

With the first COVID-19 vaccine rolling out across the country, Texas Tech University Health Sciences Center (TTUHSC) physicians Steven Berk, M.D., and Afzal Siddiqui, Ph.D., answer some questions about the safety and benefits of receiving a vaccination.

Berk, an infectious disease physician, is dean at the TTUHSC School of Medicine and executive vice president.

Siddiqui, director of the TTUHSC Center for Tropical Medicine and Infectious Disease, is known for his work to develop a vaccine for schistosomiasis, a human parasitic disease that effects more than 200 million people in Africa.

Q: Why are vaccines important?

AS: Going back hundreds of years to the 1790s when we got the first vaccine for smallpox, vaccines have been perhaps the second most important public health victory of humankind. We have saved hundreds of millions of lives using vaccines, so vaccines are effective if they are used correctly. And vaccines don't work; it's the vaccination that works, so we have to make sure that we not only have the right vaccine, but we have to make sure that the people who need the vaccine are vaccinated. There are people who think they don't need it, but they do need it because to eradicate a disease, we have to develop immunity at a larger level. That's why it is a very difficult thing to have yes or no and black or white answer. Vaccines have to be looked at in a very global sense in that not only do people who need it have to have the vaccine, but also we have to protect people; someone who may get exposed sometime should have it too.

Q: Why do we need to be vaccinated for some diseases and not others?

AS: Let me just start from the very basic: we are born with an immune system, which is designed to take care of diseases we may get through pathogens. Some of our body is trained to fight those diseases and then we get some of the training in mother's milk. As we grow older, we develop more and more of the cells that are responsible for fighting the infection through antibodies, and they are called memory cells. So that system we have is called innate immunity. But there are certain diseases that we don't have to get exposed for our body to learn how to fight them. So for those, we have developed this vaccination strategy, and that is called adaptive immunity.

Q: Do all vaccines have to be injected or can they be introduced to the body in other ways?

AS: There are many ways vaccines can be introduced and it all depends what kind of response we are looking for. The great majority of vaccines are injected into the muscles or into the subcutaneous area, the reason being that we have the right kind of antigen presenting cells. These are the cells in the body where this vaccine antigen—antigen that is in the vaccine—has to come in into the process to be given to the human body. Usually we are looking for a vaccine that is antibody based, so we want to prime the immune system with the B and T cells, which is the best way to do it in the muscle. Now, there are also vaccines where we give it orally, but very few of them where we are trying to do mucosal immune response. We have one of the polio vaccines, oral vaccine, and we also have intranasal sprays

of vaccines. But those are very limited and they're used when we are looking for a different kind of response. But most of the vaccines we have are injectable.

Q: One of the concerns people have is that they could actually get the disease from the vaccine. Is that possible?

SB: There's absolutely no doubt that that's not possible because there's no live virus in the vaccine. There's not even dead virus in the vaccine. The vaccine is a messenger RNA virus; it takes a piece of messenger RNA that codes for an antibody. That is what will kill the virus. Let me say that again. Messenger RNA is a chemical, it's a messenger, and when the body sees this chemical code, it will produce an antibody that can kill the COVID-19 virus. In fact, the messenger RNA codes very specifically for an antibody that is directed to a protein on the membrane of the virus, and it kills the virus that way. But the important point is there's no dead virus, and there's no live virus in the vaccine.

Q: What's most important thing you would like people to know about the vaccine?

SB: I think the most important thing is that scientists came up with this messenger RNA mechanism to produce antibodies, and that was done in science labs. Actually, message RNA technology has been going on for a very long time, even though there haven't been message RNA vaccines. When this vaccine was developed, it then went into what we call clinical trials; we had to find out if this is true science or science fiction, so basically we had clinical trials, which meant more than 40,000 people have received this vaccine in clinical trials. Half got a placebo, or a vaccine that essentially didn't have anything in it. The other half got the messenger RNA vaccine. Then those who made this vaccine could just stand and watch to see what the long-term results would be. When we got the results back, we saw that, for example, of the first 100 people in the whole trial that came down with COVID-19, 94 were in the placebo group and only six were in the vaccine group. That was repeated both by the Pfizer vaccine developers and then by the Moderna vaccine developers, both of them showing that this vaccine is about 95% effective in preventing individuals from getting COVID-19.

AS: There are a couple of things which I think we should just get it out of the way: even though it takes a decade to make a vaccine following the traditional pathways, the vaccines for this virus have been accelerated without doing anything limiting the safety and efficacy testing. That is very important: that from the outset, we know that we did not take any shortcuts with regards to the vaccines with the coronavirus. For example, the preclinical stage development of it was very quick because we already knew a lot about the signs of similar kind of viruses, and within months of the epidemic, we knew the genetic code of the virus. So we were able to target what was the very important area of that parasite and that was the spike protein, which is essential for this virus to infect. We knew exactly what we needed to target and that is why there was this accelerated development of this vaccine.

Q: Who took part in the clinical trials?

SB: It was a diverse group; they tried to make it diverse. All different types of people were in the clinical trials. Then they had to say, 'Well, okay, this is very, very effective. But what are the side effects?' And we've learned that the side effects were similar to those you get with influenza and some other vaccines. You get pain at the site of the injection, you may get a fever, you may get muscle aches and you may get a headache. And we know that with the second dose of the vaccine, because the Pfizer vaccine and the Moderna both need two doses.

By the time you get the second vaccine, the side effects are worse in the first with more probably more headache and more muscle aches. There are side effects, but they resolve in 24 hours, and we will recommend taking aspirin or Advil as symptomatic treatment for those side effects. We also know that in the United Kingdom, there were two individuals that had an allergic reaction to the vaccine. It turns out both of those individuals had allergic reaction reactions to vaccines before. For anyone who's had an allergic reaction to a vaccine, we're still recommending that they get the vaccine, but they'll stay in the doctor's office probably at least 30 minutes after injection just to make sure they're not going to have an allergic reaction, and if they do, that can be treated.

Q: Is there anyone who shouldn't take the vaccine?

SB: Right now, there really aren't. The CDC is not coming up with any contraindications. I do think for those who have certain conditions like HIV, autoimmune disease, they should talk to their doctor about their underlying disease and make sure that the doctor agrees that they should go ahead with the vaccine. But for the most part, the CDC doesn't see any real contraindications as far as underlying disease. Now, for all vaccines, you don't want to get any vaccine if you are febrile (feverish) or already have some kind of illness, and that includes COVID-19. If you're infected with COVID-19, then you don't get the vaccine right away, although 90 days later, CDC is still recommending the COVID vaccine for those even who have had COVID-19. That's because your immunity will last much longer with the vaccine than it will from natural infection.

Q: What about women who are breastfeeding?

SB: That's been the most sensitive because pregnant women were not specifically studied in the trials, though it turned out that there were pregnant women in the trials and they had no problem. And again, I would say if you are pregnant, talk to your OB-GYN or family doctor. But the CDC is not suggesting that you don't take the vaccine because you're pregnant, nor does the CDC recommend the pregnancy test for women of childbearing age before they get the vaccine.

Q: Would you explain herd immunity?

SB: We've heard a lot about herd immunity in two different settings. One is in the setting before the vaccine where people asked if it is possible that herd immunity would get us out of this problem. What herd immunity means is that we know for most infections, once about 70% of the population has antibodies to an infectious disease, that infectious disease dies out. The virus just can't find enough people to infect when 70% of the whole population has antibodies. Now when people suggested we would get out of COVID-19 through herd immunity; that was a huge mistake. If we waited for 70% of everybody in the country to have antibodies to COVID-19, the number of deaths would be staggering. The number of deaths in Lubbock would be in the thousands. But when we talk about the vaccine, we're talking about herd immunity in a different way. Now we're talking about giving enough people the vaccine that 70% develop antibody, and then we know that COVID-19 will essentially be over if 70% of everybody has antibodies. Now a lot of this depends on the effectiveness of the vaccine, but the great news is that the vaccine is 90% effective. If 80% of the population were to get the vaccine, and it was 90% effective, then more than 70% of everyone would have antibodies and then we would predict that the COVID-19 pandemic would end in this country if we had that high of a vaccination rate. That would be developing herd immunity through the vaccine.

Q: Many believe the flu vaccine prevents them from contracting the disease, but it also prevents the disease from being so severe if it is contracted. Is it the same with the COVID-19 vaccine?

SB: It is; it looks like that's the same thing. Some years influenza vaccine is only 40% or 50% effective in preventing the infection, but then when you follow the individuals who got the influenza vaccine, their disease is much more mild than someone who didn't get the vaccine. It looks like that's going to be the case with the COVID-19 vaccine as well, so that's another important reason to get the COVID-19 vaccine. We're hoping that it will prevent infection in the great majority of cases, but even those who do become infected should have a much milder course if they received the vaccine.

Q: We've heard how this vaccine has been essentially "fast tracked." Is there any possibility that there are other vaccines out there that could be something like an imposter vaccine? Should we be worried about getting the wrong one or should you advise people to get it as soon as they can or wait?

AS: I think that we have a very good plan. These vaccines are vetted very well by all of the regulatory agencies, all of the vaccines that are in the pipeline in the U.S., Europe and Asia. They all have their own regulatory bodies; it's a really robust process and every clinical trial has a board of very qualified and experienced people who look at how effective the vaccine is. The vaccines that will come through with approvals like emergency use or final approvals will be totally good vaccines and people should trust that judgment. Now about the fake vaccines, and you always see that they will come up. I think we have to be really careful that we don't take something that is not FDA approved and is not given by the provider people deal with. I think we should be careful that we don't get into this situation where people try to sell you something that is not real. That could be a real problem, but I think if we stick with the FDA-approved vaccines in U.S., we should be fine. And there will be categories of people who will receive these vaccines based on what the requirements are. For example, the frontline workers, the people who are at risk, the older populations, they will receive the vaccine first and then we move down the different categories that way. So, we should watch out for people selling you snake oils and just to stick with the FDA-approved vaccines.