

Podcast: Disinfection

Hello everyone, welcome to today's podcast of the Difaem Health community. I am XXX and I am here with my colleague xxx. We are still in the IPC series and today we will continue to talk about the important field of cleanliness and hygiene. In the last podcast, we took a closer look at how to clean properly. What I remember is that it is important to have a cleaning plan in order to know what has to be cleaned and when. High touch surfaces like door handles, bedrails etc. need more frequent cleaning than low touch areas and you should always go from the cleaner areas to the more dirty areas. Cloths and water must be changed when dirty or when moving to another area. Equipment must be properly kept and maintained. Is that right, XXX?

You remember well. For those of you who missed the last podcast, you can still access it on our homepage www.difaem-community.de. Today we move from the mere cleaning process, which involves mechanical action and some sort of detergent to the area of disinfection. This means, we are taking cleanliness one step further. Disinfection is necessary because mere cleaning does not necessarily kill microorganisms. To achieve a reduction of microorganisms on surfaces, we have to work with agents that kill bacteria and viruses. Therefore, a chemical disinfectant, such as chlorine, alcohol or hydrogen peroxide, should be applied after cleaning to kill any remaining microorganisms. Disinfectant solutions must be prepared and used according to the manufacturer's recommendations for volume and contact time. Concentrations with inadequate meaning too high or too low dilution during preparation may reduce effectiveness. High concentrations increase chemical exposure for users and may damage surfaces. It is always important to wear appropriate PPE while preparing disinfectants.

Okay, you said that these solutions have to be prepared. Does this imply that I cannot just buy them ready mixed in a bottle?

Well, yes, you could, but as different concentrations are necessary to kill different germs and as they are all made out of the same basic substances, it does make more sense to prepare the solutions according to the need. Especially in the case of chlorine solutions, it is easier and safer to store the dry substance than the fluid. However, if you store it in fluid form, keep in mind, that chlorine in solutions can decay fast depending on the source of the chlorine and environmental conditions. An ambient temperature or exposure to sunlight will speed up the decay. Chlorine solutions should be stored in opaque containers, in a well-ventilated and covered area that is not exposed to direct sunlight. Still the gold standard is to prepare chlorine solutions freshly every day.

Okay, I get it – fresh is best. Now, after having prepared it, what do I use the solution for?

Chlorine solutions are made of hypochlorite which displays a broad spectrum of antimicrobial activity and is effective against several common pathogens in various concentrations. Hypochlorite acts as a

strong oxidizing agent, causing oxidative damage to microbial cells. It reacts with cellular components, such as proteins, enzymes, nucleic acids, and lipids, interfering with their normal function and ultimately leading to microbial death. For example, hypochlorite is effective against rotavirus at a concentration of 0.05% or 500 parts per million also abbreviated as ppm. A concentration of 0.1% or 1000 ppm is a concentration that will inactivate the vast majority of other pathogens that may be present in health-care settings. However, for blood and body fluids spills larger than 10ml, a concentration of 0.5% or 5000 ppm is recommended. High concentrations of over 0.5% are required for some highly resistant pathogens in health-care settings such as *Candida auris* and *Clostridium difficile*.

Hypochlorite is rapidly inactivated when it is exposed to organic material like faeces or blood; therefore, regardless of the concentration used, it is important to first clean surfaces thoroughly with soap and water or detergent, using mechanical action such as scrubbing or friction. Only then, apply the disinfectant. High concentrations of chlorine solution can lead to the corrosion of metal and the irritation of skin or the mucous membrane; in addition, there are potential side effects related to chlorine smell for vulnerable people such as people with asthma. On the other side, chlorine solution is cheap and readily available, which makes it a real asset and in most cases the gold standard for disinfection in resource-limited settings.

Well, I see. Chlorine solution kills viruses as well as bacteria, even the trickier ones like clostridia and fungi and spores as well. That makes it valuable. However, you mentioned several other substances like alcohol, right?

In the healthcare setting, “alcohol” refers to two water-soluble chemical compounds—ethyl alcohol and isopropyl alcohol. However, let’s just look at ethyl alcohol, because it is more widely available. Ethyl alcohol in high concentrations above 70% kills the vegetative forms of bacteria; it is also effective against fungi and against some viruses but does not destroy bacterial spores.

For bacterial spores you would need the chlorine solution, right?

Yes, that’s right. Alcohol is labelled an intermediate level disinfectant and has some advantages: it is nontoxic, non-staining, and noncorrosive, comes at relatively low cost and is good for disinfecting small equipment or devices that can be immersed. However, for spores and mycobacteria, you still need chlorine. As alcohol is noncorrosive, we use it widely for skin disinfection like in hand rubs or as part of the disinfection in the operating theatre.

Finally, you mentioned hydrogen peroxide, this one I know, it foams well if you put it on wounds. But I never considered it as a disinfectant in general cleaning.

Yes, I can imagine that. As it is quite expensive, it is rarely used for disinfection of larger areas in resource-limited settings. However, it is nontoxic and it has detergent properties with a good cleaning ability. Hydrogen peroxide is not affected by environmental factors and is even active in the presence of organic material. Last but not least, it is safe for the environment. So it is really a good disinfectant, but as I said, it is expensive.

Okay, I have prepared my disinfectant agent, I was careful, protected myself with PPE, followed the instructions, and now – where and how do I disinfect?

The first step, as we already said, is the cleaning. It does not make sense, to apply disinfectant to an area that has not been properly cleaned before. You know this from hand disinfection: first wash your hands to remove all visible dirt, and then use the hand disinfectant. If you do not wash your hands before disinfecting them, there might still be pathogens on them despite disinfection. It is the

same with the environment: First clean, and then disinfect. Otherwise, the microbes might hide in the dirt and survive. Your disinfection efforts would then be pointless.

Generally, all areas that come into potential contact with body fluids must not only be cleaned but also disinfected. That applies for example for the major and minor theatre, the emergency department, the toilets and sinks, the surfaces in the sluices and the medication preparation areas. Equipment that has only been used by a single patient like the bed or the drip stand should be disinfected after the patient has been discharged. All the equipment that is shared by different patients like blood pressure machines, stethoscopes etc. should be disinfected regularly by the health workers that use this equipment. In the case of equipment, the health workers are responsible and not the janitors.

In areas where patients with a dysfunctional immune system are taken care of like an intensive care unit, burn units etc. the surfaces should be disinfected daily, not only cleaned.

Okay, let me recap this, because, for me as a newbie to cleaning in health care facilities, this was a lot of information:

There are basically three different disinfectants in use: Chlorine as in bleach is the most effective. It should be freshly prepared and can have different concentrations depending on what germs should be killed. It can kill bacteria, viruses, fungi, and mycobacteria and spores, which makes it highly effective. However, it is corrosive and damaging to many substances, so in some cases I use alcohol in a concentration between 70% and 90%. Alcohol does not kill all viruses and is not very effective on spores either, but is good for smaller and delicate objects that can be submerged and it can be applied to the skin as well. Lastly, there is hydrogen peroxide, which works very nicely as a disinfectant but is very expensive, and is therefore mainly used for small areas and on wounds.

Yes, correct, you paid very good attention.

I use disinfection after cleaning on surfaces that have come into potential contact with secretions and body fluids. In addition, I disinfect all equipment that has come into patient contact after the patient has been discharged and for all equipment that is shared by different patients – best after every single use. I once read that the dirtiest place in a hospital is the stethoscope of the doctor – so this should be disinfected after every use.

Well done, and as for the stethoscope: a drop of hand sanitizer on the stethoscope after every patient is a good start.

I never thought that there was so much to know about cleaning; and today we have only covered disinfection. We have not talked about sterilization yet.

We will do this in our next podcast. So turn in, you might hear something interesting or even new. Thank you all for the work you do every day with patients and with cleaning, with washing your hands and joining forces in order to break the chain of infection.

I hope to hear from you soon in our next podcast in the IPC series when we talk about sterilization. Until then: stay safe and stay blessed!

<https://www.cdc.gov/hygiene/cleaning/facility.html>

<https://www.who.int/publications/i/item/cleaning-and-disinfection-of-environmental-surfaces-in-the-context-of-covid-19>

<https://www.cdc.gov/hai/prevent/resource-limited/index.html>