Vaccine efficacy – what does it mean?

This article was published as a series of "Letters to the Editor" in the Dillon Tribune, August-September, 2022

Some people are confused about why some people who have been vaccinated still get Covid-19. The answer is simple. There has never been a vaccine that is 100% effective.

Each fall, doctors encourage us to get a flu vaccine. We need a new vaccine yearly for several reasons: viruses undergo mutations that can result in different viral strains or variants; there are over sixty different influenza variants worldwide; manufacturing a vaccine takes months & is based on predictions of which flu strains/variants will be prevalent in the coming year. We get a booster shot geared to a different combination of virus variants each year. Flu vaccines typically range from 40-60% effective. Fortunately a quadrivalent flu vaccine is now used, which protects against four separate influenza variants.

Like many others, I have been confused about what vaccine efficacy and vaccine effectiveness mean. Vaccine efficacy is determined during a clinical trial in which a control group of individuals receives the vaccine and a separate group receives a placebo (an injection with no vaccine). Researchers follow-up over time with each individual to discover whether or not they become ill. Clinical trials are completed before a new vaccine is approved for use.

For example, when the first shingles vaccine became available, it had 60% efficacy. Those of us who have had family members who suffered through shingles knew how important it was to get that vaccine, even with a low rate of efficacy.

Efficacy tells us that, in the case of the shingles shot, there was a 60% reduction in cases of shingles in the vaccinated control group compared to the unvaccinated group in the clinical trial. Unfortunately, this is a difficult concept to understand and has not been explained well to the general public.

In 2017, a new shingles shot became available that has a reported 90% efficacy rate. Those of us who understood what an astounding difference that was, when compared to the previous shingles shot, raced to our doctors or pharmacists to get the new two-dose shingles vaccine.

The vaccine efficacy rate is predictive of how the vaccine will perform in the general population, but once a vaccine is put into use, additional research studies are conducted to verify how well the vaccine performs in the general public. Those studies tell us how effective the vaccine is in the real world. And they are never 100% effective.

It has been absolutely astounding that the four different Covid-19 vaccines used in the United States were developed in an extremely short period of time. The first Covid-19 vaccine approved in the USA was developed in one year – something that had never been accomplished

in the past. Vaccines typically take 10 years or more to be developed and tested in a clinical trial. Because a large number of scientists worked together, the first Covid-19 vaccines were developed in less than one year.

The urgency of the Covid-19 pandemic, which has now killed over 1 million Americans, and over 6.6 million worldwide, spurred the US Federal Government and several other governments worldwide to provide unprecedented funding to enable researchers to develop Covid-19 vaccines in record time.

You might be surprised to learn that the USA has had 17% of all deaths worldwide, from Covid-19. Why is our death rate so high? The main reason is that the USA has a low rate of vaccination – only 67.9% of Americans are fully vaccinated. About 40,000 Americans died of Covid this summer (2022). Because so many people remain unvaccinated, as of January 2023, the USA is still experiencing over 540 deaths a day from Covid-19.

In Montana, only 52% of us have been vaccinated. That puts all of us at greater risk. As of November 2022, Montana is still experiencing over 1100 new Covid-19 cases each week. Over 3600 Montanans have died from Covid-19 throughout the pandemic thus far. The pandemic is NOT over.

Many other nations have significantly higher vaccination rates than the USA, including most countries in Europe, the Middle East, Asia, and Central and South America.

Many of the poorest nations have low vaccination rates due to limited access to vaccines. However, those same nations are not able to provide accurate reports on deaths from Covid-19, so deaths in developing nations are often under-counted. In most countries in Africa, less than 20% of individuals are vaccinated. Refer to the New York Times Covid Vaccinations Tracker for data for each country. Recently, a measles outbreak occurred in Zimbabwe, where few people have access to the measles vaccine. As of October 2022, this outbreak has caused the deaths of 744 children since April.

But why should we care about low vaccination rates in other countries? When many people are unvaccinated, that means that many more people are infected with the virus. The more people are infected, the more rapidly the virus can mutate. The more rapidly a virus mutates, the less effective become the vaccines.

When the Moderna and Pfizer Covid-19 vaccines completed clinical trials and were approved for use, they were rated with 95% efficacy. These are astoundingly high rates. Vaccine efficacy tells us that there was a 95% reduction in cases of Covid-19 in the vaccinated control group compared to the unvaccinated group in the clinical trial.

But rate of efficacy within a clinical trial is different from the performance (effectiveness) of that vaccine in the general population, as millions of individuals are vaccinated and as time passes. Vaccine effectiveness refers to how well a vaccine performs in the real world. Over the

past two years since the Covid-19 vaccines were first made available, researchers have been studying the vaccine effectiveness in the general population over a longer time than can be completed within a clinical trial.

Various recent studies have concluded that the Moderna vaccine is 93-94% effective at preventing symptomatic Covid-19, the Pfizer-BioNTech vaccine is 88-91% effective, the Johnson and Johnson (Janssen) vaccine is 66-71% effective, and the Novavax is 90% effective (however, for individuals 65 and older, Novavax effectiveness drops to 79%).

For all four vaccines, vaccinated individuals are far less likely to become seriously ill with Covid-19 than unvaccinated individuals. Although the current vaccines are slightly less effective in preventing illness from the new Covid-19 variants, they are still highly effective at preventing severe illness and death.

The Washington State Department of Health recently published data from King County, Washington. The data listed the numbers of hospitalizations and deaths from Covid-19, and compared vaccinated individuals with unvaccinated.

Daily patients in hospitals per 100,000 residents

	Ages 30-49	**Ages 50-64**	**65 & older**
Unvaccinated	0.5	2.6	10.4
Vaccinated, no booster	0.2	0.4	1.7
Vaccinated, with booster	0.1	0.2	1.7

Daily deaths per 100,000 residents

	Ages 30-49	**Ages 50-64**	**65 & older**
Unvaccinated	0	0.7	4.2
Vaccinated, no booster	0	0.1	0.8
Vaccinated, with booster	0	0	0.4

DATA TRANSLATED TO NUMBERS: The population of Seattle (which is in King County) is 741,000. The total population of King County is 2.225 million.

For all of the Covid-19 vaccines, effectiveness decreases over time. Getting a booster shot helps restore one's immunity.

No vaccine has ever been 100% effective at preventing people from becoming ill. But individuals who are vaccinated are far less likely to become seriously ill from Covid-19. Some people who have been vaccinated do still die from Covid-19 (my 91 year old vaccinated brother died of Covid in March), but far fewer deaths occur than among those who are unvaccinated.

Because polio cases have recently re-appeared in the United States, the Washington Post published an article in August 2022, "The history of polio and the vaccines that nearly eradicated it." Below is a brief summary.

Between 1894 and the 1950s, polio hit the United States hard. 20,000 people in the US were paralyzed from the virus each year, and many people died.

Jonas Salk developed influenza vaccines during World War II. By 1950, he had created the first polio vaccine. It became available to the public in 1955. This vaccine has to be injected.

In 1961, an oral polio vaccine became available, created by Albert Sabin and his research associates. That vaccine can be administered orally, either by a droplet on the tongue, or by applying a droplet to a cube of sugar.

When I was in the sixth grade in 1961, my entire school, students, teachers and staff, lined up in the school cafeteria to receive the new Sabin polio vaccine. Each of us was given a tiny paper cup with a cube of sugar in it. The cube had a droplet of vaccine on it.

Anyone who has been paralyzed by polio, or who had a family member who was paralyzed or died, knows how important vaccinations have been to slowing down the spread of this horrifying disease.

With these 2 polio vaccines, billions of doses were administered worldwide. And many governments eventually declared that polio was no longer endemic in their country. But in a number of countries, including Afghanistan and Pakistan, where vaccination rates remain low, polio still rears its ugly head.

This summer in New York, a man who developed polio became paralyzed. Because the percentage of people infected with polio that become paralyzed is very small, New York health professionals are highly concerned that many more people have been infected without knowing it.

Vaccinations save lives – both yours and those you love. Please, everyone, get your vaccinations!