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Introduction

In order to help communicate with the citizens of Moore County, county Health Director Robert Wittmann, MPH has partnered with Paul Kuzma, MD to prepare a series of articles meant to inform the public about Covid-19 and public health. Dr. Kuzma has practiced medicine in Moore County for over 20 years and is currently completing his Masters of Public Health degree at Johns Hopkins University. This is the fifth in a series of articles prepared by Dr. Paul Kuzma to further public understanding of Covid-19.

Understanding Vaccines

When we become infected with a disease-causing organism, our bodies begin to mount a defense. The goal is to destroy the organism and to prevent the disease that it can cause. If the organism is new to us and we have not been infected with it previously, it takes time to generate a protective response and the organism can multiply and infect our cells and cause us to become sick. If our response takes too long or is not sufficient, we may die of the infectious disease. If we have previously been infected with that same type of organism, our body can mount a faster and stronger defense and we have a much better chance of surviving. Our body recognizes the invader and destroys it before it gets a foothold. In fact, the response can be so effective that we never even know that we have been exposed to the organism. This is what we mean when we say that we are immune or have immunity to a disease. Our body's natural defenses have been primed and are ready to neutralize an organism before it can make us sick.

As we discussed in more detail in an earlier article in this series, cells in our immune system create this protection from disease. B-cells produce antibodies that circulate in our blood looking for infectious organisms. T-cells destroy infected cells and develop memory to the infection that helps B-cells produce more antibodies quickly if we become infected. If we have enough circulating antibodies in our blood, and if our T-cells and the rest of our immune system are primed to fight, we are much more likely to survive the next infection.

The problem with this scenario is that in order for us to have anti-bodies and a strong immune response, we would need to have been infected previously with that disease-causing germ. This means that we need to suffer and survive a potentially deadly infection in order to develop immunity. Not everyone will survive that infection. Only those of us who survive the first infection may develop immunity against future infections.

"To Protect and Promote Health through Prevention and Control of Disease and Injury."
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This is where vaccines can help. A vaccine is a way for us to develop immunity to a disease without being infected by it in the first place. Vaccines stimulate our immune system to produce antibodies and stimulate t-cells. Most vaccines contain non-infectious components of the disease-causing organism that our bodies will recognize as dangerous and develop antibodies. These antibodies will circulate in our blood and will be ready to attack if we become exposed to that infectious agent in the future. Some vaccines contain weakened or inactivated infectious agents, some contain just the antigens or toxins that the organism produces, and some of the newest vaccines under development contain the genetic code that allows us to produce antibodies and develop immunity.

Some diseases are highly infectious and can cause disease, disability and death before our bodies can mount an effective immune response. Some are so devastating that we remember them centuries later. Among the most feared are the bubonic plague, small pox and pandemic influenza. Vaccines have been developed for each of these diseases. New to this list is SARS-CoV-2, a novel coronavirus that has caused COVID-19 to become a worldwide pandemic. The word “novel” means that it is a new infectious organism and almost no one has immunity to it.

As of today, there are a number of vaccines under development for COVID-19 and several have made it to large-scale human trials. If these vaccines prove to be safe and effective, we can expect approval for human use in the near future. These vaccines are being developed by scientists around the world at a pace that has never been seen before. The previous record for the development of a vaccine was 4 years for the mumps vaccine. We are currently only about 10 months into the COVID-19 pandemic and multiple vaccines are in large-scale human trials. This is truly amazing!

While it is exciting to realize that a vaccine is on the horizon, there are still many challenges that we need to overcome before we can get our population vaccinated and immune to this terrible disease. The vaccine trials need to be completed and the data needs to be analyzed. The manufacturers will have to show that the vaccine causes people to develop an immune response. The response must be strong enough to reduce the risk of the disease in those vaccinated. It must be safe and not cause significant undesirable effects in the people who get the vaccine.

Once the vaccine is approved, we will have many more challenges before we can get enough people vaccinated to slow or stop the spread of COVID-19. We will discuss these more in the next article in this series.