams of feces per day.

If a sick person makes multiple trips to the toilet, it can result in a buildup of pathogens in the toilet both on the exterior surfaces and in the bowl water. While the initial flush of the toilet eliminates most pathogens in the water, enough microorganisms can remain to cause illness, because large numbers of the pathogens adhere to the porcelain surfaces inside the toilet. Some bacteria can even form a protective layer called a biofilm under the waterline that is hard to remove during normal cleaning.

In addition, flushing the toilet results in the production of water droplets that contain pathogens. These are released into the air and can settle onto restroom surfaces. The surfaces closest to the toilet bowl such as the toilet seat, cistern, and nearby shelving are the most effected. In studies where an experimental toilet was contaminated with bacteria and viruses, one to three *Clostridium difficile* colonies, about one *Salmonella* Enteritidis cell, and between 70 and 170 bacteriophage particles were found on the toilet seat after it was flushed. Closing the toilet seat can reduce the number of microorganisms released into the air. However, cleaning and disinfecting of restroom surfaces using chemical and physical processes are essential to preventing the spread of pathogens.

When cleaning and decontaminating bathroom surfaces, it is important to understand the difference between disinfectants and sanitizers. Both sanitizers and disinfectants are products regulated by the U.S. Environmental Protection Agency (EPA). However, there are differences between products. Disinfectants are generally used on hard surfaces and objects in order to destroy or irreversibly inactivate infectious fungi, bacteria, and viruses listed on the product label. Sanitizers are used to reduce, but not necessarily eliminate, bacteria and fungi from a surface. Sanitizers seek to achieve a level considered safe as determined by public health codes or regulations. Generally, sanitizers are used on food-contact surfaces and disinfectants on all other hard surfaces. Disinfectants also require a longer contact time than sanitizers. Disinfectants must be able to destroy

all microorganisms listed on their label in 10 minutes while non-food contact sanitizers must reduce the numbers of bacteria by at least 99.9% in 30 seconds.

Practices

There are three levels of cleaning and sanitizing/disinfecting surfaces. In increasing rigor, they are routine cleaning, vomit/fecal episode cleaning, and outbreak cleaning. This section covers routine cleaning. Additional measures are required when cleaning after a vomit or fecal episode and during an outbreak.

Clean and disinfect bathroom surfaces *at least twice* a day to reduce the spread of pathogens. If the surface becomes visibly soiled, it must be cleaned and disinfected more often. For example, potty chairs must be cleaned and disinfected after each use.

Cleaning

- Remove soil from all fixtures using a clean, reusable cloth or a disposable towel dipped in warm water, and a detergent.
- Rinse surfaces with warm to hot water to remove cleaning products and suspended debris.
- Wipe down all doorknobs, toilet seats, flush mechanisms, and faucet handles.

Wash the least contaminated surfaces first (counters and faucets). Then clean the more contaminated surfaces (toilet).

Disinfection

- Follow the instructions on the label of the disinfectant.
- Prepare the disinfecting solution daily or as needed during the day.
- Apply enough disinfecting solution to thoroughly cover the surfaces using a clean reusable cloth or a disposable towel.
- Let the solution stand for the contact time given on the label. Make sure there is enough disinfecting solution on the surface, so it does not dry up before the recommended contact time.
- Let surfaces air dry before the facilities are used.

Replace the disinfecting solution and cleaning cloths on a regular basis, such as when the water is visibly dirty. This will help reduce the contamination of other surfaces with dirty cleaning products.

Cleaning Bathroom Countertops

Most countertops are made of materials that are durable and easy to clean: ceramic tile, plastic laminate, and cultured marble.

- **Cultured marble:** Cultured marble resembles real marble, but cleaning and caring for it is easier. Avoid using abrasive cleaners and steel wool pads because they will scratch the surface, making it difficult to keep clean.
- **Plastic laminate:** Plastic laminate is made of thin layers of plastic superimposed on craft paper and overlaid on particle board or plywood. To clean plastic laminate, use a two-sided scrubbing pad with fiber on one side and a sponge on the other. Moistened slightly with water, the fiber side is just abrasive enough to loosen greasy smears and other soil. Turning the scrubber over, use the sponge side to wipe the surface clean.

Cleaning the Sink

Scrub the entire surface of the sink from the top to bottom, so mold and microorganisms are not spread to the rest of the sink.

- Start with the trim and work towards the edge of the sink.
- Scrub the faucet making sure to get at the edges where mold and mildew build up.
- Scrub the soap-holding areas working toward the basin and ending with the drain valve.
- Soak the entire surface of the sink with disinfectant using a sponge.
- Start at the edges by soaking the sponge in disinfecting solution, lightly wring it out, and then coat each surface of the sink thoroughly.
- Again, scrub working toward the basin of the sink.
- Be more liberal with the application of the disinfecting solution as you move toward the basin because this is where a majority of the soap scum and mineral deposits are located.
- Let the disinfecting solution sit for the contact time recommended on the label.
- Allow surfaces to air dry.

Cleaning the Toilet

- Before cleaning toilets, read the label on the cleaning product to determine its exact chemical makeup and how it should be used.
- Always wear rubber gloves when working with toilet cleaners. Be careful not to allow cleaners to remain in the toilet or to touch other bathroom surfaces.
- Clean and disinfect all surfaces of the toilet using disposable towels, including the outside of the tank, flush handle, surface of the seat, underside of seat, and outside of the bowl.
- Disinfect the toilet bowl by pouring a disinfecting solution into the bowl and letting it stand for 10 minutes. Then scrub the inner walls with a brush. Flush the toilet.

Make sure to clean and disinfect any sponges and the toilet brush thoroughly before using them again.

Recommended Disinfectants

See U.S. EPA list of registered products effective against noroviruses.

Follow product labels for use and dilution:

- Ethyl or isopropyl alcohol-based disinfectant (70-90%)
- Sodium hypochlorite-based disinfectant (5.25-6.15% household bleach diluted 1:10)
- Phenolic germicidal detergent solution
- Iodophor germicidal detergent solution

NOTE: See “Cleaning and Disinfecting High-Touch Surfaces” and “Cleaning Housekeeping Surfaces” fact sheets for information on cleaning door handles and floors.

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Published: March 31, 2013 **Revised:** March 5, 2013

This material is based upon work supported by the Cooperative State Research, Education and Extension Service, U.S. Department of Agriculture, under Agreement No. 2008-51110-04335, the National Integrated Food Safety Initiative of the Cooperative State Research, Education, and Extension Competitive Grants Program. Any opinions, findings, conclusions or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture.

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Cleaning and Disinfecting High-Touch Surfaces



Public Health Reasons

High-touch surfaces are surfaces that are handled frequently throughout the day by numerous people. These surfaces include doorknobs, light switches, phones, sink faucets, and toys. High-touch surfaces can become contaminated by direct contact with bodily fluids or through indirect contact with other contaminated objects, such as inadequately cleaned rags and sponges or improperly washed hands. Pathogens can stay on surfaces if they are not properly disinfecting. For example, hepatitis A virus and rotavirus can survive up to one month on hard, non-porous surfaces, while noroviruses can survive up to 42 days on the same types of surfaces. High-touch surfaces have been shown to play a role in the transmission of pathogens both directly by surface-to-mouth contact and indirectly by contamination of hands and subsequent hand-to-mouth contact.

A 2004 study by Barker et al. showed that contaminated fingers could transfer noroviruses to as many as seven clean sequentially touched surfaces. Thus, properly cleaning high-touch surfaces daily is important to limit the spread of pathogens. Cleaning prevents the build-up of soil, dust, or other foreign materials that can carry pathogens and support their growth. If cleaning is not properly performed, there is a risk of spreading pathogens instead of reducing them. Cleaning is removal of debris and involves two steps: (1) washing with a detergent and (2) rinsing with warm potable water.

Water and detergent alone may not be enough to kill all the microorganisms present, so the use of a disinfectant is also necessary. Barker et al. showed that when detergent-based cleaning did not sufficiently kill noroviruses, the wiping cloth used could transfer the virus to a secondary surface. Cleaning with a detergent alone failed to decontaminate the tested surfaces in all but one case, even with a second wiping step. However, when the surface was treated with a disinfecting solution containing 5000ppm available chlorine for 1 minute, noroviruses could only be recovered from one surface.

When decontaminating surfaces, it is important to understand that there are differences between disinfectants and sanitizers. Both sanitizers and disinfectants are products regulated by the U.S. Environmental Protection Agency (EPA). However, there are some differences in the products. Disinfectants are used on hard inanimate surfaces and objects to destroy or irreversibly inactivate infectious fungi, bacteria, and viruses that are listed on the label. On the other hand, sanitizers are used to reduce, but not necessarily eliminate, bacteria and fungi from an inanimate surface to levels considered safe as determined by public health codes and regulations. Generally, sanitizers are used on food-contact surfaces and disinfectants on all other hard surfaces. Fabric can only be sanitized. Also, disinfectants must be able to destroy all microorganisms listed on their label in 10 minutes, while sanitizers must reduce the numbers of bacteria by at least 99.9% in 30 seconds. For high touch surfaces, it is important to use a disinfectant rather than a sanitizer.

Practices

There are three levels of cleaning and sanitizing/disinfecting surfaces. In increasing rigor, they are routine cleaning, vomit/fecal episode cleaning, and outbreak cleaning. This section covers routine cleaning. Additional measures are required when cleaning after a vomit or fecal episode and during an outbreak.

Clean and disinfect high-touch surfaces every day, even if they are not visibly dirty. If they become visibly dirty, clean the surfaces immediately.

Cleaning

- Wash frequently touched surfaces with a clean, reusable cloth or a disposable towel dipped in detergent and warm water.
- Scrub vigorously to remove dirt and soil. Use a brush if necessary.
- Rinse surfaces with warm to hot water to remove cleaning products and debris.
- Disposable towels are preferred for cleaning. If using reusable cloths, launder in hot water between cleaning uses.

Disinfection

- Follow the instructions on the label of the disinfecting solution.

Do not mix disinfectants and cleaners unless the label indicates that it is safe to do so. The most common inappropriate mixture of cleaning agents is bleach with an acid or ammonia.

- Prepare a disinfecting solution daily or as needed.
- Using a clean reusable cloth or a disposable towel, apply enough disinfecting solution to cover the surfaces thoroughly.
- Let the solution stand for the contact time given on the label. Make sure there is enough disinfecting solution on the surface to stay wet for the recommended contact time.

Replace the disinfecting solution and cleaning cloths on a regular basis, such as when the water is visibly dirty, in order to reduce the contamination of other surfaces with dirty cleaning products.

Cleaning Electronic Items

- Use disinfecting wipes.
- Wipe the entire surface, paying special attention to keyboards and buttons.
- One may use more than one wipe to keep the surface wet for the given contact time.

Cleaning Toys

- Toys should be cleaned and sanitized daily.
- Any plastic or rubber toy that enters a child's mouth must be sanitized with 200 ppm bleach (1:250 dilution) and air-dried, or washed at a high temperature (170°F or 76.67°C).

Be sure to check the manufacturer instructions to determine if the dishwasher will reach the correct temperature for the final rinse. If the dishwasher does not reach this temperature, then sanitize toys using a bleach solution.

- For toys that can be immersed, pour the sanitizing solution in a large basin or sink. Remove all visible debris from the surface of the toys, and allow the toys to soak for one to five minutes to achieve sanitization.
- For toys that cannot be immersed in sanitizing solution, clean all surfaces of the toy ensuring that clean cloths and solutions do not become contaminated (*do not double dip*). Allow surfaces to remain wet for 1 to 5 minutes to achieve sanitization.
- For soft toys, pre-wash to remove visible debris. Then wash with detergent/bleach. Discard if necessary.
 - Machine-wash the soft toys in hot water (at least 140-160°F or 60-71.1°C) using bleach if fabrics are white.
 - Dry toys in a dryer on the high heat setting.

Diaper-Changing Stations

- Surfaces should have a plastic covered pad without cracks.
- Use a disposable material to cover the changing table pads. Discard after each diaper change.
- Clean the surface after every diaper change by washing with detergent and water and rinsing with clean water.
- Apply disinfecting solutions, following recommended contact time.
- Let the station air dry before the next use.

Recommended Disinfectants

See U.S. EPA list of registered products effective against noroviruses.

Follow product labels for use and dilution:

- Ethyl or isopropyl alcohol (70-90%)
- Sodium hypochlorite (5.25-6.15% household bleach diluted 1:10)
- Phenolic germicidal detergent solution
- Iodophor germicidal detergent solution

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Cleaning and Sanitizing Food-Contact Surfaces



Onions contaminated because of poor cleaning and sanitizing of equipment were the likely cause of a pathogenic E. coli O157:H7 outbreak at a fast-food restaurant in Canada that sickened 235 people in 2008.

Public Health Reasons

Surfaces that typically come into contact with food are called food-contact surfaces. Examples include utensils, cutting boards, flatware, tables, and highchairs. Also included are surfaces onto which food may drip, drain, or splash, such as the inside of a microwave oven or refrigerator.

It is important to properly clean and sanitize food-contact surfaces because during use food-contact surfaces can become contaminated with harmful microorganisms that can be transferred to food. The purpose of cleaning is to remove soil and food debris. First, wash with a detergent. Detergents help reduce the surface tension of water, so they can surround and lift soil from a surface. Second, rinse with warm potable water. Rinsing removes the suspended soil and detergent. After this, a surface may look visibly clean, however, the surface may still be contaminated with pathogenic microorganisms. Food-contact surfaces must also be sanitized in order to reduce the number of microorganisms to a safe level. Food contact sanitizers reduce the bacterial count on a surface by 99.999% or 5 logs. For example, if there are 1 million bacteria on a surface before the sanitizer is applied, then there should only be 10 bacterial cells left after the sanitizer is dry. For food-contact surfaces, sanitizers are designed to function as a final rinse after cleaning. Sanitizers differ from disinfectants in that disinfectants eliminate all of the organisms listed on the product label, which may include viruses or fungi. Disinfectants are not generally used for food-contact surfaces because they can leave harmful residues. Both sanitizers and disinfectants are products regulated by the U.S. Environmental Protection Agency (EPA). The label should indicate if the product can be used on a food-contact surface. If the label does not indicate this, the information can be looked up online by finding the EPA registration number on the label and going to the EPA Pesticide Product Labeling System (PPLS) website: www.epa.gov/opp00001/pestlabels

In one research study conducted in child-care centers in Texas, the authors reported that 41% (68/167) of food preparation surfaces tested in 27 child-care centers were positive for bacterial contamination. Another study conducted in six child-care centers found *Escherichia coli* in 8 out of 575 swabs from food preparation sites and 1 out of 289 swabs from food serving sites. This indicates that food-contact surfaces can be a potential source of harmful microorganisms in the child-care setting. Therefore, proper procedures must be in place for cleaning and sanitizing. Food contact surfaces have been found to be contaminated in other institutions including schools, office buildings, military bases, food processing facilities, restaurants, hotels, and long-term care facilities.

Practices

There are three levels of cleaning and sanitizing/disinfecting surfaces. In increasing rigor, they are routine cleaning, vomit/fecal episode cleaning, and outbreak cleaning. This section covers routine cleaning. Additional measures are required when cleaning after a vomit or fecal episode and during an outbreak.

Cleaning

- Pre-flush items by running water over the surface and through the equipment, or pre-soak items in a sink of standing water to loosen soil.
- Wash equipment and utensils to remove remaining food material using appropriate cleaning agents and equipment. Cleaning agents will vary depending on the type of food soil, the hardness of water, and the surface characteristics of the object being cleaned.
- Cleaning agents are divided into four categories:
 - **Detergents:** Use detergents to routinely wash tableware, surfaces, and equipment. Detergents can penetrate soil quickly and soften it. Examples include dishwashing detergent and automatic dishwasher detergents.
 - **Solvent cleaner:** Use periodically on surfaces where grease is burned on. Solvent cleaners are often called degreasers.
 - **Acid cleaners:** Use periodically on mineral deposits and other soils that detergents cannot remove. These cleaners are often used to remove scale in dishwashing machines and steam tables.
 - **Abrasive cleaners:** Use these cleaners to remove heavy accumulations of soil that are difficult to remove with detergents. Some abrasive cleaners also disinfect.
- For manual cleaning, materials that retain water, such as sponges and wiping cloths, must not be used. Pads and brushes must be used instead.
- Pads and brushes used for cleaning must be cleaned and sanitized, as well, to further prevent contamination of equipment and utensils.
- Rinse to remove suspended soil and cleaning compounds.

Even though surfaces look visibly clean at this point, they may still be contaminated with microorganisms, so always sanitize the surface.

Sanitization

Hot water/heat sanitization

- Heat can be used to sanitize surfaces in one of three ways: as hot steam, water, or air.
- Hot water is the most common method.
 - If hot water is used in the third compartment of a three-compartment sink, it must be at least 171°F (77°C).
 - If a high-temperature dishwashing machine is used to sanitize cleaned dishes, the final sanitizing rinse must be at least 180°F (82°C).
 - For stationary rack, single temperature machines, the rinse must be at least 165°F (74°C).
 - Cleaned items must be exposed to these temperatures for at least 30 seconds.
- The utensil surface must reach 160°F (71.1°C) as measured by an irreversibly registering temperature indicator. When the indicator has been exposed to a temperature in excess of its rating, it provides a tamper proof display of temperature achievement.

Chemical sanitizing

- Follow the instructions on the sanitizer's label and use proper dilutions.
- Different factors influence the effectiveness of chemical sanitizers. The three factors that must be considered are:
 - **Concentration:** The presence of too little sanitizer will result in an inadequate reduction of harmful microorganisms, while too much can be toxic.
 - **Temperature:** Generally, chemical sanitizers work best in water that is between 55°F (13°C) and 120°F (49°C).
 - **Contact time:** In order for the sanitizer to kill harmful microorganisms, the cleaned item must be in contact with the sanitizer (either heat or approved chemical) for the recommended length of time.
 - For example, the activity of chlorine is dramatically affected by such factors as pH, temperature, and organic load; however, chlorine is less affected by water hardness when compared to other sanitizers, such as quaternary ammonium.

Air-drying

- After applying the sanitizer, place utensils in a wire or plastic draining rack where they will not come into contact with any food or food residue and let them sit until dry.
- For equipment, after applying the sanitizer, let the equipment sit without use until dry.
- Do not use towels for drying, polishing, or any other purpose because they may re-contaminate equipment and utensils.

Never rinse or perform any other cleaning process after the sanitizing process.

Methods for Cleaning and Sanitizing

Machine-dishwashing

- Most tableware, utensils, and other equipment can be cleaned and sanitized in a dishwashing machine. Dishwashing machines sanitize by using either hot water or a chemical sanitizing solution.
- Check cleanliness of the machine at least once a day.
- Check temperatures and water pressure at least once a day.
- Make sure all detergent and sanitizer dispensers are properly filled.
- Scrape, rinse, or soak items before loading them into the machine.
- Load racks correctly and use racks designed for the items being washed.
- Check each rack as it comes out of the machine for soiled items.
- Air-dry all items.
- Keep your dishwashing machine in good repair.

High-temperature machines

- The temperature of the final sanitizing rinse must be at least 180°F (82°C). For stationary rack, single temperature machines, it must be at least 165°F (74°C).
- The machine must have a thermometer installed to measure the temperature of water at the manifold where it sprays into the tank.

Chemical-sanitizing machines

- Chemical sanitizing machines often wash at much lower temperatures, but never lower than 120°F (49°C).
- Rinse water temperature in these machines should be between 75°F and 120°F (24°C and 49°C) for the sanitizer to be effective.

Three-compartment sinks

- Rinse, scrape, or soak all items before washing them in a three-compartment sink.
- Wash items in the first sink in a detergent solution that is at least 110°F (43°C).
- Immerse or spray rinse items in the second sink using water that is at least 110°F (43°C).
- Immerse items in the third sink in hot water at or above 171°F (77°C) *or* in a properly prepared chemical sanitizing solution, made with warm water between 75°F and 125°F (24°C and 49°C).
- Air-dry all cleaned and sanitized items before storing them.

Cleaning equipment in-place

- Turn off and unplug equipment before cleaning.
- Remove food and soil from under and around the equipment.
 - Remove any detachable parts. Manually wash, rinse, and sanitize them, or run them through a dishwashing machine.
 - Wash and rinse all other food-contact surfaces that you cannot remove; then wipe or spray them with a properly prepared chemical sanitizing solution.
- Keep washcloths used for food-contact and non-food-contact surfaces in separate properly marked containers of sanitizing solution.
- Air-dry all parts and then reassemble.

Proper storage and handling

- Store utensils in a clean, dry location at least six inches off the floor, where they will not be exposed to food-splash, dust, or other contamination. It is best to keep items covered.
- Do not touch food-contact surfaces while storing the items.

Cleaning tables, countertops, and highchairs

- Tabletops, countertops, and highchair trays are considered food contact surfaces and must be sanitized.
 - Remove visible debris from the tabletop or highchair tray by washing with a disposable towel dipped in warm water and a detergent.
 - Rinse the surface with warm water to remove detergent and suspended debris.
 - Spray the surface with a sanitizer or use a disposable towel to apply enough sanitizing solution to cover the surface thoroughly.
 - Allow the recommended contact time.
 - Let the surface air dry before use.
 - Be sure to change to a clean, dry cloth or get new disposable towels between each step.

While guidelines state that a reusable towel can be used, it is recommended to use a disposable towel to avoid contamination. Whether using a reusable or disposable towel, never use the same towel to wipe the table and seat.

- Seats, benches, and chairs at the table and the seat portion of the highchair are considered high-touch surfaces and must be disinfected (See “Cleaning and Disinfecting High-touch Surfaces”).
 - Remove visible debris from the benches or chairs by washing with a disposable towel dipped in warm water and a detergent.
 - Spray the surface with a disinfectant or use a disposable towel to apply enough disinfecting solution to cover the surface thoroughly.
 - Allow the recommended contact time.
 - Let the surface air dry before use.
 - Be sure to change to a clean, dry cloth, or use a new disposable towel between each step.

Sanitizer Testing

- It is necessary to have a testing kit to measure chemical sanitizer concentrations.
- To accurately test the strength of a sanitizing solution, first determine whether chlorine or iodine is being used.
- Test kits are not interchangeable, so check with the chemical supplier to be certain that the correct kit is being used.
- The appropriate test kit must then be used throughout the day to measure chemical sanitizer concentrations.

Recommended Disinfectants

See U.S. EPA list of registered products effective against noroviruses.

- Chlorine (5.25-6.15% household bleach diluted to provide 50-100 ppm available chlorine)
Do not exceed 200 ppm available chlorine for food-contact surfaces.
- Iodophor germicidal detergent solution (12.5 to 25 ppm)

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Published: March 31, 2013 **Revised:** March 5, 2013

This material is based upon work supported by the Cooperative State Research, Education and Extension Service, U.S. Department of Agriculture, under Agreement No. 2008-51110-04335, the National Integrated Food Safety Initiative of the Cooperative State Research, Education, and Extension Competitive Grants Program. Any opinions, findings, conclusions or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture.



Cleaning Housekeeping Surfaces



In 2010, an E.coli O157:H7 outbreak at an Oregon Daycare Center was linked poor sanitation practice and resulted in the hospitalization of 4 children.

Public Health Reasons

Housekeeping surfaces, including floors, walls, counters, and furniture, are considered low-touch surfaces that require low-level disinfection. After the floors are cleaned, there is a gradual increase in microbial numbers throughout the day until a point is reached where the number of microorganisms present on the floor remains fairly constant. Cleaning these surfaces every day using water and a detergent or a low-level disinfectant designed for general housekeeping procedures can decrease the level of contamination.

Removing the soil from housekeeping surfaces is almost as important as the germicidal activity of the disinfectant used because dust and dirt can harbor microorganisms and support their growth. A one-step cleaner and disinfectant can be useful; the “cleaner” part of the product penetrates soil loads and allows the “disinfectant” part of the product to reach and then kill the microorganisms (See “Choosing a Sanitizer/Disinfectant” fact sheet).

When cleaning housekeeping surfaces, it is important to understand the differences between sanitizers and disinfectants. Both sanitizers and disinfectants are products regulated by the U.S. Environmental Protection Agency (EPA). Disinfectants are used on hard, inanimate surfaces and objects to destroy or irreversibly inactivate infectious viruses, fungi, and bacteria but not necessarily their spores. On the other hand, sanitizers are used to reduce, but not necessarily eliminate, microorganisms from the inanimate environment to levels considered safe as determined by public health codes or regulations. Sanitizers must eliminate at least 99.9% of bacteria. Generally, sanitizers are used on food-contact surfaces and disinfectants on all other surfaces. Disinfectants also require a longer contact time than sanitizers and must be able to destroy all microorganisms listed on their label in ten minutes.

Practices

There are three levels of cleaning and sanitizing/disinfecting surfaces. In increasing rigor, they are routine cleaning, vomit/fecal episode cleaning, and outbreak cleaning. This section covers routine cleaning. Additional measures are required when cleaning up after a vomit or fecal episode and during an outbreak.

Floors

- Dust surfaces prior to cleaning to remove dirt and dust that may affect the disinfecting capability of the detergent and/or disinfectant.
- There are multiple tools that can be used to remove dust:
 - a wet/dry vacuum or a vacuum with a filtration system
 - a disposable mop head treated with a chemical dust remover
 - a freshly laundered dry dust mop

Sweeping floors with a dry broom is not recommended because microorganisms attached to dust particles could become airborne and spread throughout the facility.

- Dust-removal tools should be properly cleaned and maintained in order to eliminate cross-contamination.
 - wet/dry vacuums should be cleaned inside and out with a disinfectant daily
 - disposable dust mops should be discarded after each use
 - reusable dust mops should be machine laundered daily
- Prepare a disinfecting solution as needed since disinfecting properties may decline over time.
 - use detergent and warm water, a low-level disinfectant, or a one-step detergent/disinfectant
 - follow the manufacturer's instructions for use and dilution when preparing the solution
 - the soiled disinfecting solution should be changed regularly, usually every two to three rooms
- Wet mopping or scrubbing is more effective after dust removal.
 - use sterile wet mops or freshly cleaned reusable wet mops
 - thoroughly mop the floor moving from room to room while changing mop-heads and disinfecting solution every two to three rooms

Dirty mops immersed in a bucket of disinfectant can become a vehicle for the growth of microorganisms, so mops and cleaning solution should be changed regularly.

- Follow the manufacturer instructions on safety precautions and contact time for disinfectants.

Other Housekeeping Surfaces

- Wash walls, shelves, and other non-critical items daily with a clean, reusable cloth or disposable towels dipped in detergent and warm water.
- Rinse surfaces with warm to hot water to remove cleaning products and debris.
- Disinfect surfaces with a low- or intermediate-level disinfectant on a weekly basis.
- Apply enough disinfecting solution to cover the surfaces thoroughly using a clean reusable cloth or a disposable towel.
- Let the solution stand for the contact time given on the label. Make sure there is enough disinfecting solution on the surface that it does not dry up before the recommended contact time.
- Let the surfaces air dry.

Recommended Disinfectants

See U.S. EPA list of registered products effective against noroviruses.

Follow product labels for use and dilution:

- Ethyl or isopropyl alcohol (70-90%)
- Sodium hypochlorite (5.25-6.15% household bleach diluted 1:10)
- Phenolic germicidal detergent solution
- Iodophor germicidal detergent solution

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Published: March 31, 2013 **Revised:** March 5, 2013

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Disinfectants and Sanitizers



A 2007 norovirus outbreak at an elementary school was linked to computer keyboards that had not been cleaned.

Public Health Reasons

Environmental surfaces can be a source of pathogens that cause gastrointestinal illnesses. Some pathogens have been shown to survive for long periods of time on surfaces. For example, hepatitis A virus and rotavirus can survive for up to one month on hard, non-porous surfaces, while noroviruses can survive up to 42 days on the same types of surfaces. Surfaces in a child-care center can become contaminated by direct contact with bodily fluids, such as vomit or fecal matter, or through indirect contact with other contaminated objects, such as improperly cleaned wiping cloths, food, or hands. Therefore, cleaning and decontamination of environmental surfaces is essential to preventing gastrointestinal illnesses.

In order to prevent illness, detergent-based cleaning alone is not sufficient to remove pathogens. Research conducted by Barker et al. showed that cleaning with a detergent alone failed to decontaminate tested surfaces in all but one case. When surfaces were treated with a solution containing 5000 ppm chlorine for 1 minute, noroviruses were only recovered from one surface. Therefore, a sanitizer or disinfectant must be used after cleaning.

In order to choose the proper product, it is important to understand the differences and proper uses of disinfectants and sanitizers. Both disinfectants and sanitizers are designed to kill microorganisms, but have different applications. First, sanitizers are used on food-contact surfaces and soft surfaces, such as textiles, fabrics, and carpeting, and disinfectants are used on all hard surfaces that are not considered food-contact surfaces. Another difference is that disinfectants are used to destroy or irreversibly inactivate the microorganisms listed on their label, which may include bacteria, fungi, and viruses, but not necessarily spores. Sanitizers are used to reduce, but not necessarily eliminate, bacteria from the inanimate environment to levels considered safe as determined by public health codes or regulations. Disinfectants also tend to be used at much higher concentrations and usually have a longer contact time. Sanitizers tend to be used at lower concentrations for a shorter period of time. No perfumes are allowed in food-contact sanitizers, whereas perfumes are often used in disinfectants.

In addition, sanitizers for food-contact surfaces must reduce the bacterial count by 5 logs or 99.999%. Sanitizers used on soft surfaces must reduce bacterial counts by 3 logs or 99.9%. The EPA tests the efficacy of some sanitizers by targeting *Salmonella* Typhi on cleaned food-contact surfaces. Examples of sanitizers include halide compounds such as iodophors and chlorine-based chemicals. *Escherichia coli* and *Staphylococcus aureus* are used as target organisms when testing the

efficacy of quaternary ammonium compounds. It is important to note that sanitizers are *not* effective against viruses and fungi. The most commonly used sanitizers in food production environments are chlorine, quaternary ammonium, and iodine. The Food and Drug Administration (FDA) and the U.S. Department of Agriculture (USDA) clearly state approved concentrations of sanitizers in their respective regulations. Too high or too low of a concentration is a violation of these regulations.

Both sanitizers and disinfectants are regulated by the U.S. Environmental Protection Agency (EPA). The EPA maintains a list of registered sanitizers and disinfectants on their website. The Pesticide Product Labeling System (PPLS) is at: www.epa.gov/opp00001/pestlabels/

Practices

If a product is registered with the EPA and described as a sanitizer or disinfectant, it can be used in a child-care setting as stated on the label. Check the label to determine the contact time, whether it needs to be rinsed off, and any other precautions to take when handling.

Factors Affecting the Efficacy of Sanitizers and Disinfectants

Number and location of microorganisms

- The amount of time needed to kill microorganisms increases with the number of microorganisms present.
- Food-contact equipment with multiple pieces must be disassembled to ensure that all parts are thoroughly cleaned and sanitized.
- Surfaces with crevices are more difficult to sanitize and disinfect than flat surfaces because penetration to all areas may not occur.
- Fabrics can only be sanitized, not disinfected.

Innate resistance of microorganisms

- Unlike Gram-positive bacteria, Gram-negative bacteria have an outer membrane that acts as a barrier to the uptake of sanitizers and disinfectants making it more difficult to kill these organisms. Gram-negative bacteria include *E. coli*, *Campylobacter jejunum*, and *Salmonella* spp.
- Non-enveloped viruses, which are hydrophilic and do not contain lipids, are less susceptible to germicides than enveloped viruses, which are hydrophobic and contain lipids in their envelope. Non-enveloped viruses include noroviruses, hepatitis A virus, and rotavirus. Enveloped viruses include influenza, smallpox, and human immunodeficiency virus (HIV).
- Spores are resistant to disinfection because the spore coat and cortex act as a barrier. Spore-forming bacteria include Clostridia and Bacillus species.

Concentration and potency of sanitizers and disinfectants

- The more concentrated the chemical used, the greater its efficacy and the shorter time that is necessary to kill the microorganism, with the exception of iodophors. Because disinfectants are used at a higher concentration than sanitizers, they can achieve complete destruction of microorganisms whereas sanitizers only achieve a 3-5 log reduction.

Physical and chemical factors

- **Temperature:** The activity of most disinfectants and sanitizers increases as the temperature increases, but there are some exceptions. Too great of an increase in temperature can cause the disinfectant or sanitizer to degrade.
- **pH:** An increase in pH improves the antimicrobial activity of some sanitizers and disinfectants (glutaraldehyde and quaternary ammonium compounds), but decreases the activity of others (phenols, hypochlorites, and iodine).
- **Water hardness:** This reduces the kill rate in certain sanitizers and disinfectants.

Organic and inorganic matter

- Organic matter, such as fecal matter, vomit, or food residue, can interfere with the antimicrobial activity of sanitizers and disinfectants by interacting with the chemicals in the germicide and reducing the level of activity or by protecting the microorganisms from attack by acting as a physical barrier.

Duration of exposure

- Sanitizers and disinfectants have a minimum contact time that surfaces must be exposed to the product.
- In general, longer contact times are more effective than shorter contact times.

By law, all applicable label instructions on EPA-registered products must be followed.

Biofilms

- Biofilms are microbial communities that are tightly attached to surfaces and surrounded by an extracellular matrix that protects them from the effects of sanitizers and disinfectants.
- Bacteria within biofilms are up to 1,000 times more resistant than are the same bacteria in suspension.
- No products are EPA-registered or FDA-cleared to degrade biofilms.

Surface Compatibility

- Determine whether the sanitizer or disinfectant is compatible with the surfaces on which it will be used. Mainly, determine that there will be no change in the function or appearance of the surfaces from the use of the product.
- Do not use products that are corrosive such as iodine, especially on metals.
- Plastic can be damaged by frequent or extended exposure to alcohol.

Attributes of Common Sanitizers Allowed in Foodservice Settings

Chlorine (sodium hypochlorite) compounds

- For food-contact sanitizing, the chlorine concentration must not exceed 200 ppm.
- At sanitizer levels, chlorine is effective against all vegetative bacteria.
- They are less effective in the presence of organic matter, such as food soil.
- They are unaffected by water hardness.
- They are effective between a pH range of 6-8. Most water is near neutral pH (7).
- Use at temperatures between 55°F to 120°F (13°C to 49°C).
- The strength decreases over time. (For open buckets, make fresh solutions frequently throughout the day. Sanitizers stored in opaque spray bottles can be prepared once per week if allowed by the appropriate regulatory authority.)
- They may corrode metal surfaces and bleach and damage fabrics.

Iodine

- Iodophors are a combination of iodine and a stabilizing agent or carrier.
- Dilutions of iodophors present more rapid bactericidal action than a full-strength solution.
- For food-contact sanitizing, iodine solutions must have a concentration between 12.5 and 25 ppm.
- At sanitizer levels, iodine solutions are rapidly effective against most vegetative bacteria.
- Gram-negative bacteria may be able to survive or grow in the solution.
- The optimum pH is 5.0 or less.
- It is not suitable in the presence of organic matter.
- Solutions must have a minimum temperature of 68°F (20°C). It decomposes when heated above 104°F (40°C).

- It may stain skin and cause irritation.
- Prepare solutions daily.
- It does not leave toxic residues.
- Do not use on aluminum or copper.

Quaternary ammonium compounds

- Food-contact sanitizing solutions of quaternary ammonium compounds must not have a concentration exceeding 200 ppm.
- They are effective against Gram-positive bacteria and lipid-containing, enveloped viruses.
- They have no activity against spores.
- Solutions must have a minimum temperature of 75°F (24°C).
- Gram-negative bacteria may be able to survive or grow in the solution.
- They are inactivated by proteins, soap, and anionic detergents.
- High water hardness can decrease their activity. Use with water that has a hardness of 500 mg/L or less.

Attributes of Common Disinfectants

Chlorine (sodium hypochlorite) compounds

- They are effective against a wide variety of microorganisms (vegetative bacteria and viruses, including norovirus).
- They are less effective in the presence of organic matter (such as blood). The concentration must be increased to retain action.
- They are unaffected by water hardness.
- They are effective between a pH range of 6-8. Most water is at neutral pH (7).
- The strength decreases over time. (For open buckets, make fresh solutions frequently throughout the day. Disinfectants stored in opaque spray bottles can be prepared once per week if allowed by the appropriate regulatory authority.)
- High concentrations corrode metal surfaces and bleach and damage fabrics.
- They do not leave toxic residues.

Alcohols (ethyl alcohol or isopropyl alcohol)

- They are effective against fungi, vegetative bacteria, Mycobacterium species, and some viruses, including noroviruses.
- They are not effective against spores.
- They are most effective at 60%-90% in water. Activity drops sharply when diluted below a 50% concentration.
- They may swell rubber or harden plastics.
- Do not use near flames due to flammability.

Iodine

- Iodophors are a combination of iodine and a stabilizing agent or carrier.
- It is rapidly effective against most microorganisms (vegetative bacteria, mycobacteria, and viruses).
- Gram-negative bacteria may be able to survive or grow in the solution.
- Dilutions of iodophors demonstrate more rapid bactericidal action than does a full-strength solution.
- The optimum pH is neutral to acidic.
- It is not suitable in the presence of organic matter.
- It may stain skin and cause irritation.
- Prepare solutions daily.
- It decomposes when heated above 104°F (40°C).
- Do not use on aluminum or copper.

Glutaraldehyde

- It is active against vegetative bacteria, spores, fungi, and many viruses.
- It may cause dermatitis. Wear protective gloves when handling materials that have been immersed in glutaraldehyde.
- The shelf-life is 14 days. Discard if turbid.
- It is commercially available as 2% w/v aqueous solution which must be made alkaline (pH 7.5-8.5) to "activate" (e.g. by addition of 0.3% sodium bicarbonate). It is also available in stable glyco-complexed form, which does not require addition of an alkaline buffer.

Hydrogen peroxide

- It is active against a range of microorganisms (vegetative bacteria, yeasts, viruses including norovirus, spores and fungi).
- Fungi, spores and enteric viruses require higher concentration.
- It does not have toxic end-products of decomposition.
- Do not use on aluminum, copper, zinc, or brass.

Phenolics

- They are active against bacteria and lipid-containing, enveloped viruses.
- They are not active against spores and non-lipid-containing, non-enveloped viruses.
- Gram-negative bacteria may be able to survive or grow in the solution.
- They are active in the presence of organic matter.
- They are absorbed by porous materials and the residual disinfectant can irritate tissue.

Quaternary ammonium compounds

- They are effective against Gram-positive bacteria and lipid-containing, enveloped viruses.
- They do not have an effect against spores.
- Gram-negative bacteria may be able to survive or grow in the solution.
- They are inactivated by proteins, soap, and anionic detergents.
- High water hardness can decrease their activity.

Activity of Different Types of Disinfectants

Toxicity Against	Active Disinfecting Ingredient				
	Phenolics	Chlorine Compounds	Alcohols	Glutaraldehyde	Iodophors
Fungi	good	slight	none	good	good
Bacteria (Gram +/-)	good	good	good	good	good
Mycobacteria	fair	fair	good	good	good
Spores	none	fair	none	good (<20°C)	slight
Lipid viruses	slight	slight	slight	slight	slight
Non-lipid viruses	variable	slight	variable	slight	slight

Recommended Concentration Levels For Disinfectants

Disinfectant	Concentration or Level
Glutaraldehyde, aqueous	2%
Hydrogen peroxide, stabilized	2%
Iodophors	30-50 mg of free iodine per liter; 70-150 mg of available iodine per liter
Chlorine compounds	500-5,000 mg of free chlorine per liter
Alcohol (ethyl; isopropyl)	70%
Iodine and alcohol	0.5% + 70%
Phenolic compounds, aqueous	0.5-3%
Quaternary ammonium compounds, aqueous	0.1-0.2%

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Published: March 31, 2013 **Revised:** March 5, 2013

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Monitoring the Effectiveness of Cleaning and Disinfecting Practices



A 2007 norovirus outbreak at an elementary school was linked to computer keyboards that had not been cleaned.

Public Health Reasons

Thorough cleaning of all surfaces is important to reduce the spread of microbial pathogens in child-care centers. Even though a surface appears to be clean, it can still be contaminated. Even cleaning materials, such as mops and soapy water can be a source of pathogens, particularly if they are dirty. Facilities and regulators must ensure that cleaning and disinfection or sanitization is done properly and that the proper method is used on the surfaces.

Microbial evaluations of surfaces are useful in monitoring the effectiveness of cleaning and disinfecting practices. While most child-care providers would not use these methods, they are very useful for regulators to perform in the event of repeated violations or after a documented outbreak. As well, visual inspections usually over-estimate the cleanliness of surfaces, so it is important to include some type of monitoring tool in cleaning procedures.

A microbial plate count is a monitoring method that quantifies the amount of microbes present on a surface. The surface is swabbed and then the swab is rubbed on a nutrient medium that encourages the growth of microorganisms. Following this process, the colonies are counted. An adenosine triphosphate (ATP) bioluminescence assay is another monitoring method that measures the amount of ATP (a source of energy for all living things) present on a surface. After the surface is swabbed, the ATP is released from the cells, and a reagent is added to the ATP. This causes a reaction that produces light, which is measured. A study conducted in Texas analyzed samples taken from food-contact surfaces in child-care centers using microbial plate counts to determine the effectiveness of cleaning and disinfecting procedures. Sixty-eight of the surfaces were positive for bacterial contamination, with 88% of those from the Enterobacteriaceae family, which includes a number of pathogenic bacteria. Most of the bacteria isolated were considered opportunistic pathogens that affect compromised immune systems. Two non-opportunistic pathogens were found that can infect healthy individuals (*Klebsiella pneumonia* and *Salmonella Paratyphi A*).

Practices

Microbial Plate Counts

Swabbing surfaces

- Use sterile cotton hygiene swabs pre-moistened in a buffer solution.
- Swab a 10cm X 10cm area on flat surfaces or the entire area on irregular surfaces, using a separate swab for each surface.
- Rotate the swab constantly.
- Swab each surface in multiple directions (up, down, left, right, and diagonally).

Inoculating plates

- Use a nutrient medium (tryptic soy agar or plate count agar).
- Label each plate on the bottom with the surface swabbed and the date.
- After sampling, use the same swab to streak the nutrient medium in a zigzag pattern.
- Place plate in an incubator at 37°C (98.5°F) for 24 hours to grow the microorganisms.
- Count the number of colonies on the plate.
- Judge whether a surface is “clean” or not by comparing the number of colonies to a set benchmark (usually <math><2.5</math> colony forming units/cm² for *Escherichia Coli*).

ATP Bioluminescence Assay

Preparation of luminometer

- Measure a “blank” using just the reagent and sample buffer to determine the amount of background relative light units (RLU) that needs to be subtracted from the sample RLU.

Swabbing surfaces

- Swab a 10cm X 10cm area on flat surfaces or the entire area on irregular surfaces, using a separate swab for each surface.
- Place the swab back in the swab tube.
- Mix luciferase reagent with the swab tip in order to release the ATP from the cells.
- Insert swab into luminometer and take a sample reading.
- Subtract the “blank” from the sample reading to calculate the ATP concentration found on the sampled surface.
- Compare the ATP concentration to a set benchmark (usually <math><500</math> RLU) to determine whether the surface is “clean” or not.

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Published: March 31, 2013 **Revised:** March 5, 2013

This material is based upon work supported by the Cooperative State Research, Education and Extension Service, U.S. Department of Agriculture, under Agreement No. 2008-51110-04335, the National Integrated Food Safety Initiative of the Cooperative State Research, Education, and Extension Competitive Grants Program. Any opinions, findings, conclusions or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture.

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