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MONTHLY UPDATES ABOUT VACCINES ACROSS THE LIFESPAN

Viral Shedding and COVID-19: What Can and Can't Happen

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The term "viral shedding" has been discussed during the COVID-19 pandemic. Some discussions have left a wake of misunderstanding about how and when viral shedding occurs. So, let's take a closer look.

What is viral shedding?

Even though viruses can cause a lot of damage, they are typically very simple organisms. They often contain only a few proteins and either DNA or RNA, known generally as nucleic acids. The nucleic acids are instructions for making more viruses. But even with these instructions, viruses do not have everything they need to reproduce. In order to survive, viruses must infect another organism, such as a person. Once inside the organism, the virus must gain access to a cell **(youtube.com/watch?v=jkNxmTrrZSk)**, which has the necessary machinery and building blocks to make more viruses. By taking over the cell, the virus is able to redirect the cell's activity **(youtube.com/watch?v=QHHrph7zDLw)** for its own benefit — making more of itself to survive.

Trivia Corner

What vaccine is a live, "weakened" viral vaccine?

a) Meningococcal vaccine

b) Tetanus vaccine

c) Measles vaccine

d) Hepatitis B vaccine

New viral particles that result from this process can go on to infect other cells, and with each round of replication, the number of viruses in the individual increases exponentially. The longer it takes for the individual's immune system to recognize what is happening and gain control over this process, the greater the number of viral particles that will be produced and the greater the battle between the virus and the immune system that will occur. An infected individual will recognize this battle in the form of symptoms of illness — fever, fatigue, congestion, vomiting, diarrhea, etc. The symptoms will vary based on which virus it is and what type of cells it infects. In the case of SARS-CoV-2, the virus that causes COVID-19, the primary location of the early infection is the respiratory system, specifically cells that line the inside of the nose and throat.

As viruses are produced in the nose, they may gain entry to other parts of the body, where they can infect more cell types and cause additional symptoms or complications. But these newly formed viral particles can also have a second fate. They can leave the infected person in nasal and oral secretions. *Viral shedding* refers to this second fate. Because these viruses can go on to infect someone who is exposed to the nasal or oral secretions, viral shedding and the spread of disease are closely intertwined.

During the COVID-19 pandemic, viral shedding has been discussed in relation to masking and vaccinations.

Viral shedding and masks

Because a person infected with a respiratory virus is shedding virus particles from their nose and mouth, you can quickly conclude that a mask will decrease the spread of viral particles as they are physically trapped by the mask.
This is why early messaging during the pandemic was that wearing a mask was a way to protect those around you.
This became particularly important as we learned that people infected with SARS-CoV-2 can spread the virus a few days before they develop symptoms. The fact that SARS-CoV-2 can spread in the two to three days before a person feels ill makes it more difficult to contain compared with similar viruses, like SARS-CoV-1, which was first identified in China in 2003, and MERS-CoV, which was first identified in Saudi Arabia in 2012.

Two additional aspects of masking are worth considering in the context of viral shedding:

- **A mask also protects the person who is wearing it** — Because a mask serves as a physical barrier, it offers some protection for the person wearing it. However, people can inadvertently expose themselves if they touch a contaminated mask or other surface and then touch their eyes, nose or mouth. So, a mask worn by an infected person offers more protection than a mask worn by an uninfected person because the net result is fewer infectious viral particles circulating in the air and landing on surfaces. Said another way, if you are healthy and susceptible and you find yourself in a situation with one mask and an infected person, give them the mask and physically distance. You will be safer than if you wear the mask yourself.
- **The type and fit of the mask is important** — Given that a mask serves as a physical barrier for virus particles, the type of material from which the mask is made and the snugness of its fit are important determinants of its effectiveness. This is why multilayer masks made of materials with tight fibers are more effective, and bandanas and gaiter masks are less effective. Find information on how to properly wear, remove and care for your mask in this previous Parents PACK article **(bit.ly/3p9DmXo)**.

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Trivia Answer: The correct answer is C. Measles vaccine is a live, "weakened" viral vaccine that is made by isolating measles virus and weakening it in the laboratory.
Go to **vaccine.chop.edu/trivia** *to p*lay ***Just the Vax***, the Vaccine Education Center's trivia game, where you can find this question and others like it.

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Viral shedding and vaccines

Viral shedding can occur following vaccination if the vaccine contains live, weakened viruses because that type of vaccine causes immunity through viral reproduction. Examples of routinely used live, weakened vaccines include measles, mumps, and rubella (MMR); chickenpox; rotavirus; and the intranasal influenza vaccines. The oral polio vaccine (OPV) also contains live, weakened virus. While OPV is no longer used in the U.S., it is still used in some other countries. The yellow fever vaccine, while not routinely used in the U.S., is also a live, weakened vaccine. The new COVID-19 vaccines being used in the U.S. do NOT contain live virus, so they are not capable of causing shedding, but we will get to that below.

An important distinction between a viral infection and vaccination with a live, weakened viral vaccine is the amount of virus that is shed. If vaccination causes shedding, it typically results in significantly lower quantities of virus being shed, and the shed virus particles are less likely to cause disease because they are the weakened form used to make the vaccine. However, a few exceptions exist. For example, if someone is immune compromised, they might shed virus for a longer period of time because their immune system has trouble stopping viral replication. For this reason, some people with immune-compromising conditions cannot receive live, weakened vaccines. Another consideration is that people not immune to the disease could get infected through viral shedding. Sometimes this is beneficial as in the case of the oral polio vaccine, which causes more than just vaccinated people to be protected against polio. This type of protection is called contact immunity. But on occasion, viral shedding can also result in an infection with symptoms, such as when an unimmunized person comes into contact with the chickenpox rash of a vaccinated person and develops a mild case of chickenpox.

Viral shedding and COVID-19 vaccines

Confusion related to COVID-19 vaccines has also involved aspects of viral shedding. The source of this confusion is twofold. First, people may not distinguish between the reproduction of a virus and the COVID-19 vaccines causing our bodies to produce the spike protein. Second, like the whisper-down-the-lane game, talking down the line further confounds the confusion. Let's take a closer look:

- **Viral reproduction versus production of spike protein** — Two major factors distinguish viral reproduction and the processing of the new COVID-19 vaccines — the parts of the virus involved and the location of processing.
  - **Parts of virus** — During an infection, the entire virus is produced, but the COVID-19 vaccines only introduce the nucleic acid related to one viral protein — the spike protein — so no other genes or proteins are available to produce viral particles. Simply put, it is impossible for the vaccines to result in the production of infectious virus particles. Our cells do not have the directions to make the whole virus.
  - **Location of processing** — As described earlier, when a person is infected with COVID-19, the earliest viral replication occurs in the nasal cavity. If the immune system does not gain control during those early days, the virus may spread to other parts of the body and infect cells in other locations. This is why some people seem OK in the beginning, but then after about a week, they get more severely ill. On the other hand, the mRNA and adenovirus-vector vaccines are processed near the injection site, so the spike protein is never in an area of the body from which it could be shed, such as the nose.

  For these two reasons, we can be certain that the SARS-CoV-2 virus is not shed as the vaccine is processed.
- **Whisper-down-the-lane game** — Unfortunately, because there is confusion related to whether the virus can be shed after vaccination, other misinformed ideas become conflated with the idea that a vaccinated person is shedding the virus — or even just the spike protein. For example, some people have heard that when a vaccinated person sheds the virus or spike protein, they can affect the fertility of someone else. This idea conflates the misunderstanding about viral shedding with another misunderstanding related to fertility. (No, these vaccines do not affect fertility. You can see more about that issue here **(bit.ly/34D1OH6)**). The result is fear, confusion, and further spread of misinformation as people share what they heard.

In sum, viral shedding is an issue when someone is infected with the virus that causes COVID-19, but not when they are vaccinated against it.

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