THE
IMMUNIZATION
PARTNERSHIP

History of Vaccines

Pre-recorded Webinar Script

Slide 1:

Hello and Welcome to The Immunization Partnership presentation on The History of Vaccines.

Slide 2:

Today we will be covering the history of 8 vaccine-preventable diseases: smallpox, polio, measles, Influenza, Diphtheria, Tetanus, & Pertussis, and Meningitis.

Slide 3:

This is a timeline of significant vaccination and disease dates. Events associated with smallpox are colored in medium blue, flu is in dark blue, measles is in aqua, polio in green, meningitis in orange, and diphtheria, tetanus, and pertussis covered in the DTaP vaccine are in pink.

CLICK for Animation

First on the timeline is the creation of the small pox vaccine by Edward Jenner in 1796. Small Pox had it last reported case in the US in 1949 and in 1980 the World Health Organization declared smallpox officially eradicated.

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Edward Jenner was an English physician and scientist who was the pioneer of smallpox vaccine, the world's first vaccine. Jenner is often called "the father of immunology", and his work is said to have "saved more lives than the work of any other human"

Around 1768, English physician John Fewster had realized that prior infection with cowpox rendered a person immune to smallpox. Noting the common observation that milkmaids were generally immune to smallpox, Jenner postulated that the pus in the blisters that milkmaids received from cowpox, a disease similar to smallpox, but much less virulent, protected them from smallpox. On May 14, 1796, Jenner tested his hypothesis by inoculating James Phipps, an eight-year-old boy who was the son of Jenner's gardener. He scraped pus from cowpox blisters on the hands of Sarah Nelmes, a milkmaid who had caught cowpox from a cow called Blossom. Jenner inoculated Phipps in both arms that day,

subsequently producing in Phipps a fever and some uneasiness, but no full-blown infection. The James Phipps was later exposed to small pox and showed no sign of infection.

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I want to go into the history of Smallpox…

Smallpox dates all the way back to the Egyptian Empire during the 3rd century BCE. Evidence of the disease was found on the mummy of Pharaoh Ramses V. Smallpox spread throughout the world through interactions from trade and was still prevalent in the late 1700s. Not only did 3 out of every 10 people who contracted the disease die, but those who survived generally suffered from scars to remember the painful smallpox. Variolation was an early attempt to control the disease in which people uninfected would expose themselves to a small portion of the disease either through scratching or inhaling infected matter. In 1777, George Washington took a risk and conducted the 1st mass army inoculation during the peak of a war. Because inoculation was unpopular in the US due to fear of contamination, less than 1/3 of the army had prior exposure to smallpox. This gave the British army an advantage given that inoculation was already popular in Europe so most were already immune. Washington inoculated over 3/4ths of his army. This was the first mass vaccination program in the states.

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1796 marked a turning points in smallpox prevention when physician Edward Jenner developed the vaccine. The vaccine differed from variolation in that cowpox was used to boost the immune system rather than smallpox. Therefore those vaccinated against smallpox could not contract the disease. Jenner's vaccine was gradually adopted and slowly stopped the spread of this disease. Overtime, as Jenner's vaccine became more widespread, there was a decline in smallpox cases worldwide. The last case in the U.S. occurred in 1949. Then, following strong vaccination campaigns in the 60s and 70s, the last naturally occurring smallpox case in the world was in 1977. In 1980, the World Health Organization officially declared smallpox eradicated. Because it is eradicated throughout the world, the general population is not vaccinated for smallpox. The U.S. military still has a smallpox vaccine to combat bioterrorism.

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Thomas Jefferson was an American statesman, diplomat, lawyer, architect, and Founding Father who served as the third president of the United States from 1801 to 1809. He was also a strong supporter of the Smallpox vaccine. In a letter to Dr. Jenner, Thomas Jefferson expressed his gratitude to Jenner for the inoculation. And predicted the inoculation with eradicate the smallpox virus which it did 174 years later.

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Now we will move down the timeline on to polio. Almost 100 years later, in 1894 the 1st outbreak of polio occurred in the U.S. *click*. In 1919 there was a larger outbreak in NY. In 1950s polio fears in the US were very prevalent, in 1952, 60 thousand in the US were infected with polio. In 1955, the first polio vaccine was developed and in 1961 a new polio vaccine was created.

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In 1955, Dr. Jonas Salk develops the 1st polio vaccine. This first vaccine was called IPV for inactive polio vaccine. IPV is an injectable vaccine still used today. In 1961, Dr. Albert Sabin creates an oral polio vaccine, or OPV. Our communities experienced the devastating effect of polio, when vaccine offer protection from contracting it and people lined up to receive it. The background image here is a crowd of people waiting for the oral polio vaccine in 1962.

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By the 1950s, polio was one of the most feared disease in the US. In the early years of the 50s, more than 15 thousand cases were reported each year. The US had a peak in 1952 with 52,876 cases. Before vaccines, various treatment used such as iron lungs to help polio patients breath. There are still a few patients left in the world who depend on iron lungs for survival. General, these machines have become obsolete and are stored in hospital basements if at all although they are still in a few homes and sometimes used in other countries.

The Immunization Partnership included an iron lung in their 2017 legislative day set up in Austin, TX as seen in the image on the top left. This was the first time many of our elected officials had seen an iron lung and were able visualize what it was like for polio survivors to live in the iron lung.

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In the early 1950s, before the polio vaccine was developed, the U.S. had more than 15,000 polio cases a year. By 1960, that number had decreased to less than 100 cases per year and decreased even further by the 70s to less than 10 cases per year. Today, polio has been eliminated in the US

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This image courtesy of the CDC and demonstrates the elimination of polio worldwide. In 1988, the US had already eliminated polio. Unfortunately, polio is still brought in from other countries, but the last case brought in to the US occurred in 1993.

As you can see here, successful vaccination campaigns lead to the decrease of polio not only in the US, but world-wide.

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It is still important to be vaccinated to protect oneself from polio brought in from other countries. The US has been using solely the IPV since 2000. The CDC recommends 4 doses of IPV for children at 2 months, 4 months, between 6 to 18 months, and the last between 4 to 6 years of age.

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Coming back to our overall timeline, we will move to a vaccine-preventable disease that is all too common and many have experienced: The flu.

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The flu vaccine was 1st developed and approved for military use in 1945. This development was a priority because 1 out of 67 influenza cases in the military were resulting in death during the 1918-1919 pandemic we will discuss later. This vaccine was approved for public use the following year. Both Dr. Thomas Francis Jr. & Dr. Jonas Salk were instrumental in development.

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1918

In 1918-1919, 40 million people died worldwide from the Spanish Flu. The number is so high because treatment or vaccine for the flu had not been developed by this time.

1957

By the 1957-1958 Asian Influenza epidemic, flu vaccines had been created. A vaccine was developed for the Asian flu once the new strain was identified. This vaccine is credited with preventing the death toll in the U.S. from rising to 1 million.

2009

Many of us remember the swine flu, or Novel H1N1 epidemic in 2009. Although flu cases are difficult to track today, the CDC estimates there were between 8,520-17,620 deaths in the US. The World Health Organization estimates 18,449 deaths due to swine flu worldwide.

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Even if some flu vaccines are not quite as effective as others, depending on the prominent strain that year, there are still many other important reasons to get vaccinated.

Vaccination lowers the risk of contracting a flu illness by 40-60%. If one does contract the flu, the vaccine makes the illness milder or even prevents the visible sickness all together. Getting the vaccine also significantly reduces a child's risk of death if he or she does contract the flu. Flu vaccines also have benefits for those with chronic diseases. The vaccine results in lower rates of cardiac events for those with heart disease and reduces hospitalization for those with diabetes or lung disease. The flu vaccine also helps protect people who cannot get vaccinated such as infants, the elderly, or those with compromised immune systems.

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Vaccination rates for adults since 2010 are just over 40% with the rates for the 2016-2017 season at 43.3%. The rate for children is a little higher with percentages in the high 50s. Herd immunity is a concept in which people are protected by others' vaccines. The more people that are vaccinated, the less likely those individuals will get sick. If less people are sick and more immune, the disease spreads less throughout the community. Unfortunately, the flu vaccination rates are not high enough to establish herd immunity. Many adults don't get vaccinated because they are at a lower risk of contracting the flu. Children and elderly are more at risk, but often they are the ones who cannot be vaccinated. It is important to be vaccinated, even if you are at low risk of a disease, to protect those around you who can't get the vaccine.

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Now that we have heard about the flu, we move through our timeline onto the creation of the DTaP combined vaccine in 1948. DTaP is the vaccine for Diphtheria, Tetanus, and Pertussis.

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In 1948, the DTaP combined vaccine was developed, but many other vaccines and experiments came before. Diphtheria immunization testing came first. In 1890, 2 scientists successfully immunized a guinea pig with diphtheria toxin. After further experimentation, William H. Park created an antitoxin/toxin mixture for diphtheria immunity in 1914. In 1924, the tetanus toxoid used by the U.S. military in WWII was developed. The following year, Thorvald Madsen conducted the 1st pertussis vaccine experiments that were later proved effective and safe by two American scientists in 1939. Again, in 1948, the a combined vaccine was developed and in 2014, the CDC began recommending children receive the 1st dose when they are 2 months old.

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The DTaP vaccine stands for diphtheria, tetanus, and pertussis which is whooping cough. The vaccine protects against all 3 diseases. TDaP is a similar vaccine, emphasizing tetanus, but replaces DTaP after an individual reaches age 7. …….. Before vaccinations there was up to 200 thousand diphtheria cases, hundreds of tetanus cases, and as many as 200 thousand pertussis cases in the U.S. each year. Since vaccinations, the number of diphtheria and tetanus cases reported dropped by 99% and the number of pertussis or whooping cough cases dropped by 80%.

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We have covered smallpox, polio, influenza, diphtheria, tetanus, and pertussis. We will now move to 1963 when the 1st measles vaccine was created, discuss the 2015 measles Disney outbreak, and the 2019 Outbreak .

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John Enders developed the 1st measles vaccine from an isolated measles virus he took from an ill student during a 1954 outbreak in Boston. In 1963, Maurice Hilleman created an improved vaccine that is still used today. Originally, the vaccine had to be given with human blood proteins to lessen side effects. Hilleman weakened his vaccine by passing the virus through chick embryo cells, eliminating the need for proteins. The measles vaccine was Maurice Hilleman's first, but his research led to the creation of over 40 other vaccines.

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Improved health care means, in general, better outcomes for those who get measles. Combined with high rates of vaccination, these outcomes are rare, but it is important to stay vaccinated."

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MMR is the combines vaccine for measles, mumps, and rubella, also known as German measles. The CDC recommends children get 2 doses of the vaccine, the first one between 12 to 15 months of age and the second between ages 4 and 6. Although MMR is generally only recommended for children 12 months or older, the CDC recommends a vaccination for infants younger before travel because the disease are much more common in other locations. Fortunately, MMR is only recommended for adults during an outbreak situation.

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Before the measles vaccine, more than 500 thousand cases were reported annually along with 48,000 hospitalizations, 4,000 cases of encephalitis, and 450-500 deaths. As you can see in the graph, there was a dip in measles cases following the creation of the vaccine. In 1966, a national measles campaign began. We immediately saw a decrease in cases. While medical care has also improved, fewer cases means those that were more severe had better access to medical care.

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First, note that we have different scales here. In the larger graph, cases are counted by the thousands because prior to vaccination, we had measles cases in the hundreds of thousands. Once vaccination became routine, seeing more than a few thousand was odd.
So, remember we were on track to eliminating measles in the US. We had a blip in the early 1990s. During this time there were significant groups of kids not getting vaccinated. Houston was a hotspot, but in this case it wasn't anti-vaccination parents, it was due to lack of access to health care.
So public health programs again stepped up vaccination efforts.
BUT, what happened in the early 2000s?

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In 2000, the CDC declared measles eliminated from the US because we had so few cases. Nearly half of the cases in 2001-2003 were imported.

In 2004, more than 70% were imported, but by 2005, more than half were locally-acquired infections. In recent years, most of the cases have been locally acquired, though often initiate with one imported case.
While, compared to the pre-vaccine era, these numbers look great, they are going the opposite direction in our efforts to eliminate. In fact, we're seeing more and more outbreaks. Outbreaks usually follow cycles. After a peak, like in 2014, we see a dip, because most of the population is now immune – either through vaccination or natural exposure. If vaccination drops, there's opportunity for another outbreak in a year or so as more children are not protected.

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On January 5th 2015, the California Department of Public Health was notified of a potential measles case from an 11 year old boy who had not been vaccinated. This child was hospitalized about a week earlier with a rash following his trip to Disneyland in Orange County, California. On that same day of January 5th, four more potential measles cases were reported in California and two in Utah. All patients visited one of two adjacent Disneyland's shortly before getting sick. By February 11th, there were 125 reported measles cases all beginning with a rash between December 28th and February 8th. Unfortunately, 88% of the California patients infected had not been vaccinated for measles.

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From January 1 to August 8, 2019, 1,182** individual cases of measles have been confirmed in 30 states. This is the greatest number of cases reported in the U.S. since 1992 and since measles was declared eliminated in 2000.

- Measles can cause serious complications. As of August 8, 2019, 124 of the people who got measles this year were hospitalized, and 64 reported having complications, including pneumonia and encephalitis.
- The majority of cases are among people who were not vaccinated against measles.
- More than 75% of the cases this year are linked to outbreaks in New York and New York City. Measles is more likely to spread and cause outbreaks in U.S. communities where groups of people are unvaccinated.
- All measles cases this year have been caused by measles wild-type D8 or B3.

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Our final vaccine we will be covering in Vaccine History today will be the meningitis vaccine.

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The meningitis vaccinations are effective for 4 out of the 5 common bacterial types. Those 4 types cause 70% of infections in the U.S. Increased promotion & use of the meningitis vaccine has lowered the frequency of outbreaks. In just the 1 year between 1992 and 1993, there were 8 identifiable outbreaks. In the past 11 years there has only been 13.

There are two types of meningitis vaccines, meningococcal conjugate vaccine, which is the one generally required if there is a mandate, and the serogroup B vaccine. The CDC recommends the conjugate vaccine for preteens between ages 11 and 12 and a booster at age 16. Young adults and teens between 16 to 23 can also get a serogroup B vaccine because they are in the age group most at risk. It is ideal to get a serogroup B vaccine between 16 and 18.

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According to the CDC, there are 1,000-2,600 cases each year and 1 out 10 cases result in death. 11-19% of those that survive meningitis have continuing health problems from the disease such as loss of limbs and hearing, blindness, nervous system problems, learning disability, kidney failure, seizures, and strokes. Meningitis can be contained by antibiotic if it is caught extremely early, but death and health problems are still possible. Meningitis infection progresses quickly, death can even result in 24 hours and the initial symptoms mimic typical flu. It is important to get vaccinated to prevent ever contracting this dangerous and fast disease. The image here is of Jamie Schanbaum who contracted meningitis at age 19 in 2009. She lost her fingers and lower legs."

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Because college students are at greater risk for contracting meningitis, universities are beginning to have vaccine requirements. As mentioned in the previous slide, Jamie Schanbaum was a 19 year old student at the University of Texas who contracted meningitis and lost her fingers and lower legs. In response to her and other's advocation, Texas passed SB 1107 also known as the Jamie Schanbaum Law that requires all students living on campus to have been vaccinated. Two years later, Nicolis Williams, a 20 year old student at A&M, passed away from meningitis. Nicolis is pictured here with his sister. Following Nicolis's tragedy, Texas passed HB 1816 known as the Nicolis Williams Law expanding university vaccine requirements to all students, living on or off campus. Texas is the first state to make this expansion. As of now, there is no legislation regarding the Serogroup B meningitis vaccine, only the conjugate discussed earlier.

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Thank you for taking the time to listen about the brief history of vaccines today. If you have additional questions please feel free to email info@immunizeUSA.org.