

The Usual Suspects: Microbes, Biohazards and Pathogens

How Cleaning Professionals Can Protect Themselves Against Hazards Associated With Germs Transmitted By Blood, Body Fluids, Food, Air, Water and Nonliving Surfaces

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The More We Know the Less We Fear

How can the spread of germs be controlled inside buildings? Ask a public health expert and they will say wear gloves and properly wash hands. Ask a pesticide maker and they will tell you to use disinfectants. Ask a cleaning professional and they will say effective cleaning procedures. Fact is that an effective germ control plan should include all three.

Knowledge and understanding about interactions between man and microbes and germs and germicides is a good place to begin. To know which germs and germicides are harmful, and which ones are not, and to understand what is likely to happen if we are exposed to them. Only by that knowledge and understanding can we protect ourselves from the potential hazards of germs and germicides. The more we know the less we fear.

The number of different species on this planet is estimated to be between 10 and 100 million. Man is one of them. More than 3 million are microbes. Microbes are hearty and have been around for millions of years. The future of mankind depends upon sensible coexistence with microbes.

There is little doubt that since the early 1900's we have made great improvements in controlling the spread of infectious disease in the U.S. Pneumonia, tuberculosis, enteritis and diphtheria were the leading causes of death among Americans. These four infectious illnesses caused more than 33% of all deaths in 1900. Infectious disease accounted for only 4.5% of all deaths in the U.S. in 1997. However, there has been a resurgence of infectious disease beginning sometime in the early 1980's that continues to this day. The death rate from infectious disease in the U.S. today has risen to approximately where it was 40 years ago. This resurgence has primarily been caused by global travel, sexually transmitted infections and the rise of antibiotic resistant strains of bacteria.

What Are Microbes, Biohazards and Pathogens?

Microbe is another name for microorganisms. **Biohazards** are infectious agents or dangerous biological materials that present a risk or potential risk to human health. **Pathogens** are germs that can cause disease. Simply stated, microbes, biohazards and pathogens are germs. Common types of germs are bacteria, viruses and fungi. We find germs in water, air, food, blood/body fluids on nonliving environmental surfaces, humans and animals. Most microorganisms cause us no harm, and there are many we depend upon like the ones that help digest our food. See **Table 1** for some interesting facts about germs.

Germs, Germs, Germs

There are a variety of germs in buildings that can pose a potential health risk. They include viruses like *HIV-1*, *Hepatitis A, B, C*, *Herpes Simplex* and *Influenza*; Bacteria like *Staphylococcus*, *Pseudomonas*, *Salmonella*, *E-coli*, stubborn antibiotic strains like Vancomycin Resistant Enterococcus (VRE) and Methicillin Resistant Staphylococcus Aureus (MRSA); And toxic mold strains like stachybotrys. See **Tables 2 and 3** for a list of some common germs, the diseases and transmission mode associated with them and a list of pathogenic microbes and their clinical significance.

What Kind of Environment Do Pathogens And Germs Like?

Germs like a warm, wet, dark environment that is rich in nutrients. The ideal temperature for most germs is body temperature. They thrive where it is moist, dark and where there is food to grow and reproduce.

How Germs Harm Us

In order for a germ to infect us it must find its way to our body. A germ usually escapes an infected person in respiratory droplets, feces, urine or other body fluids and is transmitted by direct or indirect routes. Direct transmission occurs from person to person by such things as handshaking, sneezing, coughing and sexual intercourse. Indirect transmission occurs when a nonliving object like a doorknob is intermediary between two humans. Microbes can spread or transmit by air, dust, blood, body fluids, water, food and by nonliving objects.

General infections are invasions of germs in the body. Community acquired infections are those that we get when we interact as part of our everyday activities. Hospital acquired infections or nosocomial infections are those that we get while in the hospital. Over 100,000 patients per year die from nosocomial infections. Health experts tell us that over 70% of those deaths are preventable. Failure to properly wash hands between patient contacts is a major cause of these infections.

Pathogens can enter our bodies through four primary routes. Swallowing contaminated food, beverages or water into the digestive tract can **ingest** harmful germs. Breathing contaminated air or vapors into the respiratory tract can cause us to **inhale** harmful germs. Puncturing our skin through a wound or an insect bite can infect our **blood stream**. And microbes can be **absorbed** through our skin.

Benefits of Controlling Germs?

If we control human exposure to biohazards, we provide a cleaner, healthier and safer indoor environment that improves productivity and helps prevent and/or break the chain of infection. Uncontrolled biohazards can cause illness and spread disease.

Breaking the Chain of Infection

Infection control experts have identified six components that make up the chain of infection. In order to get an infection there needs to be an infectious agent, susceptible host, a place where the infectious agent survives, a portal of exit from the infected host, a mode of transmission and a portal of entry into the susceptible host. See **Table 6** for a summary of the Chain of Infection. The best way to prevent exposure to pathogens is to break the chain of infection. Effective control programs can have a dramatic effect on the rate of many types of infections. The major control strategies include proper hand washing, universal precautions, appropriate and prudent use of cleaning and disinfecting agents, managed cleaning procedures and ongoing education of custodial workers. Let's take each component of the chain of infection and give examples of how to control it and break the chain.

Eliminate or Reduce the Quantity of Infectious Agent

Infectious agents can be eliminated and/or reduced on environmental surfaces with the use of proper cleaning procedures and appropriate disinfectants; Infectious agents can be effectively reduced by proper and frequent hand washing with soap and water; Hand sanitizers can be used when soap and water is not readily available.

Keep the Susceptible Host Immune System Healthy

The susceptible host can be made less susceptible by keeping themselves healthy. People with compromised immune systems are more likely to be infected by germs. Encourage proper rest, exercise and healthy eating.

Prevent the Opportunity for Germs to Leave the Reservoirs

The reservoirs where germs survive, grow and multiply can be maintained to prevent or reduce the opportunity for the germ to leave the infected host. Good cleaning and disinfecting of surfaces contaminated with germs can help inhibit the growth and multiplication of germs.

Create Barriers to Prevent Transmission From Infected Host Portals of Exit to Susceptible Host Portals of Entry

The infected host can be isolated or the infected or susceptible host can wear personal protective equipment to act as a barrier to prevent germs from leaving the infected host or entering the susceptible host. The most direct route for bacteria and viruses to travel from one host to another is not to hitch a ride on food or water, but to pass directly from one person to another. Conscientious hand washing is an important strategy for preventing transmission of germs.

Controlling Germs By Using Proper Cleaning and Disinfecting Procedures

The removal of soil is critical for good hygiene in a building. Soils are the food for many germs. Germs can be more easily controlled when soils are removed. Just as hand washing with soap and water helps prevent the spread of disease, the proper cleaning and disinfecting of nonliving contaminated surfaces is an important element to help control germs.

Some facilities choose to clean daily with an effective general-purpose cleaner and follow with a disinfectant on the high-risk surfaces like toilets, urinals, washbasins and handles. Others choose to use a one step cleaner disinfectant on all surfaces.

Cleaning is the removal of unwanted soil or contaminants. **Sanitizing** is the removal of microbes from an object to meet a minimum sanitation requirement. Sanitizing reduces the microbial population by killing 99.9% of the targeted pathogens. **Disinfecting** is the total elimination of most pathogenic organisms from inanimate objects. Disinfecting provides a higher level of germ killing than cleaning or sanitizing.

Highly Contaminated Areas Inside of Buildings

Kitchens and Food Preparation Areas

Scientists say a dirty sponge spreads germs throughout the kitchen. The kitchen sink is the most heavily contaminated surfaces in most buildings. And Dr. Charles Gerba, microbiologist at University of Arizona says, “the average plastic cutting board has got more bacteria on it than the top of the toilet seat”.

Kitchen Germ Control -- The kitchen sink should be regularly cleaned, sanitized and/or disinfected with an appropriate product. If the sink has a garbage disposal then routinely pour a few ounces of sanitizer into the disposal. Cutting boards should be cleaned and sanitized after every use. Use clean sponges or replace them with better wiping devices that will not readily harbor and transfer germs. Wearing rubber gloves and frequent hand washing should be mandatory for all food handlers and cleaning staff.

Laundry Rooms

The second most heavily contaminated place in a building is the laundry room. The primary cause of this contamination is underwear and/or diapers crawling with fecal bacteria. The inside of the washing machine is moist and warm creating a perfect environment for germs to thrive.

Laundry Room Germ Control -- Wearing rubber gloves and frequent hand washing should be mandatory for handlers of contaminated laundry. The inside of the washing machine should be periodically sanitized or disinfected. Studies have shown a high level of E-coli bacteria inside many washing machines. Linen that is heavily soiled with fecal matter such as diapers or underwear should be isolated and pretreated with a sanitizer before washing if possible.

Custodial Supply Closets

Germs can be found in significant quantities in the custodial supply closet. Germs can be found inside of dirty mop buckets, inside of poorly maintained carpet extractor solution and recovery tanks, floor sinks, floor drains, wet mops/dust mops that are improperly stored and dirty conditions. Ironically, cleaning tools can cause contamination and spread germs if they are not properly cleaned and stored.

Custodial Supply Closet Germ Control -- Wearing rubber gloves and frequent hand washing should be mandatory for custodial workers. Gloves should be worn when handling contaminated equipment or materials. Cleaning equipment and tools should be properly cleaned and stored after use. Solution and recovery tanks inside of carpet extractors, autoscrubbers and wet-dry vacuums should be cleaned and dried after each use. It is a good idea to routinely disinfect these surfaces to reduce growth of germs inside the tanks.

Washrooms, Bathrooms and Public Restrooms

The restroom has plenty of places for germs to hide. The underside of the toilet lid is one of the most contaminated surfaces in a restroom. This gross contamination is caused when the toilet or urinal is flushed causing the liquid to scatter droplets and deposit them on the underside of the toilet seat and lid or onto surrounding surfaces. These droplets can contain harmful microbes including fecal matter. In a public restroom the flushing mechanism is much stronger and the aerosol effect is much heavier causing the droplets to scatter and splatter onto the floors, partitions, walls and into the surrounding air.

Restroom Germ Control -- Contact with bathroom fixtures can expose humans to pathogens like E-coli, cryptosporidium, giardia, salmonella, clostridium and shigella. Fecal matter can be found in a variety of places in a restroom. Special care should be taken when cleaning these areas. Here is a list of restroom surfaces that should be routinely cleaned and disinfected to help control the spread of germs.

- ☞☞Toilets, toilet seats and urinals
- ☞☞Sinks, washbasins and surrounding areas
- ☞☞Floor surfaces especially under toilets, urinals and sinks
- ☞☞Partitions, walls and doorknobs and handles
- ☞☞Floor drains
- ☞☞Air vents located in ceilings or walls
- ☞☞Trash receptacles inside and outside
- ☞☞Horizontal surfaces including countertops and ledges are clean and free of soils and dirt deposits.

Controlling Germs By Using Appropriate Disinfectants

Controlling unwanted germs does not require killing all microbes anymore than controlling rats requires the annihilation of all rats. Cleaning operations should be prudent in their selection and use of disinfecting agents. It is not prudent to spray chemical disinfectants throughout our buildings without understanding the potential harmful effects they may have on human and environmental health. Care should be taken when selecting disinfecting agents and to balance the risk of the chemical with the benefit of its use.

Disinfectants are important tools to help control the spread of germs. There are various types of effective disinfecting agents. The most common disinfecting agent used by custodians is the active ingredient quaternary ammonium chloride or “quat” formulated into a variety of disinfectants, disinfectant-cleaners and sanitizers. Some quat-based germicides are effective for a broad spectrum of bacteria, viruses and fungi and can be used in relatively high dilution ratios to effectively kill germs like HIV-1, HBV, HCV, Herpes Simplex 1 and 2, Staphylococcus,

Salmonella, E-coli and many other harmful microbes. You will want to read the product label and literature to confirm your dilution ratio, contact time and what organisms your disinfectant cleaner will kill. **Table 4** lists some general information about disinfectants.

Chemical Agents Used To Control Germs

Chemicals used to control germs range from the familiar detergents and disinfectants people use in their homes to highly toxic agents used to sterilize inanimate objects in hospitals. General disinfectants are used for institutional and industrial care of buildings. These products are monitored by the Environmental Protection Agency (EPA), which requires that all manufacturers provide test data that verify the antimicrobial claims made for their products. Let's look at some of the active ingredients used to make effective disinfectants. See **Table 7** for a summary of various antimicrobial agents and their ability to kill germs.

Quaternary Ammonium Compounds (quats)-- Quaternary ammonium compounds (quats) are cationic surfactants formulated to kill germs on a variety of nonliving environmental surfaces. They can be easily formulated into one-step disinfectant cleaners that are effective cleaners and germicides in the presence of soil. They can also be used on some non-critical medical equipment. Quats are relatively low in toxicity and create few problems for the custodial worker.

Quats are typically not effective against tubercle bacillus (cause of tuberculosis) or bacterial endospores. They are effective against pseudomonas, staphylococcus and salmonella as well as antibiotic strains of bacteria including MRSA and VRE in addition to being effective against HIV-1 and Hepatitis B and C. Quat-based disinfectants are commonly used by custodial workers and are effective against HIV-1 and HBV. They are widely accepted as appropriate disinfectants for cleaning up gross contamination of blood or body fluid as required by OSHA Bloodborne Pathogens Standard.

Phenolics-- Phenolics, are phenol derivatives called cresols and used for general cleaning and disinfecting in hospitals. They are used in place of phenols and are less toxic, irritating and corrosive than their carbolic acid ancestors. Phenolics are intermediate-level disinfectants effective against the mycobacterium tuberculosis (TB). Phenolics are higher in toxicity and can be more harmful to the environment than quats. Phenolic-based disinfectants are effective against TB and accepted as appropriate disinfectants for cleaning up gross contamination of blood or body fluid as required by OSHA Bloodborne Pathogens Standard.

Hydrogen Peroxide-- Oxidizing agents such as hydrogen peroxide kill microorganisms by releasing large amounts of oxygen, which contributes to the alteration of the microbial enzymes causing destruction of the germ. Hydrogen peroxide is useful on inanimate objects and in foods. The instability of hydrogen peroxide has been a deterrent to its wide spread use as a disinfectant or sanitizer. However, new forms of stabilized hydrogen peroxide are emerging and look promising as candidates to be used in general disinfectants and sanitizers.

Alcohols-- Alcohol solutions are useful antimicrobial agents against bacteria and fungi, but they have no effect on bacterial spores. They evaporate quickly and leave no residues on surfaces. Ethyl and isopropyl alcohols are the ones commonly used for antimicrobial agents. They are very effective as the active ingredients in hand sanitizers.

Chlorine Bleach-- Chlorine bleach solutions are effective disinfectants but lack detergency and require that soils be removed from surfaces before they are effective. Hypochlorite compounds release free chlorine in solution and are effective against Hepatitis B Virus, HIV-1 and many other bacteria, viruses and fungi. Chlorine bleach solutions are effective for decontaminating blood spills in accordance with OSHA Bloodborne Pathogens Standard.

There is some controversy about whether chlorine bleach solutions are necessary for routine cleaning and decontamination activities. **Table 5** explains some of the reasons institutions no longer use household chlorine bleach solutions in their custodial cleaning activities.

Four Things That Help Disinfectants Work Better

- ☞☞ Allow the disinfecting solution to stay “wet” on the surface for appropriate contact time this will improve the soil removal and germ killing effectiveness.
- ☞☞ Keep temperature of the disinfecting solution between 50-80 degrees.
- ☞☞ Mix the disinfectant according to label directions. If the solution is mixed stronger then it can cause sticky residues and attract soils to surfaces. If the solution is mixed weaker then it will not effectively kill germs.
- ☞☞ Scrub the surface vigorously to loosen sticky, stubborn or embedded soils to allow the disinfecting agent to work more effectively.

Common Myths About Controlling Germs

There are many myths and misconceptions about how to effectively kill and control germs. Here are a few of the common myths followed with the facts to correct the misconception.

MYTH: The majority of bacteria on earth cause disease and harm people.

FACT: The vast majority of bacteria are quite harmless. In fact, many bacteria are not only harmless, but are essential for life on earth.

MYTH: Cleaning and Disinfecting are similar. Cleaning kills the germs and disinfecting makes sure they don't come back.

FACT: Cleaning products do not kill germs. They remove unwanted substances. Effective cleaning products can help control the multiplication of germs by removing their nutrient sources, but they are not germicidal.

MYTH: Sanitizers are just as effective as disinfectants.

FACT: *Sanitizing* is the removal of microbes from an object to meet a minimum sanitation requirement. Sanitizing reduces the microbial population by killing 99.9% of the targeted pathogens. *Disinfecting* is the total elimination of most pathogenic organisms from inanimate objects. Disinfecting provides a higher level of germ killing than cleaning or sanitizing.

MYTH: Chlorine Bleach solutions are effective cleaners and disinfectants!

FACT: Chlorine bleach solutions are effective against a wide range of germs. Public health officials and the CDC frequently recommend chlorine bleach solutions. It should be kept in mind that household chlorine bleach solutions do not work effectively in the presence of organic soil. Therefore, the soils on a surface must be removed before the chlorine bleach solution can provide effective sanitizing or disinfecting.

MYTH: Doubling the strength of a disinfectant solution will double its effectiveness.

FACT: Disinfectants and sanitizers are designed to work effectively at the dilution ratio listed on their label. Doubling the strength is doubling the in-use cost without improving germ-killing benefits. In addition to the wasted money, the excess ingredients from the disinfectant will be deposited onto a surface leaving it sticky, discolored and prone to attract dirt. Disinfectants and sanitizers should be mixed according to label directions. Mixing them too strong or too weak can affect their performance and cause negative consequences.

MYTH: Urinals and toilets have the highest germ count in a typical building.

FACT: According to Dr. Charles Gerba, Microbiologist at University of Arizona, “the average plastic cutting board has got more bacteria on it than the top of the toilet seat”. However, the most heavily contaminated area in the washroom is the underside of the toilet seat caused by the splattering of contaminated liquid splashed from the toilet bowl when flushed.

MYTH: The use of disinfectants is the most effective way to control the spread of germs.

FACT: Public health experts say that conscientious hand washing is the single most effective strategy in reducing exposure to germs. Wearing gloves when cleaning or handling objects contaminated with germs is the second most effect strategy.

MYTH: There are general disinfectants that are approved to kill all germs with a one-minute contact time.

FACT: The contact times needed for disinfectants to effectively kill germs must be demonstrated and approved by the EPA before it can be recommended. The heartiness of the germ being killed determines the active ingredient concentration and contact time needed to kill it. There are currently no general disinfectants that can kill all the major germs with a one-minute contact time. The typical contact time recommended on disinfectant labels for broad spectrum disinfecting is ten-minutes.

MYTH: The majority of mold spores found inside of a building are toxic and harmful to humans.

FACT: Most mold spores are not toxic and pose a relatively low risk to humans. However, there are several highly toxic forms of mold spores that can pose a high risk to humans.

Conclusions:

Unnerved by the news media frenzy about superbugs and unstoppable germs, facilities managers may inadvertently replace good cleaning practices with the use of disinfecting agents they may in fact not need. Keep in mind that overkill means overexposure.

Germs can be effectively controlled when we break the chain of infection. This can best be accomplished when we insist upon wearing appropriate personal protection equipment, require frequent hand washing, use effective disinfectants in a responsible manner and adequately educate and train or custodial workers.

A little more than a hundred years ago doctors knew a lot about disease but nothing about germs. Today we know we live in a world of germs, some horrible and some harmless. Man and microbes can live peacefully together. In fact, our existence may depend upon it.

TABLE 1: Basic Facts About Germs

Germs are found everywhere: air, water, food, blood, humans, animals and inanimate surfaces.
Germs live in groups and near their nutrients.
Germs are invisible and travel by hitchhiking by direct and indirect methods
Germs quickly adapt and multiply rapidly – doubling their numbers about every 2 hours.
Not all germs are created equal – some are harmful and some are harmless or beneficial
Germs enter our body in predictable ways: ingestion, inhalation, blood stream or absorption
Uncontrolled germs can cause illness and spread of disease

TABLE 2 List of Infectious Diseases and Associated Germs

<u>Disease</u>	<u>Germ (Microbe)</u>	<u>Transmission Mode</u>
Cholera	Vibrio cholerae	Waterborne
Botulism	Clostridium botulinum	Food or Water
Pneumonia	Streptococcus pneumoniae	Coughing or direct contact
Tetanus	Clostridium tetani	Cuts or other wounds
Tuberculosis	Mycobacterium tuberculosis	Airborne
Plaque	Yersinia pestis	Bites of fleas
Malaria	Plasmodium protozoa	Mosquitos
AIDS	Human Immunodeficiency Virus	Blood and Body Fluids
E-Coli	Eschericia coli 0157:H	Foodborne
Hepatitis	Hepatitis A Virus	Foodborne
Hepatitis	Hepatitis B and C Virus	Blood and Body Fluids

TABLE 3: List of Germs and Their Clinical Significance

List of Bacteria

Name of the Bacteria	Description of Clinical Significance
Brevibacterium ammoniagenes	Causes diaper rash.
Chlamydia psittaci	Infects birds and can be transmitted to humans, who can get flu like symptoms from it, and sometimes more serious health problems.
Corynebacterium ammoniagenes	Causes diaper rash.
Enterobacter aerogenes	Gram-negative bacteria spread by anal/oral route of infection.
Enterobacter cloacae	Agent in hospital associated infections causing urinary tract infections.
Enterococcus faecalis	Gram-negative bacteria spread by anal/oral route of infection. Causes urinary tract infections.
Escherichia coli	E-Coli. Gram-negative bacteria spread by anal/oral route of infection, resulting in diarrhea outbreaks.
Escherichia coli, Methicillin Resistant	Same clinical significance as above. But the organism has developed an immunity to the antibiotic methicillin.
Fusobacterium necrophorum	Causes gangrenous infections in man and animals
Klebsiella pneumonia	Causes urinary and respiratory tract infections. Gram-negative bacteria associated with severe pneumonia and urinary tract infections.
Klebsiella pneumonia, Methicillin Resistant	Same clinical significance as above. But the organism has developed an immunity to the antibiotic methicillin.
Listeria monocytogenes	Causes septicemia, meningitis, encephalitis, spontaneous abortion or still birth.
Mycobacterium tuberculosis	Causes tuberculosis
Proteus mirabilis	Cause of primary and secondary infections such as urinary tract infections
Proteus vulgaris	Causes urinary tract infections
Pseudomonas aeruginosa	Causes wound, burn, urinary tract infections. Gram negative bacteria identified as a major cause of hospital acquired (nosocomial) infections. Disinfectants must kill this organism to be classified as Hospital Grade.
Salmonella choleraesuis	Causes enteric fevers, gastroenteritis, septicemia. Gram negative bacteria associated with acute gastroenteritis and septicemia. Disinfectants must kill this organism to be classified as Hospital Grade.
Salmonella schottmuelleri	Causes enteric fever. Gram negative rod shape bacteria associated with acute gastroenteritis and diarrhea

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Salmonella typhi	The causative agent for typhoid fever.
Salmonella typhimurium	Gram-negative rod shape bacteria associated with acute gastroenteritis and diarrhea
Serratia marcescens	Gram-negative bacteria associated with urinary tract infections, meningitis and septicemia.
Shigella dysenteriae	Gram-negative bacteria directly spread by anal/oral route of infection; indirectly (including food, hands, flies) spread by contaminated food and inanimate objects resulting in bacillary dysentery.
Shigella flexneri	Gram-negative bacteria directly spread by anal/oral route of infection; indirectly (including food, hands, flies) spread by contaminated food and inanimate objects resulting in bacillary dysentery.
Shigella sonnei	Leading cause of shigellosis from food. Gram-negative bacteria directly spread by anal/oral route of infection; indirectly (including food, hands, flies) spread by contaminated food and inanimate objects resulting in bacillary dysentery.
Staphylococcus aureus	Foodborne pathogen causing nausea and cramps. Gram-positive bacteria identified as a major cause of hospital acquired (nosocomial) infections. Disinfectants must kill this organism to be classified as Hospital Grade.
Staphylococcus aureus (Methicillin Resistant)	The above organism has developed immunity to the antibiotic methicillin.
Staphylococcus epidermidis	Agent of infection from medical devices such as prosthetic heart valves
Streptococcus faecalis	Foodborne pathogen causing diarrhea, cramps and fever.
Streptococcus faecalis (Methicillin Resistant)	The above organism has developed immunity to the antibiotic methicillin.
Streptococcus faecalis (Vancomycin Resistant)	The above organism has developed immunity to the antibiotic vancomycin.
Streptococcus pyogenes	Causes sore throat and scarlet fever.
Yersinia enterocolitica	Causes gastroenteritis

List of Viruses

Name of the Virus	Description of Clinical Significance
Adenovirus	Causes gastroenteritis
Avian Influenza A	Affects respiratory tract of chickens
Canine distemper	Causes infectious respiratory and gastrointestinal diseases in dogs
Canine parvovirus	Causes gastroenteritis in dogs
Feline picornavirus	Causes upper respiratory infections and intestinal distress in cats
Hepatitis A Virus	Causes liver disease. Route of infection is orally.
Hepatitis B and C Virus	Causes liver disease. Route of infection is bloodborne.

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Herpes simplex Type 1 & 2	Causes skin lesions, fever blisters or genital infections.
Human Immunodeficiency Virus	Causes AIDS.
Infectious bovine rhinotracheitis	Causes infection in cattle
Influenza A/PR	Causes respiratory tract infections. Causative agent in viral flu.
Newcastle Disease Virus	Affects respiratory tract of chickens
Parainfluenza	Cause of lower respiratory tract disease in young children
Poliovirus	Causes polio
Pseudorabies virus	Causes disease in swine cattle, dogs, cats
Rubella	The causative agent of German measles.
Severe Acute Respiratory Syndrome (SARS)	This is an emerging viral disease. Origin of the virus is currently unknown. It appears to be transmitted by air and nonliving surfaces.
Vaccinia	Causes poxvirus infections.

List of Fungi

Name of the Fungi

Description of Clinical Significance

Aspergillus niger	Causes aspergillosis of the lungs, with symptoms which closely resemble tuberculosis. Black mold, found in shower and dressing rooms. Environmental contaminant may also cause aspergillus.
Candida albicans	Causes candidiasis, which takes on various forms of disease. Fungi, yeast. This organism exhibits dimorphism; exists both as fungi and yeast. Causes skin rashes. Common causes for diaper rash. Can infect both oral and vaginal cavities. Causes itching and discomfort.
Trichophyton metagrophytes	Causes Athlete's Foot and ringworm. Found in shower and dressing rooms.
Stachybotrys chartarum	Toxic mold sometimes found in buildings.

**TABLE 4:
General Information About Disinfectants**

Disinfectants are toxic by nature.
Disinfectants can be formulated with phenolics, quats, chlorine, iodine and other actives.
Actives and their percentages must be listed on disinfectant labels.
EPA must approve and register all products that claim to be disinfectants.
Active ingredients and their percentages must be listed on labels.
Official EPA registration and establishment numbers must be listed on every label.
Dilution ratio and contact times must be included on the label.
Manufacturers must prove to EPA that their disinfectant is effective for every germ claimed

TABLE 5: Why many institutions do not use chlorine bleach

1.	Lacks detergency – Household chlorine bleach may be a good disinfectant, but it is not a cleaner. It contains no wetting agents or detergents to allow the disinfecting agent to penetrate soils. Carefully read the household chlorine bleach label and you will see that a surface must be pre-cleaned before the chlorine bleach will kill the germs. Many quat-based disinfectant cleaners will clean the surface and kill the germs in a ones step process.
2.	Adversely reacts with other chemicals to create toxic byproducts and gases – Incompatible with products that contain ammonia, hydrochloric acid, phosphoric acid and acetic acid (vinegar).
3.	Emits unpleasant odors – Occupants of buildings frequently complain about bleach and bleach related odors migrating into their work areas.
4.	Attacks hard surfaces – Chlorine bleach can attack and corrode metal surfaces as well as permanently discolor hard surfaces.
5.	Discolors fibers and colored surfaces – Carpets, entrance matting and clothing are just a few of the fibers that can be damaged when contacted by chlorine bleach solutions.
6.	Damages floor finishes – Chlorine bleach can attack the floor finish coatings on the floor. The stripping and refinishing process is expensive.
7.	Rapidly loses its strength – Chlorine bleach is unstable and can lose its oxidizing and disinfecting strength rapidly compared to “quat” based disinfectant-cleaners.
8.	Is less concentrated – The recommended dilution ratio for proper disinfecting of surfaces is 1:10 (13 ounces of chlorine bleach per gallon of water) while “quat” based disinfectant-cleaners are effective when diluted up to 1:256 (1/2 ounce per gallon of water).

Table 6: Chain of Infection

Link #	Component	Description
1	Infectious Agent	Germs including bacteria, viruses, endospores and fungi are examples of infectious agents.
2	Susceptible Host	Individual susceptible to the infectious agent. Humans and animals are susceptible hosts.
3	Reservoirs	Place where infectious agent survives, grows or multiplies. Humans, animals, nonliving environmental surfaces and medical instruments are examples of reservoirs.
4	Portals of Exit	How the infectious agent leaves the host. Respiratory tract, skin, mucous membranes and GI tract are portals of exit.
5	Transmission Mode	Mode by which infectious agent travels reservoir to host. Direct or indirect contact by air, water, blood, soil, vectors or vehicles are modes of transmission.
6	Portals of Entry	Pathway by which infectious agents enter the host. Broken skin, eyes, respiratory tract, mucous membranes, GI tract are portals of entry.

**Table 7
Levels of Germicidal Action – The Ability of
Antimicrobial Chemicals to Kill Various Forms of Germs**

Applications	Chemical Agent	Germicidal* Against				
		Vegetative Bacteria	Tubercle Bacillus	Spores	Fungi	Viruses
Invasive Instruments	Ethylene Oxide Glutaraldehyde Formaldehyde Vaporized H ₂ O ₂	+	+	+	+	+
Thermometers	Phenolics, Iodines, Halogens and Alcohols	+	+	-	+	+
Floors, Walls, Bathroom Fixtures	Quats, Phenolics, Chlorines and Iodines	+	-	-	+	+

* + indicates effective; - indicates ineffective