

Difäm Health Community (DHC)

Podcast: The Chain of Infection

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Welcome again to the Difaem health community and our new podcast. The last podcast was about infection prevention and control in general and gave an overview of the different areas of IPC.

Today we will look at the fundamental purpose for IPC, which is to break the chain of infection. Infectious agents can spread from one person to another, either directly or via intermittent hosts or objects.

For this to happen, several elements are necessary that form the so-called chain of infection. Only if all elements are present and linked to each other like in a chain, transmission is possible. My colleague XXX will tell us more about the chain of infection.

XXX, which are the necessary elements of such a chain?

Hello everybody. The chain of infection starts with an infectious agent: These are the microorganisms that cause the infection, such as bacteria, viruses, fungi, or parasites.

The infectious agent lives in a so-called reservoir where it multiplies. The reservoir can be a person, an animal or even an object. Every infectious agent has typical reservoirs. Some infectious agents can only multiply in humans, others in animals; some just live and thrive in the soil or in water and do not need living reservoirs.

The next important chain link is the portal of exit. This is the pathway by which the infectious agent leaves the reservoir. For a human or animal reservoir, this can be through respiratory secretions, body fluids, or skin lesions.

Once a pathogen has exited the reservoir, it needs a mode of transmission to enter a host. Direct human-to-human contact, droplets, or direct contact with contaminated objects make this possible. In addition, indirect contact for example via a vector is possible. Vector-borne contact is transmission by an animate intermediary, an animal, insect, or parasite that transports the pathogen from reservoir to host. Transmission takes place when the vector injects salivary fluid by biting the host, or deposits faeces or eggs in a skin lesion. Malaria is the most prominent example of this.

It seems that the route of transmission determines the pathway by which the infectious agent enters the body of a susceptible host; this can be through mouth, nose, eyes, or open wounds. Pathogens often enter the body of the host by the same route they exited the

reservoir; e.g. airborne pathogens from one person's sneeze can enter through the nose of another person, or faecal-oral infections both involve the digestive tract.

This is correct. Now, the final link in the chain of infection is a susceptible host, someone at risk of infection. Infection does not occur automatically when the pathogen enters the body of a person whose immune system functions normally. Whether exposure to a pathogen results in infection depends on several factors related to the person exposed who is the host, the pathogen that is the agent, and the environment.

Host factors that influence the outcome of an exposure include the presence or absence of natural barriers, the functional state of the immune system, and the presence or absence of an invasive device.

This was a lot of information! Let me see if I got all the chain links right. The infectious agent - lives in a reservoir – leaves the reservoir through the portal of exit – uses its specific mode of transmission – and reaches the portal of entry – where it enters a susceptible host. This means that there are six different chain links that all have to interact in order to cause an infection.

Yes, all six steps are necessary for an infection to spread. In principle, this is actually good news because it shows that we have six opportunities to break the chain. Depending on the kind of pathogen, not all elements of the chain of infection are easily breakable and accessible, but if we just break one element in the chain, the spreading stops. Can you think of the different ways to break an element? Let us start with the first one, the infectious agent. How can we get rid of it?

Killing the infectious agent is one of the most difficult tasks in breaking the chain of infection, but if it were easy, we would not have infections any more. We heard that infectious agents could be bacteria. Well, antibiotics can kill bacteria.

Yes, this is correct. In the preceding podcast giving an overview of IPC, we presented linked areas of intervention that are not directly IPC but very closely related. Antimicrobial stewardship is one of them, exactly for this reason. Antibiotics can kill bacteria, antimicrobial agents fight parasites and fungi, and vaccination triggers the immune response to kill viruses. Therefore, antimicrobial stewardship is an important aspect in the attempt to break this link of the chain.

The next chain link is the reservoir. If the pathogen lives in inanimate objects like water, chlorinating the water or drying contaminated puddles is a possibility; contaminated soil can be avoided, disinfected, disposed or rinsed. If the reservoir is an animal or a human, we have to find other solutions. In order to make the reservoir smaller, we can isolate humans or animals. Most of the pathogens die eventually if they cannot move to another host. If there is no reinfection, this reservoir is cleared. Again, vaccination comes to my mind. The infected person's own immune system can break the chain of infection by killing the virus in the first place. If all potentially susceptible hosts are vaccinated, there is no more reservoir.

Yes, this is right. Sometimes, we cannot completely dry up a reservoir. However, we can reduce the number of pathogens living in it through IPC measures. Cleaning, disinfection,

spraying or sterilization all help to reduce the number of pathogens. So now, we come to the portal of exit. Any ideas here?

This is easy; we had a pandemic in the past years, so we have all learned that protective equipment can cover or block the portal of exit. Wearing a mask and covering your mouth and nose when coughing or sneezing can help to prevent the spread of infectious agents through respiratory secretions. Covering and disinfecting wounds will help if this is the portal of exit. Containing infectious fluids like urine as soon as it leaves the body is also useful. In addition, using condoms to cover the portal of exit for STIs and HIV/AIDS is also very helpful.

Right. Nonetheless, infectious agents still succeed in leaving the reservoir. Now, they are in the open and easily accessible for interventions. This is the most important situation when we can block the chain.

I know what you want to say. Washing your hands is the easiest way to block most of the modes of transmission, it does not matter whether it is faecal – oral contamination, touching contaminated objects or working with infectious fluids. In this case, also gloves play an important role and add additional protection.

Proper sanitation and hygiene are important topics as well as disinfection and decontamination of surfaces, tools and commodities. Changing the surroundings in which transmission occurs, such as improving ventilation or reducing humidity, can also decrease the survival and spread of infectious agents during the transmission phase.

It is best when individual hygiene coincides with proper decontamination, disinfection and environmental measures. The more paths of the mode of transmission are blocked, the better. If we look at the portal of entry, the measures are similar to those of blocking the portal of exit. We talk a lot about PPE here; in addition to masks and wound coverings, also eye protection plays a part, as quite some viruses like HPV or Herpes can enter the human body via the eyes. The next question will be - What can we do about our susceptible host?

It is vital to stay as healthy as possible. Following a healthy diet and leading a healthy life will keep the immune system strong. A strong immune system can fight many minor infections without us even realising. With a strong immune system, you are less susceptible to infections.

In addition, we have to respect necessary measures like isolation or quarantine in order to avoid sick persons and their surroundings. Practicing personal hygiene, as well as healthy habits make us less susceptible. Moreover, education plays a role as well. If susceptible individuals know how infectious agents are spread, they can protect themselves and their families.

Thanks for all these good points. In addition, vaccination can break the chain at this level too.

So if I wrap it up: The chain of infection can be broken at any level. All aspects of IPC contribute to this: Hand hygiene, PPE, disinfection, sanitation and hygiene, antimicrobial agents, distance and isolation. The more pieces of the chain of infection are broken, the more surely the transmission is interrupted. This is why we can never rely on one intervention only

not even if it is such an important intervention as handwashing. Every single intervention is important but only together they really work as infection prevention and control, as IPC.

Now this was very interesting and I am already looking forward to learning more about the specific areas of IPC, which will be the case in our upcoming podcasts.

We hope that you will still be with the Difaem health community and us when we continue this series. Until then: stay safe and stay blessed.